CIFOR






Field Test of CIFOR's Ecological Criteria and Indicators For Sustainable Forest Management

Bulungan Research Forest, East Kalimantan, Indonesia 1-12 September 1999

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Glossary

List of Abbreviations

ACM	Adaptive Co-Management
ATO	African Timber Organisation
BRF	Bulungan Research Forest
C&I	Criteria and Indicators
CIFOR	Center for International Forestry Research
CIMAT	Criteria and Indicators Modification and Adaptation Tool
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
FAO	Food and Agriculture Organisation of the United Nations
FMI	Forest Management Inventory
FMU	Forest Management Unit
FSC	Forest Stewardship Council
GIS	Geographic Information System
GPS	Global Positioning System
ILO	International Labour Organisation
ITTO	International Tropical Timber Organisation
ITW	Initiative Tropenwald
LEI	Lembaga Ekolabel Indonesia (Indonesian Ecolabeling Institute)
MAL	Mutu Agung Lestari
NGO	Non-Government Organisation
NTFP	Non-Timber Forest Products
P&C	Principles & Criteria
RIL	Reduced Impact Logging
RKL	Rencana Kerja Lima Tahun/Rencana Kelola Lingkungan
SFM	Sustainable Forest Management
SPAS	Stasiun Pengamatan Aliran Sungai (Stream Monitoring Station)
TPTI	Tebang Pilih Tanaman Indonesia
UNCED	United Nations Conference on Environment and Development
WWF	World Wildlife Fund

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Tini Gumartini was responsible for the logistical arrangements, and was aided by Meilinda ‘Kim’ Wan. Tini and Kim also assisted in typing the results during the field test. Widya Prajanthi was responsible for the layout of this report.

Executive Summary

CIFOR's existing set of Criteria and Indicators was therefore evaluated during a workshop in the Bulungan Research Forest, Eastern Kalimantan, Indonesia. A diverse group of participants from CIFOR, national and international non-governmental organizations, certification agencies, universities, a logging company, and from the local communities (including indigenous groups) contributed to making the evaluation comprehensive. It had been recognised that CIFOR's biodiversity C&I were too academic and were impractical for field application. Further, the increasing number of national and international certification schemes has emphasised the need for practical, applicable and flexible sets of C&I. It had been noted that some certification groups did not use the CIFOR C&I due to technical concerns and difficulties with interpretation.

In this report, we: a) review and assess the suitability of CIFOR's generic biodiversity C&I (as listed in The CIFOR Criteria and Indicators Generic Template), b) evaluate whether CIFOR's generic biodiversity C&I adequately assessed the quality of management performance, c) develop suggestions to adapt the biodiversity components of The CIFOR Criteria and Indicators Generic Template (the Generic Template) to local conditions, d) evaluate and to suggest improvements to the wording in current biodiversity C&I manuals, and, e) develop relevant recommendations pertaining to the implementation of CIFOR's biodiversity C&I, and to the agenda for future research on these. Further, we also report on initial considerations into the desirability of developing an analogous set of C&I to be used by local communities, i.e., is it possible or worthwhile to develop a set of C&I for sustainable forest management that can be implemented by and is useful to local communities? Finally, we also identify the problems and limitations of CIFOR's existing biodiversity C&I set in relation to the needs and requirements of certification agencies, particularly the Forest Stewardship Council.

1. INTRODUCTION

1.1. Background

Over the last few years, considerable efforts have been made to develop and implement sustainable forest management. The concept of sustaining the yield of timber has been known for many decades, but only recently has the emphasis shifted to sustainable forest management, which comprises aspects of environmental, social and economic functions. The progress, whether in the form of developing criteria and indicators for sustainable forest management, or in the form of developing and implementing better management practices, varies considerably from one country or region to another.

Criteria and Indicators (C&I) were intended as useful tools for collecting and organising information when conceptualising and implementing sustainable forest management. Both government and non-government organisations have developed a wide range of international, national and local C&I systems.

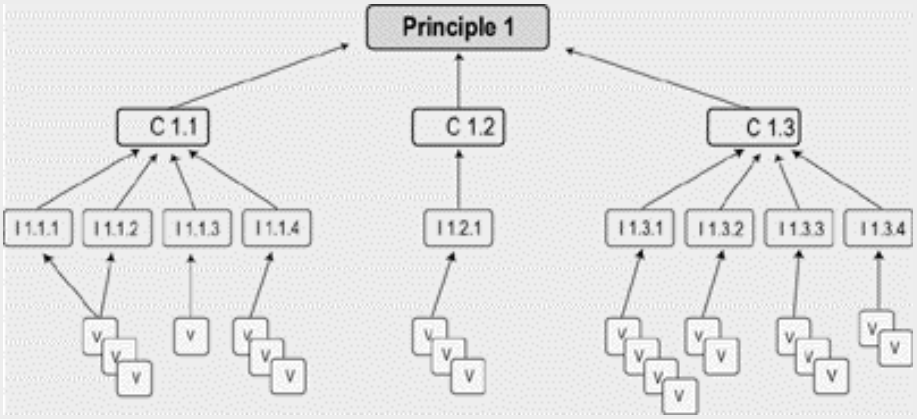
CIFOR has historically put greatest emphasis on relevance to biodiversity conservation in the context of forest management at the forest management unit (FMU) level, and on practicability; this is due to a fundamental belief in 'adaptive management', whereby forest managers at the concession level should be able to carry out self-assessments. Hugely diverse or limited skilled human resources make it impossible to achieve (and/or unrealistic to expect) rapid direct assessment of biodiversity in forest so it is important for CIFOR to design tools that do not require expert application and interpretation.

Field tests have been an integral component of the development of the CIFOR C&I set (see Annex I for a summary of previous tests).

The C&I of sustainable forest management, intended for use at the forest management unit (FMU) level, need to define indicators that describe what managers should be doing to ensure that the forest is sustainedly managed. Indicators must focus on management and its impacts, not on the collection of general data concerning biodiversity.

Before the Bulungan Research Forest (BRF) Field Test, it had been recognised that CIFOR's biodiversity C&I were too academic and were impractical for field application; they needed to be reviewed in order for modifications to be suggested. Our main concern was their adoption and acceptability by forest managers in real forest management situations, particularly the managers of the forests around the research camp. These were the managers of a large timber concession in natural forest, managed according to Indonesian forestry regulations and subject to Indonesian law. The workshop made considerable reference to local forest management activities and the people involved with them.

Box 1.1 Definitions Used during the C&I Tests for Community Managed Forests



Criteria and Indicators form part of a hierarchy of assessment tools. The four levels of this hierarchy are Principles, Criteria, Indicators and Verifiers.

Principles: A fundamental truth or law as the basis of reasoning or action. In the context of sustainable forest management, principles 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, where wisdom is defined as: a small increment in knowledge created by a person's (group's) deductive ability after attaining a sufficient level of understanding of a knowledge area. Wisdom therefore depends on knowledge.

Examples: 'Ecosystem integrity is maintained or enhanced' or 'Human well-being is assured'.

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

Example: 'Processes that maintain biodiversity are maintained'.

Indicator: An indicator is any variable or component of the forest ecosystem or the relevant management systems used to infer attributes of the resource and its utilisation. Indicators should convey a 'single meaningful message'. This 'single message' is termed information. It represents an aggregate of one or more data elements with certain established relationships.

Example: 'Landscape pattern is maintained'.

Verifier: Data or information that enhances the specificity or the ease of assessment of an indicator. At the forth level of specificity, verifiers provide specific details that would indicate or reflect a desired condition of an indicator. They add meaning, precision and are usually also site-specific 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).

Example: 'A real extent of each vegetation type in the intervention area relative to area of the vegetation type in the forest management unit'.

Source: Stork et al. 1997

Involving local communities in designing and assessing forest management is important. Their livelihoods are often affected, directly or indirectly, by how the forest is managed, both at the local level and at the larger landscape level.

Further, the increasing number of national and international certification schemes has emphasised the need for practical, applicable and flexible sets of C&I. It had been noted that some certification groups did not use the CIFOR C&I due to technical concerns and difficulties with interpretation. It is therefore imperative to identify these concerns and address them where possible to increase the potential use and application of the CIFOR C&I.

1.2 Objectives

The objectives of the BRF Field Test were to:

- Review and assess the suitability of CIFOR's generic biodiversity C&I (as listed in The CIFOR Criteria and Indicators Generic Template) in terms of practicality, objectivity, etc.
- Evaluate whether CIFOR's generic biodiversity C&I adequately assessed the quality of management performance.
- Develop suggestions to adapt the biodiversity components of The CIFOR Criteria and Indicators Generic Template (the Generic Template) to local conditions.

- Evaluate and to suggest improvements to the wording in current biodiversity C&I manuals.
- Develop relevant recommendations pertaining to the implementation of CIFOR's biodiversity C&I, and to the agenda for future research on these.

Further, within the general framework of the BRF Field Test, we intended to:

- Initiate research into the desirability of developing an analogous set of C&I to be used by local communities, viz, is it possible or worthwhile to develop a set of C&I for sustainable forest management that can be implemented by and is useful to local communities? The two questions asked were, What environmental factors are important to local people, and why?; and, What are the linkages between these factors and the C&I discussed and improved during the C&I field test?

Finally, we also aimed to:

- Identify the problems and limitations of CIFOR's existing biodiversity C&I set in relation to the needs and requirements of certification agencies, particularly the Forest Stewardship Council (FSC).
- Provide recommendations for improving CIFOR's biodiversity C&I for forest certification, with special reference to the FSC.

Because the national park contains no lowland forest, the BRF can be considered an important buffer zone for the park due to its extensive tracts of forest below 1000 m.

2.1.2 Land Use and Conflicts

The BRF shows many general characteristics of tropical forest, particularly the increasing competition for forest use among different interests; these include selective logging, shifting cultivation, the collection of non-timber forest products, coal mining and oil palm plantation.

Since 1997, a state-owned logging company, PT. Inhutani II, has been carrying out selective logging in the eastern part of the forest.

2.1.3 The Local Communities

The people inhabiting the BRF Tubu River drainage are mainly ricefarmers of the Punan and Kenyah peoples. They practise swidden rice cultivation, extensive agroforestry and the harvesting, for commercial trade, of non-timber forest products, such as gaharu (Aquilaria spp.), rattan, medicinal plants and bird nests. The Punan rely on the forest for their welfare and employment. The Tubu River has been inhabited by the Punan people for 150-200 years and there are currently six active settlements. In addition, the area contains many villages that have been abandoned over the past 50 years.

2.1.4 CIFOR and the BRF

In December 1995, the Indonesian Ministry of Forestry designated 321,000 ha of forest to CIFOR in Bulungan, East Kalimantan, to be developed as a long-term model of exemplary research-based management.

