Testing and Developing Criteria and Indicators for Sustainable Forest Management in Cameroon: The Kribi Test

Final Report

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THE CRITERIA AND INDICATORS TOOLBOX

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The tests of criteria and indicators for sustainable forest management (C&I) in Kribi, Cameroon were carried out in close co-operation with the Office National de Développement des Forêts (ONADEF) in Cameroon and with the support of Tropenbos Foundation (Netherlands), the African Timber Organization (ATO), the Directorate General for International Cooperation of the Netherlands (DGIS), CIRAD-Forêt (France), the German Agency for Technical Cooperation (GTZ), United States Agency for International Development (USAID), GWZ - Houthandel Wijma & Zonen B.V. (Netherlands), Environmentek (South Africa), International Institute for Tropical Agriculture - Humid Forest Station (IITA-HFS, Cameroon) and the Center for International Forestry Research (CIFOR, Indonesia). We thank all these institutions for their support.

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This test of C&I was built around the expertise and intellectual outputs of the 18 men and women from Cameroon, Netherlands, Belgium, France, the United States, and South Africa on the test teams. This is a report of their work. Our sincere thanks to all of them. We hope that we have reported and analysed their results accurately and well. Any omissions and errors in this respect are ours.

Executive Summary

This is the report of the sixth CIFOR test of criteria and indicators for sustainable forest management (C&I) held in Kribi, Cameroon, from 24 October to 17 November 1996. There were two main research questions pursued during the test.

1. To what extent would the 'Iterative Filtering and Generation Method' (IFGM) method used in previous tests still produce useful results if the duration of testing and the composition of teams were changed in order to lower costs?

2. How would the results of a test of C&I in Cameroon compare with those of previous tests?

We used six 3-person teams to evaluate and develop C&I, with the intention of drawing our conclusions related to these two questions based on analysis of their results. Each team was composed of one forester, one ecologist and one social scientist. The first group of three teams (Teams 1, 2 and 3) spent approximately seven days together as a team to evaluate the C&I (plus three days of home based evaluation). The second group (Teams 4, 5 and 6) was given fourteen days for the same activities (plus three days of home-based evaluation). Inter-team sharing of information related to evaluation and development of C&I was not permitted. However exchange of other types of information and expertise was encouraged.

Overall, we had an equal mix of Cameroonians and expatriates. All but two team members had previous experience in the region. Two team members had no previous experience with forestry (one was an agricultural ecologist and the other a marine economist). Fourteen of the team members were men, and four were women. The area around Kribi was selected for several reasons. Tropenbos has had a research presence in the area since 1991, and provided us with considerable co-operation, backup and expertise. Indeed, we had seven Tropenbos or previous Tropenbos researchers on our teams or as support personnel. The Wijma concession granted us access to an area of Cameroon which seemed fairly representative of those areas currently being logged, and probably subject to more logging in the future. The 'Iterative Filtering and Generation Method' developed by CIFOR is based on inter-disciplinary expert evaluation and adaptation of existing C&I to a particular set of site conditions. It is important to note that the filtering 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.

Three major steps of the process can be distinguished.

1. Preliminary single discipline evaluation of all the C&I in the 'base set'. This is done by each expert at his or her home base. The principal objective is to identify obviously redundant C&I based on an initial desk-based evaluation of all C&I in the base sets. This is the 'Form 1 exercise'.

2. Inter-disciplinary field evaluation of a selected subset of the 'base-set'. This involves inter-disciplinary interactions, site visits, discussions with stakeholders in order to identify the minimum number of reliable, relevant and cost-effective C&I for the site concerned. This is the 'Form 2 exercise'.

3. Experts workshop to discuss results. The closing workshop aimed to review the results of the testing exercise and commence discussions on their applicability beyond the selected site. Participants were experts from different disciplines and institutional backgrounds. Detailed discussions took place mainly along disciplinary lines in working group sessions. Plenary sessions and presentations provided for an exchange of information between groups.

The evaluations of C&I were carried out with the aim of identifying the *smallest number* of C&I needed to reliably assess forest management in Kribi, especially at the Tropenbos research sites on the Wijma concession. The process of identifying these C&I was based on evaluations of a total of 220 C&I:

- developed by the African Timber Organisation (ATO)[1] – CIFOR had been asked by the ATO to test this set, and it was felt that these C&I were likely to be the most regionally specific and appropriate;
- in a set compiled by CIFOR from sources not used in previous tests (FSC, Montreal Process, ITTO, TCA); and
- developed in the Netherlands by the Dutch Working Group on Sustainable Forest Management (DDB).

These C&I were not all to be field-tested, but served as a basis from which each team selected a sub-set for field evaluation. The test involved eliminating those felt to be inappropriate, and in cases where gaps existed, or existing criteria and indicators were not deemed to be suitable, new or substitute C&I were generated.

Initial evaluation using Form 1

The Cameroonian experts tended to be more rigorous in discarding C&I from the base sets than the non-Cameroonians, possibly because of their familiarity with the site conditions concerned. However these differences were not statistically significant.

There were also differences in the extent to which experts from the three disciplinary groups classified C&I. The ecologists agreed least with each other (66.8% of the C&I examined by them had the same classification), followed by the foresters (71.8%) and the social scientists (79.1%). We expect that, given differences in background and experience, differences in interpretation among individuals and groups are always to be expected. It is however difficult to define the limits for 'an acceptable amount of variation in interpretation' based on our data alone. On the whole, these data suggest that C&I in the base sets were interpreted in a broadly similar manner. It is important to note that the assessment exercise at this stage was not team based. Each expert carried out this analysis individually prior to the assembly of teams in Kribi. Based on assessment criteria it was evident that members of Team 4 were on average the most satisfied with the base set, followed by Teams 5, 2, 6, 3 and 1 respectively.

The initial filtering process identified between 45 and 70 issues from the list of 220 for each team member to investigate; issues classified by the team as specifically relating to forest management, ecology or social science.

Following the initial assessment of all C&I recorded on Form 1, field evaluation took place of a subset of C&I identified as being most appropriate. This exercise was recorded and structured based on Form 2. During this phase of the evaluation teams spent time in the forest, interviewed important forest actors, reviewed existing information and discussed the results among each other.

Results: Methods

One of the principal reasons for fielding multiple teams during the Cameroon test was to determine whether and to what extent varying the composition of the teams would also affect the C&I they propose. We found a negative correlation between the total number of C&I proposed by a team and the number of C&I held in common with other teams. Team 6 had the highest degree of commonality with other teams and teams 2 and 5 the lowest.

[1] Based on the CIFOR Côte d'Ivoire test.

We also analysed the degree to which the 49 C&I identified as being held in common among the field tests in Indonesia, Côte d'Ivoire, Brazil and Austria during Phase 1 of the CIFOR test series are covered by the Cameroon test teams. We found that whereas 80% of the Phase 1 C&I had been covered by Team 4 at the other extreme only 43% had been covered by Team 1. However the Phase 1 commonalities were completely included in the pooled results of all six Cameroon test teams.

In absolute terms we found that there was an improvement in the teams' inclusion of the commonalities as the test duration approached the 22 field days of the Phase 1 teams. Relative improvements, however, declined sharply in the period between the completion of the short duration teams' evaluation and that of the longer duration teams. Our calculations showed that the average improvement made during the six-day difference between the short and long term teams was as important to the development of the C&I as the 11-day difference between the long duration and Phase 1 test periods. The average linear rate of daily improvement for the six-day difference of the Cameroon groups was calculated at 3.1%. This index for the period between the long duration teams and the Phase 1 teams was 1.7%.

In the IFGM we have a method for field evaluation and development of C&I that is robust and flexible, because it is based on expert opinion. It builds on existing knowledge not only through the experts, but also through the incorporation of existing sets of C&I as a starting base. It is capable of injecting a relatively high degree of interdisciplinarity fairly quickly and continuously into the process of C&I development, ensuring that the results are more widely acceptable. It enables participation and inputs from a wide group of local stakeholders. The results are practice-oriented, subject to iterative improvement and peer review. These are the main strengths of the method.

One of its principal strengths is also its main weakness. The test revealed that the IFGM is heavily dependent on the composition of the team of experts. The experts must be capable of teamwork, and must have a sound knowledge of their fields and the purpose of the exercise. We have pointed out other necessary attributes for these experts. We conclude it will not be possible to entirely filter out biases introduced by experts to the C&I they propose. It will also not be entirely possible to filter out human error in a time-constrained process that is extremely taxing of the mental and conceptual capabilities of the experts. This suggests it would be unusual and therefore unreasonable to expect a flawless result from a system that is so heavily dependent on human judgement, given the time constraints under which it operates.

Our comparison of the results of the Cameroon test with the commonalities identified during previous tests, where teams had almost twice as much time, reveals that even the total of 17 days allocated to the long duration teams may have been insufficient. Although it is probably not necessary for teams to spend over a month evaluating and developing C&I, as in the Phase 1 tests, we concluded they would need about three weeks, including at least two clear weeks at the field site, to allow a minimum number of iterations through the C&I they are developing. In all at least six iterations would be required: The first two iterations taking place through the Form 1 exercise and the following three during the Form 2 period. A final, sixth iteration would then take place during the closing workshop. The amount of time required per iteration will vary from situation to situation.

Principal conclusions

- ❏ Three-member test teams work, but five- (or six-) member teams are better and safer to guarantee iterative improvement.
- ❏ One week in the field is too short, two weeks is better and about three weeks is best.
- ❏ A base set of about 250 C&I as a starting platform is manageable and sufficiently comprehensive.
- ❏ Effective teamwork is critical to success and can compensate for individual weaknesses.
- ❏ Interdisciplinarity is key to developing a streamlined and cost-effective set of C&I.

Our conclusion has been that, despite some weaknesses that need to be corrected, the IFGM is a useful tool – it builds on the strengths of human experts, but dampens the negative effects to a large extent. Its utility lies in its ability to allow experts in particular domains to interrogate an existing knowledge base quickly and efficiently.

Results: Criteria and Indicators for Sustainable Forest Management

In total, the six teams proposed 19 principles, 103 criteria, 360 indicators and 139 verifiers for a total of 621 'issues'. However there was repetition within some of the sets so that after analysis we reduced the total number of issues to 610. This formed the basis for all further analysis. Two different approaches seem to have been adopted. Whereas Teams 1, 3 and 6 proposed a relatively small number of C&I as the 'minimum reliable set' for Kribi's forests, Teams 2, 4 and 5 proposed roughly twice as many. It is important to note that teams were instructed to give C&I related to policy matters, i.e., factors extraneous to the FMU, the lowest priority among the four subject areas because there were no policy experts on any of the teams and time was a major constraint. Examining the C&I proposed by the six teams, it is clear that some confusion still existed on how to distinguish between the four levels of hierarchy, i.e., principles, criteria, indicators and verifiers.

The Cameroon test teams assessed their own C&I based on eight criteria. Comparison of these assessments with those of the teams in the Phase 1 tests (Indonesia, Côte d'Ivoire, Brazil) revealed that the average scores were lower for social and management C&I in the case of the Cameroon test. The scores for ecology were the same. Our interpretation therefore is that, with the exception of the ecological C&I, the Cameroon teams appeared to be less satisfied with their own results compared to the teams in Phase 1. We believe this is a direct consequence of the shorter duration of the Cameroon tests.

Policy C&I

The principal policy issues emerging from the proposals include the need for land-use planning, sustained and adequate funding, strengthening of institutions, reduction of pressure on forests through intersectoral coordination and the need for up-to-date information. Somewhat surprisingly there was little suggestion that there was a role for policy to secure rights of tenure and access. The policy-level C&I were proposed by foresters, social scientists and to a lesser extent ecologists.

Ecological C&I

In keeping with results from previous tests the ecological C&I developed during the Cameroon test revealed similar underlying conceptual frameworks. They showed high degrees of commonality and were usually backed by a large number of verifiers, although this varied among teams. We found that all the commonalities listed in the Phase 1 report were also included in the C&I proposed by the Cameroon teams. Areas of weakness include dealing with spillover effects, i.e., effects of the FMU on its surrounding environment and vice versa. We conclude that the ecological C&I proposed by the Cameroon teams are a good platform for the assessment of impacts on the ecology of the forests. There will be need to further refine these C&I, especially with respect to verifiers and performance thresholds. Whereas improvement with respect to verifiers may well come out of further iterations through this set of C&I, improvements with respect to performance thresholds will probably require more specialised research.

Management for Production of Goods and Services C&I

All teams unanimously agreed on the importance of planning and management plans for the forest concessions. Several verifiers were proposed of which only a few are included here. The need to codify harvesting standards was also recognised. There was considerably less consensus on C&I related to yield regulation.

This is possibly because until very recently only about 1-2 trees were being harvested per hectare. The impact on yields may have been deemed negligible. However timber utilisation is being intensified and planning and regulating yields should be of high priority, if such intensification is to be sustainable. Indicators related to guidelines for harvesting non-timber forest products (NTFPs), revision of management plans and approval by the minister in charge of forests were supported by half the teams. About 18 C&I in the proposals of the six teams were devoted to the issue of NTFPs. There was a general consensus that NTFPs were extremely important for the local communities and that they were currently poorly managed and badly marketed.

Interestingly, issues related to the legal basis for forest management, its duration and broad objectives were consistently recognised as being important only by Team 5. Team 4 did however focus on the issues of objectives and duration of concession. It is surprising that none of the other teams considered these issues to be important. Perhaps the absence of any formal management plan and recognisable planning process for the area distracted the other teams from these important issues.

Social C&I

In analysing the social C&I we are examining the outputs of the social scientists on the six teams. They represented the most heterogeneous group amongst all the experts. We had anthropologists, economists and sociologists on the teams. There was considerable heterogeneity in terms of experience as well. The third major source of variance was their institutional and national backgrounds. Given this situation we were very interested to see whether the C&I they proposed would vary a great deal.

Three teams proposed C&I related to human well-being as a general principle and related lower levels of hierarchy. An alternative formulation for this principle incorporated ‘quality of life’ as the major objective. Well-being was interpreted in terms of benefits to forest actors such as local communities, forest workers, investors and the timber-processing industry. Although this principle was not specifically mentioned by other teams, it was implied. This principle is the overriding reason for carrying out sustainable forest management.

Under well-being we have two other main principles in this section dealing with fair intergenerational access to resources and benefits, and the principle related to voice or participation/co-management. All criteria and indicators fall under these two principles. We list one other principle which deals with the ability of the forest resource to cope with the demands placed on it. This is a cross-cutting principle in that the relevant criteria and indicators were presented in the ecology and management sections. Its inclusion here reflects the concern that there should be a balance between rights and benefits on the one hand and the responsibility to the resource on the other. There was a tendency to be overly prescriptive in some cases, proposing interesting but controversial ‘remedies’ as indicators or verifiers, e.g., suggesting the inclusion of ‘vertical integration of production’. The Cameroon set includes C&I for economics, introduces the capacity for social organisation as an indicator and puts a much higher emphasis on stakeholder participation.

ATO C&I

The main differences between the C&I proposed during the Cameroon test and the ATO base set relate to the inclusion in the ATO set of research, the amount of emphasis given to plantations, the level of detail with which the principle on the permanent forest estate is treated, the more detailed treatment of silvicultural systems, the emphasis placed on feedback and revision mechanisms, e.g., for harvesting and silvicultural standards, and the attention to human health. On the other hand the Cameroon set has generally better verifiers, especially for ecology, makes proposals for C&I for economics, capacity for social organisation as an indicator and places a lot of emphasis on stakeholder participation. Its neglect of plantations stems from the relative unimportance of plantations in the Kribi area. Research may have been ignored because of the amount of Tropenbos research being carried out.

Comparison with the ATO set has shown that the Cameroon results are somewhat less detailed but on the whole there was a greater contribution towards the development of verifiers. For the most part the ATO C&I seem to have a wide applicability. There are also options for streamlining the ATO set, especially with respect to C&I related to management for production.

Of the three base sets, the ATO base set was sourced most frequently in absolute terms. It was also the set that showed the greatest amount of utility for the teams, an average of 35.1% of the C&I in the ATO set were used by the teams. The compiled set followed with 29.4% and the DDB set was the least used with only 15.2% of the C&I being sourced. It should be noted that these statistics refer only to sourcing as stated by the teams. The overall convergence of the proposals made by the six teams and the base sets were higher as some 'new' C&I proposed by the teams converged on C&I in the base sets in the course of iterations, even if they were very different initially.

Principal conclusions

- ❏ Degree of commonality varied among teams, as did the total number of C&I proposed.
- ❏ Phase 1 commonalities covered by pooled results.
- ❏ Synthesis set of C&I considered adequate and effective.
- ❏ New C&I for economics proposed.
- ❏ Particularly for ecology, useful verifiers proposed.
- ❏ ATO set most useful of base sets.

The results of the Cameroon test were generally very satisfactory. Some of the teams proposed C&I that fell somewhat short of an adequate set to assess sustainable forest management. The synthesis of the Cameroon Test C&I we have prepared covers all the important aspects of sustainable forest management, with weaknesses in the policy area. Some gaps were identified in the forest management C&I, both with respect to indicators and verifiers. The social C&I need strengthening as far as verifiers are concerned. The ecological C&I were probably the best developed of all.

List of Abbreviations

ATO	African Timber Organization
CIFOR	Center for International Forestry Research
CITES	Conference on Trade of Export and Species
DDB	Deskundigenwerkgroep Duurzaam Bosbeheer
FAO	Food and Agriculture Organization of the United Nations
FMU	Forest Management Unit
FSC	Forest Stewardship Council
ITTO	International Tropical Timber Organization
ILO	International Labour Organization
NTFP	Non-timber Forest Products
SSG	Scientific Support Group
TCA	Tratado de Cooperación Amazónica
UNCED	UN Conference on Environment and Development

1. INTRODUCTION

This is the report of the sixth CIFOR test of criteria and indicators for sustainable forest management (C&I) held in Kribi, Cameroon, from 24 October to 17 November 1996. The test was carried out in collaboration with ONADEF and with the support of the Tropenbos Foundation, the African Timber Organization, the Directorate General for International Co-operation of the Netherlands, CIRAD-Forêt, and the German Agency for Technical Co-operation (GTZ). The report builds upon previous work carried out in the CIFOR research project on criteria and indicators for sustainable forest management (Colfer 1995; Colfer *et al*. 1995; Prabhu and Tan 1996; Prabhu *et al.* 1996).

Following an introduction of the objectives and context for the test in this section, we describe our methods in Section 2. Section 3 deals with the results of the criteria and indicators evaluations carried out in Kribi. Although the development of the C&I was interdisciplinary, for convenience and ease of understanding, a cross-sectional analysis of the results of the six teams is presented according to three broadly defined disciplinary sections. The full results of each team are presented in Annex C. This section closes with a discussion of the results, especially in the light of previous tests. We conclude the report in Section 4 by establishing the lessons we have learnt and key research questions.

1.1 Research Questions and Anticipated Gains

There were two main research questions pursued in Cameroon.

1. To what extent would the 'Iterative Filtering and Generation Method' (IFGM) method used in previous tests still produce useful results if the duration of testing and the composition of teams were changed in order to lower costs?

2. How would the results of a test of C&I in Cameroon compare with those of previous tests?

The IFGM was the basic tool to answer both questions. In order to answer the first question we:

- used a larger number of teams compared to previous tests;
- varied the amount of time available to these teams; and
- reduced the strength of these teams to three members each, compared to five in previous tests.

The anticipated gains of the test in Kribi were:

- identification of C&I that are relevant, scientifically sound, cost-effective and appropriate for the conditions at the site; and
- improvements to the IFGM, and a better understanding of its utility.

2. METHODS

In this section we present and discuss the methods used to develop criteria and indicators using the IFGM, which involves iterative desk-based and field evaluations.

2.1 Conceptual Framework

The conceptual framework for the CIFOR tests of criteria and indicators is provided in Prabhu *et al*. (1996). The box below serves therefore essentially as a ready reference for the key concepts of principles, criteria, indicators and verifiers.[1] It is important to note that, consistent with the approach taken in previous tests, sustainability has been taken to mean maintaining or enhancing the contribution of forests to human well-being both of present and future generations without compromising their ecosystem integrity, i.e., their resilience, function and biological diversity. This definition of sustainable forest management in terms of broad goals has allowed CIFOR researchers the flexibility to develop more operational definitions in terms of C&I for the selected forest sites.

Decomposing the sustainability goals into key components that are either quantitatively or qualitatively measurable on the ground is an important objective of the research. C&I are key tools to develop an adaptive management system as they provide both the goals and a definition of performance thresholds, targets and processes based on the most appropriate management practices for a given area. An extremely important aspect of the C&I research and development process has been the recognition of the need to ensure transparency in their application and acceptability to most stakeholders, i.e., they form a broad and effective platform for the building of consensus.

Principle

A principle is '*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 after Liang (1994) 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: 'Ecosystem Integrity is maintained or enhanced'; 'Human well-being is assured'.

[1] Lammerts van Bueren and Blom (1997) provide a very useful tool with which to correctly assign C&I to appropriate levels of hierarchy.

Criterion

A criterion is defined as '*a principle or standard that a thing is judged by*'.[2] 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 forms. Principles form the final point of integration.

In addition to considering criteria to be second-order principles, they are 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.

For example, 'Principal functions and processes of the forest ecosystem are maintained'; 'Processes that maintain genetic diversity are conserved'; 'Just access to benefits is assured'.

Indicator

An indicator is any variable or component of the forest ecosystem or the relevant management systems used to infer attributes of the sustainability of the resource and its utilisation (after Landres 1992).

The transitive verb 'to indicate' is defined in the *Concise Oxford Dictionary* as :

- point out, make known, show; or
- be a sign or symptom of, express the presence of.

Indicators should convey a 'single meaningful message'. This 'single message' is termed information. It represents an aggregate of one or more data (see definition below) elements with certain established relationships.

Examples: 'Seed sources are secure'; 'Directional change in allele or genotypic frequencies is low'; 'Conflict levels are low and not rising'.

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 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).

At the bottom of the hierarchy are data elements. The relationship between data elements and *verifiers* is relatively close for performance thresholds (or targets) and is loose for means of verification. With this in mind we can define a data element as a 'primitive' entity that conveys a 'single value' (as opposed to a 'single message' in the case of information).

Examples: 'Number of seed trees'; 'Number of alleles'; 'Number of court cases'.

[2] *Concise Oxford Dictionary*

2.2 Team Composition

Each team was composed of one forester, one ecologist and one social scientist (Table 1, Annex D). Overall, we had an equal mix of Cameroonians and expatriates. All but two team members had previous experience in the region. Two team members had no previous experience with forestry (one was an agricultural ecologist and the other a marine economist). Fourteen of the team members were men, and four were women.

In contrast to previous teams, two of these teams included an economist in the social science slot. Interestingly, the economists themselves noted their greater concentration on social issues than anticipated, because of the glaring importance of such issues in and around the logging context. They did, however, add a somewhat different perspective to the social C&I.

The members of the six teams were, by and large, well qualified and well motivated. Although predictably we had some problems, the teams generally worked well.

2.3 Test Site

Site selection followed discussions with Tropenbos, ONADEF, ATO and members of the CIFOR project's Scientific Support Group (SSG).[3] The area around Kribi was selected for several reasons. The Wijma-Douala SARL (GWZ) timber concession had been operating in the area since 1984, and was willing to work with us in the test.[4] Initially they worked an area of 49,650 ha in the Bipindi forest area, Department of Kribi under Licence Permit No. 1600. They handed back this licence in 1990, commencing instead another licence (No. 1790) for 90,000 ha. The area is now designated a forest reserve according to the national land-use plan. As a result Wijma is actually operating in so-called *gré-à-gré*[5] concession areas (Hol 1996). The company specialises in the harvesting and utilisation of Azobe (*Lophira alata*).

Tropenbos has had a research presence in the area since 1991, and provided us with considerable cooperation, backup and expertise. Indeed, we had seven Tropenbos or previous Tropenbos researchers on our teams or as support personnel. The Wijma concession granted us access to an area of Cameroon which seemed fairly representative of those areas currently being logged, and probably subject to more logging in the future. There were also local communities (Bakola and various Bantu groups) and workers (local and in-migrating) affected by and affecting the logging operations in the area. All in all it was a satisfactory test site.

The major drawback to the area was the distance between Kribi (where the teams had to be housed) and the logging sites and communities. In previous tests, the teams were housed by the timber concessionaire, granting easier access both to human populations and to forest conditions. These teams had comparatively less access to the forest per day of 'fieldwork' than had our previous test teams. However it was possible at short notice to arrange field visits to the SOGENIC concession of 2500 ha, which was about 50 km or a 30 minute drive from the hotel where experts were housed.

2.4 Methods Used to Evaluate and Develop Criteria and Indicators

The 'Iterative Filtering and Generation Method' (IFGM) developed by CIFOR is based on interdisciplinary expert evaluation and adaptation of existing C&I to a particular set of site conditions. It is important to note that the filtering 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.

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[3] SSG: J. Heuveldop, J.-G. Bertault, E.M. Lammerts van Bueren, Riga Adiwoso S., P. Kio, B. Weber.

[4] There were some unforeseen problems with this planned cooperation, not long before the teams' arrival. However, P.H.V. Hol, a Wijma consultant familiar with Wijma conditions and operating procedures, wrote a background document (1996) which was available to all team members; and we were granted some access to Wijma facilities and activities on the ground. The lessened access to Wijma was to some extent compensated for by fairly easy access to the nearby SOGENIC concession.

[5] A kind of informal contract.

Table 1. Composition of the Cameroon test teams (Adapted from Maynard and Shepherd 1997)

Team	Expertise	Years of experience	Knowledge of criteria and indicators	Country of Origin/gender	Site/region knowledge
1	Forester, reduced impact logging	12	some	Netherlands, M	3 years on site as Tropenbos researcher
	Ecologist,	15	good	S. Africa, M	None
	Soc. Scientist, anthropologist	10	none	Cameroon, M	10 years Cameroon
2	Forester	12	none	Cameroon, M	12 years Cameroon
	Ecologist	12 (not in forests)	some	USA, F	3 years Cameroon
	Soc. Scientist, economist	10 (not in forests)	good (not in forests)	France, F	none
3	Forester	10	some	France, M	7 years West Africa
	Ecologist*	15	none	Netherlands, M	
	Soc. Scientist, anthropologist	5	none	Netherlands, F	2 years on site as Tropenbos researcher 2 yr. W. Africa
4	Forester	5	some	Belgium, M	3 years Cameroon
	Ecologist	5	none	Cameroon, F	4 years Cameroon
	Soc. Scientist, anthropologist	2	none	Cameroon, M	2 years Cameroon
5	Forester	10	good	Cameroon, M	10 years Cameroon
	Ecologist	15	some	Cameroon, M	15 years Cameroon
	Soc. Scientist, economist	10	some	France, M	6 years W. Africa
6	Forester	12	none	Cameroon, M	12 years Cameroon
	Ecologist	12	none	Cameroon, M	12 years Cameroon
	Soc. Scientist, anthropologist	2	none	Cameroon, M	2 years on site

* unable to complete test because of illness

Three major steps of the process can be distinguished.

- Preliminary single discipline evaluation of all the C&I in the 'base set' (see Annex E). This is done by each expert at his or her home base. The principal objective is to identify obviously redundant C&I based on an initial desk-based evaluation of all C&I in the base sets. This is the 'Form 1 exercise'.
- Interdisciplinary field evaluation of a selected subset of the 'base set'. This involves interdisciplinary interactions, site visits, discussions with stakeholders in order to identify the minimum number of reliable, relevant and cost-effective C&I for the site concerned. This is the 'Form 2 exercise'.
- Experts workshop to discuss results. The closing workshop had the aim of reviewing the

results of the testing exercise and commencing discussions on their applicability beyond the selected site. Participants were experts from different disciplines and institutional backgrounds. Detailed discussions take place mainly along disciplinary lines in working group sessions. Plenary sessions and presentations provided for an exchange of information between groups.

The evaluations of C&I were carried out with the aim of identifying the *smallest number* of C&I needed to reliably assess forest management in Kribi, especially at the Tropenbos research sites on the Wijma concession. The process of identifying these C&I was based on evaluations of C&I:

- developed by the African Timber Organisation (ATO).[6] CIFOR had been asked by the ATO to test this set, and it was felt that these C&Is were likely to be the most regionally specific and appropriate (Annex E);
- in a set compiled by CIFOR from sources not used in previous tests (FSC, Montreal Process, ITTO, TCA) (Annex E); and
- developed in the Netherlands by the Dutch Working Group on Sustainable Forest Management (DDB) (Annex E).

As explained above these C&I were not all to be field-tested, but served as a basis from which each team selected a subset for field evaluation. The test involved eliminating those felt to be inappropriate, and in cases where gaps existed, or existing criteria and indicators were not deemed to be suitable, new or substitute C&I were generated.

In order to answer questions related to effect of test duration, strength and composition of teams on the results six independent teams were used, each consisting of one forester, one social scientist and one ecologist. The teams were stratified into two groups of differing test duration, i.e., three replications per stratum. The first group of three teams (Teams 1, 2 and 3) spent approximately seven days together to compile results of the Form 1 exercise and to field test C&I (plus three days of home-based evaluation). The second group (Teams 4, 5 and 6) was given fourteen days for the same activities (plus three days of home-based evaluation). Inter-team sharing of information related to evaluation and development of C&I was not permitted. However exchange of other types of information and expertise was encouraged. The total strength of the teams was reduced to three persons from five in previous tests and the disciplinary, regional, and institutional backgrounds of team members were varied. At the same time every effort was made to ensure that the experts concerned were selected in consultation with ONADEF, the national partner charged with the development of C&I. They were selected to represent the kinds of experts likely to be available to carry out tests in the country.

We need to emphasise that the Kribi test was a special case in the CIFOR series of C&I tests. Whereas in previous tests there had been only one goal, i.e., evaluation of 1100 C&I with the aim of developing a 'minimum set' of C&I for the FMU concerned, in Kribi we had multiple goals in that we were evaluating the IFGM as well. In future, we expect tests to be aimed solely at developing appropriate C&I, thus eliminating the necessity for multiple teams.

To avoid introducing bias by 'coaching' one team more than others, we provided guidance on methods and goals only through briefing documents and at meetings where all 18 team members would be present. In previous tests in Indonesia, Côte d'Ivoire and Brazil the CIFOR support team's role had included a continuous interpretation of goals and methods, providing guidance to team members throughout the exercise.

The logistical and organisational demands of the six teams prevented any closer guidance to the teams than was provided. Because such evaluations of C&I cover vast knowledge and experience bases, the demands made by team members on support staff can seldom be anticipated in advance, calling for very high flexibility with respect to delivery of information and logistics.

Each team was provided with the following resources or information:

- a briefing book on the methods, including the sets of C&I that formed the 'base set' for evaluation;
- an introductory workshop on methods;
- information on suitable sites for field evaluation;

[6] Based on the CIFOR Côte d'Ivoire test.

- background information on the area and the forest management activities of the concessionaire;
- information on research carried out by the Tropenbos-Cameroon project, with access to the researchers and research reports concerned;
- information on policy, forest law and land-use in Cameroon through F. Medjo and J. Ntsengue Levodo from ONADEF and Direction des Forêts, and information on the Tropenbos research by W. van Driel and G. van Leersum from Tropenbos;
- from Day 5 copies of the draft Lammerts van Bueren and Blom (1997) paper were provided to the teams as a tool for organising the key issues into appropriate levels of the C&I hierarchy;
- a four-wheel drive vehicle with driver;
- access to guides, tree spotters and accommodation in the forest; and
- support of over 15 scientists and professionals in fields related to the management of forests.

The teams faced several major constraints.

- Travel time to the Tropenbos research sites from the hotel was not conducive to daily visits to the forest. However other forest areas were easily accessed.
- Because of the wet season no logging was taking place at the Tropenbos site (Wijma concession). However it was possible to witness logging activities in the aforementioned SOGENIC concession.
- A forest management plan was not available for the area; a situation currently typical for most Cameroonian forests.
- There was an unusual amount of illness during this test. At least seven personnel contracted malaria toward the end of the exercise.

2.5 Analysis Method

We base our analysis of criteria and indicators proposed by the teams mainly Form 1 and Form 2 (Annex B), used by all experts to record their evaluations. In addition we have consulted reports of team members and incorporated direct observation of the evaluation process. Our analysis of criteria and indicators will be both quantitative and qualitative, i.e., based on content. We ignore differences in formulation of C&I considered to be of a superficial nature only. Although the qualitative analysis is necessarily subjective, we have used this method previously with success (Prabhu *et al*. 1996). We concentrate on enabling a discussion of the following points.

- Content – how useful are the C&I resulting from the Kribi test?
- Replicability – are the results comparable?
- Duration – was the time provided adequate?
- Team strength – are three member interdisciplinary teams capable of reaching the goals set them?
- Team composition – what lessons can be learned from the Kribi test?

The analysis and discussion of replicability of results will be based first on a comparison among the C&I produced by the teams in Kribi, considering the duration of the evaluation process, and secondly comparison with the results of previous evaluations.

3. RESULTS AND DISCUSSION

3.1 Home-based Evaluation of Criteria and Indicators: Form 1 Data

In the first step of the C&I evaluation process, all 18 members of the six teams were required to assess a 'base set' of 220 C&I drawn from three sources: the African Timber Organization, the Dutch Working Group on Sustainable Forest Management (DDB) and a set compiled by the CIFOR project team. This first assessment was carried out individually by each expert at his or her home base. It was recorded on Form 1 (Annex B). Experts were required to reject C&I from the base set, if they were convinced these would not be relevant to the conditions prevailing at the site in Kribi. Doubtful C&I were to be retained. Table 2 summarises these results by teams and disciplines. The range of C&I retained after this first evaluation varied between only 54 in the case of the ecologist on Team 6 and 204 in the case of the social scientist on Team 4. The mean number of C&I retained from the base sets was highest for the social scientists with 153.8, followed by the foresters with 140.5 and the ecologists with 98.3, however these differences were not statistically significant due both to the small sample size and the high variance.

Table 2. Criteria and indicators accepted for further evaluation by team members based on Form 1 data

Teams	Forester	Ecologist	Social Scientist
T1	194	177	168
T2	108	97	97
T3	181	140	199
T4	160	57	204
T5	104	65	106
T6	96	54	149
Average	140.5	98.3	153.8
SE	17.56	20.58	18.52

T1=Team 1 and so on, SE= Standard Error

The Cameroonian experts tended to be more rigorous in discarding C&I from the base sets (mean: 111.7) than the non-Cameroonians (mean: 150.1), possibly because of their familiarity with the site conditions. However these differences were not statistically significant.

Interpretation of C&I in the base sets by teams

A classification of all C&I in the base set into one of the following four classes was required by the methodology: policy, social, ecology and management for production. We analysed this classification to determine whether there were broad differences in understanding among the experts. We found that at least two-thirds of the C&I were assigned to similar classes by experts independently of each other (Table 3).

There were however differences between the disciplinary groups, with ecologists agreeing least with each other (66.8% of the C&I examined by them bore the same classification), followed by the foresters (71.8%) and the social scientists (79.1%). We expect that given differences in background and experience, differences in interpretation among

individuals and groups are to be expected. It is however difficult to define the limits for 'an acceptable amount of variation in interpretation' based on our data alone. On the whole these data suggest that C&I in the base sets were interpreted in a similar manner.

Initial assessment of base sets

In deciding which C&I to retain for field testing and which to reject the experts were required to assess all 220 C&I against the four criteria listed in Table 4. Permissible scores were whole numbers between 1 and 5, where 1 = poor and 5 = very good. We provide the average scores of these 220 C&I for the assessment criteria by team in Table 4. It is important to note that the assessment exercise at this stage was not team based. Each expert carried out this analysis independently prior to the assembly of teams in Kribi. From Table 4 it is evident that members of Team 4 were on average the most satisfied with the base set, followed by Teams 5, 2, 6, 3 and 1. Based on these results we could expect that the final result of Team 4 to deviate least from the base set, as opposed to the set of C&I that would be proposed by Team 1.

Based on a classificatory analysis using Mahalanobis distances[7] of the scores in Table 4 we found that the teams could be grouped into four clusters. It is worth noting that there is no overlap between short duration (Teams 1-3) and the long duration teams (Teams 4-6).

Grouping of teams into clusters

Cluster 1	Team 1	
Cluster 2	Team 2	Team 3
Cluster 3	Team 4	Team 5
Cluster 4	Team 6	

C&I selected for field evaluation

On 28 October 1996 experts met for the first time and commenced work in the six teams for the rest of the test. They began a phase of intense interdisciplinary discussion on the C&I they would be prepared to evaluate as a team in the field. These discussions were focused on all 220 C&I in the base sets. In cases where the results of the home-based analysis did not lead to a definite conclusion, i.e., acceptance or rejection, teams were expected to reach a group consensus[8] on the relative merit of the criterion, indicator or verifier concerned. A similar consensus was required on the subject area of a criterion, indicator or verifier in the base sets,

Table 3. Classification of base set C&I on Form 1

Classes	**No. of issues classified similarly**		
	Foresters	**Ecologists**	**Social Scientists**
Policy	42	37	27
Social	26	40	50
Ecology	36	29	48
Management	54	41	49
Total	158	147	174
Percentage of total 220 C&I	71.8	66.8	79.1

Table 4. Average scores achieved by 220 base set C&I against four assessment criteria

	Closely related	**Easy to detect measure**	**A summary or integrative**	**Adequate response to stresses**	**Grand mean**
T1	2.3	2.4	2.2	2.2	2.3
T2	3.1	2.9	2.6	2.5	2.8
T3	2.8	3.1	2.7	2.1	2.7
T4	4.8	4.4	3.6	3.1	4.0
T5	4.2	3.0	2.8	2.6	3.2
T6	3.3	2.6	2.6	2.3	2.7
Mean	3.4	3.1	2.8	2.5	

T1= Team 1 and so on.

[7] Squared distances between class means based on the polled within class covariance matrix (see Kshirsagar 1972).

[8] Team 6 took a somewhat different approach to the other teams: they agreed that if even one of their members had rejected a criterion, indicator or verifier in the base set, then this would not be considered for field testing. This rather radical approach may have been one factor in determining the small number of C&I proposed finally by this team.

e.g., whether skid road damage was to be dealt with as a 'management' issue or whether it was more appropriate as an 'ecology' issue. As the purpose of this exercise was to match each expert's disciplinary background and experience to the portfolio of C&I he or she would evaluate in the field, the same issue was sometimes classified differently among teams. Ultimately teams allocated to experts the C&I most appropriate to their disciplinary background and experience.

The initial filtering process identified between 45 and 70 issues from the list of 220 for each team member to investigate: issues classified by the team as specifically relating to forest management, ecology or social science. Within these sets the individuals then eliminated duplication, issues they felt were beyond the scope of assessment at FMU level, and ones they felt unable to test in the available time. They were left with 10-50 C&I to work on. There then began a process of sharpening the focus of these, a process which tempted some into unproductive semantic juggling.

3.2 Field Evaluation of Criteria and Indicators: Form 2 Data

3.2.1 Background

Following the initial assessment of all C&I recorded on Form 1, field evaluation took place of all C&I identified in the discussions on Form 1 results. This exercise was recorded and structured based on Form 2 (Annex B). During this phase of the evaluation teams spent time in the forest, interviewed important forest actors and reviewed existing information. They were expected to defend their thinking first within their own team, then to the other teams of experts, then to the peer review group. This was particularly difficult if those involved did not have enough time to be fully confident in their own minds about some of the ideas they were starting to formulate. We provide an example of the entire process based on the field diary of Marie Mbolo, the ecologist on Team 4 (Table 5).

Table 5. Example of a field diary. Marie Mbolo, ecologist on Team 4, translation from French.

Dates:	Activities:	Remarks:
24-27 Oct.	Form 1 filled in at home base	
27 Oct.	Arrival at Hotel JULLY, Kribi	
28 Oct.	Presentation by Prabhu & Colfer (CIFOR) and Van Driel (Tropenbos)	Explanation of form 2 is quite unclear
29 Oct.	Presentation of Frederic Medjo (ONADEF), Joseph Tsengue (MINEF) and Gart van Leersum (WIJMA)	The English is too complicated for me.
29 & 30 Oct.	Analyse form 1. Merge the results Reject all C&I with value = 0 Discussion-Consensus with value = 0.33 - 0.66 Reject 20 C&I and keep 200 (*the rest*) Division into classes : E,F,M,P/F E : Marie S(P): Bertin Tchingankwa M,F(P): Laurent Debroux Individual selection of C&I	There was a long discussion before reaching the consensus whether to select or reject the C&I classification. An agreement/understanding at the end of the day. Many C&I are badly formulated, especially those from DBB. Several of which make no sense at all (e.g., 1.A.1 Typology, of what? Of forests or vegetation?)
	Filling of the first 2 cases of form 2 Interview with the resource people at MINEF and ONADEF on zoning plan in the new law, and ONADEF/CIFOR test coordinator in Cameroon:	Confusion between 'Initial experts & sources' General politics is not applicable in Cameroon case (e.g., (1) B.2.1 bureaucrats in control are often corrupt).

Table 5 continued

Dates:	Activities:	Remarks:
	- TSIMI MENDOUGA Jean Paul (ONADEF, Team Leader Tropenbos) - MEDJO Frederic (ONADEF/CETELCAF) - TSENGUE (MINEF / Direction des Forets)	Consultation with the local people before the management becomes effective (e.g., forests Loloundje-Nyong)
31 Oct.	Team Field Visit Visit the logging sites abandoned at WIJMA at 6 years and 4 months, undisturbed primary plot & experimental plot of Tropenbos at Ebom accompanied by Messrs. EBA'A, NJIB and ELATT (Botanist) Land, Forest botany, Natural regeneration in logging areas and in natural forest (roads and canopy openings, dispersion) Interview with Mr. EYA'A at Ebom about the local people's knowledge about flora/fauna, their dynamism and impact of logging	Regeneration is effective along the road where species, such as *Musanga cecropioides, Trema orientalis, Macaranga urifoliam, Hymenocardia heudlotii,* etc. which indicate a normal natural regeneration of the forest following a normal growth succession. Due to the road and log trails, one can easily reach forest to test C&I. Loggers must take into consideration the water course to preclude the stagnancy of water.
1 Nov.	Field visit with team 6.2.1.1 + 6.2.1.2 [*verifiers*]+ The Tropenbos experimental plan of action on the removal of vine and growth measurement.	The villagers always know whether a species is rare or not. They also use criteria of soil fertility or soil sterility. Vine cutting permits reduced opening of canopy.
2 Nov.	Field visit with other ecologists Sogenic: logging roads, improvement to natural regeneration, structure of the forest, impact of logging on soil, seasonal impact.	Logging during rainy season has bigger impact on soil. Leaving more space between skidtrails opens less of the canopy.
3 Nov.	Hotel JULLY Structuring C&I following the scheme proposed by CIFOR. The group general conceptual structure. Review of the document (CIFOR & Tropenbos) and general literature	There are problems on agreeing on the principles among the group. Many of the ideas were better understood allowing restructuring and reformulation of C&I.
4 Nov.	Hotel JULLY As on Nov. 3	
5 Nov.	Hotel JULLY Mid-point presentation of the structure by discipline and general structure to Ravi Prabhu and activities as on Nov. 3	Remarks by Ravi Prabhu on the restructuring of the ecological set and the pertinence or not of certain C&I and verifier.
6 Nov.	Hotel JULLY Setting of the definitive structure of common principles and criteria for Team 4 + activities no. 10.	It's necessary to spend a lot of time thinking.

Table 5 continued

Dates:	Activities:	Remarks:
7 Nov.	Field Leaving for Ebolowa and Meyo Centre accompanied by Laurent and A. KARSENTY Interview with M. ONDOUA. He's the provincial delegate of the environmental forest of the South & community forest and the forest Lokoundje/Nyong.	A lot of trouble reaching the logging zone (the hotel isn't very good, the food is disagreeable, ...) Notion of community forestry remains unclear or vague in Cameroon
8 Nov.	Field (continuation and end) Visit SHIMMER International, Malaysia, 3 month after logging in the Nloendom forest, logging infrastructure, method of removal. Interview the inhabitants of d'Akamessi (The Base of the SHIMMER International) on economic impact of logging. Interview M. Brevet (foreman of the SHIMMER International)	The roads are big, opening a lot of canopy and exposing the soil to erosion. The machine used compacts the soil a lot. The biological equilibrium is respected. (There are snails, and mushroom in the understorey). Raptors, top of the food chain. The company SHIMMER does not recruit local people except for many tention (guides, cashiers, skidder drivers). SHIMMER Intl. Makes too much wood waste.
9 Nov.	Hotel JULLY Reformulation of existing C&I Formulation of new C&I The final set of group 4	There is more clarity on the C&I set especially concerning verification
10 Nov.	Hotel JULLY Form 2	More clarity for filling in Form 2
11 Nov.	Hotel JULLY Final presentation to members of the team and support group	
12 Nov.	Typing of report.	

3.2.2 Quantitative analysis of the results of Form 2 data

In total the six teams proposed 19 principles, 103 criteria, 360 indicators and 139 verifiers for a total of 621 'issues'. However there was redundancy within some of the sets so that after analysis we reduced the total number of issues to 610. This formed the basis for all further discussion. Table 6 provides a quantitative overview of the final set of C&I proposed by each of the six teams. Two different approaches seem to have been adopted. Whereas Teams 1, 3 and 6 proposed a relatively small number of C&I as the 'minimum reliable set' for Kribi's forests, Teams 2, 4 and 5 proposed roughly twice as many. This trend is reflected to a lesser extent in the number of C&I sourced[9] from one of the three base sets. The main factor affecting the difference in quantitative output is the number of 'new'[10] C&I proposed by each team. Contrary to our expectations there is no discernible trend in the number of C&I between short duration teams (Teams 1-3) and long duration teams (Teams 4-6). This also holds true when the C&I are classified according to subject areas in the lower half of Table 6.

[9] These are C&I which teams cited as being based on existing C&I in the base sets. They may have subsequently been modified.

[10] These are C&I which were cited without a source in one of the base sets.

It is important to note that teams were instructed to give C&I related to policy matters, i.e., factors extraneous to the FMU, the lowest priority among the four subject areas because there were no policy experts on any team and time was a major constraint. In Table 2 we suggested that members of Team 4 appeared most satisfied with the base sets. We find that in absolute terms this trend has been continued in Table 6 with 77 C&I being sourced from the base sets. However Team 4 was second only to Team 5 in the number of 'new' C&I they proposed. Obviously they felt there was a need to complement the base sets.

Table 6. Quantitative overview of the C&I proposed by the six teams

	Team 1	**Team 2**	**Team 3***	**Team 4**	**Team 5**	**Team 6**
Total C&I	62	144	51	167	144	42
New[10]	14	74	8	90	93	4
Sourced[9]	48	70	43	77	51	38
Total Ecology	23	53	0*	55	43	14
Total Management	19	39	14	57	28	6
Total Policy	6	21	12	3	42	11
Total Social	14	31	25	54	31	11

*No ecological C&I were evaluated during the Form 2 exercise due to the illness of the ecologist.

Time spent on Assessing C&I

To understand why the amount of time provided to the teams had not resulted in significant differences in the numbers of C&I proposed, we calculated the average time a team spent on evaluating each item in the C&I sets they proposed. We assumed that for the Form 2 exercise the short duration teams (Teams 1-3) had roughly five days and the long duration teams (Teams 4-6) eleven days. Each team was assumed to have had an 8-hour working day, although this is probably an underestimate.[11] We did not take into account constraints arising from language difficulties or illness. Following these assumptions we found that Teams 1, 3, 4 and 5 spent about the same amount of time evaluating C&I. Teams 2 and 6 had markedly different results. Team 2 spent less than half as much time on assessing the C&I they proposed as compared to the other two short duration teams.

	Short duration teams			**Long duration teams**		
	Team 1	Team 2	Team 3	Team 4	Team 5	Team 6
Minutes spent assessing each C&I	116	50	94	95	110	377

Although Team 2 ended their field evaluation work at the same time as the other two short duration teams, they only handed in their reports at the same time as the long duration teams (Teams 4-6). Thus they actually took an intermediate position between the short and long duration teams in terms of the amount of time spent evaluating C&I. Team 6 is the other exception to this trend. In this case the team made a conscious effort to restrict themselves to the very minimum number of C&I possible, and decided as a team that they would avoid introducing new C&I as far as possible (see Table 6). It is obvious that Teams 2 and 6 adopted diametrically opposite strategies. These results underscore how the composition of the teams can influence the effective amount of time available for assessment.

Use of Base Sets

Of the three base sets, the ATO base set was sourced most frequently in absolute terms. It was also the set that showed the greatest utility for the teams, an average of 35.1% of the C&I in the ATO set were used by the teams (Table 7). The compiled set followed with 29.4% and the DDB set was the least used with only 15.2% of the C&I being sourced. It should be noted that the statistics provided in Table 7 refer only to sourcing as stated by the teams. The overall convergence of the proposals made by the six teams and the base sets may well

[11] Although Team 1 in their report specifically mention the importance of maintaining a regular 8-hour day for their overall productivity.

Table 7. Use of the three base sets as sources for C&I proposed by the six teams

	Total C&I	**Percentage Used by Teams**							
		Team 1	Team 2	Team 3	Team 4	Team 5	Team 6	Avg.	Std. Dev.
ATO	92	40.2	40.2	23.9	41.3	27.2	38.0	35.1	7.6
DDB	68	39.7	23.5	2.9	11.8	5.9	7.4	15.2	14.0
CS	60	31.7	40.0	28.3	41.7	18.3	16.7	29.4	10.5

Avg.= Average, Std. Dev. = Standard Deviation

be higher as some 'new' C&I proposed by the teams converged on C&I in the base sets in the course of iterations, even if they were very different initially.

Convergence of C&I proposed by Cameroon Test teams

One of the principal reasons for fielding multiple teams during the Cameroon test was to determine whether, and to what extent, varying the composition of the teams would also affect the C&I they propose. In order to determine the degree of commonality among teams we classified all the C&I according to a set of keywords. Similar issues were allocated the same key word. Iterative sorting and reclassification was carried out until we were satisfied that all had been correctly classified. The classification process was subjective as it required interpretation of the C&I. We tried to remain faithful to the authors intentions in interpreting C&I however, in order to build groups of C&I around common issues, some liberty of interpretation was necessary in some cases. By sorting the C&I from all six teams according to these keywords we were able to determine which issues were held in common amongst teams (Table 8).

Table 8 is best understood using an example from the first row: Whereas 79% of the C&I proposed by Team 1 were to be found in the proposals of any one of the other five teams, only 50% were held in common with three or more teams, based on the keywords used. There is a weak negative correlation (-0.896) between the number of C&I proposed by a team and their degree of commonality as expressed in the second column of the table. Team 6 has the highest degree of commonality and Teams 2 and 5 the lowest depending on whether the focus is on the second or third column of the table.

In Table 9 we examine the extent to which each team has covered the 163 keywords assigned to the Cameroon C&I. We stress that the keywords were assigned after a subjective analysis of content of the C&I. A different set of keywords may result in a different coverage. However as a second analysis of commonality in Table 9 will show, rankings of the degree to which the issues concerned were covered remain quite stable. The exceptions being Teams 1 and 6 which exchange rankings.

Table 8. Commonalities among Cameroon test teams

Teams	**% common***	**% common > 3^{+}**	**Total C&I**
Team 1	79.0	50.0	62
Team 2	77.8	31.3	144
Team 3	88.2	45.1	51
Team 4	79.9	33.7	167
Team 5	72.9	25.0	144
Team 6	92.9	57.1	42

* Common with at least one other team
+ Common with at least three other teams

Content similarity with previous tests

We also analysed the degree to which the 49 commonalities identified during Phase 1 (Annex H) were covered by the Cameroon test teams. We were interested in establishing only whether a commonality had been covered by the six teams, not the number of times it had been done by the same team. We found that the difference between the highest and lowest degree to which these commonalities were covered was quite considerable at 37% (Table 10). Whereas Team 4 covered roughly 80%

of the issues listed as commonalities, Teams 1 and 3 had much lower degrees of coverage, i.e., 43% and 47% respectively. In the case of Team 3 it must be recalled that they were unable to propose any ecological C&I. All 49 commonalities identified in previous tests were covered by the consolidated results of the Cameroon teams.

Table 9. Coverage of keywords by Cameroon test teams.

C&I		Keywords covered by each team					
		Team 1	Team 2	Team 3	Team 4	Team 5	Team 6
Of 163 keywords assigned to Cameroon C&I	Absolute No.	41	69	34	81	74	28
	%	25	42.3	20.9	49.7	45.4	17
	Rank	4	3	5	1	2	6

Influence of test duration on coverage of commonalities

To determine whether duration of field evaluation had an influence on the level of convergence, we examined the extent to which the 49 issues listed as 'commonalities' in Prabhu *et al*. (1996) were covered by the Cameroon teams. Teams 1-3 were in the short duration group (SG) and Teams 4-6 were in the long duration group (LG). If the majority of teams in a group had proposed a C or I related to one of the 49 commonalities, it was considered to have been covered by the group.

Table 10. Coverage of the Phase 1 commonalities by Cameroon test teams.

C&I		Commonalities covered by each team					
		Team 1	Team 2	Team 3	Team 4	Team 5	Team 6
Of 49 C&I listed as 'Commonalities' by Prabhu *et al.* (1996)	Absolute No.	21	33	23	39	34	29
	%	43	71.4	46.9	79.6	69.4	59
	Rank	6	2	5	1	3	4

Thus SG covered 29 of the commonalities or 63.3%, whereas LG covered 40 commonalities or 81.6%. The SG teams used 5 days, and the LG Teams 11 days for the Form 2 exercise. Furthermore during Phase 1 tests (TPh1) the teams required roughly 22 days for this part of the whole exercise. Using an estimate, it is possible to demonstrate that the duration of testing affected the extent to which the commonalities were covered and that the rate of improvement tends towards zero with time.

> We set the coverage value for TPh1 at 100% since all 49 commonalities were covered by these teams. The average rate of daily improvement[1] between SG and LG can be calculated as:
>
> (81.6%-63.3%)/(11 days – 5 days) = 3.1% per day.
>
> This is about 1.8 times higher than the improvement between LG and TPh1 calculated at 1.7%. This suggests that the improvement made during the six day difference between the short and long term teams was as important to the development of the C&I as the 11 day difference between LG and TPh1.

Thus although the composition of the teams was the most significant factor, the duration of the evaluation also made an important contribution towards determining content.

In both the Phase 1 tests and the Cameroon test eight assessment criteria were used to evaluate all C&I proposed during the Field evaluation (Annex B). The resulting scores represent a self-evaluation as they are essentially an assessment by each expert of the C&I they proposed. Comparing the assessments by teams during the Cameroon test with those of the teams in the Phase 1 tests (Indonesia, Côte d'Ivoire, Brazil) in Table 11, we find that the

[12] The rate of linear daily improvement for the first 5 days can be shown to be 12.7% (63.3/5).

Table 11. Average scores of C&I proposed by Cameroon and Phase 1 teams for eight assessment criteria

	Social	Management	Ecology
3 Phase 1 teams (15 experts)	4.0	4.0	4.1
6 Cameroon teams (18 experts)	3.4	3.3	4.1

average scores for the eight assessment criteria used were lower for Social and Management C&I in the case of the Cameroon test. The scores for ecology were the same. Our interpretation therefore is that, with the exception of the ecological C&I, the Cameroon teams appeared to be less satisfied with their own results compared to the teams in Phase 1. We believe this is a direct consequence of the shorter duration of the Cameroon tests.

3.2.3 Content analysis of C&I proposed by the teams

In order to facilitate a comparison of the results of the Cameroon test with those of previous tests, we use the framework of principles and criteria identified as 'commonalities' in Prabhu *et al*. (1996) as far as possible. Accordingly Section 3.2.3.1 is concerned with ecological C&I related to resource sustainability, the demand-production-supply relationship is covered under Section 3.2.3.2, and Section 3.2.3.3 deals with the 'social' issues of supply and access. Most policy-related C&I have been discussed under Section 3.2.3.2 together with management for production. As there were no policy specialists on the Cameroon teams the assessment of such C&I received the lowest priority, and are not treated separately.

Verifiers included in the synthesis lists in the following sections do not always reflect a consensus amongst teams. Instead we included verifiers because we felt they were either particularly useful for an assessment of sustainable forest management, usually because of their ease of measurability, or because they added meaning to the indicators.

The content analysis was based on classification of the 610 C&I proposed by the six teams according to appropriate keywords. We stress that the synthesis tables have resulted from an *ex post* analysis, they do not necessarily represent a coherent whole. Despite this we have sought to present them in a manner that is consistent with our aim of identifying an operational set of C&I for the Kribi forests. In presenting the C&I in the following sections we have tried to restrict editorial changes to the minimum necessary for clarity.

We suggest that the C&I proposed by the Cameroon teams can be best understood by placing them in the framework provided by Figure 1. This is an adaptation of a needs-demand-production-supply-distribution relationship, where needs, production and distribution have been expressed as well-being, 'management', supply of benefits and access to each respectively.

3.2.3.1 Ecological C&I

We found that all the commonalities listed in the Phase 1 report (Prabhu *et al.* 1996) are listed in Table 12.[13] This overlap with the Phase 1 results has also influenced the way we present the Cameroon ecological C&I. They are organised into one principle that covers the maintenance of ecosystem integrity and the three criteria related to maintenance of ecological functions, biological diversity and the capacity for natural regeneration. Only two teams proposed the principle on ecosystem integrity (Table 12). Several teams did not propose any principle at all, preferring to concentrate on criteria, indicators and verifiers (Annex C). The table shows the issues identified as being common and indicates in which sets they were contained. In some cases an issue is the synthesis of more than one indicator or verifier.

It is not always easy to separate the ecological C&I from those related to management for production. In this section we have tried to include only C&I which provide direct information on impacts on the ecosystem or the response of the ecosystem to these impacts. However we have not been entirely consistent as we also include indicators and verifiers related to the establishment of protected areas

[13] We have placed the Phase 1 indicator related to the need for interventions to be highly specific as a verifier within the framework of management for production in Section 3.2.3.2. As a result it is not to be found in Table 12.

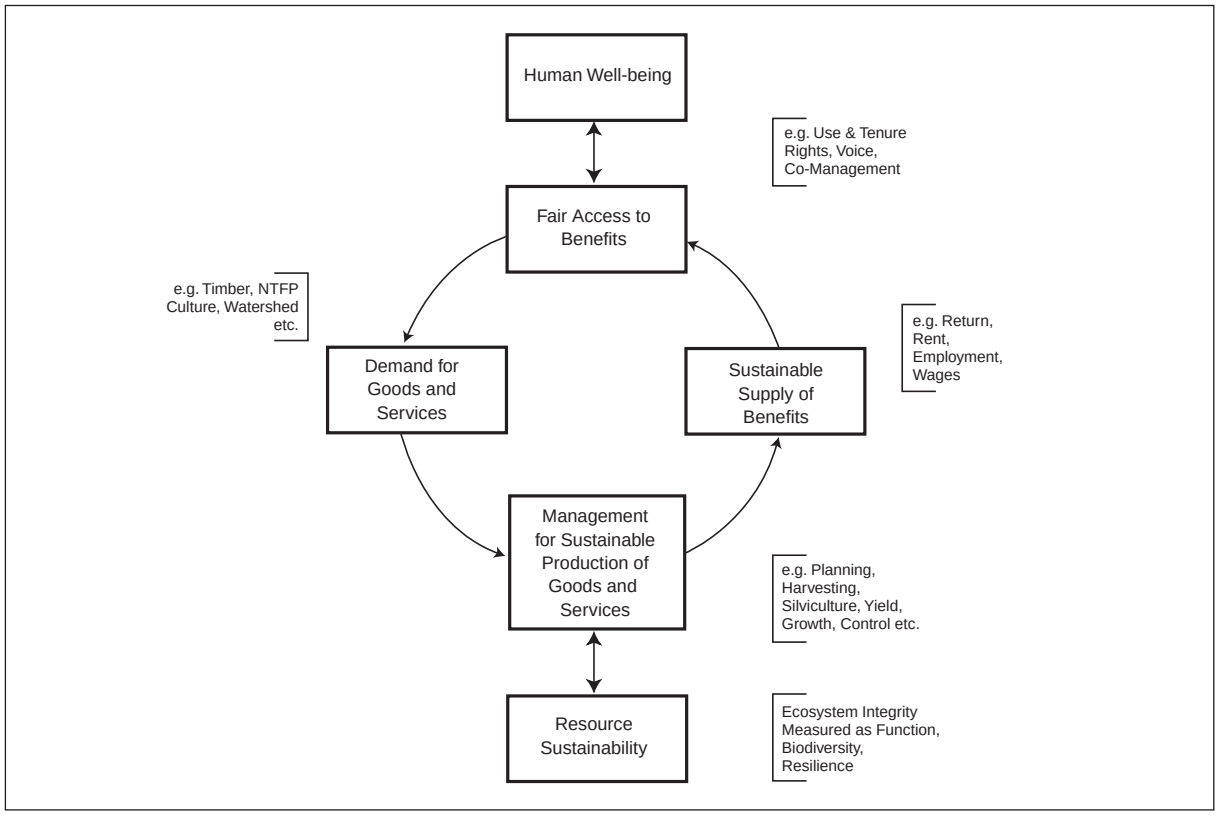

Figure 1. A framework for C&I for sustainable forest management.

or the monitoring and mapping of species, although they are clearly management activities. We included them here as it seemed more appropriate to discuss such issues within the context of the ecological criteria they ultimately serve.

The ecologists on the Cameroon teams were more successful than previous teams in their ability to develop verifiers for the indicators. It was perhaps this success that underlies the positive self-assessment reported in Table 11. A large number of verifiers were proposed of which only a few are presented in the table below. Particularly useful for the development of verifiers were field visits involving all six ecologists. These visits resulted in general discussions on forest condition following different types of impacts leading subsequently to the identification of verifiers. However the main influence on the ecologists' ability to specify verifiers was the fact that identification of criteria and indicators was for the most part relatively easy as they were following similar conceptual frameworks. Team 3 did not propose any C&I related to ecology as their ecologist was unable to complete the test.

Forest ecosystem function

There was a high degree of consensus on the need to maintain forest ecosystem functions. Although Team 2 did not formulate a criterion to this effect, they did in fact cover all the important forest functions through the indicators and verifiers they proposed so that, in effect, they too underscored the importance of forest functions. Team 6 on the other hand identified the criterion but not several of the indicators. This team took a more prescriptive approach suggesting instead that control of skidding activities and the setting up of buffer zones along water courses would in the main help minimise impacts on soil and water conservation (Annex C).

Erosion was dealt with in several different ways by all teams. In some cases the verifiers sought to determine the area of soil affected by erosion (Teams 2 and 4), in other cases (Teams 5 and 1) the formulation was more general as shown in Annex C. Team 6 defined a prescriptive verifier which sought to control skidding.

Water quality and quantity was again subject to a high degree of consensus. As in previous tests

Table 12. Synthesis of common ecological principles, criteria and indicators with selected verifiers.

Indents indicate the hierarchical level, where P = principle, C = criterion, I = indicator, V = verifier.