CIFOR's interest in the BRF is to carry out multidisciplinary, long-term research activities which cover the complexity of forest management for multiple uses, integrating social and silvicultural aspects in achieving this objective.

2.2. Participants

There were 18 team members representing the following stakeholder categories:

a) Forest management
   i. The forestry camp manager
   ii. A consultant with considerable experience in the practical planning and implementation of research into reduced impact logging (RIL)
   iii. Several research and senior field assistants

b) Certification bodies[2]
   i. Forest Stewardship Council (FSC)
   ii. Mutu Agung Lestari (MAL) Certification (MAL is an accredited LEI certification company)
c) Scientists with previous experience in developing the CIFOR C&I (including graduate students).
d) One local community representative from each of three ethnic groups, and a social scientist, who explored how the C&I related to the concerns and understanding of local communities.

(See Annex II for further description of the participants.)

2.3. The BRF Field Test Process

Although the entire CIFOR Criteria and Indicators Generic Template (the Generic Template) was under review, emphasis was on three areas:

- Forest Structure
- Forest Landscape
- Water Quality

This initial stratification, and resulting emphasis, reflected the perceived need for these particular components of the biodiversity C&I to be reviewed, the current great interest in these themes and the experience and expertise of the participants. This approach was largely predetermined before the field tests started, and although it was tabled for discussion at plenary, it received no objections from participants.

The general structure of the five days in the camp was kept open, with the general direction of daily activities decided or modified once or twice a day at plenary meetings of the team members. Outside the plenary sessions the three teams worked independently, but with all three teams undertaking the same sorts of activities. Activities were of two main types – team discussions and field visits. The field visits were used to inform and clarify discussions and provided a shared reference frame and reality check.

The first stage of this process was to review the regulatory requirements surrounding natural forest management in Indonesia and the degree to which they assure conservation of biodiversity. These discussions were assisted by representatives of the forest managers.

After these discussions, each team was able to draw up a preliminary report, outlining the degree to which its particular area of concern was addressed by legislation. They also indicated the sort of work that had already gone into the

[2]LEI was also invited, but was not able to attend the workshop.

development of the relevant indicators and verifiers, including the limitations of the work already done, and the sort of further research that might be necessary.

Throughout most of the time that the team was in the camp, there were three members of local communities staying in the camp at the team's request. Their presence was aimed at providing a reference point or a resource for team members should the need to discuss particular issues arise; for example, what particular aspects of water quality were important to them as a community. The community resource people were chosen as representatives of their communities, and because they were familiar with all the local circumstances. Their presence in the camp was also partly a precursor for further work planned by CIFOR on the development of Adaptive Co-Management (ACM). In ACM, local communities take an active role in the setting and monitoring of criteria and indicators for sustainability.

Within this broad framework of team discussions and field trips, each of the teams undertook a number of activities. The first of these was to draw up matrices: one for discussing each of the verifiers currently in the C&I, and one which could also be used for assessing any new verifiers the team deemed necessary. Table 2.1 shows an example for Verifier V.2.1.7.2: There is no change in the chemical composition of water in streams or other water bodies.

Justification	• Ease of measurement • Change in chemical composition in water is one of the major effects of logging in some forest types (e.g., boreal, coniferous)
Relevance to management	• Site-specific • Long-term monitoring over whole FMU, rather than just one-off assessments • Needed for Environmental Impact Assessment (EIA) (in an Indonesian context)
Achievable/practical	• The procedure is well documented • May be costly • Needs highly trained staff • External laboratory analysis likely • Can be simplified
Appropriate spatial scale	FMU as a whole
Accuracy	Depends on technique, from very high to low
Data quality (repeatability)	Depends on resources and techniques used
Methods	Range from pH paper through to complicated chemical analysis by external labs
Inputs by forest managers: • Expertise	Inputs by forest managers: • Depends on techniques used -- at most simple untrained staff can collect water for analysis by external laboratory
• Information	• Depends on techniques used
• Equipment	• Depends on techniques used
• Time	• Generally fairly quick -- even for most complicated techniques, FMU staff would only be involved in periodic sample collection
Inputs by third-party assessors: • Expertise	• Need to understand significance of any changes taking place in water chemistry. Should be able to undertake testing if necessary
• Information	• Company's written procedures for monitoring, results of monitoring, any lab reports available
• Equipment	• Water testing equipment. May need own sophisticated equipment for on site testing if FMU does not own such
• Time	• Quick
Easy to interpret	Highly trained staff required
Tolerable change	Further research needed

Can data be authenticated?	Relatively easy to authenticate especially if the samples are sent out to an independent (or certified) laboratory for analysis
What do forest managers think?	Indonesian managers are used to using water monitoring for measuring impacts of forestry, and chemical measurements are part of the EIA prior to logging activities. However, little use is made of this technique thereafter. This is a widely used verifier in boreal forests.

Once a team had completed its matrices for all of the relevant indicators and verifiers, the matrices were passed to both the other groups for review and comments and returned for revision. This feedback from other team members was facilitated by daily (in some cases, twice daily) plenary sessions when teams could make verbal reports on their progress. The teams then synthesised each of these specific statements into general comments about the C&I set under review, and about the whole Generic Template, under the following headings:

1. The constraints of the C&I
2. Recommendations for research
3. Recommendations for the structure of the C&I
4. Recommendations for improving the field applicability of the C&I

The procedures for the field test varied according to indicator, and included the following:

- Results from CIFOR's on-going research on the site were used to assess numerous verifiers, especially those related to water quality, forest structure and landscape pattern.
- For verifiers of landscape pattern, CIFOR personnel analysed maps provided by PT. Inhutani II.
- The expert team themselves undertook assessments of some verifiers.
- For some verifiers, no direct test was possible, but the expert team considered their practicality in the context of PT. Inhutani II's concession area.

This field test process consisted of the following main steps:

- Revision of generic C&I and verifiers
- Production of new C&I and verifiers
- Field test
- Post assessment team meeting

A brief diary of the activities is provided in Annex III.

3. CONSTRAINTS

3.1 General Comments

3.1.1 Representation of Group

Although not the primary objective of this field test, local community concerns were presented so the community representatives were indirectly involved in the group discussions. Community input regarding the biodiversity C&I was mainly collected by Steve Rhee through direct interviews with the three community representatives.

The forest managers working in the area who participated in the workshop supplied input in the form of general forestry management knowledge and were particularly helpful concerning the existing national regulations and the local impacts of their application during forestry operations. While the implications of these were specific to the context of the PT. Inhutani II concession, the information provided a practical grounding for examining the C&I.

A noted gap in representation was the lack of involvement of any conservation group or personnel during the debates. Inclusion of these concerns would have provided a balance between the realities of forest management and production forestry and the impacts and issues concerning regional conservation.

3.1.2 Structure and Process of the BRF Field Test

The general questions and confusion regarding the general objectives of the biodiversity C&I meant that much time in the field was spent discussing the merits and applicability of the biodiversity C&I. While this could probably have been done as easily in an urban setting, the reality of the field conditions (and the input of the forestry management staff) provided a useful backdrop to these discussions.

As there was considerable review of the C&I in the CIFOR Criteria and Indicators Generic Template (the Generic Template) during the field test, the actual fieldwork was limited. Thus, considerations regarding the effective applicability of the old and new verifiers were essentially based on speculation. This speculation was based, however, on the practical inputs of the forestry staff and the information provided by personnel with practical field experience. The aim was to look for verifiers applicable to forestry managers and those that made use of existing (or easily modified) information.

Despite the fact that the actual fieldwork was limited, it paralleled closely the amount of time and the basic approach normally taken by assessment teams for forest certification.

3.1.3 Objectives/Verifiers

The review of CIFOR's Generic Template often found a lack of theoretical or demonstrated relationship between verifiers and the biodiversity objectives. In the field, this often results in confusion regarding what is to be protected and for what purpose.

With reference to the local situation in Indonesia, the lack of clear conservation planning and limited knowledge regarding the existing regulations creates additional problems in defining the objectives of preserving the biodiversity.

Furthermore, some verifiers are more useful for monitoring changes over a long period rather than for monitoring short-term direct impacts. This type of assessment requires the long-term and consistent investment of resources but does not provide direct and easy-to-interpret results. This point generated serious doubts regarding the applicability of the existing verifiers and prompted the search for new, more practical measurements or for modifications of the existing verifiers. Other concerns related to the measurement of verifiers are the appropriate spatial (and temporal) scale required, and the guidelines regarding the placement of measurement stations.

3.1.4 Forest Management Interests and Biodiversity Conservation

A basic conceptual problem was the endeavour to reconcile forest management practices with conservation issues, especially for those resources, such as water, which were already sources of contention between different groups of interest. Forest managers rejected many of the existing verifiers, which had been defined by conservationists rather than people with practical management knowledge or skills, because they were judged inappropriate or irrelevant in terms of forest management.

A further obstacle was identifying and defining those cases in which external factors can influence good management practices without the manager being clearly or directly responsible. This specific matter was skipped, often by referring to the management plan, which provides terms of reference, but such a plan is not exhaustive in terms of defining good and bad management practices.

There was a general feeling that there should be greater focus on management activities rather than the responses or downstream effects. If the emphasis were put on the prevention of impacts, rather than dealing with them after they had happened, good management of the FMU should follow.

The generic template makes extensive use of the terms 'acceptable', 'adequate' and 'significant', but these are difficult to interpret. However, the current approach of using expert teams and peer review may provide the level of credibility needed for certification markets, while scoring systems may be more applicable to helping

forest managers choose which verifiers are the right ones for their forest. (This issue is further discussed in section 5.5).

3.2 Group-Specific Comments

3.2.1 Water Quality Group

Impacts on water quality can occur in different places in an FMU, and the site conditions at measurement stations will affect results. This problem can be compensated for through appropriate sampling design. The current set of biodiversity C&I is useful mainly for monitoring long-term change and therefore has limited utility for certification, and spotchecks are often not possible (except for sedimentation). Water quality undergoes many changes for many different reasons, and any assessment system must allow for and accommodate these causalities.

3.2.2 Forest Structure Group

Forest structure can be difficult to assess, primarily because the issues range from the level of general forest to specific species. Input from a variety of forest users is required to provide clear ideas regarding both the key elements and the minimum areas or numbers of either patches or individuals to be protected. There is currently little information regarding the relative importance of species and the interpretation of the assessment results requires a broad view.

3.2.3 Forest Landscape Group

Landscape verifiers have largely assumed the presence of GIS, digital maps, and the expertise and capacity to use these. These are often, however, not available.