Issue P C I V	T 1	T 2	T 3	T 4	T 5	T 6
Maintenance of Ecosystem Integrity				✓		✓
The main ecological functions of the forest are maintained	✓			✓	✓	✓
Production capacity of the soil is maintained	✓	✓		✓	✓	
Ten centimetres of black lumpy soil mixed with tattered leaves					★	
Erosion from skid trails and roads is within acceptable limits	★					
Streams and rivers are not depositing increased amounts of silt at monitored sites where deposition naturally occurs	★					
Water supply and quality is not adversely impacted	✓	✓		✓	✓	
No inadvertent ponding or water logging in FMU		★		★	★	
Water quality (suspended solids and mineral content) is not deteriorating at monitored 'choke points'	★	★				
Stream flow (low flow and high flow) is consistent with norms and is not changing	★					
No chemical contamination to food chains and ecosystems				✓		✓
Area and percentage of forest land managed primarily for protective functions (e.g., watersheds, flood protection, avalanche, riparian zones) are well defined and delimited on maps and in the field	✓	✓		✓		✓
Area and percentage of forest land actually managed primarily for protective functions		★				
Proportion of area of permanent production in areas of environmental protection		★				
Impacts to biodiversity of the forest ecosystem are minimised		✓		✓		✓
Shape, location and design of forest compartments attempt to minimise current and future edge effects due to forest fragmentation				✓	✓	
The structure of the forest is similar to the natural forest		✓		✓	✓	
Secondary forest canopy is multistrata; 4 to 5 distinct layers beneath a 'dominant' overstorey which provides 80% land cover per hectare.		★				
Visibility and easy moving within the forest is maintained naturally (i.e., small number of herbaceous species in the understorey)				★		
There is no gap in the size class distribution					★	
Lianas remain below 20% cover in the subcanopy layer of the forest	★					
Regenerated overstorey is comprised of the same number of species as in undisturbed forests		★				
Big (large diameter) trees can to be found in the forest		★				
Infestations of 'alien weed' species do not exceed 15% of the forest area	★					
Number of plant species composing the litter layer in regenerated forest is similar to that in undisturbed forest		★				
The presence of pollination insects and animals (e.g., bees, butterflies) in the forest and surroundings				★		
Presence in the rivers and streams of benthic species (e.g.:, molluscs, gastropods)				★		
Canopy opening is controlled so that light-demanding species are not more abundant than in natural gaps	✓	✓		✓	✓	

Table 12 continued

Issue P C I V	T 1	T 2	T 3	T 4	T 5	T 6
Light-demanding (i.e., pioneer) species do not form dense stands within the forest				★		
The ratio of gap phase: shade-tolerant tree species in the forest remains constant	★					
Canopy gaps within the forest do not exceed 15% of area	★					
Roads are narrow to minimise the effect of canopy opening				★		
Rare or endangered species and habitats protected	✓	✓		✓	✓	✓
Existence of maps, data/information indicating distribution and vital areas of endangered, rare, endemic or indicator species	★	★		★	★	
The capacity of forest for natural regeneration is ensured		✓		✓	✓	✓
The biomass or the number of harvestable trees per hectare is maintained at the level of natural forest					★	
Seedlings of all forest species (harvested and non-harvested) are found in the understorey of the forest or in natural and artificial gaps				★		
If enrichment planting carried out in logged forests, it is with species that were harvested in the forest		★		★	★	★
Zones of biological protection where no interference is authorised are created in the permanent estate forest and well delimited in the field.		✓		✓		✓
Corridors of uncut forest based on stream sides with links up slopes and across ridges to connect adjoining catchments and forest areas which will not be harvested are retained		✓		✓	✓	✓
Animal species which are negatively impacted (due to logging or hunting) during the exploitation period maintain their ability to recover and exist as viable populations in the area	✓	✓		✓	✓	
Village harvest of wildlife species (for consumption and sale) changes by less than ± 10% during the logging process/period		★				
Wildlife map (1:20,000) with movement/migration routes					★	
Data/information (species lists) on fauna in the forest are available	★					

Note: ★ verifiers are selected subjectively

ponding and waterlogging were considered to be very effective means of determining whether the water regime was being adversely affected by forest management. This is reflected in Table 12. Two teams suggested verifiers based on monitoring. While monitoring of water quality and quantity is still not widely practised in most tropical moist forest regions including Cameroon, there is an increasing tendency to introduce such activities. Thus this verifier is likely to be increasingly important in future as such data become available.

Only two teams identified the need to prevent chemical contamination to food chains and ecosystems. This is probably because the use of such chemicals in Cameroonian forests is currently very restricted. Both teams were reacting to perceptions of possible changes in the management system. It is interesting to note that this was not an issue in the ATO set of C&I.

The subject of protected areas was dealt with in several ways and under different headings by the teams. The ecological C&I were covered in the issues of areas for soil and water protection, biological protection and establishment of corridors. It is also addressed in the section on management C&I.

Biodiversity

There was less general consensus on this criterion and related indicators than for the criterion on forest

ecosystem function. This is because the assessment of biodiversity was considered to be fraught with several conceptual problems: its operational definition, baselines and what might constitute an 'acceptable' impact. There was however widespread consensus on the need to ensure the protection of rare and endangered species and that this was an effective indicator of the diversity and structure of natural forests.

Less agreement was found on the indicator related to forest structure. Teams 1 and 6 apparently did not consider this to be an important indicator. However Team 1 did propose verifiers related to structure (Table 12). Whereas some of the verifiers are immediately applicable to any condition of forest management, such as the verifier related to visibility in the understorey or large diameter trees, others require some data collection and analysis before they can be used.

Canopy opening was considered an important indicator by four of the five teams involved. Verifiers range from using the presence of light-demanding pioneer species to indicate the effect of canopy opening, physical determination of the area of canopy gaps, to restrictions in infrastructure design and implementation. Although several methods exist for the determination of canopy gap size, such as the use of densitometers or hemispherical fish-eye photographs (e.g., Mitchell and Whitmore 1993), this is not an easy verifier to apply under conditions where the appropriate data collection and analysis capacities are not available.

Capacity for natural regeneration

This criterion relates to the resilience of a forest ecosystem, i.e., its ability to recover after impact. Four of the five teams concerned agreed explicitly on its importance. Other areas of consensus include indicators on zones for biological protection, the existence of corridors and the resilience of animal species to human pressure. Most teams devoted several verifiers to the assessment of impacts on the fauna, prompted both by the perception of their ecological importance and their role in meeting subsistence and cash needs of local people.

One issue that was considered important was the question of enrichment planting, included here as a verifier. This was debated in all teams and the consensus was that exotics should not generally be used if enrichment planting were to be deemed necessary, because they change the structure of the forest and could potentially affect the regeneration of other species. Obviously this verifier applies equally to the criterion on biodiversity. The same applies to the verifier on the biomass of harvestable trees, as it relates both to structure (i.e., biodiversity) and presence of seed sources (i.e., natural regeneration).

Other issues

There were a number of proposals for C&I that did not fit comfortably under one of the three criteria mentioned above. Most of these related to traditional shifting agriculture or agroforestry within forests. These C&I recognise that forests are managed for a variety of functions including their ability to provide nutrients to regenerate agricultural plots during fallows, or to maintain productivity over long periods of time in agroforestry systems. They also recognise the need to monitor the relative benefits of different kinds of forest management and the competition between these uses in terms of area. Indicators and verifiers of this nature were proposed by Teams 2, 3, 4 and 5 (Annex C). In the case of Team 3 the proposal was made by the social scientist.

Teams 1 and 2 also proposed indicators and verifiers related to the nature and sources of ecological information. The assumption was that if the information exists and is used by the relevant stakeholders, the resulting management decisions are more likely to lead to sustainable forest management than otherwise.

3.2.3.2 C&I related to management for production of goods and services

In this section we present both policy level C&I, i.e., those that are outside the control of forest managers, and forest management unit (FMU) level C&I. Most of the issues listed in Tables 13&14 are of a prescriptive nature. This is hard to avoid as management itself is based on sets of prescriptions.

Policy

Earlier we pointed out that policy was accorded the lowest priority as we did not have the relevant specialists on our teams. Another reason was that our focus was on the FMU level. Nonetheless several teams did propose C&I related to policy aspects, which we present here as a synthesis. Once again we have allowed ourselves to be guided by the structure of the commonalities in the Phase 1 report.

Six indicators emerge as being important: appropriate funding, a proper land-use plan, existence of a permanent forest estate, up-to-date information, an efficient forest service and efforts by the

government to reduce extrasectoral pressures on forests (Table 13). Worth noting are two issues, declared here as indicators, related to forest industries' stable access to resources and their installed capacity for transformation or production. Although both of these were proposed by only one team each, we feel they are important enough to merit inclusion in the synthesis.

Table 13. Synthesis of common principles, criteria and indicators and selected verifiers related to policy-level aspects of sustainable forest management that affect the FMU

Indents indicate the hierarchical level, where P = principle, C = criterion, I = indicator, V = verifier

Issue P C I V	T 1	T 2	T 3	T 4	T 5	T 6
Sustainability of the Forest and its Multiple Functions is a High Political Priority					✓	
The government has clear forest development objectives and realistic action plan to meet them		✓			✓	✓
There is a mechanism for sustained and adequate funding for the management of Government forests		✓	✓		✓	✓
Government has a special fund for financing of forest management activities					★	
Total amount of forest taxes compare favourably to the amount of the fund					★	
[Financial] Incentives exist for long-term forest management				★	★	
Land-use planning indicates allocations for different forms of land use in relation to forest categories	✓	✓	✓	✓	✓	✓
There is a permanent forest estate governed by laws and regulations which are the basis for its sustainable management	✓	✓			✓	✓
The government has a system of reliable, adequate and updated information on the forestry sector (especially a national forestry inventory) which enables the government to update its action plans and adjust the means of implementation	✓	✓			✓	✓
Forestry industries are guaranteed stable access to wood resources for a period corresponding at least to the period of rotation				✓		
The transformation capacities (volume of raw material input in the first and second transformation) are voluntarily limited in order to avoid general over-capacities at the national level [14]					✓	
There is a forestry service in charge of the management of all the forests with sufficient human and materials resources to fulfil its mandate		✓	✓	✓	✓	
Mechanisms exist to cope with pressures on the land for non-forestry uses to maintain the long-term integrity of the managed forests	✓	✓		✓	✓	
A national environmental quality policy exists		✓			✓	
At the international level, the government has ratified or approved treaties conventions or recommendations on sustainable development of forests issued especially by such organisations as ILO, CITES, ITTO, FAO, UNCED					✓	✓

Note: ★ verifiers are selected subjectively

[14] This was the subject of much controversy within Team 5, both because of the content and because it was so obviously outside the scope of the FMU. However it was agreed that there was a strong correlation between over capacity and over harvesting.

FMU

The synthesis of our analysis of the FMU-level C&I is organised to fit with a management systems approach which cycles through objectives setting, planning, implementation, control and protection with feedback loops (Table 14). A similar organisation of results was used by several of the teams.

Although only the three long duration teams were explicit that the need for forests to be managed for sustainable production is a principle, it is safe to assume that all six teams were operating to the same broad principle. Interestingly, issues related to the legal basis for forest management, its duration and broad objectives were consistently recognised as being important only by Team 5. Team 4 did however focus on the issues of objectives and duration of concession. It is surprising that none of the other teams considered these issues to be important. Perhaps the absence of any formal management plan and recognisable planning process for the area distracted the other teams from these important issues.

Planning

All teams agreed on the importance of planning and management plans for the forest concessions. Several verifiers were proposed of which only a few are included here. The need to codify harvesting standards was recognised explicitly by four teams, however Team 5 included a verifier on FAO standards which in effect dictate how to determine codes of best practice. Team 1 covered codes of practice along with other items in Indicator 6.1 (see Annex C).

There was considerably less consensus on C&I related to yield regulation. This is possibly because, until very recently, only about 1-2 trees were being harvested per hectare. The impact on yields was perhaps deemed negligible. However timber utilisation is being intensified and planning and regulating yields is of high priority, if such intensification is to be sustainable.

Indicators related to guidelines for harvesting non-timber forest products (NTFPs), revision of management plans and approval by the minister in charge of forests were supported by half the teams. The indicator in Table 14 requiring the approval of planning by the Minister in charge of forests was also proposed by the Côte d'Ivoire team of the Phase 1 tests and reflects the need to ensure security of access to the resource and appropriate involvement of senior levels of government in the management process. About 18 C&I in the proposals of the six teams were devoted to the issue of NTFPs. There was a general consensus that NTFPs were extremely important for the local communities and that they were currently poorly managed and badly marketed.

Implementation

Major areas of focus under the criterion on implementation are on infrastructure, marking and mapping of trees, the felling and work programmes, and efficiencies of utilisation. Skidding damage is also an area of priority and was identified as such also in the ecological C&I (Section 3.2.3.1). Silviculture was supported by only half the teams, perhaps because currently silvicultural interventions are rare and the theoretical basis in such forests uncertain. The related issue of rehabilitation of degraded areas received an equal amount of support, albeit from a different combination of teams. The issue of zoning was considered important only by two teams, possibly because of the inherent difficulties and expense of carrying out a proper zoning exercise.

Several verifiers focused on the need to suspend logging activities during periods of heavy rainfall. Some even suggested suspending logging activities during the rainy season. Indeed this was the case with the Wijma concession. On the other hand, logging was continuing in smaller and institutionally different concession areas with quite drastic impacts on the soil.

Monitoring and control

There was a high degree of agreement on the need for effective monitoring and control, and the related need for proper documentation and record keeping. This extends also to the maintenance of spatial records such as in maps. The indicator relating to environmental maps was defined by some teams for the policy level (indicated with a 3 and 'p' in the relevant field of the table). We include them here for better comparison. Two other indicators related to information functions, i.e., inventory and research, were proposed by four teams each. Only half the teams recognised the need to protect harvested units from external disturbance. This is surprising but may be explained by the fact that there was a perception that impacts were still relatively minor because of relatively low population densities.

Table 14. Synthesis of common principles, criteria and indicators with selected verifiers related to sustainable management for production of goods and services.

Indents indicate the hierarchical level, where P = principle, C = criterion, I = indicator, V = verifier.

Issue P C I V	T 1	T 2	T 3	T 4	T 5	T 6
FMU						
Forests are Managed for a Sustainable Production				✓	✓	✓
Forest management unit is implementing forest management on the basis of a legal title on the land, recognised customary rights or suitable lease agreements		✓	✓		✓	
Duration of the concession takes into consideration the felling cycles				✓	✓	
Objectives of management are well determined and clearly stated				✓	✓	
Management planning involves all stakeholders and takes into account all the components and functions of the forest such as timber production, NTFPs, ecology and well-being of the local population	✓	✓	✓	✓	✓	✓
A management plan has been established for the sustainable management of the forest taking into account all its components and functions such as timber production, other forest products, contribution to the well-being of the local people, ecology	✓	✓	✓	✓	✓	✓
The management plan looks beyond the second cutting cycle	★					
There is evidence of inclusion of the local population in the management plan design	★					
Harvesting standards are explicit and cover key issues *(such as minimum number of large trees to be retained per ha and species, maximum number of trees to be removed per ha, the minimum exploitable diameter for each species, minimum number of large trees to be retained as seed producers [mother trees] per ha and species)*		★	★	★		★
Harvesting codes are comparable with FAO standards for best forest management					★	
Yield regulation by area and/or volume prescribed compatible with sustainable production of the forest			✓		✓	
Allowable annual cuts, minimum exploitable diameters, maximum number of trees to be harvested per hectare are specified					★	
Guidelines for rational harvesting of NTFP are defined and put into practice		✓	✓	✓		
Management plan is periodically submitted to revision	✓			✓	✓	
The felling cycle is specified based on growth rates, minimum exploitable diameters and lower diameters measured during inventory					★	
The management plan is revised and approved every five years	★					
Management plan is approved by minister in charge of the forest	✓				✓	✓
Implementation of management is conducive to sustainability (Management plan is effectively implemented)			✓	✓		✓
The forest unit is zoned into areas to be managed for various objectives	✓				✓	
Boundaries are marked on the field		✓		✓	✓	
Infrastructure for logging is designed, established and maintained in such a way that negative impacts on the environment are minimised		✓	✓	✓	✓	
Rational infrastructure required for logging is made permanent		★		★		

Table 14 continued

Issue P C I V	T 1	T 2	T 3	T 4	T 5	T 6
Road and tracks network within the forest management unit is minimised				★		
Trees to be protected as seed crop and potential crop trees are plotted on a map and conspicuously marked prior to felling		✓	✓	✓	✓	
The felling and work programme is operational, clear and realistic. Each harvest is subject to prior validation and decision	✓	✓		✓	✓	✓
Reduced impact felling specified and implemented				★		
Logging activities are suspended during heavy rain periods		★				
Skidding damage to trees and soil minimised		✓	✓	✓		
Guaranteeing the continued production and harvest of other forest products by means of silvicultural systems			✓	✓		✓
Interventions if applied, are highly specific to the individual tree level, instead of to species or whole stand						★
Tree growth rates (at monitored sites) are not declining	★			★		
Rehabilitation of degraded and impacted forest is undertaken in accordance with a code of practice	✓	✓			✓	
Workers and staff of economic operators have adequate training to implement management				✓		
Efficiency of systems of production and transformation of forest products	✓	✓		✓	✓	
No saw logs remain rotting in the forest, at landings or the port		★				
The volume of output is maximum at each step of the wood chain				★		
Use of sawmill wastes				★		
Domestic recovery rates for each line of products (within the 1st and 2nd transformation) bear comparison to regional or international rates					★	
A wide range of NTFPs is effectively marketed				★		
Effective mechanisms of monitoring and control guarantee implementation of law and management plan.	✓	✓	✓	✓		✓
Documentation and records of all management activities are kept in a form that makes it possible for monitoring to occur	✓	✓	✓	✓	✓	
Field control of timber production is effectively implemented				★		
Control of the harvest and sale of NTFP by the forestry service and/or local communities				★		
The extent to which ecosystems, vegetation types and species are specified is shown on environmental maps	✓	✓ p	✓ p	✓	✓ p	
Inventory of all forest uses and forest products is available	✓	✓		✓	✓	
Pre-harvest inventory satisfactorily completed according to national standards			★			
Continuous forest inventory plots are established and measured regularly		★		★		
NTFPs and their uses are identified			★			
Results from monitoring and research and other new scientific and technical information are incorporated into the implementation and revision of the management plan			✓	✓	✓	✓
Harvested forest units are protected from fires, encroachment, premature re-entry and other types of disturbances		✓	✓		✓	

Note: ★ verifiers are selected subjectively

Table 15. Additional issues proposed by Cameroon teams related to economic sustainability

Issue	T1	T2	T3	T4	T5	T6
Government rent from forest exploitation is indexed to the value of timber products		★				
Rate of return and pay-back period of logging companies is compatible with the exploitable timber regeneration period		★				
Vertical integration of the economic operators is optimised at each step of the value adding process				★		
A wide range of NTFPs is effectively marketed				★		
Efficiency gap between domestic transformation units and international standards					★	

Note: ★ verifiers are selected subjectively

Other issues

Team 2 proposed an indicator that reflected the need for intersectoral collaboration at the policy level. Teams 2, 4 and 5 devoted considerable attention to issues of an economic nature.[15] We list here a selection of such issues (Table 15), in addition to those mentioned previously. Most of these indicators or verifiers relate to the policy level and not to the FMU. The issue dealing with vertical integration is somewhat controversial, as vertical integration has not demonstrably led to sustainability anywhere. In fact there are several examples of it having an opposite effect. However stress has been laid on the need for optimisation of the process. We include it here essentially to provoke discussion.

In five indicators and verifiers Teams 2 and 5 focused on the issue of plantations (Annex C). Whereas some of these were more ecological in nature others dealt more with the policy level, such as the national forest plantation plan. Generally the teams agreed that plantations were an important issue, but were not in agreement whether they should be considering plantations at all during the test, as natural forests were the declared focus.

All teams stressed the importance of mapping as a management tool by incorporating several indicators and verifiers. Verifiers related to mapping were proposed for the assessment of all aspects of forest management.

3.2.3.3 Social C&I

In analysing the social C&I we are examining the outputs of the social scientists on the six teams. They represented the most heterogeneous group amongst all the experts. We had anthropologists, economists and sociologists on the teams. There was considerable heterogeneity of experience as well. The third major source of variance was their institutional and national backgrounds. Given this situation we were very interested to see whether the C&I they proposed would vary a great deal.

Three teams proposed C&I related to human well-being as a general principle and related lower levels of hierarchy (Table 16). An alternative formulation for this principle incorporated ‘quality of life’ as the major objective. Well-being was interpreted in terms of benefits to forest actors such as local communities, forest workers, investors and timber processing industry. Although this principle was not specifically mentioned by other teams, it was implied. As suggested in Figure 1 this principle is the overriding reason for carrying out sustainable forest management.

Under well-being we have two other main principles in this section dealing with fair intergenerational access to resources and benefits, and the principle related to voice or participation/co-management. All criteria and indicators fall under these two principles. We list one other principle which deals with the ability of the forest resource

[15] The introduction of C&I related to economics is a direct result of the incorporation of economists on our teams for the first time.

Table 16. Synthesis of common principles, criteria and indicators with selected verifiers related to social sustainability

Indents indicate the hierarchical level, where P = principle, C = criterion, I = indicator, V = verifier.

Issue P C I V	T 1	T 2	T 3	T 4	T 5	T 6
Economic and Social Benefits from Forest Management shall Improve the Well-being of all Stakeholders			✓	✓	✓	
Forest Management Maintains Fair Intergenerational Access to Resources and Economic Benefits		✓	✓	✓	✓	✓
Stakeholders' property, tenure and use rights are clear to all parties and are secure	✓	✓	✓	✓	✓	✓
A legislative framework enshrines traditional property and land-use rights		✓		✓		
National policy aims at the recognition of the cultural integrity of specific social groups and communities	✓				✓	
Damages and/or loss caused by commercial logging and forest management are compensated in a fair manner	✓	✓	✓	✓	✓	
The level of compensation paid or given by loggers to the local people for harvesting trees claimed by the latter is in proportion with the commercial value					★	
Arrangements between loggers and local people for compensation for loss or damages resulting from the harvesting operations					★	
Effective mechanisms ensure a system of benefit sharing accepted by all stakeholders	✓	✓	✓	✓	✓	✓
Numbers of trees of cultural, social and economic importance for local populations felled by loggers					★	
Level of knowledge by local people of the commercial value of local timber and/or NTFPs in high demand					★	
Forest-dependent people have the opportunity to be employed and trained by forest companies		✓	✓	✓	✓	
Percentage of local people recruited since the beginning of logging in the FMU					★	
Rate of return and pay-back period of logging companies is compatible with the regeneration period for merchantable timber		✓	✓		✓	
Wages and other benefits conform at least to national standards			✓		✓	
Percentage of fixed salary against total income					★	
Impact of logging on income level of local forest-dependent people		★				
Forest management has no adverse effect on health					✓	
Working conditions during harvesting operations *vis-à-vis* the ILO rules and prescription		★			★	
Stakeholders, including forest actors, have a voice in forest management (*participation, co-management*)	✓	✓	✓	✓	✓	✓
Effective mechanisms exist for two way communication related to forest management among stakeholders	✓	✓	✓	✓	✓	
There is a procedure for dialogue and conflict resolution between various stakeholders and within stakeholder groups			✓	✓	✓	
Existence and level of acceptance of mechanisms for punishment of non-compliance with forest management rules			★			

Table 16 continued

Issue P C I V	T 1	T 2	T 3	T 4	T 5	T 6
Existence of a consultative committee structure				★		
Amount of voice of local communities in the allocation of cutting licences on their customary lands			★			
Local communities have the legal and organisational means to act as efficient forest management bodies			✓	✓		
Demand for forest goods/services expressed by stakeholders and beneficiaries is consistent with forest's capacity to meet it.	✓	✓		✓		
Statistics: Forest-based incomes, types of forest use and their values, population (demographics) and local initiatives		★		★		★

Note: ★ verifiers are selected subjectively

to cope with the demands placed on it. This is a cross-cutting principle in that the criteria and indicators relevant to it were presented in the ecology and management sections. Its inclusion here reflects the concern that there should be a balance between rights and benefits on the one hand and the responsibility to the resource on the other.

Intergenerational Access

There was general consensus among teams on the importance of clear and secure tenure and use rights and the need for fair sharing of benefits. This is a consensus that Cameroon teams share with previous test teams. There was only slightly less consensus on the issue of compensation for damages and on opportunities for employment and training. These two criteria and two indicators were therefore considered to form the backbone for the assessment of fair intergenerational access to resources and benefits. However they are not sufficient in themselves. The teams have proposed other indicators and verifiers which are included in Annex C.

Two indicators related to policy are included here. The first one deals with the legislative framework and the second with policy-level recognition of the importance of cultural integrity. The fact that these were supported only by two teams each could be somewhat misleading, as not all teams addressed policy. In previous tests, where more time was available, policy-level issues affecting the FMU were always considered.

The rate of return and amortisation period was considered an important indicator by half the teams. This recognises the importance of one of the main incentives for industrial-scale or market-oriented forest management. On the level of the individual we have an indicator related to wages and other benefits. It is difficult to explain why only two teams considered this a good indicator of the fulfilment of fair intergenerational access to resources. Only one team selected health as a possible indicator. This may be because the causal links between forest management and health are not always clear. The Indonesian and Côte d'Ivoire C&I testing teams also identified the health of local people as an important social indicator. A direct causal link exists between health and forest management as far as working conditions are concerned, as shown by the verifier related to ILO worker safety norms.

Several interesting and fairly easily measurable verifiers have been included here from the proposals of the teams, particularly Team 5. The question of appropriate compensation was identified as important during field visits, where it was apparent that local people were often not being fairly compensated for the loss of trees important to their livelihoods. This was often linked to their lack of knowledge of the true commercial value of these tree species. Another interesting verifier is the one related to the percentage of fixed to total income. It was clear from some of the discussions with workers that most were being compensated only on a piece basis and therefore were forced to fell high volumes, with little regard for their own health or that of the environment.

Voice

The need to ensure that the stakeholders had an adequate voice in forest management was identified by all teams as being very important. This has been a common concern of all C&I testing teams so far. Voice was expressed as participation by some teams and as co-management by others. The underlying concern is the same: stakeholders must be allowed to have a say in forest management if it is affecting their lives. Based on the results of Team 4, in Figure 1 we have suggested that voice was a mechanism that ensured a fair distribution of benefits, as it enables adequate articulation of needs. Such articulation is a condition for the satisfaction of needs. However the Cameroon test teams also recognised that there have to be effective mechanisms in place to ensure that communication takes place in a fair manner.

We list two indicators in Table 16 that underline the need for proper procedures to regulate dialogue and conflicts and the need for appropriate legal and organisational means to facilitate co-management. Two of the three verifiers deal with mechanisms for ensuring participation, i.e., the underlying thinking is highly prescriptive. The third verifier examines a situation as it currently applies across Cameroon: the need for adequate voice in the allocation of *vente de coupe* (cutting licences).

Demand for goods and services is in accordance with forest's capacity to meet it

This is a basic principle. Three teams identified it within their sets of social C&I, recognising that demands must be in accordance with supply, and benefits must relate to responsibilities. The criteria and indicators for this principle have already been provided in previous sections.

Other issues

Two suggestions made by Teams 2 and 5 are indicative of some original ideas that emerged out of the evaluation of social C&I. Both are highly prescriptive.

- Saw logs not removed from the forest within 7 months of harvest become local property, free for the taking.
- An ad hoc institution involving the stakeholders or their delegates has been created, is working, and is effectively a place for negotiation, co-management and definition of rights and duties at the FMU level.

Most teams affirmed the importance of recognising the utility of local knowledge as indicators or verifiers of voice. Some were included in the social sets, some in the management for production set. There was a general consensus that local knowledge could be very important for improving forest management.

Several teams included statistics related to forest-based incomes, types of forest use and values, local initiatives etc. as verifiers for indicators. Such existing information will probably form a major part of the data for any assessment of social sustainability of forest management. These suggestions are included in the reports of the teams in Annex C and are not discussed further here.

3.3 Closing Workshop

The Final Workshop was held between 14 and 16 November 1996, and was attended by over 70 participants (Annex F). This was considerably larger than we had planned[16] and resulted in some unnecessarily complicated logistics. There were participants from government, universities, NGO's, and projects, as in our previous tests. The workshop basically involved 1fi days of presentations, to acquaint participants with the process the team had followed; and 1fi days of working group activity (Annex G). Working groups were divided by discipline, though participants were free to select working groups outside their discipline if they chose.

Although the workshop did serve to acquaint a variety of actors with our activities, and there was significant interest in the topic, we were somewhat disappointed in the way it worked out. The necessity to deal with the output of six teams was more complex than anticipated. Our analytical teams tried hard to put these results into a more accessible form, but there was very little time for analysis between the end of the fieldwork and the beginning of the workshop. In retrospect, expert team members felt that it would have been more productive to

[16] Due to factors outside our control.

have presented only one synthesis set of C&I to the workshop.

Several of our team members were unable to attend because of illness. For future workshops of this kind we would reduce the number of participants and extend the period for analysis between the end of fieldwork and the beginning of the workshop. The presence of all team members would of course be desirable (though illness is never possible to predict/control). However as no future test of C&I is envisaged with six parallel teams, these problems should not arise in the future.

3.4 Discussion

We begin with a discussion of the methods in general. Based essentially on the reports of test team members and support scientists we discuss both the theoretical utility of a methodological step and how it was realised within the context of the Cameroon test. We move then to a discussion of the results of the testing exercise, i.e., the C&I proposed by the teams. We focus here on the content and the amount of commonality among the proposals of the six teams. Based on this we discuss the effect of duration, composition of the teams and their strength in the final sections.

3.4.1 Methods

The IFGM was considered to be a useful methodology for identification of a locally adapted set of C&I based on expert opinion. Most experts felt there was still room for some improvement and made suggestions accordingly. Some of these reflect specific problems encountered in applying the methods at Kribi; others are more related to the design of the methods and therefore are of a more fundamental nature. As Karsenty (1996) notes it is important that the scope of the contribution of a method such as the IFGM is properly understood. He sees the building of consensus among a group of experts within an interdisciplinary process as being the main motor for the IFGM. He suggests that a disappointing result of such a process would be the establishment of the lowest common denominator.[17] Although a process that simply guarantees the achievement of a lowest common denominator consensus would also have its merits, the IFGM goes beyond this because, although it promotes consensus building, it also allows dissenting opinions, especially for the domain expert. The report of Team 5, Karsenty's team, clearly reflects this.

It is with good reason that the IFGM seeks to promote consensus building. All C&I processes have in common that they seek essentially to establish a more practical interpretation of sustainable forest management for a given interest group. This is a consensus building process, as all parties concerned must be prepared to defend the final result. The IFGM seeks to mirror this process on a much smaller scale, acknowledging thereby that without a shared vision of sustainability there can be no sustainable forest management.

In discussing the methods we distinguish between the design and its application. Turning first to the design we can distinguish the following four steps: Preparation – briefing book, background information; Form 1 exercise – initial evaluation of 220 C&I; Form 2 exercise – field evaluation of a subset of the initial 220 C&I; Final workshop – peer review and identification of gaps.

None of the experts in the Cameroon or the previous tests has questioned these four steps. Generally it was felt that they represented an efficient way to evaluate and develop C&I. However, no alternatives were tested during the Cameroon test.

Preparation: briefing documents

The preparation phase commenced with receipt of the Briefing Book by team members. Most felt that the briefing book was a good and thorough beginning to the testing process.[18] There was however the feeling that it would have been more easily accessible had a professional manual writer done the writing. Maynard and Shepherd (1997) point out that 'there were assumptions of knowledge which came from the authors' over familiarity with the subject matter. While, as the participants became more familiar with the process, the strength and clarity of the overall design eventually proved its worth as a tool for getting through the volume of

[17] Team 6 was the only team that took an approach which was more or less in accordance with establishment of the lowest common denominator.

[18] For example, reports of Teams 1 and 5.

work....'. We noticed differences between experts who had read and digested the information provided in the briefing book and those who had not given it sufficient attention. The former invariably took on the function of 'methods interpreters' for the latter. This we feel suggests strongly the need for a standardised training prior to a testing exercise.

Most experts felt that the Lammerts van Bueren and Blom (1997) paper provided to them had been very useful for understanding the use of the hierarchy of principles, criteria, indicators and verifiers. Some however felt that its usefulness had been constrained because it was distributed after the test had commenced and regretted this.[19]

The background information on the Wijma concession and the presentations on topics related to forest management in the Kribi area and in Cameroon received a very mixed reception from experts. Some complained that the background information on the concession prepared by Hol (1996), contained some factual inaccuracies. The main complaint was however that such a document could not replace a proper management plan. While this is true, there was very little that could be done about it as there is no management plan, nor for that matter is there a designated FMU, in the Kribi region. These are conditions quite typical for Cameroon at the time of the test. Information provided during presentations was found to be good by some experts, notably those from Cameroon, others would have rather spent their time elsewhere. The objective of these presentations was to ensure a shared knowledge platform and a common frame of reference. Divided perceptions on how to proceed in the absence of a clearly designated FMU were a source of irritation in some teams. These kinds of irritations illustrate very clearly the utility of a field evaluation of C&I, as this is the reality within which C&I are to be developed. Such problems enable the identification of key issues for C&I to focus on. There was a greater volume of data available to the experts on this FMU than would be found in many other areas, because of the research work being carried out by Tropenbos. Most teams consulted this information, although some did so more thoroughly, usually because there was a Tropenbos researcher on the team who could guide them to the right information quickly.

Form 1: home-based evaluation of C&I

The Form 1 exercise was found to be very helpful. The short duration teams generally commented more favourably on this exercise than did the longer duration teams. This was probably because most short duration teams did not have sufficient time to complete the Form 2 exercise properly and perhaps because the Form 1 exercise was fresher in their memories during report writing. Team 2 in their report note '[F]orm one provided the best and most successful team interaction, and, though difficult, was a good, and necessary introduction to the program, and each other'. It was considered to be an important tool for the facilitation of interdisciplinarity.

A few suggestions for improvement were made and it is useful to discuss them here. Ngeh (1996) suggests that completed Forms 1 should be submitted in advance of the first meeting of the team in order to facilitate analysis and to save time during the initial period in the field. Team 3 in its report notes that it would have been useful to require each expert to develop a set of C&I for the FMU concerned prior to their arrival at the site. The benefit of developing such a list at an early stage is that thereafter discussions among team members could be more focused and progress quicker. The drawback is that there may be a tendency to be less receptive to new ideas and new information and to be overly defensive of such C&I.

Form 2: field evaluation

Form 2 was both praised and criticised. Form 2 was designed to be a careful documentary process that monitored the development of new C&I and any changes to existing C&I. While most team members acknowledged the importance of Form 2 for the documentation they felt that in its present form it was too much of an additional administrative burden, and should be simplified. Most also felt that more explanation of some of the boxes (especially 'K' and 'L', see Annex B) would have been helpful. Some team members treated Form 2 as an *ex post* exercise, not as an ongoing record of C&I evaluation that it should have been. The criticisms partly reflect the tension that exists between their need to reduce workloads to a minimum and the

[19] A draft of the paper was distributed a few days after the teams assembled in Kribi in order to better understand its value as a tool by the experts by comparing their self-expressed ability to deal with the hierarchy before and after receipt of the paper.

need to document their thought and reasoning processes for subsequent analysis. Obviously both Form 2 and its documentation require improvement, but this will have to be carried out with care.[20]

Most experts welcomed the field trips for evaluation of C&I, finding them to be very useful. There was a feeling that longer periods in the field would have been more helpful. Mbolo (1996) has this to say:

> It is indispensable, because it opens new horizons, permits one to confirm that some things one considered impossible in the office are true, and the reverse. It would be better if it lasted longer (3-6 days) and concerned various sites.

The exception being Team 3, a short duration team, which in its report suggested that field trips should be limited to one day but with focused objectives. Karsenty (1996) notes that he found field trips to have contributed to the sharing of knowledge, and the assessment of C&I in one's own disciplinary field. However he doubts whether new knowledge or gaps in representation could be bridged during field trips. This would be true if field evaluations were restricted only to field trips. In reality, the evaluation process carries on in discussions with team members subsequently, and through further information gathering and triangulation with other sources of information. The purpose of the field trip is to provide a common physical frame-of-reference that allows objective discussion of the C&I under development and to introduce important information that might otherwise have been overlooked. Its success is dependent on the people concerned, their understanding of the underlying issues and their ability to communicate across disciplines. Obviously longer periods of shared experience would be conducive to better communication and to identification of gaps. However factors such as organisational ability of the teams, their focus and team dynamics have a strong effect on the value and required duration of field trips, as the reports of Teams 1, 2 and 5 reveal.

Beginning with the consensus building exercise around Form 1 results, interdisciplinarity was incorporated into the entire field test. All team work was conceived as being interdisciplinary, field visits were across disciplines for the most part, evaluations on Form 2 were required to be read, commented on and discussed by all team members. Thus the final set proposed by each team was the result of intensive interdisciplinary exercises and discussion. This was acknowledged by the experts, who singled out interdisciplinarity as one of the great strengths of the method. However it is clear that one or even two weeks is seldom sufficient to break down all disciplinary barriers, even using the tools we have employed. Most felt that longer interdisciplinary exchanges would have been better. Most participants also underscored the importance of being able to discuss their ideas with colleagues from the same discipline. As Maynard and Shepherd also note, despite the degree of interdisciplinarity being very high in these small teams, three-member teams may be below the critical size for C&I testing teams with respect to enabling discussions both within and across disciplines. Although each Cameroon team only had three members there were in fact a large number of experts from each of the disciplines assembled at the same site and available for discussions. In the future, however, most tests will involve only one team and not six as in Cameroon, thus drastically reducing the number of experts at the test site.

As in some of the previous tests language proved to be a constraint to discussion and C&I development. Apart from differences in the understanding and use of words between disciplines, some experts also felt handicapped by their inadequate competence in either French or English, the language of the three base sets and of some of the briefing sessions. In retrospect we should have provided more tools to facilitate communication between languages. Although the ATO set of C&I were available in two languages,[21] the other two base sets were only available in English. Despite our stipulation that all team members were to be fluent in both languages, it would have been better to have provided materials in both French and English to the teams.

Obviously the logistics of managing the needs of six teams concurrently was quite demanding. This was especially true as negotiations with the concessionaire could only be concluded very

[20] One suggestion was to include a box to distinguish between state and trend indicators (Karsenty, 1996).

[21] Some team members complained that the two versions of the ATO set were not identical due to different translations.

shortly before the test was due to begin.[22] Communication between Cameroon and Indonesia is difficult. For instance, the official letter from the Minister of Environment and Forests inviting CIFOR to carry out the tests of C&I took over five months to reach Indonesia. All these factors resulted in delays to the test, little flexibility with respect to the timing and an extremely short preparation period. The result was a series of irritations for team members that might have otherwise been avoided. Although some experts were generally satisfied with logistics (Mbolo 1996), most quite naturally found room for improvement. Despite this, as Maynard and Shepherd (1997) note, we were successful in having six teams working on the same subject in the same FMU without undue crowding. There is no doubt that with greater lead time, and with the logistics being handled from within the country, it would be possible to run a field exercise without any major problems.

3.4.2 Content of the C&I proposed by the Cameroon test teams

Any discussion of the content of the proposals made by the six teams is difficult in the absence of an objective and absolute measure for what constitutes an 'optimal' set of C&I. Thus all the yardsticks we have used are comparative only. We are either comparing among the six teams, or between them and the results of previous tests. This we have done using quantitative measures and qualitative analysis, both of which involve some degree of subjective 'expert judgement' on our part. In judging the merits and content of the C&I proposed by the six teams, we need also to take into account the baseline from which these C&I were developed. For Cameroon this baseline is low. The Cameroonian National Working Group on Forest Certification provided us with a first draft of their C&I after commencement of the test. The ONADEF group led by Njib Ntep had also just commenced work on C&I development. The timing of the CIFOR test could thus be viewed as fortunate as it was conducive to the work of these groups.

Examining the C&I proposed by the six teams, it is clear that some confusion still existed about how to distinguish between the four levels of hierarchy. This we had also noticed in previous tests. Although with the Lammerts van Bueren and Blom (1997) paper all teams had a tool with which issues could be more easily sorted into appropriate levels of hierarchy, it is obvious that the complexity of the issues concerned and a very limited period of time in which to carry out the classification was too much for the experts on occasion. Most of these problems were corrected in preparing the synthesis provided in Tables 12 to 16. Blom (1997) in her analysis of how the DDB set was utilised by the experts, notes that the base sets themselves show weaknesses in this regard, thus also leading to such misclassification. She points out that in one case a criterion wrongly classified as an indicator had been criticised because it was not measurable and did not produce replicable results. However measurability is not a feature of criteria as much as it is of indicators or verifiers. She stresses the importance of clearly distinguishing between the hierarchical levels. She also suggests that it would be useful to make a distinction between attributes for criteria and attributes for indicators. A manual for field evaluation of C&I currently under development seeks to address some of these problems (Prabhu *et al.* 1998). However it is likely that there will be a need to carry out some 'conceptual cleaning' of such C&I sets after a test has been completed, as part of a subsequent desk exercise. We stress that sorting the key issues and measures of sustainable forest management into hierarchical levels is intended only to facilitate improvements to the overall C&I package. There is, in our opinion, little utility in allowing such a classification exercise to become an end in itself.

3.4.2.1 Ecological C&I

In keeping with results from previous tests the ecological C&I developed during the Cameroon test, revealed similar underlying conceptual frameworks. They showed high degrees of commonality and were usually backed by a large number of verifiers, although this varied among teams.

All this suggests that the content of the ecological C&I was generally satisfactory. Areas of weakness include dealing with spillover effects, i.e., effects of the FMU on its environment and vice versa. This weakness may have been exarcebated because of the lack of a defined FMU at the test site, however dealing with landscape-level interactions is a complicated problem in itself. Maynard

[22] That these negotiations were successful was only because of the good offices of Tropenbos.

and Shepherd (1997) criticise that 'given the hypothesis that a particular forest is sustainable, the ecologists seemed to want to try to identify all the evidence which would prove the hypothesis, rather than looking for the minimum amount of evidence needed to disprove it'. Consider this statement in the light of a definition of what Kolb (1994) considers to be a healthy or sustainable forest ecosystem.

A forest ecosystem is healthy or sustainable if:

- it had the physical environment, biotic resources, and trophic networks needed to support productive forests in at least some seral stages;
- it possessed resistance to dramatic changes in population or key organisms within the ecosystem beyond what would be expected for successional trends;
- it had a functional equilibrium between supply and demand of essential resources, such as water, nutrients, light, and space, for most of the vegetation components;
- and it had a diversity of seral stages, cover types, and stand structures that would provide habitat for many native species and a framework for all essential ecosystem processes.

The C&I proposed by the Cameroon teams stay well within the bounds of this definition. The problem lies in our current inability to define precisely what we mean by 'a minimum amount of evidence' or C&I on the one hand, and appropriate performance thresholds on the other. Without performance thresholds it is not possible to define non-sustainability. However our current knowledge of critical thresholds in the tropical moist forests is far from adequate. This leaves ecologists seeking to define the conditions they find acceptable or unacceptable based on experience, a situation that may be currently acceptable, but that will be much less so in the future. Thus Maynard and Shepherd's criticism would appear to be too harsh.

On comparing the results of the Cameroon test to the output of a recent workshop of experts on biodiversity C&I held at CIFOR, we find that many of the indicators and verifiers suggested by the Cameroon teams are similar to those proposed by the workshop (Stork *et al*. 1997). We have also pointed out the similarity between the Cameroon results and previous tests. We found that all the commonalities listed in the Phase 1 report are contained in our synthesis list. Stolte (1996) developed a monitoring framework based on the ecological C&I proposed by the Cameroon teams, which contains recommendations on how this framework could be realised within Cameroon. Thus we conclude that the ecological C&I proposed by the Cameroon teams are a good platform for the assessment of impacts on the ecology of the forests. There will be need to further refine these C&I, especially with respect to verifiers and performance thresholds. Whereas improvement with respect to verifiers may well emerge from further iterations and rigorous review of this set of C&I, improvements in performance thresholds will probably require more specialised research.

3.4.2.2 Policy and management for production C&I

Maynard and Shepherd (1997) rightly noted that in many respects the foresters had the most clearly defined work to carry out. The ATO C&I covered forest management issues very thoroughly, giving them a broad and strong base from which to work. The main drawback for them was the lack of a management plan within the FMU against which to test the various issues. As a group they tended to work more from their own previous experience rather than with the evidence of the site before them. But this was true of the other groups as well, and is probably the result of having to resolve the contradictions between the existing system and the hypothetical minimum requirements of a sustainable forest management system.

Policy issues were given less attention than they deserved considering their importance for sustainability at the FMU level. However this was a constraint of the time available to the teams and, as such, the lower level of development is understandable. The principal issues emerging from the proposals include the need for land-use planning, sustained and adequate funding, strengthening of institutions, reduction of pressure on forests through intersectoral coordination and the need for up-to-date information. Somewhat surprisingly there was little suggestion that there was a role for policy to secure rights of tenure and access.[23] The

[23] This last issue was presented in Table 15.

policy-level C&I were proposed by foresters, social scientists and, to a lesser extent, the ecologists.

There was more apparent diversity in the proposals made by the foresters than was initially expected. However for the most part their adaptations were minor. As might have been expected the foresters all identified the importance of a management plan as being core to the whole sustainability issue. Even so, most included the management plan in a system which involved objective setting, planning, implementation, control and various feedback loops. This in fact is very similar to an Environmental Management System, although the Cameroon results do not have the same degree of sophistication or completeness.

Two results stand out in this part of the Cameroon C&I: the importance attached to NTFPs; and the attention given by some teams to the involvement of stakeholders in the planning process.[24] On the other hand there was a lack of precision regarding silvicultural systems and codes of forest practice, especially for harvesting. These C&I reflect the current status of forest management in Cameroon. The teams believed the most pressing and important contribution to sustainable forest management in Cameroon would have to come from land-use planning, establishment of FMUs, proper planning and effective control, rather than from silviculture or harvesting codes. This may be true currently, but the near future will show a shift in this emphasis to include the latter two.

We find that there is still room for improvement in the way most of the C&I are worded. Many are too verbose and cover more than one issue, where a simple, clearly formulated sentence would have been preferable. This is especially true of C&I related to the management plan. In general, C&I oriented towards outcomes rather than prescriptions are preferable as they leave more flexibility in the hands of the manager to achieve the outcome. Prescriptive C&I are especially in need of continual revision if they are not to be counterproductive and stifle innovation over time. This makes them more expensive in the long run than outcome-oriented C&I. However it will not always be possible or advisable to identify only outcome-oriented C&I, as many forest managers in the tropics are uncertain of how to achieve the results society expects from forest management.

3.4.2.3 C&I related to impacts on social sustainability

Considering that the social scientists were the most heterogeneous and least experienced group there is a surprising amount of commonality among the proposals made by the teams (Table 16). Maynard and Shepherd (1997) point out that social C&I represent issues that are often multi-layered, contradictory and shifting, much more so than the two other groups. For example, resource access and land tenure within an FMU are likely to be ordered by one set of rules or laws which are recognised at the national level (which change only very occasionally); but there are then local traditional rules and traditions – usually more than one set – which by their nature tend to be adaptive rather than static. Sikod (1996), in his note to the working group on social C&I at the closing workshop of the Cameroon test, illustrated some of the controversy still surrounding social C&I. He suggested that it was necessary to be more explicit about the links between sustainability and issues such as benefit sharing, local knowledge of management plans, NTFPs, and access and tenure rights. Referring to the last two he provides this dissenting view point:

> NTFPs – they are talked of by everyone as being very important, at the same time as improving well being, but in my experience NTFPs have nearly always been associated with the most marginalised people and it is only a sense of romanticism which makes you all think they are important. I might almost go as far as to say that NTFP use could be used as an indicator for the vulnerability of the forest rather than its sustainability.
>
> Traditional land tenure rights – or rights of access to resources
>
> a) there is a presumption that there is a definitive set
>
> b) surely it is just this kind of right that is allowing urban based well off people to claim ancestral rights in forest areas and pay people to go in and use chainsaws to clear the forest

[24] In the following subsection we present Sikod's (1996) view on these two issues.

c) these are systems which were born out of a time when resources were perceived as being abundant and sustainability has never been a goal within such systems as such so it is expecting to much to think that they can help implement it now

d) A lot of comments are made about hard edged boundaries and the defining of property rights, surely one of the beauties of many of these traditional systems is their lack of precision, often determined by one households needs, hunting trails criss crossing one another 'my brother can use it if he has a bigger family than me' but by defining them as of 15/11/'96 don't they immediately become rigid and inflexible, reflecting the advantage of whoever has the greatest influence in the community on that day

Given the lack of a clear definition, so far, about the meaning of sustainability in the social context, it is hard to be precise about what needs to be measured. Colfer (1995), Colfer *et al.* (1995) and Wollenberg and Colfer (1996) have provided an interpretation of social sustainability in terms of C&I that goes a long way towards improving this situation. At the same time there is general agreement that measures are required in this area. There are some methodologies for measurement under development by CIFOR (Colfer 1997), but none of the teams were familiar enough with them for extensive use during the tests. There will always have to be a greater degree of local knowledge and good judgement for the analysis of social sustainability criteria. In the same way, heavy emphasis on the skill, integrity and experience of the person undertaking the work will be needed, since there will never be time for more than minimum sample sizes. Good selection, and good training, will be paramount. There is a need to ensure that social scientists on C&I teams are the most qualified available, both because the problem is intractable and because of the tendency to undervalue social science input.

To set definitive limits to minimum data requirements is hard enough in the context of forest management or ecology, where it is possible to set parameters, replicate the process a number of times and then redefine the parameters. In the social sciences replicability is far more difficult. Even setting parameters in the first place may be difficult, when the overall situation is affected by so many off-site factors. Seasonal and temporal changes, are also likely to be more dramatic than for the other two disciplines.

The disparate nature of the social scientists and the complexity of their task was reflected in the output, which was far more heterogeneous than that of either of the other two disciplines. The economists, in particular, tended to create a number of new C&I. All group members tended to focus on issues beyond the scope of the FMU as well as within it, and identify the importance of national-level policy C&Is as well as those relevant to the local level. There was a tendency to be overly prescriptive in some cases, proposing interesting but controversial 'remedies' as indicators or verifiers, e.g., suggesting the inclusion of 'vertical integration of production'.

Nonetheless the social C&I overall reflect a useful stepping stone in our quest for a more operational definition of sustainability from a social and economic standpoint. There are interesting contributions on how voice and co-management can be linked to access to benefits and sustainable forest management.

3.4.3 Effect of available time on evaluation results

During the Cameroon test a great deal was achieved in a relatively short period of time. However one of the questions the test was to answer was just how much time would be considered sufficient? Our analysis showed that somewhere towards the end of the two week (long duration) exercise the marginal improvement per day had fallen off considerably. Certainly all short duration teams expressed their dissatisfaction with the amount of time available to them. They agree that with more time they would have been able to do a more thorough job of evaluating the C&I. This is very much less the case with long duration teams. Team 5 for instance felt with improved planning and equitable distribution of work between the disciplines, 2 weeks would just be enough for the exercise. If at all, not more than a further two days would be required. The Cameroon test shows that under pressure and with adequate support even relatively inexperienced personnel can be expected to progress a long way down the line of understanding and implementing an assessment of C&I for sustainability.

Time is required to understand and internalise the objectives of C&I development, Eyog Matig

(1996) noted that it took him a few days to completely understand the objectives and methods of C&I evaluation. There is also a need to have enough time to establish a basis for teamwork and interdisciplinarity. Finally, at least two if not three iterations are needed through the C&I. Ultimately the quality of output will be determined not by the number of hours put into the evaluation process, but the number of effective iterations. This suggests that there are ways and means of economising on time, including:

- ensure that all team members have a thorough understanding of the underlying concepts and methods, if necessary through a training workshop;
- ensure that all home-based exercises have been properly completed in advance of testing;
- eliminate language problems as far as possible;
- compile all relevant background information in advance, including management plans, maps, etc.;
- use electronic media as far as possible for data input and analysis;
- minimise access distances to the field site; and
- provide support to ensure smooth organisation and logistics.

Our comparison of the results of the Cameroon test with the commonalities identified during longer previous tests, reveals that even the long duration teams did not have quite enough time. Although it is probably not necessary for teams to spend over a month evaluating and developing C&I, as in the Phase 1 tests, they would need about three weeks, including at least two clear weeks at the field site, to allow time for a minimum number of iterations through the C&I they are developing. In all at least six iterations would be required: the first two taking place through the Form 1 exercise and the next three during the Form 2 period. A final, sixth iteration would then take place during the closing workshop.[25] The amount of time required per iteration will vary from situation to situation depending on the degree to which all the above factors have an influence.

3.4.4 Effect of composition and team strength

We were interested in the composition of the teams because this is a factor that can be influenced quite simply by an institution interested in developing C&I. As the base sets, site, background information and logistics provided to the teams was the same, the variation among the teams could have either been due to the amount of time available to them or due to the composition of the teams. Our quantitative analysis of the results of the six teams suggest that of the two factors, the more important influence was the composition rather than the amount time available. Composition of the teams is complex, involving experience, disciplinary backgrounds, cultural and professional outlooks and personality structures. It is in fact a whole set of variables. It was not feasible to carry out a controlled study of any one of these variables during the Cameroon test.

Examining the results of the Cameroon test we find that the team with the lowest average age and professional experience (i.e., Team 4) was easily as good as, if not better than, teams with more experience. Teams with a great deal of experience at the test site did not perform better than those that had never visited the site prior to the test, as shown in the results of Teams 2 and 4 in comparison with Teams 1, 5 and 6. Sikod (1996) notes that '[T]he combination of nationalities is beneficial. Nationals having a better knowledge tend to concentrate faster on relevant national issues, however expatriates are more open and may help identifying new issues'. Our analysis of the very narrow database suggests that this may be true.

Maynard and Shepherd (1997) note that the three-person team worked very well in terms of personal dynamics. Everyone had to be fully involved, and the level of interdependency led to a far greater level of interdisciplinarity than might have been expected. Where there happened to be a natural team dynamic with valuable 'supplementary' skills, such as good group management, facilitation and creative thinking, the intensity of the small group worked extremely well. Where there was not that dynamic or there was any kind of per-

[25] The value of this last iteration depends a great deal on whether the workshop participants have sufficiently understood the purpose and methods of the C&I test and are competent to review them. If this is not the case, the result will be less than satisfactory.

sonality clash or major professional difference, the fact that there were only three people compounded any problems. While there are a number of advantages in having only three experts on a team, the range of skills and experience needed within the group to give thorough coverage in all aspects in each discipline will only be found in such a small number of people if they are carefully selected. Although we used three-member teams in Cameroon, there were in fact a large number of experts with similar disciplinary backgrounds assembled on site. As we have already pointed out disciplinary discussions are just as important as discussions across disciplines. From this point of view, and in the interests of reducing the risk that illness or personality clashes could pose to a three-person team, we suggest that teams should usually have five to six members, unless access to qualified discussion partners can be ensured.

Although there was an overall strategy in the way the teams had been put together, the presence within each of a good manager/facilitator was pure chance. In this area, there needs to be more systematic team selection. While it is hard to spell out exactly what makes a good contribution to team dynamics, it did seem that a clear understanding of the objectives and management of C&I were more important than disciplinary expertise alone. It was an advantage when a team member was willing to have the most basic assumptions of his/her discipline challenged, without being too protective, and in some teams it was unfortunately all too common for much group time to be taken up by one member defending a passionately held minor point which did not contribute to the overall process. The ideal qualities were perhaps present in those who had enough confidence in their own ability and experience to absorb the scrutiny of others, and those who were fresh enough to their subject not to be overly dogmatic.

3.4.5 Replicability of results

In Sections 3.2.2 and 3.2.3 we have shown that the degree to which teams proposed similar C&I varied somewhat but, in general, it was lower than we expected. We believe this to be a result of two factors: firstly the composition of the teams and secondly the amount of time available. Obviously each expert brought his or her unique experience, interests and conceptual approach to the common problem. This resulted almost immediately in a rapid diversification of the common base set of 220 C&I. With time however there was a trend towards convergence around similar issues. We do not expect independent teams to converge on exactly the same issues within the duration of a test of C&I, such as the ones we have carried out, although at the core these issues would be very similar. It is doubtful that any C&I process based on expert opinion would lead to the development of replica sets of C&I.

Comparing the results of the Cameroon test, as represented in the synthesis tables, and those of other tests, we found all commonalities to have been covered. In general replicability of results was within expectations, if allowance is made for the fact that the Cameroon results do not represent the output of a single team. We believe our synthesis would have been very similar to the output of the closing workshop, had it functioned in the way intended.

In Annex I we present the C&I from the ATO set and the Cameroon synthesis that are not held in common. Analysing these differences it is clear that for the most part these differences are simply in the degree of detail. The exception is policy-level C&I which are handled more thoroughly in the ATO set. Some of the ATO C&I not included in the Cameroon synthesis seem to be somewhat repetitive, so that their exclusion would not affect the utility of the Cameroon set. The main differences relate to the inclusion in the ATO set of research, the amount of emphasis given to plantations, the level of detail with which the principle on the permanent forest estate is treated, the more detailed treatment of silvicultural systems, the emphasis placed on feedback and revision mechanisms, e.g., for harvesting and silvicultural standards, and the attention to human health. On the other hand the Cameroon set generally has better verifiers, especially for ecology, includes C&I for economics, introduces the capacity for social organisation as an indicator and puts a much higher emphasis on stakeholder participation. Its neglect of plantations stems from the relative unimportance of plantations in the Kribi area. Research may have been ignored because of the amount of Tropenbos research being carried out.

As in previous CIFOR tests the main contribution of the Cameroon test to the cost-effectiveness of the C&I was the identification of what was considered a ‘minimum set’. We suggest that this is the most important step towards reducing the costs of an assessment exercise. While it is also important to know the cost of assessing a particular indicator

and its associated verifiers, this information will tend to be very site specific. Factors affecting these costs are the amount of information already available and its quality. For instance, if information is available from long-term monitoring, this could be readily used. However if it is not available alternative sources have to be sought which can vary considerably in nature, accessibility and reliability. Determination of exact costs involved in assessing verifiers was beyond the remit of the Cameroon teams.

The DDB set was found to be generally less useful. A number of experts felt that it was difficult to understand and very difficult to apply at the FMU level. Some issues were picked up only from this set, notably cultural integrity and the need for a national environmental quality policy. The DDB set is currently under major revision (Blom 1997).

On the one hand our results from Cameroon indicate that independent teams employing the IFGM will not deliver results that are exactly the same. On the other hand, we find that on the whole the results are sufficiently similar as to establish the utility of the IFGM. Certainly this is underscored when we compare the Cameroon synthesis with results from other tests. The IFGM, with its series of filters, field evaluation steps, stakeholder involvement and peer reviews, has delivered a useful and acceptable C&I platform for sustainability assessment, fulfilling thereby its primary objective. Until we have alternative cost-effective tools to determine what within reasonable doubt constitutes a 'minimum number of relevant and scientifically appropriate C&I with which to adequately assess sustainable forest management', we suggest that it will not be possible to do so without expert opinion.

4. CONCLUSIONS

In this section we present our conclusions with respect to the methods and the C&I developed during the Cameroon test.

4.1 The IFGM

In the IFGM we have a method for field evaluation and development of C&I that is robust and flexible, because it is based on expert opinion. It builds on existing knowledge not only through the experts, but also through the incorporation of existing sets of C&I as a starting base. It is capable of injecting a relatively high degree of interdisciplinarity fairly quickly and continuously into the process of C&I development, ensuring thereby that the results are more widely acceptable. It enables participation and inputs from a wide group of local stakeholders. The results are practice-oriented, subject to iterative improvement and peer review. These are the main strengths of the method.

One of its principal strengths is also its main weakness. The IFGM is heavily dependent on the composition of the team of experts. The experts must be capable of teamwork, and must have a sound knowledge of their fields and the purpose of the exercise. We have pointed out other attributes that these experts should have. Even if they fulfil these requirements it will not be possible to entirely filter out biases introduced to the C&I they propose, be this through omission or inclusion of issues. It will also not be entirely possible to filter out human error in a process that is extremely taxing of the mental and conceptual capabilities of the experts. Thus the results of an IFGM process will always have some weaknesses, despite all the filters and reviews built into the system. We suggest it would be unusual and therefore unreasonable to expect a flawless result from a system that is so heavily dependent on human judgement, given the time constraints.

However our conclusion has been that, despite some weaknesses that need to be resolved, the IFGM is a useful tool – it builds on the strengths of human experts, but dampens the negative effects to a large extent. Its utility lies in its ability to allow experts in particular domains to interrogate an existing knowledge base quickly and efficiently.

It is important to understand that the IFGM was not designed to deliver new knowledge, nor can it deliver an in-depth analysis of a situation. If either of these are an objective we suggest that more fundamental research, possibly over longer terms, would be required. If on the other hand there is need for a tool that could quickly and reliably develop an appropriate set of C&I for a given FMU-level situation then the IFGM would seem to have obvious advantages. We foresee the IFGM as a tool to adapt generic templates of criteria and indicators for sustainable forest management to particular needs and contexts. Beyond this it could be used to deliver a platform of C&I for building consensus on sustainable forest management. Used in the manner we have followed during the CIFOR tests, the IFGM could very easily be used to identify core sets of C&I for larger geographical areas than a single FMU.

We summarise our understanding of the elements that should be incorporated into an IFGM-based evaluation and development of C&I at a

particular site in Table 17. We anticipate a period of between three and four weeks for the assessment would be necessary. It may be possible to reduce the time further to about three weeks in total, but clearly compromises have to be weighed up carefully.

It is important to note that:

- close attention needs to be given to the selection of team members;
- there seems to be something of a correspondence between smooth interdisciplinary communication and good results;
- residing within the concession area during the test has important advantages;
- managing three-member teams is easier than managing larger teams, unless there are conflicts between team members, but larger teams have a greater depth of experience and are more certain to have the necessary 'critical mass'; and
- a workshop directly following an exercise of this kind to examine the results of several teams requires a longer period of preparation (and either a smaller group of participants or division into smaller working groups) if it is to work effectively.

In terms of the overall costs involved in C&I evaluation and development we can conclude that some savings are possible as far as time is concerned. They will be greater if it is possible to reduce 'downtime' due to travelling, logistics, etc. We have also been able to show that even younger,

Table 17. Suggested schedule of operations for the IFGM

Phase	Activity	Timeline/Time required	Remarks
	Selection of sites, collaborators and team members	Well in advance	Either 5-6 team members plus one coordinator, or three team members with appropriate access to back-up scientists/professionals
Filter #1	Briefing documents to team members for reading	First activity/1-2 days	Briefing book contains methods, TOR and forms plus site information, including data on management, ecology and people.
	First briefing of team members by project staff	At least 3 days later/ 1 day	Ideally this would be a one-day training session
	Home-based evaluation of C&I in base sets	Approximately 14 days before the test/2 days	Objective: mark C&I for selection or rejection
	Form 1 sent to coordinator for collation	Approximately 10 days before the test	
	Comparison and collation of results from Form 1 by coordinator	To be completed by the arrival of team members at assembly point/site	
	Arrival of team members at assembly point	Day 0: At least 3 weeks after initial documents were received	
	Discussion of results from Form 1, finalisation of subset for field testing, after discarding overlaps, redundancies, and determination of cut-off scores and selection of 'priority' C&I	From arrival onwards/ 2 days	
	Assignment of C&I from the subset to each member of the team	By Day 2 after assembly	

less experienced experts can make valuable contributions to C&I development. So savings in terms of personnel are also possible. However there are several other factors to be taken into account. It is possible to lower costs by using three-person teams, however there is an associated increase in risk of failure that needs to be taken into account. Generally the results of the Cameroon test suggest that savings, while possible, will not be dramatic when compared to previous CIFOR tests of 34 days duration with five-member teams.

4.2 Contents of the C&I

This was the first time C&I were developed in parallel exercises, allowing us to gauge for a given set of conditions the diversity of responses possible. The Cameroon test showed that different approaches are possible under these conditions, but it also made clear that the basic expectations of forests and the approach to measuring their fulfilment was very similar. It is important to stress however that the results were not identical. In the previous section we concluded that these differences could be partly attributed to weaknesses in the IFGM. Another substantial part of the variation is attributable to the fact that the broad definition of sustainability, as was composed in Cameroon, cannot be entirely separated from the group of people involved. This is because the impetus for the process is at least partially fuelled by the need for a social consensus.