4. RESULTS

The revised set of criteria, indicators, and verifiers is presented and discussed here. (The detailed review results are described in Annexes IV–VI).

4.1 Water Quality

Current water quality measurements are often site-specific and do not provide an accurate assessment of the quality of water in the whole FMU. There is a need to provide long-term monitoring of water quality over the whole FMU rather than just site-specific 'spot' assessments. This type of information is relevant to managers, as it is generally required in most forest management plans. (In Indonesia, this is a requirement for the environmental management plan for the concession).

The assessment of forest concessions based on water quality requires an understanding of all the processes contributing to the verifier. It should also be borne in mind that the more detailed the parameters, the more complicated and expensive the equipment required.

Measurements of water quality are commonly used to assess the impact of forestry, so there is considerable scope for refining the techniques and the usefulness of the results.

To incorporate these techniques to test water quality will require forest companies to provide some basic training for their staff and to establish some baseline information against which future tests could be compared. Interpretation of the results requires longer-term monitoring and gathering of data, but these results could be used to provide information on water quality to third-party assessors such as certification bodies.

Forest managers are directly responsible for the impacts of the forestry activities in their concessions, and poor management will often result in changes to streamflow. Access to up-to-date streamflow information as well as knowledge of the changes over time will provide managers with the measurements to accurately assess whether they are effective in controlling the negative impacts of forestry.

More information is needed to provide a basis of comparison over time and some refinement of the techniques to provide managers with a 'package' they can use in the field.

Based on a Surat Edaran (Circular Letter) of the Ministry of Forestry's Directorate General of Reforestation and Land Rehabilitation (this later became a Ministerial Decree), all forest concessionaires are required to install at least one water monitoring station (SPAS) in every 5-year management area. PT. Inhutani II installed its SPAS on the River Rian for its 1993/1994-1997/1998 management area.

PT. Inhutani II is currently preparing for a streambank survey of the impact of logging on the 50 m buffer zone on each side of the stream. There is a regulatory requirement for concessions to protect this buffer during logging. The width of the buffer depends on the width of the river: 50 m for rivers below 30 m width and 100 m for rivers above 30 m width.

The results of the review of the verifiers and indicators applicable to water quality follow, while Annex IV contains further details.

Indicator I.2.1.7 ***There is no significant change in the quality and quantity of water from the catchment.***

Verifier V.2.1.7.1 **There is no significant change in the abundance and diversity of aquatic organisms.**

Aquatic organisms are sensitive to changes in water quality. The use of benthic macroinvertebrates has relevance because the techniques for sampling these organisms is cost-effective and may make a more detailed and expensive chemical composition analysis unnecessary. However, fish sampling may, under some circumstances, be a more appropriate measure for water quality assessment.

Water quality testing does not currently involve and measure information regarding aquatic fauna (invertebrates and fish), in part usually due to the high costs of the equipment and sufficiently skilled staff/workers. Managers could carry out the simple sampling of indicators such as macroinvertebrates or fish and this would require relatively little training. There is, however, still a need for staff to be trained to a level that enables them to identify fish or indicator invertebrate species and to measure relative abundance.

Long-term assessment of this verifier would be possible if fish/invertebrate populations were recorded regularly. This type of information would also enable crosschecking between separate sites to provide comparative measures of relative abundance. In terms of assessments by third-party certification assessors, this type of measure would enable comparisons.

It should also be noted that aquatic insects are widely used as water quality indicators in many European countries (including at the national level), and this information is taken into account when making policy decisions and can be used as valid evidence in legal cases.

A study on the abundance and diversity of aquatic insects took place in Central Kalimantan (at the concession of PT. Kayu Mas) as part of the first CIFOR biodiversity C&I field test. It documented the potential relevance and use of aquatic insects as bio-indicators, because they are easy to sample and a popular

identification chart is available (produced by Wetlands International). Preliminary studies in Bulungan Research Forest (in February 1999) showed that logging affects the composition and structure of aquatic insect communities. Furthermore, the abundance of the most sensitive species of aquatic insect (the stonefly nymph) was significantly reduced at streams affected by recent logging.

Verifier V.2.1.7.2 **There is no significant change in the chemical composition of water in streams or other water bodies.**

Change in the chemical composition of water is one of the major effects of logging in some forest types and this verifier provides an easy measurement of the change in water quality. Furthermore, current government regulations require forest concessionaires to conduct water monitoring.

The major constraint to obtaining detailed water quality analysis is the cost of the procedure and the need for trained staff. While the analysis can be as simple as pH testing, it is likely that, for meaningful results, external laboratory analysis will be required until methods can be simplified and adapted to field conditions.

Verifier V.2.1.7.3 **There are no significant changes in the decomposition rate in the water in streams and/or other water bodies.**

This is a relatively easy parameter to assess and provides a cost-effective measure of the influence of the nutrient cycle, which, however, can adversely affect the whole ecosystem.

The leaf bag method provides a repeatable test using inexpensive equipment; leaves from abundant species are kept in a bag and immersed in streamwater for several weeks. However, it is not easy to interpret the results as they depend on a variety of conditions such as light input and original water quality. In cases where greater accuracy is required, the techniques can be refined and augmented to provide the necessary information.

A quantitative approach would require the leaves to be oven-dried and weighed before and after treatment. The qualitative approach of assessing the percentage of damage to leaves before and after treatment would be another alternative that could be explored further.

Decomposition rates cannot be assessed immediately, as leaf bags must to be set up in the field several weeks prior to assessment. This verifier is therefore of real relevance within the context of a long-term monitoring scheme. Forest concessionaires do not currently use this as part of standard management procedure, but perhaps they should.

Data collected in Central Kalimantan using the leaf bag method showed that the decomposition rate of organic material was significantly lower in streams in logged areas compared to those in unlogged areas.

Verifier V.2.1.7.4 There is no significant change in streamflow.

A change in streamflow is among the most obvious impacts of logging and it is relatively easy to measure water levels and flow rates. In order to assess the results of good management, streamflow can be measured with data from water monitoring stations or through direct observation over time. There is, however, a need to ensure that the monitoring covers the entire FMU and is not based on only one part of the concession; moreover, conclusions should be drawn from observations or data with a timescale that is indicative of potential variations. The gathering of waterflow data requires low expertise and it is only in the context of extensive analysis that specific technical training is required.

New Verifier V.2.1.7.5 There is no significant increase in sedimentation.

A major impact of logging is increased sedimentation in streams within and downstream of the concession area. This can have adverse impacts on local communities and biodiversity both onsite and offsite.

Sedimentation relates to the proper construction and management of infrastructure elements in the concession. It can, for example, be controlled and minimised by constructing better roads and drainage, preventing roads crossing streams and avoiding the ponding of streams.

This is relevant to forest management because it is easy to measure, monitor and interpret. Basic training of staff and simple sampling equipment should suffice.

As with the other water quality monitoring verifiers, there is a need to ensure that measurements are representative of the entire concession and not of just one area. The management and monitoring of individual felling blocks to ensure there is no sedimentation will ensure the main watercourses downstream are not affected.

Recording the changes in the condition of a watercourse over time will show how successful the management of this aspect has been and the results can be used for third-party assessment information. Other information potentially useful for outside assessment would be community perceptions and detailed records of sediment conditions over time. However, there is a need for baseline information and an understanding of other causes of sedimentation.

New Verifier V.2.1.7.6 Chemicals, fuel, oil and liquid non-organic waste are not leaked into streams and other water bodies.

Bearing in mind that managers of forest concessions are responsible for the impacts in their areas and the prevention of damage to the environment from spills and pollution, a good forest management plan should contain a stated concern to ensure that spillage of waste material does not occur, as it can be highly damaging to the water quality and associated environments. There is, therefore, zero tolerance for change on this verifier.

By monitoring this aspect throughout the concession, the manager would also benefit financially through the implementation of less wasteful practices and through compliance with the stringent laws in many countries concerning environmental pollution as a result of forestry practices.

This verifier is easy and inexpensive to implement and monitor. The requirements for addressing it are relatively simple, consisting mainly of company procedures and policies for fuel and waste management. The effectiveness of the procedures can be monitored by comparing practice with the management plan and by making occasional field checks in the FMU.

The management must ensure that staff members are informed about the policies and management procedures. Third-party assessment of this verifier consists of field monitoring, reviews of company procedures, company records and any complaints regarding pollution that have been directed towards the company.

New Verifier V.2.1.7.7 There is no blockage of streams leading to ponding.

The absence of ponding is a very good verifier as it indicates properly engineered drainage and a well-managed forest concession. Other possible benefits include the reduction of damage to roads as a result of improperly maintained or constructed drainage.

This verifier is very relevant to management. In many countries, forest management regulations attempt to prevent ponding during or after the construction of logging roads. If applied to the entire FMU and down to the level of individual felling blocks, satisfying this verifier would be another indication of a well-managed forest concession.

Monitoring requirements are low but there is a need to improve techniques for building and maintaining roads. This would require either qualified staff or more training for the existing road construction division. As there is plenty of literature available regarding road construction, information is not limited and it takes no longer to build a better road so no (or only marginal) extra cost is incurred.

Assessing and monitoring this verifier is relatively easy and requires only spotchecks along access roads to detect the presence of ponds. The results are also easy to interpret as the ponds are either present or absent.

4.2 Forest Structure

Many verifiers were either unclear or difficult to measure in the field. The group discussions focused on the applicability of the C&I to the forest managers who will ultimately be called upon to manage specific indicators or to provide the measurements and information for assessment.

Forest managers were interviewed in the field to see if the verifiers: a) had any meaning to the manager; and b) could be measured using existing information or skills.

Forest structure is a very important component of biodiversity, but, unfortunately, it is also the most sensitive to human intervention (such as logging). In an area that has been allocated for harvesting, the structure is changed, and determining the degree of acceptable or sustainable change still requires much study.

The results of the review of the verifiers and indicators applicable to forest structure follow, while Annex V contains further details.

Criterion C.2.1	**The processes that maintain biodiversity in managed forest (FMU) are conserved.**
Indicator I.2.1.2	***Changes in the diversity of habitat as a result of human interventions are maintained within critical limits as defined by natural variation and/or regional conservation objectives.***
Verifier V.2.1.2.1	**All diameter size classes of harvested and unharvested trees are maintained.**

The aim of this verifier is to ensure that the managers of forest concessions include in their management plans the conditions and controls to ensure all tree species are maintained in future stands. As many species of wildlife depend on tree species of specific size, maintaining a variety of size classes sustains these interdependencies.

Although this is an important verifier, it is potentially in conflict with timber production that targets certain size classes of commercial species and the forestry policies in some countries to eliminate non-commercial species. There is, however, a need to incorporate this consideration in forest management plans.