Turning now to the question of the utility of the outputs of the six teams, we conclude that barring a few 'flights of fancy' the results are by and large

Table 17 continued

Phase	Activity	Timeline/Time required	Remarks
Filter #2	1. Entry of C&I on Form 2 2. Meeting with policy makers, regulatory institutions and policy 'influencers'	Day 3 onwards/2-3 days **optional**, **only if policy C&I are to be included in the set**	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	Day 3 onwards (or Day 6 onwards)/ 14 days	It is during this phase of the testing that the C&I undergo the most qualitative changes, although their quantity may not change very much.
	Formal team discussions of C&I	Every third to fourth day during the 14 days	Participation is not restricted to expert and project team members. Forest managers and other stakeholders are invited to participate in small numbers.
	Initial compilation of results based on Form 2 evaluations	From Day 17/3 days	Preparation for Closing Workshop. Only team and project members.
	Analysis of results by team leader/coordinator	From Day 20 on	Does not involve all members. This should be restricted to about 1 week, so that the memory of the test is sufficiently fresh for team members
Filter #3	Closing Workshop	Around Day 28/3 days	This is the final phase of each test and the single most important review the C&I are subjected to. Modifications and rejections are permitted.
	Short review of test, completion of reports	Day 30	Only team and project members.
	Preparation of final report	This may be completed up to a month or two later/roughly 7-10 days	By team leader only
	Total working days required by all team members	26 days	An additional 7 to 10 days would be required for the team leader. The coordinator will need considerably longer.

practicable. The significant difference is the degree to which the definition has been decomposed into principles, criteria, indicators and verifiers. Some teams have put a higher demand on prospective assessors, providing them with fewer and larger steps by which to integrate the relevant information into a decision. Decision making is thus somewhat simpler. Others have provided many more smaller steps which serve to enhance the transparency of the decision process. Our synthesis has sought to bring together the best of both approaches. These synthesis tables we feel provide a sufficiently concise yet comprehensive platform of C&I to enable assessment of forest management in the field. This is not to say that there are no weaknesses, such as in the policy area.

We identified some gaps in the 'management for production of goods and services' C&I, with respect to both indicators and verifiers. The verifiers for social C&I need strengthening. The ecological C&I were probably the best developed of all. Another weakness we felt was the tendency on occasion to be overly prescriptive, at times forcing a previously held view on to a new situation.

There is a need to define or improve performance thresholds for almost all of the verifiers. This is a difficult task usually involving a lot of site-specific information and a clear idea or agreement on management objectives. For example, in a forest that also serves as a water catchment the performance threshold for water quality would be much higher than in one where the main output was going to be timber. Similar examples could be found for conservation targets vs. utilisation targets. It is ultimately with the further development of the verifiers that we would be able to make any realistic estimates of the costs and the cost-effectiveness of an assessment based on C&I. Failing this information we can only reiterate that by identifying C&I that are relevant, objective and information efficient we have made a big contribution towards cost-effectiveness.

On the whole the results of the Kribi test will be a very useful platform for further development of criteria and indicators in Cameroon. They can be used as the basis for other tests planned by ONADEF. There will be a need to consider how such FMU level C&I can be linked with national policy and objectives. Ultimately C&I will have to cover both the horizontal variation in geographic space, and the vertical variation in political space from the national level to the FMU.

Comparison with the ATO set has shown that the Cameroon results, as represented by the synthesis tables, are somewhat less detailed but on the whole there was a greater contribution towards the development of verifiers. There is important information for the ATO from the analysis of the Cameroon results. For the most part their C&I seem to have a wide applicability. There are also options for streamlining the ATO set, especially with respect to C&I related to management for production. We believe they will be an important input towards developing a regional C&I template for the ATO countries. This kind of a template is useful for forest managers as it promotes the development of C&I for their forest management units.

We believe it is the incorporation of such C&Is into the management plans of FMUs that will lead ultimately to improvements in management,. Much as there must be clarity about objectives and targets in the management plan, there must also be an indication of how an external assessor could determine whether these objectives have been met. This must be expected of all forest management units aspiring to put their management on a sustainable basis. In the final analysis the C&I must enable an external assessor to establish for a given FMU the existence and condition of an adaptive management system that is capable of maintaining an existing satisfactory performance or of mitigating a poor one over time. Performance in this case would be measured on the condition of the ecological, social and economic systems. We do not think the Cameroon results in themselves are sufficient to enable such a decision. They are however an important step in this direction.

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Annex A

TERMS OF REFERENCE FOR EXPERTS INCLUDING SCHEDULE OF ACTIVITIES

Terms of Reference for consultants on long duration teams of the Cameroon Test

Objectives:

Identify criteria and indicators that are objective, cost-effective and relevant to the sustainable management of forests, based on tests of existing sets of sustainability criteria and indicators. These sets are the criteria and indicators of the African Timber Organization (ATO), Dutch Working Group and a compiled set.

Background information:

Criteria and indicators for sustainable management of forests will be evaluated on their cost-effectiveness, plausibility, acceptability and feasibility in a series of tests, within the framework of a consultative process with participating countries in Asia, Africa, Latin America and Europe. The final output of the project will consist of recommended generic and regionally relevant criteria and indicators incorporated within a system to evaluate the sustainability of forest management. It is important to note most if not all criteria and indicators to date have been designed to test whether management is potentially sustainable and not sustainability itself. Hence they constitute perceptions of best management practices or good forest stewardship. Evaluation of these criteria and indicators will need to take this into account.

The test in will be the sixth of these tests. The first test was carried out in Germany (Bovenden) in November 1994. The second test took place in Indonesia (PT. Kiani Lestari, East Kalimantan) in March 1995. The third test in CÙte d'Ivoire (Haut Sassandra, Bossematiè) in June 1995. The fourth and fifth tests took place in October/November 1995 in Brazil (CEMEX, Santarem) and Austria (Gf˜hl, Krems) respectively.

It is important to note that we are trying to identify a minimum set of reliable and cost-effective criteria and indicators focusing on the Kribi forest area (Wijma concession) as the case studies. The assessment of the management of the Wijma concession is expressly outside the terms-of-reference, as this is not the objective of the test. Nor are we attempting to define a definitive set of criteria and indicators for the whole of Cameroon. Although criteria and indicators are important for the certification process, certification is only one of several prospective utilisers of criteria and indicators. This project concentrates solely on criteria and indicators for sustainable forest management and does not deal with certification.

The criteria and indicators recommended by the consultant and his or her team members will serve as an instrument for improving the methodology and means of testing or developing reliable criteria and indicators, and will be compared and analysed in the light of results from other tests conducted under this project for this purpose. They will also serve as a platform for discussion during the workshop.

Basic requirements:

Consultants are expected to:

1. 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.
2. Have a good understanding of current debates on evaluation of sustainability and certification.
3. Be ready to work in a multidisciplinary team under the coordination of the CIFOR project-coordinator.
4. Comply with the procedures set out for the test in this document, and the briefing book.
5. Have a good working knowledge of the French and English languages. Knowledge of local Cameroonian languages will be an advantage.
7. Inform himself/herself of forestry conditions in West and Central Africa, especially of management practices in Cameroon.
8. Report back to his/her home institution/organisation on the results of the test as applicable.

Methods to be used:

I) Team Concept

The team is to act as a cohesive multidisciplinary unit to evaluate the selected criteria and indicators. The need for inter-disciplinary communication is stressed. To achieve this team members must:

1. Maximise exchange of information. This will take place both on an informal basis and more formally during designated daily 'debriefing' periods, team discussions and workshops.
2. Carry out operations both within and outside their areas of specialisation.
3. Take an active and creative role in all discussions and workshops.

II) Evaluation of Criteria and Indicators

a) Home: For the test in Cameroon, C&I will be evaluated for a period of 3 days at the home bases of consultants (see Schedule). This will include any necessary discussions and study of files.

b) Field: Field evaluation of biophysical and social criteria and indicators will be carried out for a period of 12 days.

c) Internal reviews: During the field phase 4 days will be dedicated to internal reviews, discussions and report writing.

When evaluating the validity of criteria and indicators either during the office or field phase, the consultant must consider the following:

- 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?

- Is it possible to suggest upper or lower limits for the criterion or indicator concerned?
- Does this criterion/indicator merit recommendation in a final set of reliable and cost-effective C&I relevant to the conditions prevailing at the site?

Furthermore it is very important to:

- keep in mind the comparative nature of the test and the objectives of the research programme;
- give preference to simply measured, easily understood criteria and indicators over more complicated ones;
- be prepared to formulate new criteria and indicators where deficits have been recognised;
- 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.

Evaluation of criteria and indicators will take place iteratively in two major steps:

1) **First comprehensive and broad evaluation of <u>all</u> criteria and indicators** based on responses to a limited number of questions contained in Form 1. The first review of all criteria and indicators will take place during the preparation period at the consultant's home base. Subsequent reviews will take place during field testing and discussions using the Wijma concession as a focus.

   The consultant will use the comprehensive evaluations to develop with other team members a subset of priority criteria and indicators. The subset will represent the consultants' view of what constitute the most important criteria and indicators for assessing sustainability of the ecosystem, the management and social systems, based on the existing sets of criteria and indicators.

2) **Detailed field evaluation of a <u>subset</u> of 'priority' criteria and indicators**.
   The team will divide responsibilities along the lines of specialisation and experience of team members for the subsequent investigation of the validity of criteria and indicators. Each team member will lead a detailed evaluation of a subset of such criteria and indicators. The subsequent investigations will be carried out in a flexible and innovative manner, which will include for example the formation of small interdisciplinary task-oriented teams. <u>The field exercise will be used to test the viability of the selected criteria and indicators.</u> Form 2 will be utilized as a basis for this evaluation, however the consultant is encouraged to develop additional evaluation methods and materials as needed.

   <u>For the purpose of these investigations, consultants are encouraged to bring with them reference literature important to their areas of specialisation.</u>

   The results of the investigations will be reviewed and synthesized in a series of group discussion sessions by the team. These discussions will provide a basis for the report to be presented at the closing workshop.

III) Workshop

The consultant will attend at least the first of the workshops listed below, during the course of the test. Participation in the second workshop will be subject to a separate communication.

Initial Workshop (October 28). The aim is to make the methodology of the field testing clear to all team members. Suggestions for modification of the methodology may be made. During this workshop members will select the priority set of criteria and indicators, from the existing sets. Each selected criterion or indicator is to be cross-referenced (as far as possible) to similar criteria and indicators in the remaining sets.

Final Workshop (November 14-16). To discuss:

1) the similarities and differences between the results obtained by the six teams;
2) their consequences for the methods used to develop and test C&I; and
3) the recommended criteria and indicators with respect to their cost-effectiveness and usefulness as evaluation tools.

IV) Expected outputs

A) **Report on initial evaluation of all selected criteria and indicators**. This report will consist of completed Form 1.

B) **Report on evaluation of criteria and indicators recommended by the consultant**. The consultant will be expected to provide detailed justification for his/her recommendations, essentially on Form 2.

C) **Report on evaluation of methodology**. The consultant will give a concise report on his/her evaluation of methodology.

D) **The final report** of the test will summarise the results of all other reports and the closing workshop. It will be prepared by the team leader.

V) Other

Additional documents such as the briefing book, schedule of operations, procedures for data collection, procedures for evaluating criteria and indicators, and the criteria and indicators themselves are to be considered to be parts of the Terms-of-Reference.

VI) Time available/deadlines

Test duration:	October 28 - November 16, 1996
Reports A) & B) (first iteration) completed by:	28.10.1996
Reports A) & B) (final) completed by:	13.11.1996
Report C) completed by:	16.11.1996
Report D) completed by:	18.11.1996

Schedule of test in Cameroon:

Activity (in chronological order)	Time	Venue
1) Preparation, Form 1 *Arrival in Kribi/Field site on October 27/28 - Field Phase*	3 days	Home base
2) Introductory workshop to discuss methods, to effect initial selection of priority criteria and indicators and set tasks	1 day	Oct. 28, 1996
3) Field site parallel investigation of management, biophysical and social criteria/indicators at the forest management unit level	12 days	
4) Mid-term review (November 5)	1 day	
5) Preparation for closing workshop, completion of report	2 days	
6) Closing Workshop	3 days (if applicable)	
Total:	**19/(22) days**	

VII) Inter-Team Exchange of Information

As one of the main objectives of the test in Cameroon is to compare results among teams, for the duration of field testing the consultant must not in any way communicate his or her results to persons other than his or her team members or to CIFOR support scientists, in order not to unduly influence the results of other teams.

Annex B

EXCERPT FROM BRIEFING BOOK, FORM 1 AND FORM 2

Summary

Tests of criteria and indicators for sustainable forest management in Kribi

Dates: October 20-November 18, 1996

Objectives:

1. Testing and developing criteria and indicators for sustainable forest management suitable for the forest sites of Kribi area in Cameroon, based on existing (global, regional or national) sets of C&I.
2. Evaluation of the consistency of testing methods.

Methods:

Objective 1: Testing and developing C&I for the Kribi site will be carried out based on the 'Iterative Filtering and Generation Method' developed by CIFOR. This method is based on interdisciplinary expert evaluation and adaptation of existing C&I to a particular set of site conditions. Three major steps of the process can be distinguished:

a) Preliminary single discipline evaluation of the all C&I in the 'base set' (see Annex E). This is done by each expert at his or her home base. The principal objective is to identify obviously redundant C&I and carry out an initial desk-based evaluation of the remaining C&I.

b) Interdisciplinary field evaluation of a selected subset of the 'base set'. This involves inter-disciplinary interactions, site visits, discussions with stakeholders in order to identify the minimum number of reliable, relevant and cost-effective C&I for the site concerned.

c) Experts workshop to discuss results. The closing workshop has the aim of reviewing the results of the testing exercise and commencing discussions on their applicability beyond the selected site. Participants are experts from different disciplines and institutional backgrounds. Detailed discussions take pace mainly along disciplinary lines in working group sessions. Plenary sessions and presentations provide for an exchange of information between groups. The workshop has a duration of three days.

Objective 2: Tests of consistency of results using the 'Iterative Filtering and Generation Method'. Six different three-member teams will carry out tests of C&I using the same methods and at the same site. By comparing the results of these six teams information on their consistency will be obtained.

In order to assess time needs and understand cost implications of testing C&I the six teams will be divided into two groups. The first group of three teams will spend approximately seven days field testing C&I (plus three days of home-based evaluation). The second group will spend fourteen days field testing C&I (plus three days of home-based evaluation).

A major focus of the closing workshop will be on understanding the differences and the similarities among the C&I proposed by each of the six teams.

Introduction

The purpose of this manual is to introduce the methods developed by CIFOR for generation, development and evaluation of criteria and indicators (C&I) for sustainable forest management at the forest management unit (FMU) level.

C&I are tools which can be used to conceptualise, evaluate and implement sustainable forest management. They may be identified at various levels: global, regional (and ecoregional), national and subnational or, as in our 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, the 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. Just as it is unlikely that a single set of C&I will apply uniformly across the globe, it is equally unlikely that a set of C&I developed for the national level will be meaningful at the forest level.

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

Objectives of C&I testing

The principal aim of field testing is to identify criteria and indicators that are objective, cost-effective and relevant to the sustainable management of forests. The focus will be on identifying the *smallest number* of C&I needed to reliably assess forest management in a cost-effective manner. The process of identifying these C&I will be based on evaluations of C&I of the African Timber Organization (ATO), Dutch Working Group and a compiled set (together they constitute the 'base set', see Annex E). In cases where gaps exist, or existing criteria and indicators are not deemed to be suitable, new or substitute C&I are to be generated which fulfil the conditions listed above. This is an iterative process which will involve multiple stakeholders.

It will be important to recall that the focus is on a particular FMU. The main focus will be on indicators. Evaluation and development of criteria and verifiers will play a subordinate role. It is suggested that principles need not be evaluated.

The secondary aim is to evaluate whether the Iterative Filtering and Generation Method produces consistent results, by using six different teams to carry out tests of C&I using the same methods and at the same site. Comparison of the results from these six teams will provide information on the consistency of the Iterative Filtering and Generation Method.

In order to assess time needs and understand cost implications of testing C&I the six teams will be divided into two groups. The first group of three teams will spend approximately seven days field testing C&I (plus three days of home-based evaluation). The second group will spend fourteen days field testing C&I (plus three days of home-based evaluation).

Conceptual framework

The conceptual framework is designed to provide a context and guidelines for the development of C&I. Such a 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 of sustainability takes place;
- facilitates the operationalisation of the elements by elaborating the hierarchical links and relationships among the 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 is also necessary to provide 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.

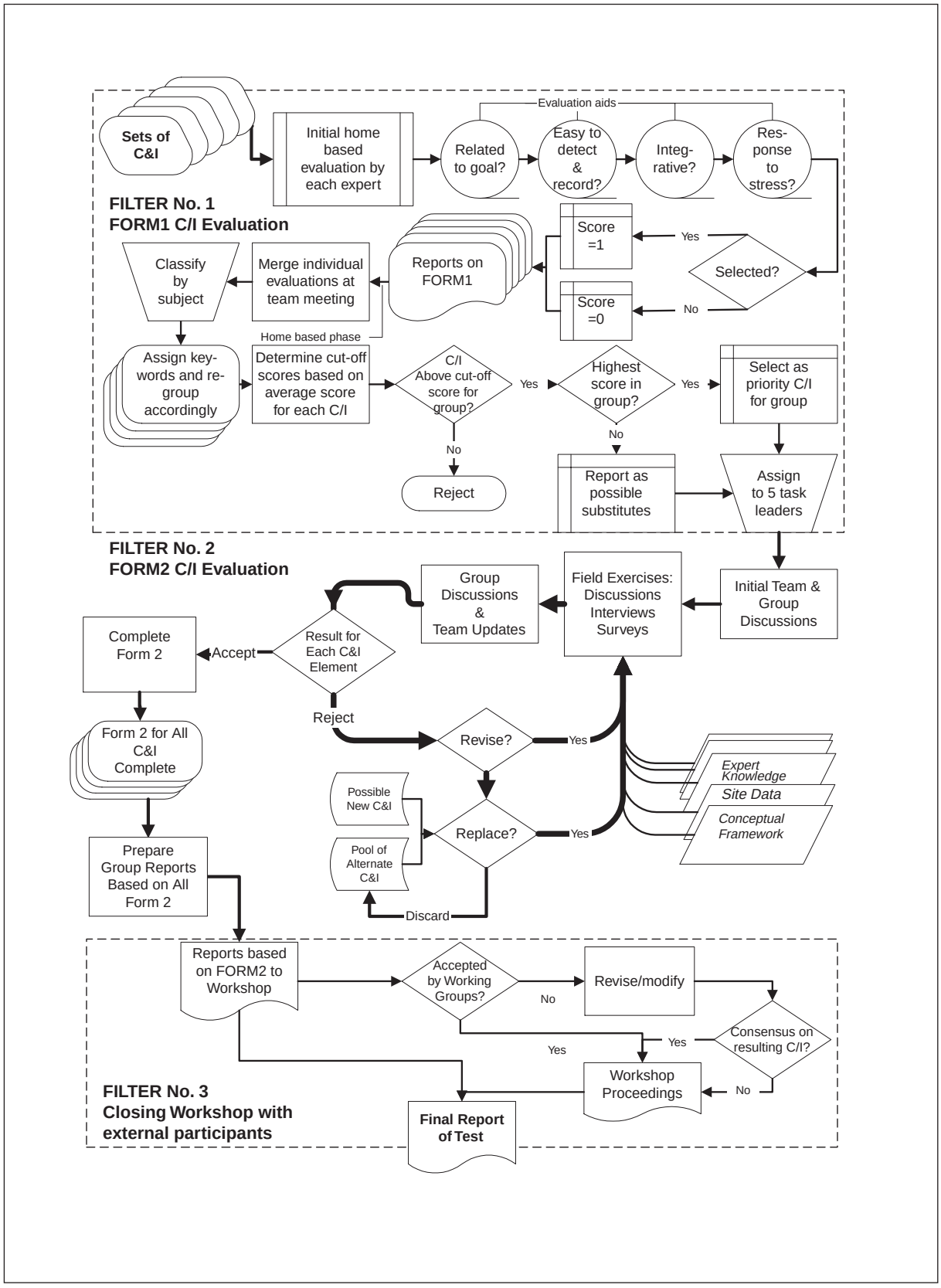

Figure 1. Flowchart of the entire CIFOR process of developing C&I for sustainable forest management at the FMU level.

FORM 1 AND FORM 2

TESTING CRITERIA AND INDICATORS FOR THE SUSTAINABLE MANAGEMENT OF FORESTS
Response Form No. 1: Evaluation of all criteria and indicators
Instructions for users

Purpose of the form

The objective of the response form is to enable a preliminary evaluation of all criteria and indicators to determine, based on best professional judgment, the most important ones for assessing sustainability of the ecosystem, management and social systems. This first examination should concentrate on eliminating only the most obviously deficient criteria and indicators. The results of this first evaluation will be discussed with other panel members in Kribi, to determine the subset considered by the team to be 'priority' criteria meriting further and more detailed evaluation.

Method

The criteria and indicators are to be evaluated in the context of conditions in at the FMU/country. The task of a system to *evaluate* sustainability is to assess the satisfaction of the following two conditions:

1. ecosystem integrity is ensured/maintained; and
2. well-being of people *(primarily local people)* is maintained or enhanced.

These conditions represent the biophysical, social and temporal elements of sustainability and are discussed in greater detail in the *Briefing Book*. Fulfilment of the above two conditions is expected to takes place continuously over long but not infinite periods of time.

The following five questions have been designed as aids to focus on important attributes of criteria and indicators and enable the elimination of obviously deficient criteria and indicators.

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

2. **Easy to detect, record & 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 stresses? =** Does the indicator continue to give you useful and meaningful information over a wide range of situations?

5. **Important and therefore selected as 'priority'?** = Is it relevant and appropriate? Is it useful ? Is it worth further investigation during the field phase?

➔ Please use a scale of 1-5 in answering the five questions listed on Response Form No. 1.
➔ Please photocopy the form as required.

Please try and record your responses on the attached simple program. Remember to make print outs for safety!

Form 1: Evaluation of all criteria and indicators

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

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

Testing Criteria and Indicators for the Sustainable Management of Forests
Response Form 2
Instructions for users

1. This form has been designed to record assessments of criteria and indicators selected for more intensive evaluation, after analysis of Form 1. It has also been designed to provide a transparent record of how you reached your conclusions.

2. Filling in the form.

a) The first six unnumbered boxes on page 1 identify which panel member is primarily responsible for the evaluation of the criterion or indicator ('Expert's Initials'), which of the sets it originated from ('Source'), its number or reference as recorded in the source (Criteria No. or Indicator), its subject matter ('Class') and whether after completion of the field phase it was recommended or not ('Recommendation').

b) Box A: Please enter the *original* text of the criterion or indicator, you have selected as being the most worth evaluating from amongst the sets provided. Please refer to relevant Response Forms No. 1 of all panel members, before effecting your selection.

c) Box B: Justify your selection of this criterion or indicator, giving the main arguments.

d) Attributes, Box C:

General: Two entry boxes have been provided for each question in this *and subsequent sections*. The first box (d) refers to the criterion or indicator as listed in Box D, which is the initial selection. If the initial selection has to be modified, this will be recorded in Box O on page 4. This final version must be subjected to a renewed evaluation (o). By comparing evaluations (d) and (o) the reader can assess whether the final version is significantly better than the initial version.

1) **Provides a summary or integrative measure?** Does it sum up or integrate a lot of information? Is it information efficient?

2) **Closely and unambiguously related to the assessment goal?** Is it closely related to its assessment goal? Is it diagnostically specific? Is the criterion or indicator easy to detect, record and interpret?

3) **Adequate response range to stresses?** Is it sensitive to changes in the environment or the system? Does it provide meaningful information over these changes?

4) **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?

5) **Appealing to users?** Does it appeal? Would a potential user feel invited to use it? Is it cost-effective?

6) **Easy to detect, record and interpret?** How feasible is the criterion/indicator? Will it produce repeatable results?

7) **Precisely defined?** Is the meaning clear? Is the definition precise? Would two different people understand it the same way? (Test this on your fellow panel members.)

8) **Will it produce replicable results?** Is it reliable and repeatable? How robust are predictions based on this indicator or criterion?

9) **How relevant is this criterion or indicator?** Your opinion on the relevance of this criterion or indicator to sustainability.

10) **Other:** Specify, e.g., Is an absolute or a relative measure better?

e) Box D: Give bibliographic references to provide additional weight to your justification, if you can.

f) Box E: Give the references, wherever possible, of similar criteria and indicators from the other sets.

g) Box F: If the criterion or indicator selected in Box D has undergone changes in its definition, the final version of this criterion or indicator should be recorded here. It is assumed that justification for these changes can be found in pages 2 & 3.

h) Box G: Record additional notes in this space. If a criterion or indicator is rejected, please provide the reasons here.

i) Box J: Maintain a daily diary of your efforts to evaluate the criterion or indicator. This will be of help to you in justifying to the workshop your reasons for selecting or rejecting it. It will also be of help to CIFOR staff for the analysis of your recommendations after the field phase. Please feel free to add additional pages if desired.

j) Box K: In this box 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, 5-year and 20-year management plans exist' would be an input resulting out of 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 how committed management is to achieving its goals.

k) Box L: 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 how the system 'responds' to stress or strain, is an effective way of looking at causes and effects. Examining whether the major sources of stress, and the systems' responses to these stresses, have been captured in criteria and indicators facilitates objective conclusions on their effectiveness and reliability.

l) Box M: Criteria and indicators constitute a network or web to capture information. The boxes above have attempted to examine whether the right strands have been woven into this web, and that the mesh is neither too small nor too large for the information we want to capture. In this box 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.

m) Box N: The workshop notes will be used to record the most important conclusions of the workshop on the criterion or indicator.

TESTING CRITERIA AND INDICATORS: CIFOR METHOD

Form 2: Field responses

TEAM NO. 3

EXPERT'S INITIAL JB
A=....., B=....., C=.....

SOURCE ATO
state source document

IDENTIFICATION NO. E6
IN SOURCE

FINAL IDENTIFICATION NO. (AS REPORTED IN FINAL LIST) E6

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

RECOMMENDATION (AFTER FIELD TESTING) Yes X / No

Enter the selected criterion or indicator as stated in the source document in this space (use Box O for final vers.):

There is a procedure for dialogue and conflict resolution between various stakeholders

A

Justify your selection of this criterion or indicator:

The logging company in the XXX area has an opportunistic attitude vis-a-vis the population. Conflicts are solved in an adhoc manner, and most often external authorities are called upon to restore order and to 'solve' problems. The actual way of dialogue and conflict resolution causes dissatisfaction among local people.

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?	3	3	Easy to detect, record and interpret? Feasible?	5	5
Closely and unambiguously related to the assessment goal?	5	5	Precisely defined? (clear)	5	5
Adequate response range to stresses? (Sensitive)	3	3	Will it produce replicable results? (reliable)	5	5
Diagnostically specific?	5	5	How relevant is this criterion or indicator?	4	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
Base Set1										
Base Set2										
Base Set3										

E

Final version of criterion/indicator, state only if different to definition on page 1 (Box A):

There is a procedure for dialogue and conflict resolution between various stakeholders and within stakeholder groups (indicator)

F

G

NOTES: Please record your notes on evaluating the criterion/indicator (Box A) here:

30/10 *People from the villages where a logger is working with a job in the city often enjoy a high status and can play an important role as intermediaries between the villagers, the logger and the state.*
Villagers prefer to solve conflicts between them at village level, and hesitate to involve the authorities.
Village chiefs do not have enough authority to control forest utilisation by fellow villagers and outsiders.
the villagers feel powerless regarding the empty promises of the logger.

02/11 *The villagers try to negotiate with the logging companies on 'empty promises'. The feel at the one hand that the officials do not want to help them because they 'eat' from the logger. At the other hand they count on them → an ambiguous attitude.*

H

Would this C&I need to be evaluated

in the field?	X
in the office?	
both?	

I

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.

- *Documentation on socio-political organisation of the ethnic groups concerned.*
- *Documentation on the forestry law.*

J

Diary of Important Actions to Evaluate C&I

Date	Action	Remarks
30/10	*Field visit (social scientists) to the village of E. in the XXX-area. Method: Group discussion (participatory mapping) (4-5 men)*	*Some women came and joined the discussion (unusual in the XXX-area)*
02/11	*Field visit (social scientists) to the village of B. (50 km from K./ road K.-E). Method: Group discussion (5-6 men)*	

FUNCTION 1

Justify:		(d)	(o)		(d)	(o)		(d)	(o)
	Human Input	X	X	Human Process			Outcome		

K Task Leader: .....

FUNCTION 2

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

L Task Leader: .....

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

Biophysical:

Social:

Management:

Other:

M Task Leader: .....

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

WORKSHOP NOTES (for office use only)

Did the workshop accept this criterion indicator unchanged? YES ☐ NO ☐

Why?

Were revisions called for? YES ☐ NO ☐

State revision:

State justification for revision:

OR was this criterion or indicator rejected as being unsuitable? YES ☐ NO ☐

State reasons:

N

Annex C

CRITERIA AND INDICATORS PROPOSED BY THE SIX TEAMS

Team 1: David Everard, Gart van Leersum, John Mope Simo

Principle	Criterion	Indicator - Team 1	Verifier	Class	Base set overlap
	Knowledge of extent, types and management/ administration of all forests at a national scale.	Maps indicating forest types, forest communities and forest associated ecosystems (i.e., wetlands) at the FMU scale.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
	The government implements measures in order to promote the participation of various stakeholders (mainly neighbouring villagers) in protecting the forest.	There is a permanent forest estate governed by laws and regulations which are the basis for its sustainable management. The permanent forest estate is the result of negotiation between all stakeholders within the framework of a procedure of coordinated planning of the allocation of lands based on appropriate and updated information.		S	ATO: A1.1; A1.2; E1.2 DDB: 5D2 CS: S18
		All parties involved participate in the management of natural resources in a manner accepted by all.		S	ATO: E1.1 DDB: 6A CS: S14
		Tenure/use rights are well defined and upheld.		S	ATO: E1.2 DDB: CS: S21
		Effectiveness of systems of forest and related agencies administration and control mechanisms.		S	ATO: DDB: CS:
	The forest unit is zoned into areas to be managed for various objectives.	Areas to be utilised (i.e., logged) are identified and clearly indicated on maps.		E	ATO: B1; B1.1; B2 DDB: 1B; 1B1; 1B1.1; 4A; 4A1 CS:
		Areas to be protected are identified and clearly indicated on maps.		E	ATO: D2.1; D2.2; D2.3; DZ.4 DDB: 1A2; 2B; 2B5; 4A1; 4A2 CS: M6; E11; E16; E17

Team 1 continued

Principle	Criterion	Indicator - Team 1	Verifier	Class	Base set overlap
		Other forms of land use (i.e., agriculture) within the forest unit is clearly indicated on maps.		E	ATO: D2.1; D2.2; D2.3; DZ.4 DDB: 1A2; 2B; 2B5; 4A1; 4A2 CS: M6; E11; E16; E17
	Knowledge, information and data on resources (timber and non-timber) and components (flora and fauna) of the forest is available.	Inventory (all size classes) of all existing and potential timber species is undertaken and the data is available.		E	ATO: C1.1; CI1; CI2.3; CII1 DDB: 2A; 2A1; 4A2 CS: M1; M6; M10; M15; E15
		Forest types (composition, structure and function) are adequately described from a vegetation survey.		E	ATO: C1.1; C1.2.1 DDB: 2A; 3A2.1; 4A2; 5B CS: m6
		Data/information (species lists) on fauna in the forest is available.		E	ATO: C1; CI; CII; D2; D2.2; DDB: 2A CS:
		Data/information on rare, threatened, endemic, indicator/keystone species and other important species is available.		E	ATO: D2.7 DDB: 2B; 4A2; 5D1 CS: E7; E15
	The planning process is directed at information, consultation and participation of local communities.	The government has a system of reliable, adequate and updated information on the forestry sector (especially a national forestry inventory) which enables the government to update its action plans and adjust themeans of implementation.		S	ATO: A1.2; B3.2; C1.2; C1.4; DDB: 3A1; 3A2 CS:
		The management plan is approved by the appropriate ministries, widely published and made available to all stakeholders.		S	ATO: DDB: CS:
		National policy aimed at the recognition of the cultural integrity of specific social groups and communities, the observation of customary land use rights and prevention or fair resolution of conflicts between various categories of forest users.		S	ATO: DDB: CS:
		Local people participate in the designing, monitoring and evaluation of strategies aimed at environmental education and their empowerment.		S	ATO: CI2.1; CI2.3; CI2.4; CI2.7; CI2.8; CI2.9; CI3; CI3.1; CI4; CI4.1; CI4.2; CI4.3; CI4.4; CII1 DDB: 5D1; 5D2 CS: M1; M6; M7; M8; M9; M10; M11; M12; M17; M18

Team 1 continued

Principle	Criterion	Indicator - Team 1	Verifier	Class	Base set overlap
	A management plan has been established, reflecting clearly the inclusion of the local population in its design.	There is a management plan, comprising: inventory; maps; objectives; activities proposed; results expected; feasibility studies; financial plan; growth rates; cutting cycle; protection areas; codes of practice (felling, skidding, roads); local population practices and assessment of their durability; manpower plan – local population; projection expected damage levels.		M	ATO: DDB: CS:
		The management plan looks beyond the second cutting cycle.		M	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		There is evidence of inclusion of the local population in the management plan design.		M	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Copies of the Government-approved (revised) management and annual work plans are present at village level.		M	ATO: A1.2 DDB: 1A; A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
	Planning and implementation of the management plan… and administration is transparent.	Forest operations are properly carried out with minimal damage.		M	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Documentation and records.... for public monitoring to occur.		M	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Degree of forest products utilisation.		M	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
	Abiotic conditions of the forest are protected according to a documented and available code of practice.	Erosion from skid trails and roads is within acceptable limits?		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Streams and rivers are not depositing increased amounts of silt at monitored sites where deposition naturally occurs.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Water quality (suspended solids and mineral content) is not deteriorating at monitored ‘choke points’.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Stream flow (low flow and high flow) is consistent with norms and is not changing.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6

Team 1 continued

Principle	Criterion	Indicator - Team 1	Verifier	Class	Base set overlap
		A code of practice exists.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
	Biotic features (species and processes) are protected.	Species composition of plant communities (at monitoring sites) is not changing significantly as a result of logging.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Canopy gaps within the forest do not exceed 15% of area.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Infestations of 'alien weed' species do not exceed 15% of the forest.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Indicator species?? (plant or animal) numbers are not declining.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Tree growth rates (at monitored sites) are not declining.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Lianas remain below 20% cover in the subcanopy layer of the forest.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		The ratio of gap phase: shade-tolerant tree species in the forest remains constant.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
	Negative impacts of various interventions on forest products and services are minimised.	There is planning and control of the harvest of timber and NTFPs.		S	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Damages caused are compensated for in a fair manner.		S	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Inventory of positive and negative effects of timber harvest for welfare and prosperity of local communities.		S	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
	Identifying and recognising the forest functions of various forest users, especially local communities.	Local people's perceptions, aspirations and values of the forest are recognised and accepted by all stakeholders so that they do not feel alienated from 'their forest'.		S	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6

Team 1 continued

Principle	Criterion	Indicator - Team 1	Verifier	Class	Base set overlap
		Forest-dependent people and logging companies share in the responsibilities and benefits that accrue from sustainable forest utilisation.		S	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		The demand for goods and services, expressed by stakeholders, on the forest is consistent with the forest's capacity to meet it.		S	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		The government implements appropriate programmes to stabilise agriculture.		S	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Viability and adaptability to changing economic conditions of forest-dependent communities, including indigenous communities.		S	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
	Integrated environmental management (impact assessment, ecological monitoring, environmental auditing) is followed.	Degraded areas and areas impacted upon by forestry and related activities are mapped and monitored.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Rehabilitation of degraded and impacted forest is undertaken in accordance with a code of practice.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Environmental impact assessments of proposed forestry operation, and environmental auditing of existing management is undertaken and reported.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Environmental education programmes (all parties) are developed and implemented.		E	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
	Management plan is updated periodically to allow inclusion of accrued knowledge, research, results, etc.	The management plan is revised and approved every five years.		M	ATO: A1.2 DDB: 1A; 1A1.1; 1A2.1; 1B; 1B1; 1C CS: m6
		Evidence of updating the management plan.		M	ATO: DDB: 1 CS: m6

Team 2: Martine Antona, Simo Hubert, Sue Ellen Johnson

CIV	Subject (Criterion/Indicator/Verifier) - Team 2	ATO	DDB	CS
1.1	Capacity of forest for natural regeneration is ensured.			
1.1.1	Rates of regeneration of forest ecosystem {structure} in logged areas are comparable to those of natural gaps (with 15%).			
1.2	Maintain{ing} capacity for natural regeneration of the forest.			
1.2.1	Natural regeneration results in similar structure, biomass and (functional) composition as the original forest (within 12 years) OR resembles successional stage in natural gaps in the original forest.			
1.2.2	Percentage composition of timber species populations harvested results in a less than <10% shift in species composition/abundance of harvestable timber species populations ('harvestable community composition').			
1.2.3	If enrichment planting carried out in logged forests, it is with spp that were harvested in the forest.	1.D.2.6		
1.2.4	Gap colonizing/pioneer species are the same as those in natural gaps (tree falls).			
1.3	Protecting and preserving threatened {tree} species.			
1.3.1	NTFP species are the objects of conservation and domestication studies.	1.D.2.8		
1.3.2	Big (large diameter) trees can to be found in the forest.			
1.3.3	Harvestable maximum as well as minimum diameters for every timber species are defined and followed. [The largest 20% cannot be harvested]			
1.3.4	For harvestable timber species, 15% of individuals of every size class remain, undamaged, in the forest (or FMU).			
1.3.4.1	Of the total population of harvestable timber species inventoried pre-harvest, the 15% largest [oldest] individuals are left for conservation.			
1.3.4.2	Sawn logs not removed from forest within 7 months of harvest become [are recognized as] local property, free for the taking.			
1.3.4.3	No sawn logs remain rotting in the forest or at landings or the port.			
1.3.4.4	Unmarketed logs which remain unprocessed, and rot result in corresponding decreases in concession area or rights to that species. I need a better understanding of legal rights.			
1.4	{Negative} impacts on biodiversity minimized.	*1.D.2		
1.5	Rare or endangered species and habitats protected.	*1.D.2.7		
1.6	{Animal} species which have been negatively affected during logging retain their ability to recover and exist as viable populations in the area.			E20
1.7	Size of biological reserves is adapted to suit the object[ives] of habitat preservation.			
1.7.1	ID of rare, endangered, endemic {and indicator} species.			E15
1.7.2	The extent to which ecosystems, vegetation and species are [can be] identified by various stakeholders.		2.1.A.1.1	
1.7.3	Village harvest of wildlife species (for consumption and sale) changes by less than 10% during the logging process/period.			
1.7.4	Village harvest area of NTFPs increases as a result of logging.			
1.7.5	Area and percentage of forest land actually managed primarily for protective functions.			E5
1.7.6	Area and percentage of forest with diminished number of biological components [on a 0.1 ha grid basis]; indicative of change in fundamental ecological processes and ecological continuity.			E3

Team 2 continued

CIV	Subject (Criterion/Indicator/Verifier) - Team 2	ATO	DDB	CS
1.7.7	Protected areas are topographic units/blocks. They are proportionally representative of the topo-'distribution' of the actual total forest area. (X % slope X, slope y, X% wetlands...)			
1.7.8	Protected reserves are centrally and peripherally located.			
1.8	Infrastructure is designed, established and maintained in such a way that negative impacts on the environment are minimized.	1.C.I.4		
1.8.1	Multiple scales defined in management guidelines. (not just a per hectare basis – but guidelines ? range from 0.1 ha to 10,000 ha; appropriate to the processes or FMU of concern.			
1.8.2	Number of standing (or unharvested) dead and diseased trees per hectare in regenerating stands is less than in unlogged forest.			
1.9	Canopy opening is minimized.			E13
1.10	Disturbance is not recurrent.			
1.10.1	Each area of 'intensively' logged parcels (defined as 'groups' of trees felled or skid trails within ?150 m of each other) cannot be larger than a total of X ha. Such parcels are separated by undisturbed areas of 3 times their magnitude. (island ha)			
1.10.2	Intensively exploited areas are long and narrow (preferable to square or round areas).			
1.10.3	Area and % of forest affected by processes or agents {exceeds} the range of historic variation.			E2
1.10.4	Light demand pioneer species do not form dense stands greater than $40m^2$.	1.D.1.2		
1.10.5	[Specific contiguous areas of light-demanding pioneer species are not greater than...x2]. – what can be detected with aerial photography.			
1.10.6	Roads and trails do not disturb the overstorey.			
1.10.6.1	Skid trails not detectable at any time from overhead (aerial view).			
1.10.6.2	Less than 50% of active/new logging roads in an FMU detectable from overhead.			
1.10.7	Total incursions less than x km , xm per ha.			
1.10.7.1	Any skid trail must service more than 2 trees.			
1.10.7.2	Km of skid trails should exceed km of road.			
1.10.8	Gap diameter (width) is comparable to natural tree falls.			
1.10.9	For any/every/each area where canopy disturbed-destroyed, adjacent/surrounding area (with undisturbed normal forest light environment) is 12 times greater than the disturbed area.			
1.10.10	Long-lived woody upright perennial canopy exists.			
1.10.11	Herbaceous species [perennials (or annuals)] are less prevalent than tree species (biomass is less).			
1.10.12	Secondary forest canopy is multistrata; 4 to 5 distinct layers beneath a 'dominant' overstorey which provides 80% land cover per hectare.			
1.10.13	Understorey light environment [? at ground level and at 1.5 m?] is affected by logging activities in less than [?15]% of the total active logging area/FMU. {% of understorey with light incursion due to logging disturbance is less than 90%.}			
1.10.14	Regenerated overstorey is comprised of the same number of species as in undisturbed forests.			
1.10.15	Number of phyto-species composing the litter layer in regenerated forest is similar to that in undisturbed forest.			

Team 2 continued

CIV	Subject (Criterion/Indicator/Verifier) - Team 2	ATO	DDB	CS
1.10.16	In regenerated secondary forests, variation of [overstorey] canopy height is less than [10 m?], with gaps less than 10m x 10m.			
1.11	Forest function of water filtration and storage is maintained.	1.D.3		
1.12	Forest continues to function as a hydrological screen for the area.		2.4.C	
1.12.1	Infrastructure doesn't change overland water flow.	1.C.I.4.4		
1.12.2	Water {system} supply and quality do not decrease.	1.D.3.1		
1.12.3	Logging only occurs during dry season.			
1.12.4	Local (on-site-- within logged catchments (first-order)) hydrological processes: run-off, retention and infiltration change less than 5%.			
1.12.5	Change in wetlands species [vegetative composition] within [0.5 km? of] felling site, skid trail or log landing area.			
1.12.6	No ponding or waterlogging as a result of forest management.			E12
1.12.7	Multiple scales/orders of catchments monitored off and on-site.			
1.12.8	Skid trails do not cross or parallel year-round water courses to management			
1.12.9	Skid trails and truck roads follow contour.			
1.12.10	No infrastructure within 150 m of a water course or water body.			
1.12.11	No skid trails (logging) on slopes greater than [?15%].			
2.1	Demand for forest goods/services expressed by stakeholders and beneficiaries is consistent with forest's capacity to meet it.	1.E4		
2.1.1	Substitute/alternative goods, markets, infrastructure, technology and incentives available to supply forest product gaps/ demand for indirect forest 'users'.			
2.1.2	Substitution (and costs) of modern medicines relative to forest/traditional remedies.			
2.1.3	There exist technologies and functioning programmes for enrichment timber planting and establishment [of mixed timber species stands] with subsistence food crop production, where cultivation has followed logging activities.			
2.1.4	Local people have the right to establish and retain the rights to timber plantings of less than 100 ha, in logged over areas of concessions.			
2.1.5	Villagers have an understanding and clear strategy for forest use and management during and following exploitation.			
2.1.6	Actual value of locally produced value-added wood products relative to actual value of whole log exports.			
2.1.7	Relative % of returns from cultivation, plantation, and exploited timber, value-added and NTFP to villages [local people] and timber companies.			
2.1.8	Regeneration rates – carrying capacity under current management known.			
1.13	Production capacity of the soil is maintained		2.5.A.1	
1.13.1	Regeneration of site (soil and overstory biomass) nutrients within 10 years (--comparable to traditional shifting cultivation fallow).			
1.13.2	Traditional cultivation (with normal land productivity), and fallowing are possible following logging.			
1.13.3	Traditional fallow successional sequence species establishes following cultivation of logged parcels.			
1.13.4	Where logging is followed by subsistence cultivation, traditional long-term fallowing follows.			

Team 2 continued

CIV	Subject (Criterion/Indicator/Verifier) - Team 2	ATO	DDB	CS
1.13.5	Cultivation immediately follows logging – without a regeneration period.			
1.13.6	Area and % of forest soils affected by alterations in physical-chemical properties (erosion/compaction) [as a result of logging (and logging access) activities] are assessed.			M2, E5A
1.13.7	Comparative/differential landscape and off-site impact of traditional (shifting) cultivation (at local population densities) and conventional – actual – logging evaluated.			
1.13.8	Locally owned plantations provide 40% of harvested timber to concessionaires.			
3.1	A management plan has been established for the sustainable management of the forest taking into account all its components and functions such as timber production, other forest products, contribution to the well-being of the local people, ecology.	C.1.A		
3.1.1	Reforestation is implemented with chosen species in conformity with the specifications of the management plan.	C.I.3.1		
3.1.2	Inventory of ecosystems, etc. on management unit level.		4.A.2	
3.1.3	The boundaries of the permanent forest estate are well marked in the field.	B.1.2		
3.1.4	The felling programmes are adjusted rapidly if the change in data collected in the field is significantly different from that on which the manager's initial estimate is based. The management plan is amended to be consistent with the true data.	C.I.2.6		
3.1.5	Documentation and records of all forest management activities are kept in a form that makes it possible for monitoring to occur.			M16
3.1.6	Rules for acceptable disturbance within management unit.		4.B.1	
3.1.7	Management techniques are well understood and applied by all stakeholders (forest service, local population, timber industrialists).	E.2.1		
3.1.8	Planning and implementation of logging are carried out in conformity with guidelines of the management plan and the contract agreement based on technical and social standards as well as financial specifications.	C.I.2		
3.1.9	Continuous forest inventory (CFI) plots established and measured regularly.			M15
3.1.10	Proportion of area of permanent production in areas of environmental protection.			E6
3.1.11	Ecologically sensitive areas, especially buffer zones along water courses are protected.			E11
3.1.12	Corridors of uncut forest based on streamsides with links up slopes and across ridges to connect adjoining catchments and forest areas which will not be harvested are retained.			E16
3.1.13	Tree marking of seed stock and potential crop trees.			M18
3.1.14	In the area of harvesting, the standards are explicit on: minimum number of large trees to be retained as seed producers (mother trees) per ha and species; and maximum number of trees to be harvested per ha.	C.1.2.1		
3.1.15	Trees to be protected are plotted on a map and conspicuously marked, prior to harvest.	C.I.2.8		
3.1.16	Existing, ongoing and future plantations in the national forest plantation plan can contribute to supply the timber sector.	A.3.1		
3.1.17	Harvest and management planning.		5.C.2	
3.2	The Government has clear forest development objectives and a realistic action plan to meet them.	A.1		
3.2.1	A system of laws and regulations.	1.B.1.1		
3.2.2	National environmental mapping of forest ecosystem types.	1.A		

Team 2 continued

CIV	Subject (Criterion/Indicator/Verifier) - Team 2	ATO	DDB	CS
3.3	Land-use planning which indicates destinations for different forms of land use in relation to forest categories.		2B	
3.3.1	Maps of the forested areas to be protected in the Permanent Forest Estate (PFE)	1.A.2		
3.3.2	Maps indicating sites of conversion forests:		2.B.5	
3.4	Inventory of the various categories of forest use and their importance for the different social groups.		2.A	
3.4.1	Statistics of forest incomes for the various categories of users.		2.A.2	
3.5	Forestry service and other stakeholders of the sector have enough capacity to properly develop and manage the forest for all its roles (timber production,other forest products, ecology, farmer-forest relationship).	C.2		
3.5.1	Well-managed community forest exists.			
3.6	Efficient measures have been taken by the authorities to monitor the forest and to protect against clearing, fire, settlements and illegal gathering of forest products.	B.2		
3.6.1	There is a control mechanism (direct or delegated control, type and frequency of control) complied with by the forest service.	B.2.1		
3.7	National environmental quality policy.	1C		
3.7.1	The Government has a system of reliable, adequate and updated information on the forestry sector (especially a national forest inventory) which enables it to update its action plans and adjust the means of implementation.			
4.1	Infrastructure (roads, bridges, firebreaks, etc...) is designed, established and maintained in such a way that negative impacts on the environment (forest, soil, water course network) are reduced to a strict minimum.	C.I.4		
4.1.1	Minimum infrastructure required for logging is made permanent.	C.I.4.3		
4.1.2	Sizes of infrastructure (primary and secondary roads, timber yards, skidding tracks) are reduced to the barest minimum possible.	C.I.4.2		
5.1	Sharing of benefits from the forest is considered equitable.			E5
5.1.1	Arrangement for share of revenues from timber and non-timber products for local community.		5.E.3	
5.1.2	Arrangements for compensations for loss or damage.		6.C.3	
5.1.3	Economic participation of local community in commercial forest use.		5E	
5.1.4	Forest-dependent people and company officials understand each other's plans and interests.			S19
5.1.5	Minimum infrastructure required for logging is made permanent.	C.I.4.3		
5.2	The Government has a system of reliable, adequate and updated information on the forestry sector (especially a national forest inventory) which enables it to update its action plans and adjust the means of implementation.	A.1.2		
5.2.1	Inventory of positive and negative effects of timber harvest for welfare and prosperity of local community.		6.C.2	
5.2.2	Forest dependent people share in economic benefits of forest utilisation.			S16
5.2.3	Non-timber forest products and their uses are identified.	C.II.1		
5.2.4	Inventory of local initiatives.		6.B.1.4	
5.3	All Stakeholders participate in forest resources management.		E.2	

Team 2 continued

CIV	Subject (Criterion/Indicator/Verifier) - Team 2	ATO	DDB	CS
5.3.1	There is collaboration between the forestry service, agricultural service, public order authorities and other public services concerned in forest management.		B.2.3	
5.3.2	Mechanisms for consultation and the effective participation of local communities in the management of forest resources, depending upon the scale of management.			S14
5.3.3	Effective mechanisms exist for two-way communication related to forest management among stakeholders.			S18
5.4	There is a mechanism for sustained and adequate funding for the management of Government forests.	A.2.1		
5.4.1	Government rent from forest exploitation is indexed to the value of timber products.			
5.5	A legislative framework, with traditional property rights and land use rights enshrined.		3.A.2.2	
5.5.1	The methods of access to forest resources are clearly defined and respected by all stakeholders.	E.1.1		
5.5.2	Forest management unit is implementing forest management on the basis of a legal title of the land, recognised customary rights or lease agreements.			S21
5.6	Impact of logging on income level of local forest-dependent people is assessed.			
5.6.1	Forest-dependent people have the opportunity to be employed and trained by forest companies.		E.5.3	
5.6.2	Existence of legal labour proceedings and/or public actions in which the company is involved.			S22
5.6.3	Direct and indirect employment in the forest sector and forest sector employment as a proportion of total employment.			S3
5.6.4	Efficiency of systems of production and transformation of forest products.			S9
5.7.1	There is a direct, sustainable, efficient system to interest various stakeholders in protecting the forest against clearing, fires and poaching.	B.3.1		
5.7.2	Guidelines for rational harvesting of non-timber forest products are defined and put into practice.	C.II.2		
5.7.3	Rate of return and pay-back period of logging companies is compatible with the exploitable timber regeneration period.			
5.7.4	Capacity of local industrial transformation (premiere transformation) does not exceed the FMU production potential.			
5.7.5	Recovery rate of domestic primary transformation is not below regional or international standards.			

Team 3: Eric Forni, (Fred Vooren), Jolanda van den Berg

P	C	I	V	PRINCIPLES, CRITERIA, INDICATORS AND VERIFIERS TEAM 3	Source	Remarks & alter.	
1				[NATIONAL LEVEL]			P
	1.1			**The government allocates adequate means for sustainable management of forests.**	A.2		P
		1.1.1		There is a mechanism for sustained and adequate funding for the management of Government forests.	A.2.1		P
		1.1.2		There is a forestry service in charge of the management of all the forests, with the capacity (staff, level of formation, means) to fulfil its mandate.	A.2.2 (rev.)		P
		1.1.3		Forest research is allocated sufficient means (human and material) and its results are applied.	A.2.3		P
	1.2			**Land use planning which indicates destinations for different forms of land use in relation to forest categories. This planning is the result of negotiation between all stakeholders within the framework of a procedure of coordinated planning based on appropriate and updated information**	2.B (REV.)		P
		1.2.1		There exists a map showing the different destinations of forest (permanent protected, permanent productive, conversion forests,...).	B.1.1 (rev.)		P
		1.2.2		In the area of harvesting, the standards are explicit on: minimum number of large trees to be retained as seed producers (mother trees) per ha and species; maximum number of trees to be harvested per ha; harvesting systems and equipment to match forest conditions in order to reduce impact; the minimum exploitable diameter for each species.	C.1.2.1 (REV.)		P
		1.2.3		Yield regulation by area and/or volume prescribed compatible with sustainable production of the forest.	m8		P
	1.3			**Management is effectively implemented.**	C.1.3		P
		1.3.1		Pre-harvest inventory satisfactorily completed according to national standards.	m10		P
		1.3.2		Tree marking of seed stock and potential crop trees.	m18		P
		1.3.3		Infrastructure is laid out prior to harvesting and in accordance with prescriptions on the basis of the pre-harvest inventory map.	m11		P
		1.3.4		Skidding damage to trees and soil minimized.	m13		P
	1.4			**Effectiveness of systems of administration and control.**	m3		P
		1.4.1		Documentation and records of all forest management activities are kept in a form that makes it possible for monitoring to occur.	m16		P
		1.4.2		The follow up and the control of the implementation of the management plan are done on the basis of the information included in the appropriate documents.	C.1.4		P
		1.4.3		The procedure of control is followed by results. (Mission reports, case files, transactions, condemnations, etc.).	B.2.2		P
2				[FMU LEVEL]			P
	2.1			**The forest is managed in a sustainable perspective taking into account all its components and functions such as timber production, other forest products, contribution to the well-being of the local people, customary claims on land and other resources, ecology.**	C.1 (rev.)		P

Team 3 continued

P	C	I	V	PRINCIPLES, CRITERIA, INDICATORS AND VERIFIERS TEAM 3	Source	Remarks & alter.	
		2.1.1		There is a management plan comprising: a) Definition of the forest area subjected to sustainable management; b) Key findings of studies and analyses on all the functions and uses of the forest (timber production, other forest products, farmer-forest relationship, forest ecosystem); c) Definition of objectives in these various uses, their spatial organization and their hierarchy; d) Relevant action plans to meet these objectives; e) Reference to laws and regulations governing such actions (particularly the national directives on management); f) Economic and financial evaluation; g) A set of maps allowing a clear summarized over-view of the results of studies, the objectives and the action plans.	C.1.1		P
		2.1.2		Silvicultural systems prescribed and appropriate to forest type and produce grown.	m7		P
	2.2			**Guaranteeing the continued harvest of other forest products.**	5.D.		P
		2.2.1		NTFP and their uses are identified.	C.II.1		P
		2.2.2		Customary or newly introduced mechanisms for control of harvesting exist at community level and are accepted by all parties.	NEW 3	n3	P
		2.2.3		Guidelines for rational harvesting of NTFPs are defined and put into practice.	C.II.2		P
		2.2.4		The demand for NTFPs is consistent with the forest capacity to meet it.	E.4 (rev.)		P
		2.2.5		There is a direct, sustainable efficient system to interest various stakeholders in protecting the forest against clearing, fires and poaching.	B.3.1	n3	P
3				FOREST MANAGEMENT MAINTAINS FAIR INTERGENERATIONAL ACCESS TO RESOURCES AND ECONOMIC BENEFITS.			S
	3.1			**Forest-dependent people share in economic benefits of, and participate in, commercial forest exploitation.**	s16 (rev.)	5.E, 5.E.3	S
		3.1.1		Forest-dependent people have the opportunity to be employed and trained by forest companies.	E.5.3	5.E.1, s17	S
		3.1.2		Level of local social economic infrastructure is maintained or enhanced.	NEW 4	C.I.4.3	S
	3.2			**Sharing of benefits from forest management is considered equitable by all parties involved.**	E.5 (rev.)		S
		3.2.1		Damages and/or loss caused by commercial logging and forest management are compensated for in a fair manner.	E.5.1 (rev.)	6.C.3	S
		3.2.2		Average wage rates and injury rates in major employment categories within the forest sector.	s4		S
		3.2.3		Profitability and rate of return of forest management per stakeholder group.	s8 (rev.)	B.3.1	S
		3.2.4		Nature and quantity of benefits deriving from forest management per stakeholder group.	sll (rev.)	B.3.1	S
	3.3			**The legal and customary rights of local communities to own, use and manage their lands, territories and resources shall be recognized and respected.**	NEW 5	CI, E.1.1	S

Team 3 continued

P	C	I	V	PRINCIPLES, CRITERIA, INDICATORS AND VERIFIERS TEAM 3	Source	Remarks & alter.	
		3.3.1		Local communities have effective voice in the allocation of vente de coupe on their customary lands.	NEW 6		S
		3.3.2		Area and percentage 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.	s2		S
		3.3.3		Area and percentage of forest land used for subsistence purposes.	s6		S
	3.4			**The property rights on forest resources of all stakeholders should be clearly defined, perceived and accepted by all.**	E. (Rev.)		S
		3.4.1		Forest management unit is implementing forest management on the basis of a legal title to the land, recognized customary rights or lease agreements.	s21		S
		3.4.2		There is a procedure for dialogue and conflict resolution between various stakeholders and within stakeholder groups.	E.6 (rev.)		S
4				STAKEHOLDERS, INCLUDING FOREST ACTORS, HAVE A VOICE IN FOREST MANAGEMENT.			S
	4.1			**All the parties involved have an acknowledged right and adequate means to participate in the management of natural resources.**	E.2.3 (rev.)	E.5.4, 6.B, S.14	S
		4.1.1		Adequate level of organizational capacity exists at the community level.	NEW 7		S
		4.1.2		Local communities have detailed knowledge of forestry laws, as well as forest management plan.	NEW 8		S
		4.1.3		Agreement exists on rights and duties of all stakeholders.	NEW 9	E, s15	S
		4.1.4		Effective mechanisms exist for two-way communication related to forest management among stakeholders.	s18	E.2.2	S
		4.1.5		Conflicts among stakeholders are minimal.	s20		S
		4.1.6		Mechanisms for punishment of non-compliance with forest management rules exist, and operate effectively in a manner accepted by all stakeholders.	NEW 10	C.II.2, n3	S
		4.1.7		Forest utilization is based on necessary compromises and complementarities.	E.5.4		S

Team 4: Bertin Tchikangwa, Laurent Debroux, Marie Mbolo

P	C	I	V	PRINCIPLES, CRITERIA, INDICATORS AND VERIFIERS TEAM 4	Source	Remarks & alter.	
1				LONG TERM ACCESS TO FOREST RESOURCES SHALL BE INSURED TO ALL STAKEHOLDERS.	(1) E.1	Rev.	S
	1.1			**Forest management is based on secured tenure rights of all stakeholders and integrated uses.**		Rev. (2) 6.A (2) 6.C. (2) 2.C. (3) s21	S
		1.1.1		All categories of forest uses for economical, social and cultural purposes, and their importance to each social group, are identified.		Rev.	S
		1.1.2		The customary rights procured by all forms of traditional use of forest spaces (shifting cultivation, hunting, fishing, collecting) are explicitly recognized.	(1) E.1.1	Rev. (2) 3.A.2 (2) 2.B	S
			1.1.2.1	*Map of occupation of space by local populations (customary territories).*	New		S
			1.1.2.2	*Possibility of legal recognition of customary territories (community forests) accessible to local populations. Community forestry statutes.*	(2) 3.A.2.2		S
		1.1.3		Forestry industries are guaranteed stable access to wood resources for a period corresponding at least to the period of rotation.	New		M
			1.1.3.1	*The duration of the management contract foreseen in the law and the anticipated guarantee of renewal of the management contract.*	New		M
			1.1.3.2	*The various forms of sustainable land and forest resources use for economic, social and cultural purposes are identified and integrated.*	(2) 6.A	(3) s6, (3) s2 (2) 2.A (3) 6.C	S
			1.1.3.3	*Inventory of all forest uses and forest products is available.*	(2) 3.A.2.1	Rev. (2) 2.A.1	S
			1.1.3.4	*Statistics of forest incomes for various categories of users is available.*	(2) 2.A.2	Rev.	S
			1.1.3.5	*Appropriate sociological and anthropological research is carried out to identify the social and cultural functions of forest for the local people.*	(3) s2		
	1.2			**Non-forestry activities are compatible with long term integrity and viability of forest ecosystem.**	(1) A.3		M
		1.2.1		Pressures on the land for non-forestry uses maintain the long-term integrity of the managed forests.	New		M
		1.2.2		Forest management provides benefits to its actors which are comparable to those which other uses of the land would provide.	New		M
2				ECONOMIC AND SOCIAL BENEFITS FROM FOREST MANAGEMENT SHALL IMPROVE THE WELL-BEING OF ALL STAKEHOLDERS.	New		S
	2.1			**Forest management provides long-term and secure benefits to investment.**	(3) S.1		M

Team 4 continued

P	C	I	V	PRINCIPLES, CRITERIA, INDICATORS AND VERIFIERS TEAM 4	Source	Remarks & alter.	
		2.1.1		Exploitation and transformation of timber provides certain and long-term benefits to industrial and artisanal operators.	New		M
			2.1.1.1	*Perspectives of the international and local timber markets.*	New		M
		2.1.2		Local communities are involved in the processing of NTFPs and/or timber and some stages of commercialization.	New		S
			2.1.2.1	*Techniques and tools for transformation at the community level.*	New		S
			2.1.2.2	*Means of transport.*	New		S
			2.1.2.3	*Cooperatives for production/commercialization.*	New		S
	2.2			**Effective mechanisms ensure a system of benefit sharing accepted by all stakeholders.**	(1) E.5		S
		2.2.1		Taxes levied on the industrial exploitation of forestry products are redistributed in a direct manner: 1) to the village communities, 2) to the 'communes', 3) to the forestry administration, and 4) to the national budget.	(2) 5.E.3	(2) 5.E (3) s16	S
			2.2.1.1	*The proportions of this redistribution are inscribed in the law (of finance).*			S
		2.2.2		The mechanism for redistribution and for the reallocation of the parts allocated to the forestry administration and to the 'communes' is foreseen in the law and institutionalized.			S
			2.2.2.1	*The parts allocated to the forestry administration are reinvested in the forestry sector.*			S
			2.2.2.2	*The communities know and approve of the use of the parts allocated to the 'communes'.*			S
			2.2.2.3	*The allocation of benefits received by the communities is decided in conformity with the management structure which they have adopted.*			S
		2.2.3		Forestry companies bring financial support and techniques for the development of collective infrastructures of local communities.			S
	2.3			**Timber exploitation contributes to local employment.**			S
		2.3.1		Local people have priority access to be employed and trained by the forest companies.	s17	Rev.	S
		2.3.2		Log exports are limited in favor of local processing.	New		M
			2.3.2.1	*Respect for legal quotas.*	New		M
			2.3.2.2	*Existence of incentives.*	New		M
			2.3.2.3	*Tools for operational primary and secondary processing.*	New		M
		2.3.3		Local enterprises for adding value to the residues of industrial exploitation exist.	New		S
			2.3.3.1	*Use of wood abandoned in the forest.*	New		S
			2.3.3.2	*Use of sawmill wastes.*			
	2.4			**Negative effects on the well-being of stakeholders are limited in a measure accepted by all.**			S