The pre-harvest inventories provide the information necessary to monitor this verifier. There may be a need for more explicit information regarding the range of size classes present, but this should be possible with improved field identification by forestry staff. The policy to leave representatives of all size classes has to be clear and known by all involved in the forestry operation. Any third-party testing of

this verifier should be done through the forestry assessment (pre- and post-harvesting inventories) and through additional inventories to authenticate the data.

Verifier V.2.1.2.3 Frequency distributions of leaf size and shape are maintained within natural variation.

This verifier could provide information regarding changes in vegetation and the diversity of vegetation. However, there are other methods to assess vegetation diversity that provide practical information related to the management of forest concessions and which are more applicable to conditions in the field.

New Verifier V.2.1.2.4 At least 10% of mother trees (of commercial species) above harvesting size are left as seed trees (or until further research proves otherwise) (for dioecious species, the percentage should be double).

In order to maintain diversity in forest structure and the persistence of seed trees there is a need to ensure that a percentage of large trees are maintained. Many species of wildlife depend on large trees for roosts or habitat so the preservation of these trees will preserve habitats.

This verifier is relevant to the management of forestry concessions as the practice of not cutting some trees is already implemented to a small degree in many concessions. The limitation, however, is that the trees left are generally only those which are flawed and have no commercial value. The information to test this verifier currently exists through the pre- and post-harvesting inventories, but the effective protection of biodiversity requires both a well-formed policy and that the trees selected for protection be demarcated.

As a testing criterion for third-party assessment, the standard inventory information could be used or it could be supplemented with more detailed spatial information. For dioecious species, a more detailed inventory with these species clearly demarcated and the numbers doubled to ensure adequate protection would be necessary.

New Verifier V.2.1.2.5 The elements of forest structure are protected (e.g., tallest trees, fig trees, fruit trees, hollow trees, (wild fruit trees), lianas, natural understorey maintenance, etc.).

This verifier provides an indication of good forest management based on preserving biodiversity. The pre- and post-harvesting inventories do not currently contain the information required to test this verifier, but could be modified to do so. Testing this verifier could be based on observations in the field or on the forest inventories. The usefulness of the verifier will be limited when there are tree species with commercial importance in question.

The expertise required to test the verifier and interpret the results is minimal and is based on inventory results and observations. National or regional policy guidelines related to wildlife management are required regarding which aspects of forest structure should be protected.

Inclusion of this verifier, as a key component of the forest management plan, will encourage managers to consider biodiversity when preparing the management plans for the FMU.

Verifier V.2.1.2.7 The distribution of aboveground biomass does not show significant change as compared to undisturbed forest.

The concern for leaving large trees has been addressed by other verifiers and further assessments of biomass can be gathered using the forestry inventory data.

Based on interviews with forest management personnel in the field, the opinion is that this verifier has little practical field application and would yield little information of use to improving the management of an FMU.

New Indicator I.2.1.8 Presence of undesirable vegetation types is controlled (includes undesirable local vegetation).

Natural biodiversity can be severely affected by the introduction or predominance of undesirable vegetation (including undesirable local vegetation). There is therefore a need to ensure forest concession managers are aware of the potential problem and are able to prevent this occurring. The presence of undesirable vegetation also poses a threat to regeneration (including that of commercially important timber and non-timber species) and native fauna.

This is directly relevant to management and, in order for forestry to be sustainable, this indicator should be incorporated in the forestry management plan under the direct control of the forest manager. In terms of biodiversity C&I, this is one of the most basic indicators regarding good forest management.

FMU managers are also aware of this problem and, in many areas, the invasion of undesirable species has a direct impact on the ability of the forest to regenerate for a second cutting cycle. Assessment of the problem can be from several aspects and these are outlined with the verifiers for this indicator.

The methods to assess this indicator can be field observations, comparisons using forest inventories (e.g., using aerial photos, remote sensing). Some additional inventory information may be necessary and knowledge of potentially invasive species would be required. The results are relatively easy to interpret and the levels of tolerable change can be site-specific.

New Verifier V.2.1.8.1 Canopy openness is managed to control undesirable vegetation types.

In order to control undesirable vegetation and to limit changes in the vegetation composition, it is necessary to manage the amount of openness in the canopy as a result of forestry activities.

This is directly relevant to managing forestry resources, it can be controlled by the FMU manager and the results will have a direct impact on the quality and regeneration of the forest resources.

There are several methods for assessing the change in the canopy including observations in the field, pre- and post-harvesting inventories and use of densiometers for more accurate qualitative measurements. The existing forestry inventories could be improved with some training of key staff to provide information that is of sufficient quality to measure change.

New Verifier V.2.1.8.2 Exotic species are not invading.

This verifier is needed to ensure there is no transformation of the forest habitat through the invasion of exotic species.

This is directly relevant to management, as the forest concession has to be managed to provide future resources. Measurement of this verifier can be through making observations and incorporating the existing forest inventories. In terms of expertise, there will be a need for some training regarding the potential problem and the possible controls. This should be coordinated with national and regional policies regarding biodiversity and invasive species. In the absence of these policies, it would be an indication of good management for the FMU to exercise a degree of self-control on these aspects.

In cases where third-party assessment is desired for certification, the amount of non-native, invasive species present in an FMU could be used as a direct measurement of the quality of the management.

New Verifier V.2.1.8.3 Species not native to the site are not introduced or planted in the FMU if there is a threat of their spreading.

The purpose of this verifier is to ensure that the native biodiversity is sustained and that future problem species are not introduced to the FMU.

The manager of an FMU is responsible for the activities in the concession and this type of management is directly under his control. Many concessions currently plant quick-growing, non-native species for erosion control. While this satisfies the need

to prevent erosion within the FMU, there is the possibility of introducing a non-native species that may eventually overwhelm the native species. In terms of long-term management based on maintaining biodiversity, this is clearly undesirable.

The planting of exotic species is often a policy directive and there is a need for a clear statement regarding the species that are allowed and those that must be avoided. In the absence of policy, the precautionary principle should apply and non-native species should be avoided. Clear regulations and guidelines are required, and forestry managers and staff should be trained regarding the potential problems.

This verifier can be measured through field observations. However, there is a need for sound knowledge of native and non-native species. No exotic species should be introduced, and satisfying this verifier would indicate a well-managed FMU.

New Indicator I.2.1.9 No native/indigenous species are eliminated by activities in the FMU.

This indicator is considered a fundamental component of the maintenance of biodiversity in an FMU, and should be included as a statement in the forest management plan so that managers are aware of and committed to their part in ensuring the sustainable management of the forest resources. Several verifiers have been included as measures of how successfully an FMU is managed based on the above indicator.

New Verifier V.2.1.9.1 Protected species are known to all actors in the FMU.

All those involved in the forestry operation must know which species are protected. It is otherwise very difficult to regulate the protection of these species.

FMU managers must ensure that all their staff members are aware of, and comply with, the regulations governing the use of the forest resource. The villages adjacent to the FMU must be involved and informed in the same way.

This indicator can be monitored through existing inventories, third-party assessments, and interviews with relevant actors. Normal inventory skills should suffice, but these could be supplemented with methods to ensure that the villages are also properly informed.

There is scope for the involvement of both national and regional, government and non-government agencies that are involved with natural resources by incorporating their aims and objectives.

New Verifier V.2.1.9.2 Protected species are not hunted or collected.

The managers of an FMU should be made aware of their role in biodiversity protection and their responsibility to ensure the resource is sustainedly managed.

By including this verifier in the forest management plan, the statement of intent has been made to ensure that the species in the FMU will be protected during forestry activities. As the management is responsible for all activities in the concession area, the aims of this verifier are achievable.

The forest management plan should be coordinated with existing policy regarding protected species and biodiversity management. Measurements of success could include spotchecks in the FMU, checks on the local markets, and third-party assessments if required.

It should be easy to interpret the results based on the existence of clear legal statements and policy guidelines for the management of wildlife and biodiversity.

New Verifier V.2.1.9.3 Non-specific hunting methods are not allowed in the FMU by concession staff (e.g., snares, traps, poisoning, explosives).

Non-selective hunting methods can be very destructive and can eliminate vulnerable species of wildlife.

The managers of an FMU have to be aware of their role in maintaining all biodiversity in the area for which they are responsible. Controlling hunting by concession staff would provide an indication of good management of the forest resources. The manager is responsible for all activities occurring in the FMU and can restrict hunting according to the guidelines outlined in the forest management plan.

The methods for monitoring whether the conditions of this verifier are being met include spotchecks of the camp, forest and local markets as well as interviews with the local people.

New Verifier V.2.1.9.4 According to available information sources, no known species have been eliminated.

Criterion C.6.3 Forest management plan is comprehensive.

New Indicator I.6.3.7 National and regional conservation policies have been incorporated in the forest management plan.

Forestry planning has to be compatible with national and regional conservation requirements and there is a need to have these requirements as stated FMU policy guidelines.

These policies are directly related to the management of an FMU and should be used to define the operation's activities and objectives. The basic measure of success in this will be that the policy has been incorporated in the forest management plan and that the plan is being followed. This will have to be measured at the planning stage, when the management plan is being written, and subsequent forestry activities should be carried out with the conservation policies as an underlying guideline.

No verifiers were proposed.

New Indicator I.6.3.8 Areas and elements of biodiversity importance have been identified and included in the forest management plan. Identification to include global, national and regional stakeholder concerns.

To address the concerns and needs of biodiversity in FMU management, the areas should be identified and the management concerns should be incorporated in the area management plans. This is an important indicator and should be one of the first to be considered in order to establish a framework for the rest of the biodiversity C&I.

If biodiversity conservation is to play any role in guiding better management of forestry resources, these concerns have to be incorporated in the forest management plans at the planning stage. The benefit will be a better-managed FMU. Incorporating biodiversity in the management plan is achievable as a general statement and implementation will depend very much on the policy requirements for forest managers.

There is a need to crossreference forestry policies with other national and regional level policies regarding forests and forest-related resources. These non-timber policies will provide a wider scope for identifying areas of biodiversity importance. Forest management planning will therefore require inputs from other agencies in order to satisfy the biodiversity requirements. The requirements should be based on national and regional biodiversity conservation policies and goals and these goals should be incorporated in the forest management plan.

Third-party testing of these parameters will require knowledge of the regional biodiversity policies to ensure that the managers have incorporated these in the management plans.

New Verifier V.6.3.8.1 Comprehensive biodiversity requirements with spatial referencing and operational terms are included in the forest management plan (locally determined).

The preservation and conservation of biodiversity is a key goal and, as such, these concerns have to be given high priority in the management of forest resources. Unless there is a requirement that biodiversity concerns are included in the forest management plan, there is a chance that these concerns will either be omitted or be given only secondary importance with regard to management.

The managers of forest concessions are responsible for the resources in their concessions and, by incorporating a stewardship role in the management plan, they become directly responsible for biodiversity management.

Criterion C.6.4 Implementation of the management plan is effective.

The factors affecting biodiversity must be addressed in the management plan in order for the biodiversity C&I to have a positive impact on the management of forestry resources. The current set of C&I is quite extensive; however, during the field test, it was felt that more influence could be placed on management decisions directly affecting the operations (and ultimately the biodiversity) of the FMU. The following new verifiers are proposed to address these concerns.

New Verifier V.6.4.5.3 Roads are planned and constructed by personnel qualified to do these tasks.

26 In order to minimise erosion and reduce the amount of impact due to forestry operations, it is essential that the infrastructure be properly planned and constructed. Any measures to lessen the impact on the forest resource will have a direct effect on the biodiversity of the area.

This is achievable and directly related to the management of the FMU as it is under the control of the concession manager. Planning infrastructure to minimise the impact on the biodiversity of the area will result in well-engineered roads and service access.

The acceptable level of accuracy required is that the infrastructure has to be according to the plan. This verifier is relatively easy to assess as the roads either are in accordance with the plan or are altered on justifiable engineering and environmental grounds. A prerequisite for good road construction is the availability of appropriately scaled topographic maps.

New Verifier V.6.4.5.4 Bridges and culverts are in place and are maintained to be viable for long-term usage.

The blocking of watercourses and streams is often one of the most significant impacts resulting from activities in an FMU. This verifier is aimed at preventing the creation of stagnant water through blocked streams and ponding. This, in turn, will minimise erosion and any threats caused by impounding water.

The essential requirements are that bridges and culverts are properly planned and that action is taken if they are not intended to be long-term facilities. In terms of applicability to management, well-built infrastructure results in lower costs in terms of maintenance. No additional skills are required provided that the road construction unit employs trained staff with adequate road and bridge engineering ability.

As a measure of good management, this verifier, and its associated indicator, can be tested against the management plan and easily assessed through observations of the road and water quality in the FMU. One of the concerns expressed by the management personnel interviewed was the increased cost of building better bridges.

Verifier V.6.4.3.3 Areas of specific conservation status are clearly demarcated and recognised by all actors.

4.3 Forest Landscape

Since digital maps were not available, verifiers V.2.1.1.6. and V.2.1.1.10 could not be tested. This further emphasised that assessment should not yet rely on GIS and related technologies, because these are not currently available to most forest concessionaires in Indonesia (certainly including PT. Inhutani II).

The fire tower could not be used for observing the landscape pattern and assessing the patch structure of logged and unlogged areas because the fire tower was too low (and hence the view to virgin forest was obstructed).

Visits to the conventional logging area, reduced impact logging (RIL) area and the permanent sample plots were used to compare the methods for determining the landscape verifiers. Groundchecks showed that the crown density of conventional logging was lower than that for the RIL area, and the RIL area was less dense than the virgin forest area. However, no way was found to observe these differences at the landscape level.

Some discussions centred on appropriate verifiers understandable to forest managers:

1. Adequate spatial information (such as a map of resources) are available, as are adequate management, ownership and inventories.
2. Variation within the full range of natural vegetation found in the FMU should not be depleted.
3. The protection forest should be spread across all distinguishable variation in the FMU's natural vegetation.
4. The mobility of wildlife and genes should be facilitated by corridors and by minimising barriers, and corridors should be wide and barriers (open ground) should be narrow within the FMU.

5. Ecologically sensitive areas and features should be identified and protected (pools, caves, springs, river banks, etc.).
6. Virgin forest reserve areas should be located as representatively as possible, also (all else being equal) as far as possible from settlements.
7. Wildlife migration routes should be identified and not obstructed.

Further, no related biodiversity management plans should be located under the 'Production of Goods and Services' aspect but under the 'Management Plan' aspect, which relates to all indicators/verifiers.

The results of the review of the verifiers and indicators applicable to the forest landscape follow, while Annex VI contains further details.

Verifier V.2.1.1.1 Adequate spatial information (maps, aerial photographs/satellite images) are available.

This is a very important verifier as resource maps are the basic data for all management activities and are essential for planning the management of resources. In order to monitor the changes in the forest landscape, it is necessary for managers of forest concessions to have a series of maps providing up-to-date information. In Indonesia, the managers are required to have satellite-based maps every two years and aerial photograph–based maps every five years. To further address the need to maintain the forest landscape, accurate vegetation maps are required and should be available at the concession office.

It is very important that the maps are sufficiently accurate and they should therefore be ground-truthed to ensure that the information is sound.

Verifier V.2.1.1.2 Variation within the full range of natural vegetation found in the FMU should be maintained.

This is essential in terms of managing a forest resource to maintain biodiversity, and ensuring this verifier is met will prevent the loss of individual types of vegetation and habitat. As the market for forest products changes over time, it is also in the concession managers' interest to ensure they have the full range of potential forest products for future use.

As the forest concession rules and laws in many tropical countries either advocate selective felling or prevent clear felling of forest, this verifier relates directly to many current management practices. In Indonesia, for example, the Tebang Pilih Tanaman Indonesia (TPTI) outlines the guidelines for managing forest concessions and forbids concessions to carry out clear cutting.

Managers are able to observe changes in vegetation type provided they have the baseline information from which to make comparisons. The verifier is relatively

easy to measure against the management plan; however, the levels of tolerable change allowed will depend on the overall management objectives for the concession.

As with spatial information, the higher the quality of the information available, the easier the task of assessing concessions for certification.

Verifier V.2.1.1.9 Mobility of wildlife should be facilitated by corridors and minimised barriers.

To protect the ranges of mobile species of wildlife, it is necessary to ensure that there are areas of forest that connect and allow freedom of movement between areas of good habitat. There are also secondary benefits to the provision of corridors such as erosion control and the protection of genetic variation in the landscape.

Currently, many forest concessions are already required to provide such corridors as part of the management plan so no extra effort is required. In Indonesia, this is included in the forest management plan as one of the conditions of the environmental management plan (RKL).

Although the corridors should be established at the planning stage of the forest concession using good maps, this may be beyond the ability of many forest concession managers. The need for corridors also depends on the presence and range of wildlife species in the concession area, and knowledge of those species' specific habitat requirements. These limitations could be overcome through involving regional wildlife authorities in the planning phase of the forest concession or by using expert consultants.

Once incorporated as part of the management plan, the existence of the corridors can be verified; this verification can be as simple as using groundchecks or as complicated as conducting wildlife surveys.

Indicator I.2.2.2 Ecologically sensitive areas and features should be identified and protected (water sources, caves, riverbanks, etc.).

The exploitation of forest resources may result in important ecological areas being degraded unless these areas have been identified and provided with some sort of protection within the concession. This indicator is important as concern for the environment is fundamental to conservation and a positive result in this matter is an effective indicator of good concession management.

Under many of the laws governing the use of forest resources, the concession

holder has an obligation to protect areas of ecological importance. In Indonesia, the concession holder is obliged under the terms of the TPTI and environmental management plan (RKL) to protect ecologically sensitive areas.

As incorporating areas protecting ecological diversity is already part of many management criteria, these areas must be properly identified. Good maps are a prerequisite as is some expertise in surveying and identifying the areas to be included.

As is the case with wildlife corridors, the possibility of involving regional wildlife and biodiversity bodies to assist with preparing the forest resource management plan should be explored. Assessing the tolerable change allowed or acceptable will require long-term monitoring of populations and habitat use. The most immediate assessment, however, can be whether or not the corridors exist and are in place according to the statement in the management plan.

New Verifier V.2.1.1.12 Virgin forest reserve areas (biodiversity areas, seed stands etc.) should be located as representatively as possible, and as far as possible from settlements.

Reserve virgin forests are needed for conserving gene pools. This resource has many potential applications including research, medicine applications, and forest products and services. There is a need to apply the 'Precautionary Principle' with some forest lands to ensure that the resource is protected for potential applications as yet unknown. Further, protecting representative virgin forest stands is extremely beneficial for the overall protection of biodiversity.

As this is already a requirement of many forest concession management plans, implementation of this verifier does not require extra effort and actually ensures that future productivity of the forest is maintained. Problems do, however, arise in identifying the areas of forest to be preserved and the extent of these areas. In these cases, there is probably a need for more guidance and enforcement from national and regional forestry and resource management agencies.

These virgin forest areas should be identified and allocated during the management planning stage with the areas being clearly demarcated on the ground. Checking that these areas have been included in the management plan and exist on the ground requires going to the field and being able to identify the area.

4.4 Social Issues

- During the field test, interviews with representatives of the local communities were conducted to gain an appreciation of the local view with regard to biodiversity. The aim of their inclusion was to gain an appreciation of their view of the forest and to the developments taking place with regard to forest management. The indigenous people of Borneo have used forests for

agriculture and sustenance for several hundred years and have developed their own criteria for selecting land suitable for cultivation or exploitation. One aim of this study was to ascertain whether some, and which, of these criteria could be incorporated or adapted into use with the biodiversity C&I. The two main questions asked in the research initiative were:

- Which environmental factors are important to local people, and why?
- What are the linkages between these factors and the Criteria and Indicators discussed and improved during the C&I workshop?

Three representatives from different communities and ethnic groups adjacent to the BRF provided information concerning the above. Steve Rhee structured the interviews according to the three main areas of the field test: Water Quality, Forest Structure and Forest Landscape.

The results of this effort follow, while Annex VII contains the full report.

4.4.1 Water Quality

Water is very important to all the villages in the area as a means of transport, a source of drinking water, a source of food and a source of water for daily use such as for bathing and washing. Sedimentation was highlighted as a critical issue with clear water being considered healthier for drinking, bathing, cleaning clothes and catching fish. Changes in the river water quality and flow rates had been noted, but no indication as to cause had been given.

Possible linkages between water quality C&I and local concerns regarding water:

- Local community observations concerning the increased frequency and duration of murky river water reiterate and reinforce the verifier that addresses sedimentation of rivers.
- The local community did not mention anything about the chemical composition of water, yet the decrease in fish supply noted by local community members might be an indication of a loss of certain elements or compounds in the water. Identification of all species commonly found and the monitoring of their abundance may be useful.
- Local people did not mention aquatic insect species, but, again, an understanding of the species found in the rivers and their population fluctuations may indicate the abundance of certain aquatic insect species.
- Much like the water quality monitoring group, the local community is quite concerned about the perceived increase in streamflow and rapids. This, of course, not only increases the danger to local community members, but will also affect aquatic life.