Team 4 continued

P	C	I	V	PRINCIPLES, CRITERIA, INDICATORS AND VERIFIERS TEAM 4	Source	Remarks & alter.	
		2.4.1		Measures are taken by the companies to minimize the adverse effect of timber production on the quality of life of local communities and forest workers.	(3) s7	Rev.	S
			2.4.1.1	*Fair compensation of damages.*			S
			2.4.1.2	*Desirable specimens of commercial trees also used locally remain around the villages after logging activities.*			S
3				ALL STAKEHOLDERS SHALL PARTICIPATE IN THE CONCEPTION AND IMPLEMENTATION OF FOREST MANAGEMENT.	(1) E.2	Rev.	S
	3.1			**Effective mechanisms ensure information, consultation and participation of all stakeholders in the decision process.**	(2) 3.A	Rev. (3) s14	S
		3.1.1		Procedures for two-way communication related to forest management among all stakeholders is clearly established.	(3) s18	Rev. (2)3.A.1.2	S
			3.1.1.1	*Existence of a consultative committee structure.*			S
			3.1.1.2	*Contract of collaboration among the forest and agricultural services, public appeals and all public services concerned with forest management at the national and local levels.*	B.2.3	Rev.	S
			3.1.1.3	*Contract between the forest service and the environmental and/or development NGOs, the universities and research institutions.*	New		S
		3.1.2		Efficient mechanisms for collective decisions lead to coordinated actions (and participatory evaluation).	New		S
			3.1.2.1	*Existence of a local decision-making committee which unites at least the forest service, the representatives of local communities and economic operators in the forestry sector.*	New		S
		3.1.3		There is a fair procedure for dialogue and conflict resolution between various stakeholders.	(1) E.6	Rev. (3) s20 (2) 3.A.2	S
			3.1.3.1	*Possibility of judicial recourse.*			S
	3.2			**Agreement between managing partners results in a management plan taking into account all forest functions.**	(1) C.1		M
		3.2.1		The definition of the objectives and their hierarchy stress the value of multiple uses of forest areas for non-concurrent activities.	New		M
			3.2.1.1	*The objectives respect the zoning plan and national political concerns.*	(1) C.1.1		M
			3.2.1.2	*Maps showing the limits among the forest categories (priority objective).*	(1) B.1.1		M
			3.2.1.3	*Maps showing the overlay of non-concurrent uses.*	New		M
			3.2.1.4	*Boundaries are marked on the field.*	(1) B.1.2		
		3.2.2		Management plan of a forest area is a contract between forestry service and one or several stakeholders using this area, with respect to national directives.	New		M
			3.2.2.1	*Management plan is available and clearly explicit rights and duties of each partner.*	New		M

Team 4 continued

P	C	I	V	PRINCIPLES, CRITERIA, INDICATORS AND VERIFIERS TEAM 4	Source	Remarks & alter.	
			3.2.2.2	*Financial clauses are clearly defined.*	(1) C.I.2.9		M
			3.2.2.3	*Management plan is approved by minister in charge of the forest.*	(1) C.1.2		M
			3.2.2.4	*A summary of the management plan is broadly diffused.*	New		M
			3.2.2.5	*Management plan is periodically submitted to revision.*	New		M
		3.2.3		Management takes into account productive functions (see Principle 4), ecological functions (see Principle 5) and socioeconomic functions (see Principle 2) of the forest.	(1) C.1		M
	3.3			**Stakeholders have the capacity to effectively implement the management plan**	(1) C.2		M
		3.3.1		Forestry service has enough staff and means to fulfil its mandate.	(1) A.2.2		M
		3.3.2		Local communities have the legal and organizational means to act as an efficient forest management body.			S
			3.3.2.1	*The law recognizes local communities as legal persons with statutes organizing an internal structure (local management committee) and mechanisms for collective decisions.*			S
			3.3.2.2	*All interest groups (user groups/gender) are involved in the community management structure.*			S
			3.3.2.3	*Inventory of community forestry initiatives legally accepted in the village territories adjacent to the FMU.*			S
		3.3.3		Workers and staff of economic operators have adequate training to implement management.	(1) C.2		M
4				CONTINUED AND COST-EFFECTIVE PRODUCTION OF GOODS IS EFFECTIVELY IMPLEMENTED.	(1) C.I		M
	4.1			**Vertical integration of the economic operators is optimized at each step of the value-adding process.**	New		M
		4.1.1		The volume output is maximum at each step of the wood chain.	(3) s.9		M
			4.1.1.1	*Output volume from the exploitation..*	(3) s.9		M
			4.1.1.2	*Sawmill output.*	(3) s.9		M
		4.1.2		Balance between production and the market.	New		M
			4.1.2.1	*Unsold volumes are minimized.*	New		M
		4.1.3		Rate of recovery of harvested NTFPs is optimized.	New		M
	4.2			**Management diversifies production of goods and services from the forest.**	(3) m4		M
		4.2.1		Timber market and transformation processes are open to new timber species.	New		M
		4.2.2		A wide range of NTFPs is effectively valorized.	(3) m4		M
		4.2.3		Singularity and rarity of forest ecosystem are valorized through economic services.	New		M
	4.3			**Harvest and silvicultural systems ensure continued timber production.**	(1) C.I		M

Team 4 continued

P	C	I	V	PRINCIPLES, CRITERIA, INDICATORS AND VERIFIERS TEAM 4	Source	Remarks & alter.	
		4.3.1		Calculation of allowable cut, rotation period and areas to be harvested are clearly detailed consistent with national directives, inventories, increment data and regeneration process.	(1) C.I.2.4	Rev. (3) m8	M
			4.3.1.1	*Harvesting standards are explicit on: minimum number of large trees to be retained per ha and species, maximum number of trees to be removed per ha, the minimum exploitable diameter for each species.*	(1) C.I.2.1		M
		4.3.2		Rational infrastructure required for logging is made permanent.	(1) C.I.4.3		M
		4.3.3		Pre-harvest inventory includes marking on the field and marking of trees to be felled and potential crop trees.	(1) C.I.2.7 (1) C.I.2.8	(3) m10	M
		4.3.4		Logging maintains growth of potential crop trees and natural regeneration of timber species.	(3) m9		M
		4.3.5		Silvicultural practices improve growth of potential crop trees a nd natural regeneration when necessary.	(1) D.1.3	(3) m7	M
		4.3.6		In default of natural regeneration, enrichment planting is implemented.	(1) D.2.6		M
	4.4			**Guidelines for rational harvesting of NTFPs are put into practice.**	(1) C.II.2		M
		4.4.1		Guidelines are based on local knowledge of ecosystems and their sustainable use by the local populations.	(2) 6.B.	Rev.	S
		4.4.2		Spatial and temporal organization and methods of hunting are compatible with long-term renewal of game population.	New		M
		4.4.3		NTFPs in high demand are the object of domestication (intensification) trials.	(1) D.2.8	Rev.	M
		4.4.4		Commercialization of NTFPs respects the law and contributes to the long-term well-being of local people.	New		M
		4.4.5		NTFP-dependent people have opportunities (techniques, market) to diversify their sources of income.	New		M
5				MANAGEMENT MAINTAINS ECOSYSTEM'S INTEGRITY.			E
	5.1			**Management guarantees long-term viability of forest ecosystem.**			E
		5.1.1		Shape, location and design of forest compartments attempt to minimize current and future edge effects due to forest fragmentation.	(3) e 17		E
			5.1.1.1	*Road and tracks network within the forest management unit is minimized.*	New		E
			5.1.1.2	*The extent to which ecosystems, vegetation types and species are specified is shown on environmental maps and maps indicating the sustainability of the soil.*	(2) 1.A.1.1		E
			5.1.1.3	*Area and percentage of forest land managed primarily for protective functions (e.g., watersheds, flood protection, avalanche, riparian zones.) are well defined and delimited on maps and in the field.*	(3) E.5.a		E
			5.1.1.4	*Zones of biological protection where no interference is authorized are created in the permanent estate forest and well delimited in the field.*	(1) D.2.1		E

Team 4 continued

P	C	I	V	PRINCIPLES, CRITERIA, INDICATORS AND VERIFIERS TEAM 4	Source	Remarks & alter.	
		5.1.2		Infrastructure for logging is designed, established and maintained in such a way that negative impacts on the environment are minimized.	(1) C.I.4		E
			5.1.2.1	*The size of inadvertent ponding or water logging as a result of forest management are minimized.*	(3) e12		E
			5.1.2.2	*Routes are narrow and minimize the effect of canopy opening.*	New		E
			5.1.2.3	*Bridges must be built taking into account flows in water courses.*	New		E
		5.1.3		Vertical stratification of the forest is maintained and protected.	New		E
			5.1.3.1	*Reduced-impact felling specified and implemented.*	(3) m 12		E
			5.1.3.2	*Skidding damage to trees and soil are minimized.*	(3) m 13		E
		5.1.4		The capacity of forest for natural regeneration is ensured.	(1) D.1		E
			5.1.4.1	*Area and percentage of forest land with diminished biological components indicative of changes in fundamental ecological processes (e.g., soil nutrients, seed dispersal, pollination) are minimized.*	(3) e 3		E
			5.1.4.2	*Seedlings of all forest species (harvested and non-harvested) are found in understorey of the forest or in natural and artificial gaps.*	New		E
			5.1.4.3	*Animal species which are negatively impacted (due to logging or hunting) during exploitation period retain, conserve, their ability to recover and exist as viable populations in the area*	(3) e 20		E
			5.1.4.4	*The presence of pollination insects and animals (e.g., bees, butterflies) in the forest and surroundings.*	New		E
			5.1.4.5	*Traces indicating the consumption by animals of edible seeds and fruits of zoochorus species.*	New		E
		5.1.5		No chemical contamination to food chains and ecosystems.	(3) e 10		E
			5.1.5.1	*Presence in the rivers and streams of benthic species (e.g.: mollusk, gastropods).*	New		E
			5.1.5.2	*Presence in the understorey of forest and permanent cash crops of snails, edible mushrooms species and small frogs living on leaves.*	New		E
			5.1.5.3	*Presence of birds of prey.*	New		E
	5.2			**Critical ecosystem functions and processes are maintained and secured.**	(3) e 14		E
		5.2.1		Special provisions for the protection of sensitive areas (plain streams banks, steep slopes) are defined and implemented in management plan	(1) D.2.4		E
			5.2.1.1	*Corridors of uncut forest based on stream sides with links up slopes and across ridges to connect adjoining catchments and forest areas which will not be harvested are retained.*	(3) e 16		E
		5.2.2		The function of water filtration (protection of water and soil) of the forest is maintained.	(1) D.3		E
			5.2.2.1	*Water system (regime of rivers and streams) and quality do not decrease.*	(1) D.3.3		E

Team 4 continued

P	C	I	V	PRINCIPLES, CRITERIA, INDICATORS AND VERIFIERS TEAM 4	Source	Remarks & alter.	
		5.2.3		The properties and functions of the soil in the forest are maintained and protected.	New		E
			5.2.3.1	*Area and percentage of forest land with significant compaction, erosion or change in soil physical properties are minimized.*	(3) e.5.b		E
			5.2.3.2	*More longer skid trails than wider roads within the harvested units.*	New		E
		5.2.4		Soils and water restoration programs are implemented where necessary.			E
	5.3			**Forest management maintains or improves all levels of biodiversity.**			E
		5.3.1		Biological protected areas and reserves are created.	New		E
			5.3.1.1	*The size of biological and protected areas is adapted to suit the object of biodiversity preservation.*	(1) D.2.2		E
			5.3.1.2	*The area and percentage of forest affected by processes or agents beyond the range of historic variation (e.g., by insects, disease, competition for exotic species, fires, storms, land clearance) within the biological reserves are minimized.*	(3) e 2		E
			5.3.1.3	*Research programs on biodiversity within biological reserves are implemented and effective.*	New		E
		5.3.2		Negative impacts of various interventions on biodiversity are minimized.	(1) D.2		E
			5.3.2.1	*Utilization of environmentally friendly technologies (e.g., utilization of biodegradable insecticides, fungicides).*	(3) m5		E
			5.3.2.2	*Light-demanding (pioneer) species do not form dense stands within the forest.*	(1) D.1.2		E
			5.3.2.3	*Visibility and easy moving within the forest is maintained (i.e., small amount of herbaceous species in understorey).*	New		E
		5.3.3		No genetic creaming.	New		E
			5.3.3.1	*Presence in the cutting area of good specimens of standing commercial species ensuring perennial availability of genetic resources.*	New		
		5.3.4		Measures to protect, recuperate and restore sustainable use of wild populations or species in danger of extinction.	(3) e7		E
			5.3.4.1	*Identification and inventory of endangered, rare, endemic or indicator species.*	(3) e15		E
			5.3.4.2	*Existence of maps indicating distribution and vital areas of endangered, rare, endemic or indicator species.*	New		E
			5.3.4.3	*Existence of database on reproduction, densities, migration, foot sources of endangered, rare, endemic or indicator animal species.*	New		E
			5.3.4.4	*Existence of database on the phenology, seeds, dispersal and population dynamism (e.g., succession, diameters distribution) of endangered, rare, endemic or indicator vegetal species.*	New		E
		5.3.5		Compensatory actions are taken to minimize negative impacts on ecosystems and ensure regeneration and biodiversity conservation in affected areas.	New		E

Team 4 continued

P	C	I	V	PRINCIPLES, CRITERIA, INDICATORS AND VERIFIERS TEAM 4	Source	Remarks & alter.	
			5.3.5.1	*Introduction in rivers and streams of young fish, animal indicator, endemic and threatened species from local species.*	New		E
			5.3.5.2	*Agroforestry attempts with neighboring local species are implemented involving villagers.*	New		E
			5.3.5.3	*Enrichment plantings are implemented using indigenous species.*	(1) D.2.6		E
			5.3.5.4	*Aquaculture is done using local species.*	New		E
6				CONTROL AND MONITORING SHALL BE CONDUCTED IN ORDER TO IMPROVE FOREST MANAGEMENT.	(1) B.2		M
	6.1			**Effective mechanisms of control guarantee implementation of law and management plan.**	(1) B.2.1		M
		6.1.1		Forestry service is in charge of control (direct or delegated) of management of all forests.	(1) B.2.1		M
			6.1.1.1	*Non-compliance to management is penalized.*	(1) C.I.2.10		M
			6.1.1.2	*Field control of timber production is effectively implemented.*	New		M
			6.1.1.3	*Control of timber exports is effectively implemented.*	New		M
			6.1.1.4	*Control of the harvest and sale of NTFPs by the forestry service and/or local communities.*			S
		6.1.2		Indirect control mechanism can contribute to sustainable management of forests.	New		M
			6.1.2.1	*Existence of a certification label.*	New		M
	6.2			**Management takes into account permanent results from monitoring.**	(1) C.I.2.6		M
		6.2.1		Records from management activities are kept in a form that makes it possible for monitoring to occur.	(3) m16		M
		6.2.2		Effective monitoring provides up-to-date information about social, ecological and technical management parameters.			S
			6.2.2.1	*Continuous forest inventory plots are established and measured regularly.*	(3) m.15		M
		6.2.3		Applied research is undertaken in order to improve management systems.			E
		6.2.4		Management plan can be adjusted rapidly if monitoring provides significant changes in management parameters.	(1) C.I.2.6		M

Team 5: Alain Karsenty, Oscar Eyog Matig, Chiambeng Paulinus Ngeh

Principles	Criteria	Indicators	Verifiers
GLOBAL POLICY AND LEGAL FRAMEWORK			
1. ATO.A (General policy) Sustainability of the forest and its multiple functions is a high political priority.	**1. ATO.A1** The Government has clear forest development objectives and realistic action plan to meet them.	**1. DDB 1.B1 (Reformulated)** National forest policy and programme.	
		2. ATO A.12 (Modified) Government has a system of reliable and updated information on the forestry sector (especially national forest inventories) which enables it to prepare and update its action plans and programmes.	
		3. ATO A.11 There is a permanent forest estate governed by laws and regulations which are the basis for its sustainable management. This permanent forest estate is the result of negotiation between all stakeholders within the framework of a procedure of coordinated planning of allocation of lands based on appropriate and updated information.	- Laws and regulation - **ATO B.1.2** Boundaries of PFE are well marked in the field and correspond to maps. - Stakeholders know their rights and responsibilities in the PFE.
		4. ATO A2 (Modified) There is a forestry service in charge of the management of all the forests with sufficient human and material resources to fulfil its mandate.	
	2. DDB.1C National environmental quality policy.	**5. New** Existing norms or rules for different ecosystem quality.	
	3. NEW National environmental mapping of forest ecosystem types at the scale of 1/500 000è.	**6. New** Existing national forest typology maps (same scale): Protected forests, productive forests, corridors, etc.	
	4. ATO A3 Actions are taken by the Government to reduce all types of pressure on the forest	**7. DDB 2.B** Land -use planning which indicates destination for different forms of land use in relation to forest categories.	Land-use map
		8. ATO A.32 (Modified) The Government implements on-farm research programmes on agroforestry techniques to stabilise agriculture.	
		9. ATO A.31 Existing, ongoing and future plantations in the national forest plantation plan can contribute to supply the timber sector.	
		10. NEW Assist in the management of community and private forests.	

Team 5 continued

Principles	Criteria	Indicators	Verifiers
	5. NEW Incentives exist for long-term forest management	**11. NEW** Duration of concession takes into consideration the felling cycles.	**NEW** The duration is at least equal to the felling cycle.
		12. NEW Number of years for return on the investment made by the concessionaire at the FMU level, in regard to the duration of the concession. **13. NEW** Percentage of extra costs incurred by the implementation of the FMU management plan on the gross margin realized by the company on the FMU.	
		14. NEW The peasants are given incentives to plant trees on their fields and fallow.	Adequate legal measures like property rights on trees planted.
	6. ATO A.4 At the international level, the government has ratified or approved treaties, conventions or recommendations on sustainable development of forests issued especially by such organisations as ILO, CITES, ITTO, FAO, UNCED.	**15. NEW** Government laws and regulations facilitate the implementation and respect of the approved treaties, conventions and recommendations.	
	7. CS.A.2 National policy aimed at the recognition of the cultural integrity of specific social groups, the observation of traditional land use and the prevention of fair resolution of conflicts between various categories of forest users.		
	8. NEW Government has a special fund for financing forest management activities.	**16. NEW** All revenues from forest resources due to the state are allocated to the fund.	3) Total amount of forest taxes compared to the amount of the funds.
		17. ATO A.23 (Reformulated) Significant part of the fund is allocated to forest research and its results applied.	4) Proportion of research funds to total revenue from forest resources.
		18. NEW Use of funds for other purposes is regulated by law.	5) Copies of laws or decrees allocating funds for other uses.
		19. NEW The forest economic rent captured by the Government is indexed to the real commercial value derived from forest exploitation through adequate mechanisms.	- Auction systems for quota export. - Export taxes based on updated F.O.B. prices.

Team 5 continued

Principles	Criteria	Indicators	Verifiers
	9. NEW The transformation capacities (volume of raw material input in the 1st & 2nd transformation) are voluntarily limited in order to avoid general over-capacities at the national level.	**20. NEW** Incentives are given to industrialist to move from first and second transformation to third transformation.	
	10. CS.S9 Efficiency of systems of production and transformation of forest products	**21. NEW** Importance of the gap in efficiency between the domestic transformation units and the international standards.	**NEW** Difference between domestic recovery rates for each line of products (within the first and second transformation) and regional or international ones.
MANAGEMENT			
2. ATO.C (Modified) Forests are managed to maintain production as well as multiple functions.	**11. ATO C1** Management planning involves all stakeholders and takes into account all the components and functions of the forest such as timber production, NTFPs, ecology and well-being of the local population.	**22. NEW** Characterisation of forest unit and description of resources and their multiple functions and roles, making maximum use of local expertise and knowledge.	Biophysical properties. Socioeconomic studies. Multiple resource inventories. C, M6. Maps of resources, management, ownership and inventories.
		23. NEW Objectives of management are well determined and clearly stated.	Stakeholders know the management policy that affects them. Management objectives are compatible with forest potential.
		24. NEW The felling cycle is specified based on growth rates, minimum exploitable diameters and lower diameters measured during inventory.	
		25. ATO C.12 Management plan is accepted by all stakeholders and approved by the minister in charge of forests.	
	12. NEW Forest exploitation is compatible with resource base.	**26. CS M8** Harvest and yield regulation by area/or volume prescribed.	**ATO C.1.2.4** Allowable annual cuts, minimum exploitable diameters, maximum number of trees to be harvested per hectare are specified.
	13. NEW Management is implemented so as to limit damages and disturbance.	**27. ATO CI23 (Reformulated)** Periodically, harvestable areas and trees over the management period are assessed and mapped.	

Team 5 continued

Principles	Criteria	Indicators	Verifiers
		28. ATO CI28 (Modified) Trees to be protected as seed crop and potential crop trees are plotted on a map and conspicuously marked prior to felling.	Limits and marked trees are visible.
		29. ATO CI41 (Modified) Establishment of infrastructure takes into account key parameters like topography, hydrology, ecologically fragile and protection zones, as well as the need for exploitation.	Compare with FAO standards for best forest management.
		30. ATO CI22 (Modified) Low-impact felling and skidding techniques are used. (See FAO standards and codes for logging and felling).	**C, E12** No inadvertent ponding or water-logging in FMU. **C, m13** Skidding damage to trees and soils minimised.
		31. NEW Premium linked to compliance with guidelines for reduced impact harvesting is available for each category of worker (fellers, skidders, foreman, etc.).	**NEW** Percentage of the performance premium against the total revenue.
		32. NEW Logging activities are suspended during heavy rain periods.	
		33. ATO D26 (Modified) Enrichment planting uses species adapted to the site, preferably indigenous species harvested from the management unit.	
		34. CS m17 (Reformulated) Harvested forest units are protected from fires, encroachment, premature re-entry and other types of disturbances.	26) Aerial photographs and satellite images.
	14. ATO C1.4 The follow-up and control of management are done on the basis of information included in the appropriate documents.	**35. NEW** Results from monitoring and research and other new scientific and technical information is incorporated into the implementation and revision of the management plan.	27) Research reports and scientific publications.
		36. NEW Management plan is revised periodically to take into account results of monitoring or new scientific and technical information as well as socio-economic and environmental changes.	
		37. CS M16 Documentation and records of all management activities are kept in a form that makes it possible for monitoring to occur.	
3. NEW Forests are co-managed by stakeholders on a basis of multiple uses, mutual recognition of rights and sharing of the commercial benefits.	**15. ATO E1** Stakeholders' tenure **and use** rights are clear to all parties and are secure.	**38. ATO E11** The **rules** of access to forest resources are clearly defined and respected by all stakeholders.	

Team 5 continued

Principles	Criteria	Indicators	Verifiers
	16. ATO E6 There is a procedure for dialogue and conflict resolution between various stakeholders.	**39. NEW** An *ad hoc* institution involving the stakeholders or their delegates has been created, is working, and is effectively a place for negotiation, co-management and definition of rights and duties at the FMU level.	**NEW (reformulation of 3.S.20)** Conflicts are settled **and fair solutions for conflicts have been found in the close past.**
	17. ATO-DDB (E.5 and 2.5.E reformulated) Economic participation of local communities in commercial forest uses with a sharing of benefits considered equitable.	**40. NEW** The commercial value of timber and/or NTFPs in high demand are known by local populations.	**NEW** The level of compensation paid or given by loggers to the peasants for harvesting trees claimed by the last ones is in proportion with the commercial value.
		41. DDB.6C3 Arrangements between exploiters and peasants for compensations for loss or damages resulting from the harvesting operations.	
		42. NEW A fraction of the taxes paid by concessionaires is allocated to local development.	**NEW** Amount of forestry taxes allocated to the 'communes'.
			NEW Amount of taxes allocated to the villages or value of the collective equipment granted by the Government.
SOCIAL			
4. CS.S7 (reformulated) The quality of life of the populations of the forest area shall be improved or at least maintained.	**18. ATO E3** Forest management has no adverse effect on health.	**43. ATO E31** Necessary preventive measures are taken by concessionaires or the managers to minimize and possibly to take into account health risks linked to forest activities.	**NEW** Working conditions during harvesting operations comply with ILO rules and prescription.
		44. ATO. E52 Wages and other benefits are at least conform to the national standards.	
		45. NEW The main part of worker revenues comes from fixed salary.	**NEW** Percentage of the fixed salary against the total revenue.
		46. CS.S22 Existence of legal labor proceedings and/or public actions in which the company is involved.	
	19. NEW The concessionaires fulfil all agreements made with the local populations.	**47. NEW** Authentic documents attesting to the agreements.	**NEW** Building or maintenance of infrastructures for which agreements have been made.

Team 5 continued

Principles	Criteria	Indicators	Verifiers
		48. ATO E53 Forest-dependent people have the opportunity to be employed and trained by forest companies.	**NEW** Percentage of local people who have been recruited since the beginning of the exploitation of the FMU.
	20. CS.S10 (reformulated) Impact of the economic use of the forest on the availability of forest resources of importance to local populations.	**49. NEW** Numbers of trees of cultural, social and economic importance for local populations felled by loggers.	
	21. ATO B.32 (modified) Appropriate methods exist for implementation of programme for the enlightenment and education of the rural populations.		
ECOLOGY			
5. ATO D The main ecological functions of the forest are maintained.	**22. NEW** Securing at all stages the critical functions and processes of the forest.	**50. NEW** Humic horizon of the soil is thick and the litter is decomposing.	Ten centimeters of black lumpy soil mixed with tattered leaves.
		51. NEW Soil microfauna (earthworms, ants, termites, snails, etc.) have their activities maintained.	The traces of their activities in the forest (their mounds).
		52. ATO D32 Erosion and other forms of soil degradation are minimized.	Runoff is less than 25%.
		53. ATO D33 Soil and water restoration programmes are implemented when necessary (the forestry cover of the soil has disappeared and humic horizon is threatened).	- Microcatchment management. - Runoff less than 25%.
		54. NEW The structure of the forest is similar to the natural forest.	
		55. NEW Species composition of wildlife is similar to that of the natural forest.	Different species of wildlife are abundant and their activities are visible in the forest.
	23. NEW Maintaining natural regeneration of the forest by minimizing negative impacts of various interventions on biodiversity.	**56. ATO D11** Logging is not authorized if stratification of forest (different class sizes) is disturbed.	There is a gap in the class size distribution.
		57. NEW Canopy opening is controlled so that light-demanding species are not greater than the natural gap	- Species composition. - Aerial photographs. - For the gap size (to be determined by research).

Team 5 continued

Principles	Criteria	Indicators	Verifiers
		58. NEW Endemic and endangered species are identified and protected.	The forest reserves maps and its terms of references.
		59. ATO D21 Zones of biological protection where no disturbance (genetic pollution or any destruction) is authorized are created in permanent forest estate.	Documents of creation.
		60. NEW Fragmentation of the forest is minimized at a level to allow seed and pollen dispersal.	A great number of corridors in the forest.
		61. NEW Tree plantations are realized where forest has been destroyed and when the measures taken for natural regeneration have failed.	The recovery of natural forest after plantation.
		62. NEW Soil microfauna (earthworms, ants, termites, snails, etc.) have their activities maintained.	The traces of their activities in the forest (their mounds).
		63. NEW The biomass or the number of harvestable trees per hectare is maintained at the level of natural forest.	At least 3 harvestable trees per hectare.
		64. NEW Maintaining the richness of wildlife population at a high level.	Different species of wildlife are abundant and their activities are visible in the forest.
6. NEW Forests are managed for a sustainable production.	**24. NEW** The management plan is flexible in order to incorporate the update ecological information from research.	**65. NEW** The growth and the rotation cycle of the main species are known.	To determined by research stations.
		66. NEW The behaviour (aggregates or randomized distribution) of the species is recognized.	Maps from the data of the inventory on the permanent sample plot (to be created in each FMU).
		67. NEW Phenological information (sexual mature diameter, mode of seed dispersal, etc.) are taken into account.	To be determined by research stations.
		68. NEW Inventory of FMU (in the permanent sample plot) has been made and mapped (1/20 000è) for all tree species above 10 cm diameter.	Maps are available.
		69. NEW Wildlife map (1/20 000è) with their routes.	Map is available.
		70. NEW A special map (1/20.000è) for non-timber forest species is realized. The data on the organs (bark, leaves, fruit or roots) used and quantity needed are available.	Map is available.

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Ecology

Ref	P	C	I	V	Description - Team 6	Observation	Source
D	I				**Maintenance of Ecosystem Integrity**	reformulated	1
e14&D		1			*Ecosystem function is maintained*	reformulated	1, 3
e10			1		No chemical contamination to food chains and ecosystem, especially by fishing with pesticides	reformulated	3
e11			2		To maintain water infiltration in the soil, ecologically sensitive areas are protected (especially forests on the summit of hills, buffer zones along water courses).	reformulated	3
D.3.2, e12			3		Skidding is reduced or prohibited during rainy season to minimise erosion.	new	1
D.2		2			*Impacts to biodiversity of the forest ecosystem are minimised.*	reformulated	1
D.2.7,e7, e15			1		Species and population in danger of extinction are identified and protected (rare or endemic species, indicators).	reformulated	1, 3
D.2.6			2		If enrichment planting is carried out in logged-over forests, preference is given to species that are actually harvested in the forest, or to species in high demand.	unchanged	1
e19			3		Interventions, if applied, are highly specific to the individual tree level, instead of to species or whole stand.	unchanged	1
e13, e1, e17			4		Maximum number of trees to be harvested per ha does not exceeded 1.4/ha and maximum number adjacent trees that can be felled does not exceed 3.	reformulated	3
D1		3			*The capacity of the forest for natural regeneration is insured.*	unchanged	1
D.2.1			1		Representative areas, retained as zones of biological protection, are created in the permanent forest estate.	reformulated	1
				1	The size and location of biological reserves should be adapted to suit the objective of effective preservation.	reformulated	1
e11			2		Corridors of uncut forest based on stream sides with links up slopes and across ridges to connect adjoining catchment.	unchanged	3

FOREST MANAGEMENT

Ref	P	C	I	V	Description - Team 6	Observation	Source
	I				**Sustainable production of forest goods and services**		
A.1		1			*The Government has clear forest development objectives and a realistic plan to meet them.*	unchanged	1
A.1.1			1		There is a permanent forest estate governed by laws and regulations which are the basis for its sustainable management. This permanent forest estate is the result of negotiation between all stakeholders within the framework of a procedure of coordinated planning of the allocation of lands based on the appropriate information.	unchanged	1
A.1.2			2		The Government has a system of reliable, adequate and updated information on the forestry sector (specially a national forest inventory) which enables it to update its action plans and adjust the means of implementation.	unchanged	1
A.2		2			*The Government and/or international institutions jointly allocate adequate means for sustainable management of forests.*	reformulated	1
A.2.1			3		There is a clear mechanism for sustained and adequate funding for the management of Government and community forests.	unchanged	1
A.2.3			4		Forestry research is allocated sufficient means (human and material) and its results are applied.	unchanged	1
A.4					At international level, the Government has ratified or approved treaties, conventions or recommendations on sustainable development of forest issued especially by such organizations as ILO, CITES, ITTO, FAO, UNICED.	unchanged	1
					Some international or foreign organisations are financially and technically involved in operational programmes aimed at sustainable forest management.	new	new
6.A					Various forms of sustainable land use are integrated in a regional land management plan.	reformulated	2
B.1					Areas devoted to forestry activities or permanent forest estate are clearly delimited and their boundaries have been well established.	unchanged	1
B.2.2					The procedure of control is followed by results (mission reports, case files, transactions, condemnations, etc.).	unchanged	1
C.1					A management plan has been established for sustainable management of the forest, taking into account all its components and functions such as timber production, other forest products, contribution to the well-being of the local people, ecology.	unchanged	1
C.1.3		3			*Management plan is effectively implemented.*	unchanged	1
C.I.2		4			*In the area of timber harvesting, the standards are explicit on: minimum number of large trees to be retained as seed producers (mother trees) per ha and species.*	reformulated	1

Forest Management continued

Ref	P	C	I	V	Description - Team 6	Observation	Source
C.I.2.5					The felling and work programme is operational, clear and realistic. Each harvest is subject to prior validation and decision.	unchanged	1
5.C					Guaranteeing the continued production of valuable, endangered timber species by means of silvicultural systems.	reformulated	2
5.D					Guaranteeing the continued production and harvest of other forest products by means of silvicultural systems.	reformulated	2

Social and Economic Environment

Ref	P	C	I	V	Description - Team 6	Observation	Source
	I				**Forest management maintains fair intergenerational access to resources and economic benefits.**	unchanged	
		1			*The stakeholders' access to resources, tenure and use rights are secure.*	reformulated	
E.1			1		Tenure, use and property rights are recognized by the forest legislation.	reformulated	1
2.A			2		All types of forest uses, their importance and values for various stakeholders are identified.	reformulated	2
New					Access and extraction of NTFPs are regulated.	new	new
		2			*Social and economic benefits are maintained and improved.*	reformulated	
S8			1		The revenues derived from logging are fairly shared among the different stakeholders.	reformulated	1
New					The sharing of benefits by local people takes into account the social categories within the community (ethnic groups, old people, young people, men, women, etc.).	new	new
	II				**Each stakeholder has a voice in forest management.**	reformulated	
		1			*All stakeholders are involved in forest management.*	reformulated	
E.2.1			1		Local people are aware of and understand the management plan and the forest law.	reformulated	1
E.2.3			2		All stakeholders are involved in the decision-making process (information, training, dialogue, consultation, compromise).	reformulated	1
New					Local organisations interact with other stakeholders.	new	new

Annex D

LIST OF EXPERT AND SUPPORT TEAM MEMBERS

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Annex E

C&I FOR TESTING - THE 'BASE SETS'

ATO C&I for the Sustainable Management of African Tropical Forests

Principle:	Criterion:	Indicator:
A. (General policy). Sustainability of the forest and its multiple functions is a high political priority.	A.1 The Government has clear forest development objectives and a realistic action plan to meet them.	A.1.1 There is a permanent forest estate governed by laws and regulations which are the basis for its sustainable management. This permanent forest estate is the result of negotiation between all stakeholders within the framework of a procedure of coordinated planning of the allocation of lands, based on appropriate and updated information.
		A.1.2 The Government has a system of reliable, adequate and updated information on the forestry sector (especially a national forest inventory) which enables it to update its action plans and adjust the means of implementation.
	A.2 The Government allocates adequate means for sustainable management of forests.	A.2.1 There is a mechanism for sustained and adequate funding for the management of Government forests.
		A.2.2 There is a forestry service in charge of the management of all the forests, with adequate staffing to fulfil its mandate.
		A.2.3 Forest research is allocated sufficient means (human and material) and its results are applied.
	A.3 Actions are taken by the Government to reduce all types of pressure on the forest.	A.3.1 Existing, ongoing and future plantations in the national forest plantation plan can contribute to supply the timber sector.
		A.3.2 The Government implements appropriate programmes to stabilise agriculture.

ATO C&I for the Sustainable Management of African Tropical Forests continued

Principle:	Criterion:	Indicator:
	A.4 At international level, the Government has ratified or approved treaties, conventions or recommendations on sustainable development of forests issued especially by such organizations as ILO, CITES, ITTO, FAO, UNCED.	(No indicator)
B. Areas devoted to forestry activities or the permanent forest estate are not declining.	B.1 Areas devoted to forestry activities or permanent forest estate are clearly delimited and their boundaries have been well established.	B.1.1 There exists a map showing the boundaries of the permanent forest estate.
		B.1.2 The boundaries of the permanent forest estate are well marked in the field.
	B.2 Efficient measures have been taken by the authorities to monitor the forest and to protect against clearing, fire, settlements and illegal gathering of forest products.	B.2.1 There is a control mechanism (direct or delegated control, type and frequency of control) complied with by the forest service.
		B.2.2 The procedure of control is followed by results (mission reports, case files, transactions, condemnations, etc.).
		B.2.3 There is collaboration between the forestry service, agricultural service, public order authorities and other public services concerned in forest management.
	B.3 The Government implements measures in order to promote the participation of various stakeholders (mainly neighboring villagers) in protecting the forest.	B.3.1 There is a direct, sustainable, efficient system to interest various stakeholders in protecting the forest against clearing, fires and poaching.
		B.3.2 Programmes for the enlightenment and education of the rural population are implemented.
C. Forests are adequately managed and developed irrespective of their role.	C.1 A management plan has been established for the sustainable management of the forest taking into account all its components and functions such as timber production, other forest products, contribution to the well-being of the local people, ecology.	C.1.1 There is a management plan comprising: a. Definition of the forest area subjected to sustainable management; b. Key findings of studies and analyses on all the functions and uses of the forest (timber production, other forest products, farmer-forest relationship, forest ecosystem); c. Definition of objectives in these various uses, their spatial organization and their hierarchy; d. Relevant action plans to meet these objectives;

ATO C&I for the Sustainable Management of African Tropical Forests continued

Principle:	Criterion:	Indicator:
		e. Reference to laws and regulations governing such actions (particularly the national directives on management); f. Economic and financial evaluation; g. A set of maps allowing a clear summarized overview of the results of studies (vegetation map, forest settlement map, etc.), the objectives (map of working circles) and the action plans (map of blocks for harvesting, coupes, replanting, etc.).
		C.1.2 Management is approved by the Minister in charge of forests.
		C.1.3 Management is effectively implemented.
		C.1.4 The follow-up and the control of implementation of the management plan are done on the basis of the information included in the appropriate documents.
	C.2 Forestry service and other stakeholders of the sector have enough capacity to properly develop and manage the forest for all its roles (timber production, other forest products, ecology, farmer-forest relationship).	(No indicator)
C.I. Sustainable timber production (in quantity and quality) is guaranteed.	C.I.1 Standards for silvicultural and other activities adapted to the specific ecology of the forest and ensuring sustainable management have been developed and are operational.	
	C.I.2 Adequate effort of investigation is undertaken to define, validate or adjust silvicultural and work standards.	C.1.2.1 In the area of harvesting, the standards are explicit on: - minimum number of large trees to be retained as seed producers (mother trees) per ha and species; - maximum number of trees to be harvested per ha; - harvesting techniques for large trees to be removed should be such as to avoid too large gaps; - the minimum exploitable diameter for each species.
	C.I.2 Planning and implementation of logging are carried out in conformity with guidelines of the management plan and the contract agreement based on technical and social standards as well as financial specifications.	C.I.2.2 Operational low-impact felling and skidding techniques are available.

ATO C&I for the Sustainable Management of African Tropical Forests continued

Principle:	Criterion:	Indicator:
		C.I.2.3 Fully consistent with silvicultural standards, and based on previous inventory, the area to be harvested over the management plan period is assessed and mapped.
		C.I.2.4 Calculations of allowable cut and rotation period are clearly detailed in the management plan and are consistent with silvicultural standards, increment data, prior inventory and harvestable areas, and are established at levels considered compatible with sustainable production of the forest.
		C.I.2.5 The felling and work programme is operational, clear and realistic. Each harvest is subject to prior validation and design.
		C.I.2.6 The felling programmes are adjusted rapidly if the change in data collected in the field is significantly different from that on which the manager's initial estimate is based. The management plan is amended to be consistent with the true data.
		C.I.2.7 Trees to be felled are previously plotted on a map and marked. Their selection is in compliance with silvicultural standards and protection means specific to the particular coupe.
		C.I.2.8 Trees to be protected are plotted on a map and conspicuously marked, prior to harvest.
		C.I.2.9 Financial clauses, technical standards for logging and specific arrangements to protect the forest are clearly specified in the management plan compartment register.
		C.I.2.10 The application of provisions of the contract agreement is to be assessed periodically. Non-compliance is penalized.
	C.I.3 Deforested areas are regenerated by natural of artificial means.	C.I.3.1 Reforestation is implemented with chosen species in conformity with the specifications of the management plan.
	C.I.4 Infrastructure (roads, bridges, firebreaks, etc.) is designed, established and maintained in such a way that negative impacts on the environment (forest, soil, water course network) are reduced to a strict minimum.	C.I.4.1 The planning and establishment of infrastructure (primary and secondary roads, timber yards, skidding tracks) takes into consideration the topography of the forest areas and the needs of exploitation.

ATO C&I for the Sustainable Management of African Tropical Forests continued

Principle:	Criterion:	Indicator:
		C.I.4.2 Size of infrastructure (primary and secondary roads, timber yards, skidding tracks) is reduced to the barest minimum possible.
		C.I.4.3 Minimum infrastructure required for logging is made permanent.
		C.I.4.4 Measures are taken to ensure that infrastructure established for logging and forest management in general, do not disturb the flow of water in the network of rivers, streams, etc.
C.II Sustainable production of non-timber forest products is ensured.	C.II.1 Non-timber forest products and their uses are identified.	
	C.II.2 Guidelines for rational harvesting of non-timber forest products are defined and put into practice.	
	C.II.3 Research is undertaken in order to define the conditions for a sustainable use of non-timber forest products.	
	C.II.4 Guidelines for harvesting of non-timber forest products are monitored, evaluated and can be corrected if necessary.	
D. The main ecological functions of the forest are maintained.	D.1 The capacity of the forest for natural regeneration is ensured.	D.1.1 Logging is not authorized if the vertical stratification of forest is disturbed.
		D.1.2 Light-demanding (pioneer) species do not form dense stands within the forest.
		D.1.3 Actions are taken to assure natural regeneration when necessary.
	D.2 Negative impacts of various interventions on biodiversity are minimized.	D.2.1 Zones of biological protection where no interference is authorized are created in the permanent forest estate.
		D.2.2 The size of biological reserves is adapted to suit the object of preservation.
		D.2.3 Selection of biological preservation areas should take into account their potential for effective protection.
		D.2.4 Special provisions for the protection of sensitive areas, plains stream bank, steep slopes should be defined in the management plan.

ATO C&I for the Sustainable Management of African Tropical Forests continued

Principle:	Criterion:	Indicator:
		D.2.5 The management plans of forest only provide for single-species or exotic-species plantations when other types of silvicultural action have been considered by forest management experts and abandoned for justified reasons.
		D.2.6 If enrichment planting are carried out in logged-over forests, preference will be given to species that were actually harvested in the forest.
		D.2.7 Rare or endangered species are protected.
		D.2.8 Non-timber forest products in high demand are the object of conservation and domestication trials.
	D.3 The function of water filtration (protection of water and soils) of the forests is maintained.	D.3.1 Water system (regime) and quality do not decrease.
		D.3.2 Erosion and other forms of soil degradation are minimized.
		D.3.3 Soil and water restoration programmes are implemented when necessary.
E. The rights and duties of all stakeholders should be clearly defined, perceived and accepted by all.	E.1 All stakeholders have their user or property rights well defined and secure.	E.1.1 The methods of access to forest resources are clearly defined and respected by all stakeholders.
		E.1.2 Stakeholders' tenure rights are clear to all parties and are secure.
	E.2 All stakeholders participate in forest resources management.	E.2.1 Management techniques are well understood and applied by all stakeholders (forest service, local population, timber industrialists).
		E.2.2 There is efficient communication between various stakeholders.
		E.2.3 All the parties involved participate in the management of natural resources in a manner accepted by all.
	E.3 Forest management has no adverse effect on health.	E.3.1 Necessary preventive measures are taken by concessionaires or the managers to minimize and possibly to take into account health risks linked to forest activities.

ATO C&I for the Sustainable Management of African Tropical Forests continued

Principle:	Criterion:	Indicator:
	E.4 The demand for goods and services expressed by beneficiaries and stakeholders on the forest is consistent with its capacity to meet it.	E.4.1 The needs of the population are taken into account in the management plan.
	E.5 Sharing of benefits from the forest is considered equitable.	E.5.1 Damages caused are compensated for in a fair manner.
		E.5.2 Wages and other benefits conform to national standards.
		E.5.3 Forest-dependent people have the opportunity to be employed and trained by forest companies.
		E.5.4 Forest utilization is based on necessary compromises and complementarities.
	E.6 There is a procedure for dialogue and conflict resolution between various stakeholders.	

DDB CRITERIA AND INDICATORS

Criteria, Indicators and Norms per Policy Area, National Level

On the basis of the previously mentioned definition of sustainable forest management and the principles against which a country's forest policy should be assessed the criteria, indicators and norms per policy area are given below. Policy area should be understood to refer to the legal as well as the administrative level.

General

Criterion

A. National management and control mechanisms

A number of general principles are needed to assess the effectiveness and capability of the various policy measures:

1. General regulations for forest management
2. General control mechanisms
3. General inventories

Information on the ecological situation, land use, the status of ecosystem types and the extent of deforestation and degradation of forests should be readily available.

1. Ecologically Directed Policy

Policy aimed at the preservation of biodiversity and protection and management of areas of adequate size and location with different forest ecosystem types.

Criterion:	Indicator:	Norm:
1.A. National environmental mapping of forest ecosystem types.	**1.A.1** Typology.	**1.A.1.1** The extent to which ecosystems, vegetations and species are specified.
	1.A.2 Maps of the forested areas to be protected in the Permanent Forest Estate (PFE).	**1.A.2.1** Adequate scale.
1.B. National forest protection policy.	**1.B.1** A national plan.	**1.B.1.1** A system of laws and regulations.
1.C. National environmental quality policy.	**1.C.1** Adequate targets and timetables.	

2. Socio-Economic Policy

Policy aimed at the sustainability of forest functions and a fair distribution of costs and benefits among the various forest users.

Criterion:	Indicator:	Norm:
2.A. Inventory of the various categories of forest use and their importance for the different social groups.	**2.A.1** Typology of actual uses and intensity of use.	
	2.A. 2 Statistics of forest incomes for the various categories of users.	
2.B. Land use planning which indicates destinations for different forms of land use in relation to forest categories.	**2.B.1** Selection criteria for productive forests.	
	2.B.2 Selection procedure	**2.B.2.1** Definition of destinations.
	2.B.3 Maps indicating forest areas.	**2.B.3.1** Based on environmental maps and maps indicating suitability of soils.
	2.B.4 Rules and guidelines for protection procedures and implementation.	
	2.B.5 Maps indicating sites of conversion forests.	**2.B.5.1** Convincing arguments for conversion to other sustainable land use.
2.C. Policy based on the recognition of the multiple use of forests and a fair distribution of costs and benefits among the various forest users.	**2.C.1** National forest policy plan.	

3. Socio-Cultural policy

Policy aimed at the recognition of forests as a renewable source of energy and as a resource for local communities.

Criterion:	Indicator:	Norm:
3.A. Planning process directed at information, consultation and participation of local communities.	**3.A.1** National socio-cultural policy.	**3.A.1.1** Procedures for consultation.
		3.A.1.2 Consultation procedures for participation.
		3.A.1.3 Employment plans.
		3.A.1.4 Terms of employment.
	3.A.2 National policy aimed at the recognition of the cultural integrity of specific social groups, the observation of traditional land use rights and the prevention or fair resolution of conflicts between various categories of forest users.	**3.A.2.1** Inventory of all forest uses and forest products.
		3.A.2.2 A legislative framework, with traditional property rights and land use rights enshrined.

Criteria, Indicators and Norms per Policy Area, Management Unit Level

Policies on the management unit level should find their point of reference in national rules and regulations on sustainable management. The criteria, indicators and norms on management unit level are also classified according to type of policy.

4. Ecologically Directed Management

Policy aimed at safeguarding sustainability of ecological processes, regulatory environmental functions and the ecological conditions of all forest functions.

Criterion:	Indicator:	Norm:
4.A. Protecting the size and quality of forest ecosystems.	**4.A.1** Identification and recognition of forested areas/management units on regional/local level.	
	4.A.2 Inventory of ecosystems etc. on management unit level.	
	4.A.3 Rules providing for acceptance of external effects of timber harvest on climate, opening up of forested area, roads, settlers, watershed management, water quality, etc.	
4.B. Maintaining the forest's capacity for natural regeneration.	**4.B.1** Rules for acceptable disturbance within management unit.	
4.C. Maintaining the forest's function as a hydrological or orological screen for its surroundings.		
4.D. Protecting or preserving threatened (tree) species.	**4.D.1** Rules for management of unit; procedure for the selection of indicators.	

5. Socio-Economic Management

Policy aimed at preserving the forest as a sustainable, renewable source of income for all relevant categories of forest users (for more details see 'ITTO Guidelines for the Sustainable Management of Natural Tropical Forests', Chapter 3: Forest Management).

Criterion:	Indicator:	Norm:
5.A. Guaranteeing basic abiotic and biotic conditions for the production capacity of forest areas.	**5.A.1** Production capacity of soil.	
	5.A.2 Groundwater regime.	
5.B. Mapping forest areas and forest functions.		
5.C. Guaranteeing the continued timber production by means of regulations covering:	**5.C.1** Silvicultural systems.	
	5.C.2 Harvest and management planning.	
	5.C.3 Management reports.	
5.D. Guaranteeing the continued harvest of other forest products.	**5.D.1** Inventory of importance of non-timber forest products.	
	5.D.2 Planning and control of harvest of non-timber forest products.	
5.E. Economic participation of local community in commercial forest use.	**5.E.1** Employment.	
	5.E.2 Terms of employment.	
	5.E.3 Arrangement for share of revenues from timber and non-timber products for local community.	

6. Socio-Cultural Management

Policy aimed at recognising and honouring the local community's traditional rights and uses of forests.

Criterion:	Indicator:	Norm:
6.A. Integrating various forms of sustainable land use.		
6.B. Putting local knowledge of ecosystems and their sustainable uses to optimum use.	**6.B.1** Documentation of ...	**6.B.1.1** Specifications.
		6.B.1.2 Possibility of appeal and procedures.
		6.B.1.3 Involvement of representative NGOs.
		6.B.1.4 Inventory of local initiatives.
6.C. Identifying and recognising the forest functions for the local community.	**6.C.1** Inventory of forest uses and forest products for local use.	
	6.C.2 Inventory of positive and negative effects of timber harvest for welfare and prosperity of local community.	
	6.C.3 Arrangements for compensations for loss or damage.	

COMPILED SET OF C&I

ECOLOGY

e1	Fragmentation of forest types.
e2	Area and percentage 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.
e3	Area and percentage of forest land with diminished biologi-cal 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.).
e4	Area and percentage of forest land with significant soil erosion.
e5	Area and percentage of forest land managed primarily for protective functions, e.g., watersheds, flood protection, avalanche protection, riparian zones
e5	Area and percentage of forest land with significant compaction or change in soil physical properties resulting from human activities
e6	Proportion of area of permanent production in areas of environmental protection.
e7	Measures to protect, recuperate and restore sustainable use of wild populations of species in danger of extinction.
e8	Area and percentage of forest affected by processes or other natural agents (insect attack, disease, fire, etc.) and by human actions.
e9	Rates of regeneration and forest ecosystem structure.
e10	No chemical contamination to food chains and ecosystem.
e11	Ecologically sensitive areas, especially buffer zones along water courses are protected.
e12	No inadvertent ponding or waterlogging as a result of forest management
e13	Canopy opening is minimised
e14	Maintenance of critical ecosystem functions and processes is secured at all stages of forest management (spatial and temporal).
e15	Identification of endangered, rare, endemic or indicator species
e16	Corridors of uncut forest based on stream sides with links up slopes and across ridges to connect adjoining catchments and forest areas which will not be harvested are retained.
e17	Shape, location and design of forest compartments attempt to minimize current and future edge effects due to forest fragmentation.
e18	The management plan recognizes the natural variability in the forest and differences in rates of recovery (stand productivity and vegetation structure), and has monitoring mechanisms sensitive enough to detect these differences
e19	Interventions, if applied, are highly specific to the individual tree level, instead of to species or whole stands.
e20	Animal species which are negatively impacted during logging retain their ability to recover and exist as viable populations in the area.

PRODUCTION SYSTEM

m1	Annual extraction of timber and non-timber forest products compatible with the sustainability capacity of the resource base.
m2	Area and percentage of forest soils affected by significant alterations in physicochemical properties and erosion.
m3	Effectiveness of systems of administration and control.
m4	Degree of diversification of production.
m5	Degree of utilization of environmentally friendly technologies.
m6	Maps of resources, management, ownership and inventories available.
m7	Silvicultural systems prescribed and appropriate to forest type and produce grown.
m8	Yield regulation by area and/or volume prescribed.
m9	Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact.
m10	Pre-harvest inventory satisfactorily completed.
m11	Infrastructure is laid out prior to harvesting and in accordance with prescriptions.
m12	Reduced-impact felling specified and implemented.
m13	Skidding damage to trees and soil minimised.
m15	Continuous forest inventory (CFI) plots established and measured regularly.
m16	Documentation and records of all forest management activities are kept in a form that makes it possible for monitoring to occur.
m17	Worked coupes are protected (e.g., from fire, encroachment and premature re-entry.
m18	Tree marking of seed stock and potential crop trees.

SOCIAL

s1	d. Rates of return on investment.
s2	a. Area and percentage 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.
s3	a. Direct and indirect employment in the forest sector and forest sector employment as a proportion of total employment.
s4	b. Average wage rates and injury rates in major employment categories within the forest sector.
s5	c. Viability and adaptability to changing economic condi-tions, of forest dependent communities, including indige-nous communities.
s6	d. Area and percentage of forest land used for subsistence purposes.
s7	a. Quality of life of local populations.
s8	b. Profitability and rate of return of forest management.
s9	c. Efficiency of systems of production and transformation of forest products.
s10	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.
s11	f. Nature and quantity of benefits deriving from forest management.
s12	g. Annual quantity of products extracted per hectare.
s13	h. Aggregate value of production.
s14	i. Mechanisms for consultation and the effective participation of local communities in the management of forest resources, depending upon the scale of management.
s15	Tenure/use rights are well defined and upheld.
s16	Forest-dependent people share in economic benefits of forest utilisation.
s17	Opportunities exist for local people/forest dependent people to get employment and training from forest companies.
s18	Effective mechanisms exist for two-way communication related to forest management among stakeholders.
s19	Forest dependent people and company officials understand each other's plans and interests.
s20	Conflicts are minimal or settled.
s21	Forest management unit is implementing forest management on the basis of a legal title of the land, recognised customary rights or lease agreements.
s22	Existence of legal labour proceedings and/or public actions in which the company is involved.

Annex F

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Annex G

FINAL WORKSHOP AGENDA

Day 1: November 14

Chairs: Jean-Williams Sollo (ONADEF), Gill Shepherd (CIFOR/ODI)

08:00-08:30	Registration of participants
08:30-09:30	Opening speeches
09:30-10:00	Break
10:00-10:30	**Introduction to the CIFOR project** - Ravi Prabhu
10:30-12:00	**How can criteria and indicators be used?** Panel members: Philémon Selebangué, Dominiek Plouvier, Njib Ntep Dieudonné, Carol Colfer, Erik Lammerts van Bueren, Chairs: Sollo, Shepherd
12:00-13:30	Lunch
13:30-15:30	**Methods followed to evaluate criteria & indicators** C&I related to management for production: Gart van Leersum, Nsangou Mama Ecological criteria & indicators: Oscar Eyog Matig, Sue Ellen Johnson Social criteria & indicators: John Mope Simo, Alain Karsenty Conceptual framework: Ravi Prabhu
15:30-16:00	Break
16:00-17:30	**Discussion**

Day 2: November 15

Chairs: Nkoulou Ndanga, (Department des Forêts), Emmanuel Pouna (CIEFE)

08:30-09:00	*Presentation on a topic of general interest*
09:00-10:00	**Two examples of the development of C&I by the teams:** Team 1 (short term: 12 days), Team 4 (longer term: 19 days)
10:00-10:30	Break
10:30-13:00	**Introduction to Working Groups & Methods** **First working group session**

I) Working Group on Management Criteria & Indicators (Working Group Leader: Thomas Tata-Fofung, Rapporteur: Richard Eba'a Atyi)

II) Working Group on Ecological (Biophysical) Criteria & Indicators (Working Group Leader: Philip Kio, Rapporteur:)

III) Working Group on Social Criteria & Indicators (Working Group Leader: Fondo Sikod, Rapporteurs: Bill Maynard, François Tiayon)

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*)**

Day 3: November 16

Chairs: Philemon Selebangue (ATO), Erik Lammerts van Bueren (Tropenbos)

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 Working Group Session Working Groups I, II & III continue as before or as mixed groups.
12:30-13:30	Lunch
13:30-15:00	Reports of second working group session (*plenary*)
15:30-16:00	Break
16:00-17:30	Wrap-up session (*plenary*)

Annex H

LIST OF PHASE 1 COMMONALITIES

The following are the common principles, criteria and indicators identified after analysis of the underlying issues in the C&I proposed by the test teams in Indonesia, Côte d'Ivoire, and Brazil.

Policy

PRINCIPLE: ***POLICY, PLANNING AND INSTITUTIONAL FRAMEWORK ARE CONDUCIVE TO SUSTAINABLE FOREST MANAGEMENT.***

CRITERION: *THERE IS SUSTAINED AND ADEQUATE FUNDING FOR THE MANAGEMENT OF FORESTS.*

Indicators:

- *Policy and planning are based on recent and accurate information.*
- *Effective instruments for intersectoral coordination on land use and land management exist.*
- *There is a permanent forest estate (PFE), adequately protected by law, which is the basis for sustainable management, including both protection and production forest.*
- *There is a regional land-use plan or PFE which reflects the different forested land uses, including attention to such matters as population, agricultural uses, conservation, environmental, economic and cultural values.*
- *Institutions responsible for forest management and research are adequately funded and staffed.*

Ecology

PRINCIPLE: ***MAINTENANCE OF ECOSYSTEM INTEGRITY.***

CRITERION: *ECOSYSTEM FUNCTION IS MAINTAINED.*

Indicators:

- *No chemical contamination to food chains and ecosystem.*
- *Ecologically sensitive areas, especially buffer zones along water courses, are protected.*
- *No inadvertent ponding or waterlogging as a result of forest management.*
- *Soil erosion is minimised.*

CRITERION: *IMPACTS TO BIODIVERSITY OF THE FOREST ECOSYSTEM ARE MINIMISED.*

- *Endangered plant and animal species are protected.*
- *Interventions are highly specific, selective and are confined to the barest minimum.*
- *Canopy opening is minimised.*
- *Enrichment planting, if carried out, should be based on indigenous, locally adapted species.*

CRITERION: *THE CAPACITY OF THE FOREST TO REGENERATE NATURALLY IS ENSURED.*

- *Representative areas, especially sites of ecological importance, are protected or appropriately managed.*
- *Corridors of unlogged forest are retained.*

Social Environment

PRINCIPLE [implied]: *FOREST MANAGEMENT MAINTAINS FAIR INTERGENERATIONAL ACCESS TO RESOURCES AND ECONOMIC BENEFITS*.

CRITERION: *STAKEHOLDERS'/FOREST ACTORS' TENURE AND USE RIGHTS ARE SECURE*.

Indicators:

- *Tenure/use rights are well defined and upheld*.
- *Forest-dependent people share in economic benefits of forest utilisation.*
- *Opportunities exist for local people/forest-dependent people to get employment and training from forest companies.*

PRINCIPLE [implied]: *STAKEHOLDERS, INCLUDING FOREST ACTORS, HAVE A VOICE IN FOREST MANAGEMENT.*

CRITERION: *STAKEHOLDERS/LOCAL POPULATIONS PARTICIPATE IN FOREST MANAGEMENT*.

Indicators:

- *Effective mechanisms exist for two-way communication related to forest management among stakeholders.*
- *Forest-dependent people and company officials understand each other's plans and interests*.

CRITERION: *FOREST-DEPENDENT PEOPLE/STAKEHOLDERS HAVE THE RIGHT TO HELP MONITOR FOREST UTILISATION.*

Indicator:

- *Conflicts are minimal or settled.*

Production of Goods and Services

PRINCIPLE: ***YIELD AND QUALITY OF FOREST GOODS AND SERVICES ARE SUSTAINABLE.***

CRITERION: *MANAGEMENT OBJECTIVES ARE CLEARLY AND PRECISELY DESCRIBED AND DOCUMENTED.*

Indicators:

- *Objectives are clearly stated in terms of the major functions of the forest, with due respect to their spatial distribution.*

CRITERION: *A COMPREHENSIVE FOREST MANAGEMENT PLAN IS AVAILABLE.*

- *Maps of resources, management, ownership and inventories available.*
- *Silvicultural systems prescribed and appropriate to forest type and produce grown.*
- *Yield regulation by area and/or volume prescribed.*
- *Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact.*

CRITERION: *THE MANAGEMENT PLAN IS EFFECTIVELY IMPLEMENTED.*

- *Pre-harvest inventory satisfactorily completed.*
- *Infrastructure is laid out prior to harvesting and in accordance with prescriptions.*
- *Reduced impact felling specified and implemented.*
- *Skidding damage to trees and soil minimised.*

CRITERION: *AN EFFECTIVE MONITORING AND CONTROL SYSTEM AUDITS MANAGEMENT'S CONFORMITY WITH PLANNING.*

- *Continuous forest inventory (CFI) plots established and measured regularly.*
- *Documentation and records of all forest management activities are kept in a form that makes it possible for monitoring to occur.*
- *Worked coupes are protected (e.g., from fire, encroachment and premature re-entry.*
- *Tree marking of seed stock and potential crop trees.*

Annex I

RESULTS OF THE COMPARISON BETWEEN ATO AND CAMEROON TEST ON C&I

The following C&I in the ATO set were not covered by the Cameroon results:

A.2.3	Forest research is allocated sufficient means (human and material) and its results are applied.
A.3.1	Existing, ongoing and future plantations in the national forest plantation plan can contribute to supply the timber sector.
B.	Areas devoted to forestry activities or the permanent forest estate are not declining.
B.1	Areas devoted to forestry activities or permanent forest estate are clearly delimited and their boundaries have been well established.
B.1.1	There exists a map showing the boundaries of the permanent forest estate.
B.1.2	The boundaries of the permanent forest estate are well marked in the field.
B.2	Efficient measures have been taken by the authorities to monitor the forest and to protect against clearing, fire, settlements and illegal gathering of forest products.
B.2.1	There is a control mechanism (direct or delegated control, type and frequency of control) complied with by the forest service.
B.2.2	The procedure of control is followed by results (mission reports, casse files, transactions, condemnations, etc.).
B.2.3	There is collaboration between the forestry service, agricultural service, public order authorities and other public services concerned in forest management.
B.3	The Government implements measures in order to promote the participation of various stakeholders (mainly neighboring villagers) in protecting the forest.
B.3.1	There is a direct, sustainable, efficient system to interest various stakeholders in protecting the forest against clearing, fires and poaching.
B.3.2	Programs for the enlightenment and education of the rural population are implemented.
C.	Forests are adequately managed and developed irrespective of their role.
C.1.4	The follow-up and the control of the implementation of the management plan are done on the basis of the information included in the appropriate documents.
C.I.1	Standards for silvicultural and other activities adapted to the specific ecology of the forest and ensuring sustainable management have been developed and are operational.
C.I.2	Adequate effort of investigation is undertaken to define, validate or adjust silvicultural and work standards.

C.I.2.3 Fully consistent with silvicultural standards, and based on previous inventory, the area to be harvested over the management plan period is assessed and mapped.

C.I.2.4 Calculations of allowable cut and rotation period are clearly detailed in the management plan and are consistent with silvicultural standards, increment data, prior inventory and harvestable areas, and are established at levels considered compatible.

C.I.2.6 The felling programs are adjusted rapidly if the change in data collected in the field is significantly different from that on which the manager's initial estimate is based. The management plan is amended to be consistent with the true data.

C.I.2.9 Financial clauses, technical standards for logging and specific arrangements to protect the forest are clearly specified in the management plan compartment register.

C.I.2.10 The application of provisions of the contract agreement is to be assessed periodically. Non-compliance is penalized.

C.I.3 Deforested areas are regenerated by natural or artificial means.

C.I.3.1 Reforestation is implemented with chosen species in conformity with the specifications of the management plan.

C.II.2 Guidelines for rational harvesting of non-timber forest products are defined and put into practice.

C.II.3 Research is undertaken in order to define the conditions for a sustainable use of non-timber forest products.

C.II.4 Guidelines for harvesting of non-timber forest products are monitored, evaluated and can be corrected if necessary.

D.1.3 Actions are taken to assure natural regeneration when necessary.

D.2.2 The size of biological reserves is adapted to suit the object of preservation.

D.2.3 Selection of biological preservation areas should take into account their potential for effective protection.

D.2.5 The management plans of forests only provide for single-species or exotic-species plantations when other types of silvicultural action have been considered by forest management experts and abandoned for justified reasons.

D.2.6 If enrichment planting is carried out in logged-over forests, preference will be given to species that were actually harvested in the forest.

D.2.8 Non-timber forest products in high demand are the object of conservation and domestication trials.

D.3 The function of water filtration (protection of water and soils) of the forests is maintained.

D.3.3 Soil and water restoration programs are implemented when necessary.

E. The rights and duties of all stakeholders should be clearly defined, perceived and accepted by all.

E.1.1 The methods of access to forest resources are clearly defined and respected by all stakeholders.

E.2.1 Management techniques are well understood and applied by all stakeholders (forest service, local population, timber industrialists).

E.3.1 Necessary preventive measures are taken by concessionaires or the managers to minimize and possibly to take into account health risks linked to forest activities.