4.4.2 Forest Structure

The forest in the vicinity of the usual dwelling of the local people is used for different purposes and they examine the structure to indicate the probability of finding various forest products. As they tend to use the forest adjacent to their villages, they have intimate knowledge of their own surroundings through the traditional knowledge passed down through generations.

Local residents have their own separate sets of indicator species used to indicate, respectively: a) whether the soil can be farmed; b) the presence of certain valuable plants; and, c) the presence of desired animal species. Forest structure is very important to the local communities for the provision of valuable non-timber forest products such as rattan and gaharu (sandal-wood).

Possible linkages between forest structure C&I and local concerns:

- The Forest Structure group emphasises the need to maintain the existing biodiversity. The comments and observations of the local community also support this to a certain extent. Local community members employ a diverse portfolio of livelihood practices that are directly dependent upon the biodiversity found in the surrounding forest. Although local individuals might not necessarily share a concern over a specific species, the local community is well aware of the importance of the existing biodiversity.
- When gleaning the forest structure C&I, there appeared to be a strong emphasis on maintaining the pre-harvest integrity of forest. This is precisely what local community members conveyed in both the three-day interview sessions and during Steve's fieldwork period. Local rationale includes the following: the existing vegetation provides great benefit to the local people by providing the aforementioned goods and services and the existing forest structure attracts many animal species that they hunt for food.
- Local people also maintain the same concern regarding seed trees/parent trees and the primacy of regeneration. An example provided by local people was that, when harvesting rattan, local people only harvest old rattan, leaving the maturing rattan for future harvests and regeneration.
- Invasive or non-native species, however, may be a point of contention. Conversations and interviews with local people indicate that they are not concerned with the idea of non-native species; perhaps they would support the introduction of invasives or non-natives if these species were of use to them, either for subsistence or cash income. Examples of this are the local desire to cultivate oil palm and the already established planting of citrus trees that are not native to the area. Critical to local people is that local vegetation provides tangible benefit.

4.4.3 Forest Landscape

Local people have an intimate knowledge of the forest in the vicinity of their villages and the concept of the forest landscape has a high importance to the village as a whole. Many of the indigenous groups have adat (or local customary laws) that relate to the conservation of islands of forest within the community lands to ensure a supply of jungle produce and to maintain the health of the forest. Often, agriculture takes the form of tended forest to maintain certain fruit trees or areas of valuable jungle produce. These areas were traditionally part of the community land and were protected and managed through the community. With the arrival of land surveys and more private ownership, the community land status is somewhat confusing and is often not respected by all the community.

Possible linkages between landscape C&I and local concerns:

- The Landscape group emphasises maintaining existing vegetation types; the local community also emphasises this point (see discussion in Forest Structure).
- With respect to ecologically sensitive areas such as riverbanks and water sources, the local community has expressed noticeable changes in and concerns regarding these ecologically sensitive areas. Much depends upon how 'ecologically sensitive area' is defined.
- The idea of forest reserves to maintain biodiversity is intimately linked to, if not the same idea as, local community notions regarding protected forests.
- Wildlife corridors address concerns expressed by the local community over the loss of animals to hunt. Community members also have a strong grasp of the migration patterns of certain species such as wild boar. Corridors would be of direct importance to them in the sense of facilitating the migration of those species they hunt.

4.5 Certification Issues

The major problems and limitations of CIFOR's existing biodiversity C&I set in relation to the needs and requirements of certification agencies, with special reference to the FSC, were identified with a view to the Principles and Criteria for Forest Stewardship (see Annex VIII).

1. Possibly, the major shortcoming of the C&I with regard to FSC users is their scope. The FSC is global in application, being relevant to forests in tropical, temperate and boreal regions, and to forests under a wide range of management practices, from industrial tree plantations to the smallscale community management of natural forests.

   The C&I are currently specifically relevant for use in large tropical logging concessions—specific examples include V.2.1.3.3 and V.2.1.3.5. The verifiers state 'The abundance of nests of social bees is maintained within

natural variation' and 'Fruiting intensity in known bat-pollinated tree species does not show significant change as undisturbed forest'. These are clearly tropical in their reference. While the section from which they are taken contains other verifiers of relevance to both tropical and other types of forests, users of the C&I for other forest types could find the task of searching through the text for relevant references off-putting.

It is also important to note the use of undisturbed forest as a measure of change. In much of western Europe, the forest that is considered of highest biodiversity value can in no way be considered undisturbed, having undergone centuries of intervention. This appears in a number of verifiers, including V.2.1.5.3, V.2.1.5.4, V.2.1.6.1 and V.2.1.6.2.

Verifier V.2.1.4.2 ('Number of different birdcall groups does not vary significantly as compared to that in unlogged forest') is probably not appropriate, because bird populations have been reported to be significantly higher in logged-over compared to unlogged forests.

2. The FSC principles and criteria are essentially practical in their approach. They are designed for use by forest managers and, by necessity, are the product of a certain amount of compromise between our understanding of 'best practice' in forest management, and what forest managers are willing and able to do.

In seeking to interpret these P&C for their own forests, forest managers will find in the C&I a document that is sufficiently different in tone for it to be difficult to see how the two documents relate to each other in a direct sense.

If the FSC P&C can be said to be a practical compromise, the CIFOR C&I are uncompromisingly academic. Though described as being designed for logging concessions, there are certain parts of them that it is clearly beyond the ability of any forest manager to meet. For example, many of the verifiers for indicator I.2.11 'Landscape pattern is maintained', deal with the concepts of vegetation patches, weighted patch size, contagion indexes, dominance of patch structure, fractal dimensions of patch shape, percolation index that specify landscape 'connectivity', and so forth.

From an academic point of view, it may be necessary that some of these techniques be used to gain concrete evidence of the impacts of forest management. However, most forest managers will probably not have sufficient training and/or the facilities necessary to deal with such concepts and techniques. Sustainable forest management is, by necessity, riddled with compromise, and aimed at achieving the best under the conditions. While this may not engender confidence in the academic researcher, it stops forest managers from becoming disheartened by lists of unattainable requirements, and gets them on the road of gradual improvement over time.

3. In relation to the above point, the relevance of some criteria and/or verifiers to the conservation of biodiversity is not clear. This includes the verifiers dealing with landscape patterns: contagion indices, percolation indices and so forth. Forest managers will always seek the path of least resistance to achieve sustainable forest management, and will be unwilling to implement new management regimes if they feel these may not actually bring the required results. There may be very good reasons for the inclusion of such techniques, and they may well yield the required results efficiently. In that case, it may be a case of misunderstanding on the part of the forest managers, and there may be a need for more explanatory notes to clarify why such techniques are appropriate and of benefit to the managers.

4. The cost of using the C&I relates to their academic nature. This will be the major factor affecting choice among forest managers, and will be significant for a number of other key users, including national working groups trying to develop standards for sustainable forest management in their countries.

5. The decision-making processes involved in the use of C&I are currently too academic, and it is uncertain whether the scientific basis of much of this system is proven in its ability to identify suitable C&I correctly. This is the case both in terms of which of the individual criteria and indicators to select as being appropriate for further revision according to local field conditions, and how to then decide whether the site-specific C&I are being met. Further work on this would be beneficial, and the process may become more palatable if a much greater degree of flexibility in the decision-making processes is allowed. The basis of such systems should probably continue to be the existing, subjective, expert opinion systems used in certification circles, at least in the short term, until a system is identified that is both sufficiently rigorous and has an acceptable cost and bureaucratic burden.

6. Common to both the P&C and the C&I is the lack of a substantial number of concrete examples of the implementation of either the P&C or the C&I. The first forests were certified using FSC principles and criteria in 1991, but the number of certified forests is still quite low. Certification is often undertaken for commercial reasons by forest managers who are often not inclined to report writing. There are only a few detailed expositions or studies of their use outside academia.

   There are no concrete examples of the CIFOR C&I having been used directly in the development process of any nation- or region-specific P&C. This is despite the fact that the CIFOR C&I project: a) has been active since 1993; and b) has involved many representatives of the ‘certification sector’ (including the FSC and certification bodies) since the beginning.

   The world of forestry is generally conservative and potential users of the C&I may be avoiding them because they cannot see any other members of their ‘peer group’ using them. Their impression may be, despite what is written in

the CIFOR documentation, that the C&I are only for the academic world. It may be necessary to develop a critical mass of experience before the process becomes self-sustaining.

7. In their structure, both the FSC P&C and the CIFOR C&I share a common weakness as far as practical use by forest managers is concerned. The compartmentalisation of principles, criteria and indicators into theoretical groups may make it difficult for managers to imagine how the criteria in a particular section relate to their activities, because the criteria may not directly relate to forest management practices. For example, the theoretical sections of the C&I include 'Ecology', 'Policy', 'Social', etc.

   A forest manager will think of forest management in terms of practical actions, such as felling, planting, road construction, and transport. Each of these activities relates clearly to both policy and ecology. However, a forest manager may not realise and/or appreciate the potential adverse social impacts of these activities. Promoting sustainable forest management should encompass engendering an understanding of these linkages that exist in forest management; for example, by reflecting the inter-relatedness of these issues in the structure of its documents.

   Many of the biodiversity C&I can be seen as having linkages to the social C&I, but this is not always clear when reading them. A forest manager might find it easier to accept a criterion that requires maintaining water quality if it is clear that this helps to meet another criterion that demands that local community access to forest goods and services be maintained.

   Changes of thinking of this kind are not easy, even if the managers are keen and committed, and the managers need encouragement in the form of documents which reinforce the new, rather than the old, lines of thought.

8. It is made clear within most forest certification systems that they apply only to the actions of the forest manager being observed. If there are negative effects on biodiversity in an FMU resulting from forces beyond the control of the manager, these do not preclude the FMU from certification. In the current set of C&I, it is difficult to differentiate between damage to biodiversity caused by a manager's actions, and that which is not. Thus, one verifier (V.2.1.7.2) states that the chemical composition of streamwater should not show significant variation as compared to that in unlogged forest, while another (V.2.1.7.4) requires that streamflow does not show significant change as compared to the flow in an unlogged site. Chemical composition and streamflow are the result of a number of factors, some of which will undoubtedly be due to forest management practices, and some of which may not be. This is especially the case if the headwaters of a river are not within the concession. A forest manager would be understandably nervous about being committed to certification based on standards developed from such criteria and indicators. Failure may be due to factors outside the control of management.

Criteria and Indicators must be clearer about the scale and scope of their application, to avoid any such uncertainties. Thus, criteria related to water quality should explicitly state where measurements should be taken, because the test results for a river could be different as it leaves a logging area and as it leaves the concession.

9. As stated above, the FSC P&C have a global application and, as such, their working language, as for the CIFOR C&I, is English. However, in the working groups that have been set up in a number of countries to develop the FSC P&C into nation- and/or region-specific standards, the emphasis has been to include as many of the forest stakeholders as possible in the process. The CIFOR C&I might be more readily used if available in a range of other languages.

10. There could be concern among some potential C&I users that they represent a snapshot of our understanding about sustainable forest management at the time of the final publication of the project documentation. They may ask how likely it is that, as knowledge increases, the C&I have been updated. The FSC P&C are in a constant state of revision (which also does little to help their users, as they are then in a position of aiming at a moving target). The C&I in their current form represent a detailed look at a small part of the forest management spectrum, after six years' work. How likely is it that the C&I will be enlarged to include representation for all forest types and management styles and, more importantly, will they be updated regularly to ensure that they reflect our understanding of current best practice?

5. DISCUSSION

The objectives of the field test were to test the current 'minimum set' of biodiversity Criteria and Indicators (C&I) in a certification context. The problems with the current set of verifiers were acknowledged and the goal of the field test was to find appropriate methods to reformulate what is required to adequately manage forests to maintain biodiversity. The field test was intended to provide direction for the verifiers in terms of improved wording, better focus, enhanced clarity and field applicability.

The verifiers should be revalued and reweighted and should come in at the second level if there are differences in opinion. It is hoped that this will solve problems with overlaps, as the initial system is limited with regard to verifiers that test similar or overlapping indicators.

5.1 Water Quality

The indicators in the ecology-related C&I are currently arranged in descending order of importance. A point requiring consideration is whether water quality and related indicators should have been placed higher in the hierarchy. As an indicator of good management, water quality is one of the most obvious and easily tested parameters and also has considerable value with surrounding stakeholders.

Local communities interviewed during the Bulungan field test highlighted the sedimentation of rivers as a critical issue. Some mention was made of the increased occurrence of floods, but this was largely unsubstantiated so a clear indication of causality cannot be provided at this time. There has also been some indication that river fish supplies have been reduced, but the cause of this change has not been confirmed.

There is a distinct possibility that local communities can be used as information sources relating to water quality indicators.

5.2 Forest Structure

The production of goods and services C&I were developed to ensure that the production of goods and services in an FMU must be sustainable. Given this objective, there is a need to link this section directly with indicators in the ecology sections to ensure that biodiversity concerns are considered in forest management plans.

Communities also have a role to play in the maintenance of forest structure. Local people use various types of forest for different purposes and will often examine the structure of forest to indicate the probability of finding various forest products.

The biodiversity C&I mirror the local community concern to protect and sustain the biodiversity of the forest. The focus of the local community is utilitarian and members employ a diverse portfolio of livelihood practices depending largely on the extent of the biodiversity in the area of the village. Local village concerns focus on the maintenance of the pre-harvest integrity of the forest to continue providing forest produce such as rattan.

There is extensive local knowledge as regards the need to ensure that an adequate supply of seeds and seed trees exists for future regeneration and the local knowledge of the conditions could be utilised as an indicator.

5.3 Forest Landscape

One of the main questions needing consideration is how areas of biodiversity are selected. Regulations in some countries recommend the areas to be left as 'biodiversity' forest, but the criteria for these are often unclear. The areas are to be identified prior to forestry operations, but the problems are usually in determining when the areas are to be designated, how they are to be decided, how they will be demarcated and who will enforce or check to see that this has been done.

The communities associated with an FMU emphasise the need to maintain existing vegetation types. Many indigenous groups have local, traditional laws governing the use of riverbanks as well as communal land. While concepts such as 'ecologically sensitive' are confusing, there is a clear understanding of the purpose of communal land and the reasons for protecting it.

Communities, in general, share the concern for the need to provide wildlife corridors between areas of forestry operations. The importance of corridors to local villages is for the provision of habitat for the wildlife that still constitutes a large portion of the local diet.

5.4 Other Verifiers

The filed evaluations addressed only a subset of the verifiers that had been proposed by the previous CIFOR work. However, the lessons can be generalised and applied to the remaining verifiers; i.e., do they appear relevant to management activities, and I it practical to implement and interpret them? Our general conclusion is that, almost without exception, they are difficult to use and interpret and have little current practicality or value to forest managers.

Those that do capture valuable ideas appear better expressed in the new verifiers already proposed within the working groups, e.g., the status of juvenile trees. This general criticism of past work arises from its emphasis on academic interests and research. Rather than simply stating that interpretation (or some other step) is currently impractical, the argument that 'more research is required' was not viewed

as grounds to disallow these previous verifiers. We, on the other hand, have decided that 'needing more work'is grounds for disqualification as such procedures cannot currently be given over to managers or certifiers. This does not mean that the underlying concepts in these additional verifiers are unsound or irrelevant to sustainable forestry. For example, we all agree that pollination of the vegetation should be maintained, but it is currently impossible to propose a satisfactory means of assessment that will provide cost-effective information to managers. Further research and development is required before such a verifier is likely to be helpful in operational forest management.

5.5 Objectivity, Statistics and Quantified Assessments

Objectivity in C&I assessments is clearly desirable when it offers to increase the fairness and transparency of assessments. However, we felt that, to date, the quest for objectivity has not always led to the desired goals, but has arguably increased complexity and confusion. An example of this is to examine the word 'significant' and why we choose to reject its use. Stork et al. (1998) propose that many of their verifiers are assessed through a procedure where the harvested forest being assessed is compared with a pristine forest and ideally reveals no 'significant' difference. The problem is that such significance is a statistically-defined concept and is here best expressed as the estimated probability that the hypothesis is true (e.g., the two forests are equivalent) given the collected information.

This appears useful but is deeply problematic for several reasons. Firstly, significance denotes only the detection of a difference—not the magnitude of the difference.

Secondly, the ability to detect differences requires adequate information—in scientific studies, this would be termed the need for an appropriate experimental design, the details of which are inflexibly stringent. For example, it is not satisfactory to have single sets of observations; such a comparison would never be 'significant', as statistical analysis cannot be made without independent replication of sample locations. As many field researchers can vouch, forest studies are often large and difficult and frequently fail to indicate the proposed differences as significant, even when they may appear obvious. Given the difficulties many scientists have with these issues, it is hardly realistic to suppose they can be usefully offloaded on forest managers who will generally feel they have more pressing concerns.

Thirdly, the ability to detect significance not only varies with the replication of the observations, but also with the statistical procedure used, and the decisions made in applying it. The truth is (contrary to schoolroom dogma) that there is much judgement used within statistics, there are even many schools of thought that would follow procedures differently due to some fundamental differences in approach. Such judgement undermines any pretence of objectivity.

Fourthly, the appropriateness of any comparison between any two pieces of forest is fundamentally flawed; as for any measurement parameter, a 100% sample would prove that the two pieces are ‘significantly’ different (whether they were harvested or not). These discussions could be developed further, but they are clearly of an esoteric nature when viewed from a manager’s perspective.

Additional discussions could serve to examine the need and dependencies on explicit quantified procedures in general. It may be that C&I need scientific credibility, but this is best found through common sense and the application of well-founded management practices rather than by overcomplicating the monitoring process.

Our view is to recognise that judgement is likely to remain the foundation of verifier assessment and interpretation, and to believe that good data can inform and assist this judgement but must not become a research project in itself. We feel it is important to recognise that management objectives will have to be a compromise between competing demands and local contexts.

Further, we recognise that verifier data are merely one part of the information that needs to be assessed, and that local contexts and history will play a major part in understanding the state of the forests and what a manager can be judged on. Thus we believe it is better to be explicit that ‘good management’ is a relative, rather than an absolute term, and is thus best assessed with some allowance for subjective insight and interpretation.

6. RECOMMENDATIONS

6.1 General

The current set of biodiversity Criteria and Indicators (C&I) has been developed based on substantial research with the view to provide measurements to assess the state of the biodiversity during and following activities in an FMU. The scientific basis for the verifiers is sound; however, the relevance to management and utility in the field is in question. There needs to be a focus on providing the management of an FMU with more biodiversity-oriented information during all stages of operation (beginning with the planning) to ensure these considerations are included. Currently, FMU management focuses mainly on production-oriented timber operations, which are often in conflict with many of the verifiers of the biodiversity C&I. Recognition of this and the adaptation of the verifiers to conditions in the field will result in better management of an FMU and sustained biodiversity. The starting point is to have biodiversity included as a management consideration.

The importance of potential future timber products, maintained today as part of biodiversity, has to be stressed to the FMU managers so that they are aware of their role in protecting and managing these resources. The land use decisions of all users in and around the FMU have to be brought into the biodiversity discussion and included in the C&I. The land use decisions regarding the forest frontier are directly related to the maintenance of the biodiversity of the FMU.

There has been some discussion regarding the role of local communities as forest managers. This approach has been tried in several countries, notably Nepal and the Philippines, and the indications from these examples are that community management has the potential to work. The general opinion of the field test group was that, while community management of forests should be investigated as a possibility, it should be carried out under similar conditions and guidelines to those currently required by FMU managers.

The evaluation of the biodiversity C&I has to take into consideration the reality of FMU management and the expertise levels of forest managers. Under the current forestry regulations in many countries, managers are concerned primarily with forest timber production and harvesting in the short term. While sound policies do exist in many of these countries, enforcement of the regulations is often lacking. Given these conditions, it is not recommended to assume that the managers will be concerned with anything more than maximising profits. Unless presented as a condition of a concession or as part of a certification process, biodiversity concerns will be afforded little or no consideration.

Several of the biodiversity C&I have been reworded, some new ones have been added and some have been recommended for exclusion. The rationale in each case was based on the applicability of the verifier and indicator to the conditions in

the field and with respect to forest managers. The consensus of the field test team was that biodiversity has to be included in the forest management plan and that FMU managers have to be made aware of their role in protecting and perpetuating biodiversity.

There is a need to review the current set of verifiers with the recommended changes in order to reach a consensus on the updated version.

6.2 Water Quality

There needs to be more focus on devising assessment systems measuring change over time. These systems need to be simple and the results easily interpreted in order to be applicable in the field.

Consideration of community influences on the biodiversity C&I and their feedback regarding the effects of FMU activities needs to be included. More work is required to devise methods to incorporate this information accurately and fairly. Community input is important; however, there needs to be a method to ensure that the information is reliable and untainted by political agendas.

The biodiversity C&I provide very good guidance for research topics to provide broader baseline data regarding forest functions and changes as a result of management. However, for the C&I to be of use as an assessment tool for good forest management there is a need to shift the focus from academic considerations to the actual management-related issues. The information provided by the academic considerations is still required as baseline data; however, the need is for indicators that are relevant to forest management and are easily interpreted by non-scientist forest managers.

Particular attention should be put into investigating the decomposition ability of streams in relation to logging pressure of upstream areas.

Community-based indicators of water quality: changes in water quality are one of the major impacts of forestry on communities living in and around forestry concessions. Their concept of what is acceptably clean water may not comply with academic or environmental concepts. As daily users of the water leaving the concession, they are important monitors of water quality, and could prove useful in a feedback loopback to forest managers.

Quick and cheap methods for measuring water height and debit that can be moved annually to follow annual operations areas.

Change the focus of the water C&I to be much more management-oriented in order that unwanted impacts are minimised, rather than relying on measuring for esoteric effects.

6.3 Forest Structure and Landscape

The measurement parameters need to be better defined to focus on what aspects of forest structure it is most important to maintain. As highlighted by all the field test teams, these aspects have to be applicable and relevant to forest managers and the management of FMUs.

The keystone elements of forest structure have to be determined and identified in a manner easily understood by the forest management. Involving the managers in this process will provide a visible goal supported by the biodiversity C&I. The minimum requirements have to be established to provide clear guidelines for forest managers and other associated stakeholders.

Practical methods to preserve the balance between harvesting and maintaining structure need to be investigated and related to the conditions in the field. RIL is one of the improvements in techniques, but improvements are still needed, including better harvesting techniques and improved road construction. The national and regional conservation concerns also have to be incorporated in the forest management plans to ensure these issues are considered.

6.4 C&I Structure

There are some problems with the hierarchical structure of the current biodiversity C&I and there is a need to review the structure with the view of improving the testing process. During the field test review of the 'minimum set' and CIFOR's Criteria and Indicators Generic Template (the Generic Template), several concerns emerged:

- Hierarchy: the question raised was how to deal with and accommodate the overlaps in the verifiers. The relative importance of one verifier against another has not been clarified, and this creates difficulties when overlaps are encountered.
- Structure: there was some inconsistency in the criteria/indicator/verifier structure with the biodiversity C&I occurring in several different areas of the Generic Template. If biodiversity is being tested or assessed, there is a need to have a checklist of all those verifiers relating to biodiversity.
- Consider different structures for different users. For forest managers, the C&I should be structured according to forestry field operations, such as planning, road construction, logging, and replanting, which reflects the way in which forest managers think about forest management. Academics and policy setters may be able to relate to the C&I as currently structured.
- Consider guidelines for each user group.
- As short a document as possible. Short sentences. Easy words. The document should be technical but mindful of the wide range of readership for a set of generic C&I.

- The text should be in the active voice, and have a positive tone.
- Crossreferencing is very important to ensure that all relevant C&I are taken into consideration.

6.5 Certification

1. Efforts should be put into making the C&I absolutely generic. This will involve gaining inputs from a number of different eco-zones. The C&I have already been tested in Boise, Idaho and it was found that the majority of C&I are applicable in varying degrees. This supports the idea that it is feasible to develop a template that is applicable to tropical, temperate and boreal zones, and a range of management regimes within those zones.

2. It is recommended that further development of the C&I should focus on their use for forest managers, and the stakeholder groups that will use them to develop their own specific C&I or forest management standards.

3. Rigorous efforts should be made to make their use cost-effective, both in terms of the resources needed to implement them, and the costs of the effects of implementing them. This means looking at both the efforts to assess whether a criterion has been met, and the resources needed by the forest manager to ensure that management meets a particular criterion.

4. Attempts should be made to strengthen links with the FSC and other similar bodies, to ensure that C&I are brought to the attention of the national working groups. This should also be of use in ensuring the proper documentation of all examples of the C&I being used to develop nation- or region-specific standards.

5. Some time should be given to trying to rearrange the C&I according to field activities. For example, having a section headed ‘felling’, and, within that, giving C&I for felling that protects biodiversity, takes into account social issues (and the same applies to road construction, transportation, forest management planning, etc.).

6. The C&I should be available in as wide a range of languages as possible, and in Spanish as soon as possible. National standards processes work widely in local languages to facilitate as wide a range of inputs as possible. Spanish and Portuguese would cover Latin America; French would make the C&I more accessible to West Africa; and Indonesian may be sufficient for both Indonesia and Malaysia.

7. The C&I should draw on the latest scientific information available, and continue to be relevant to forestry as it changes over time. The development of the C&I is, therefore, not a single activity but a process which should continue into perpetuity. The current C&I system is an adequate baseline for

current use and for the needs of further revision. Revision could either be a part of a scheduled timetable or be conducted on an ad hoc basis as new information becomes available, or as the state of world forests requires new C&I.

8. CIFOR should review its ownership of the biodiversity C&I. The C&I project was discontinued as a stand-alone research programme, and instead became part of the Adaptive Co-Management (ACM) Project. If it is no longer to be part of the research strategy within ACM, further development of the C&I should either be placed within a separate project within CIFOR, or a mechanism should be ensured to transfer their continued development and maintenance to another organisation. Without such continuity, there is a risk of the CIFOR C&I quickly becoming obsolete.

9. Local communities should be strongly involved in the maintenance and development of the C&I. In particular, mechanisms for managers should include local communities in setting and monitoring standards.

10. In the preamble to the C&I documentation, it is acknowledged that the C&I will also be of interest to policy setters. While it is possible that C&I users at this level will find the documents in their current form easier to use than, say, forest management, it would be beneficial to review them with regard to the specific needs of such users.

6.6 Strategic Alliances

Above, we recommended important directions for CIFOR's future efforts on biodiversity C&I. We suggest that these directions are crucial, though CIFOR may not currently have a comparative advantage in some of these areas of research. We therefore recommend that CIFOR should:

- Explore potential synergies between CIFOR's biodiversity C&I and similar relevant initiatives. Thus, there are several similar ongoing C&I processes being carried out by other organisations (see Introduction and Annex IX). There has been only limited collaboration and cooperation between these initiatives. The substantial overlap and similarity between CIFOR's revised set of criteria and indicators (as presented in this report), and that developed by the ITTO (see Annex X), suggests that closer collaboration and cooperation would be appropriate.
- Improve the education and public understanding of the C&I process and purpose. This might be achieved through the involvement of, and collaboration with, an international institution with educational capacity (such as CATIE?).
- Improve the applicability and practicability of the biodiversity C&I. The involvement of, and collaboration with, an international institution with a comparative advantage, such as Tropenbos, may provide just that.

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ANNEXES

ANNEX I. Summary of CIFOR Tests

The Germany Test (17–18 November 1994) evaluated four sets of Criteria and Indicators (C&I), including Smart Wood, Woodmark, ITW and Helsinki. The test site was Forstamt Bovenden, a temperate, mixed beech–dominated, broadleaf forest heavily influenced by humans. The project team identified eight attributes as important for assessing the overall suitability of various C&I proposed for a given situation: relevant; closely and unambiguously related logically to the assessment goal; precisely defined; diagnostically specific; easy to detect, record and interpret; having an adequate response range to changes in levels of stress on the forest management, ecological or social systems; providing a summary or integrative measure over space and/or time; and, appealing to users.

The Indonesian Test (4 March–3 April 1995) focused on the management of evergreen dipterocarp-dominated forests in East Kalimantan. The test site extended over 340 000 ha, had a relatively high human population density and was a privately-owned concession on state forest land. Logging occurred only in primary forest.

The Côte d'Ivoire Test (June 1995) was conducted in the Forêts Classées du Haut Sassandra and Bossematié. Both forests were located in a moist semi-evergreen zone and both showed the effects of overharvesting. There was a great deal of commonality between the C&I emerging from this test and those emerging from the Indonesian test.

The Brazilian Test (23 October–19 November 1995) was conducted in tropical lowland evergreen forest with low to medium human population pressure that was increasing rapidly due to colonisation. Logging occurred in areas that had previously experienced light logging. C&I sets from Woodmark, Smart Wood, Initiative Tropenwald and Lembaga Ekolabel Indonesia were evaluated.

The Austrian Test (18 September–3 November 1995) aimed to select the smallest possible number of C&I to allow for the best possible judgements about forest sustainability specifically for Austria. The motivation for the test was a new law in Austria requiring the quality-marking of timber and timber products that originated from sustainable forest management. The test resulted in a set of 140 C&I that the test team considered practical and justifiable for certification.

The Cameroon Test (24 October–17 November 1996) took place in Kribi, Cameroons and evaluated C&I sets from the ATO, the Dutch Working Group and a set compiled by CIFOR. The result indicated that 14 days in the field plus

additional time for preparation and workshops seemed adequate for producing C&I that were useful for iteration, either through further tests or workshops and conferences. The Cameroon team proposed 19 principles, 103 criteria, 360 indicators and 139 verifiers.

The North American Test (8 June–10 July 1998) was conducted in the area of the Boise National Forest, Idaho. The group tested 207 C&I in detail; 71 were accepted or accepted with revision; 65 were rejected; and 5 new indicators were proposed.

The Gabon Test (April 1998) took place near Lastoursville in the Compagnie Equatoriale des Bois logging concession area (505 000 ha). It was funded by the European Union as part of the ATO Initiative on C&I. Sets from ATO and from CIFOR were evaluated. The result was a 238-item set (4 principles, 16 criteria, 67 indicators and 158 verifiers).

The Central African Republic Test (9 November–11 December 1998) took place in Batalimo and Ngotto (Industries Forestières de Batalimo concession areas). The starting point was the set developed during the Gabon test. The result was a set made of 256 items (4 principles, 17 criteria, 69 indicators and 166 verifiers).

Annex II. Participants

The participants, according to the stakeholder category they represented.

Forest management:

- Aldi Abdillah, PT. Inhutani II, forest manager and environmental consultant.
- Art Klasson, Consultant for CIFOR's project on RIL, and presently at the Tropical Forest Foundation (based in Jakarta); has a practical background both as a forest manager and as a forest management consultant, with wide experience from temperate and tropical parts of the world.
- Hari Priyadi, CIFOR.

Certification:

- Ian Rowland, in several ways representing the FSC interests; helped to ensure that we stayed on track with respect to certification issues. Ian has been part of the C&I development process from the very start through the Soil Association.
- Taufik Margani, MAL Certification; provided his views on CIFOR's biodiversity C&I in relation to certification.

Researchers:

- Douglas Sheil, CIFOR: has been a critic of the current biodiversity C&I set.
- Herlina Hartanto, CIFOR; is a researcher of water quality with past CIFOR field test experience.
- Herry Purnomo, CIFOR, forester; has past CIFOR field test experience, particularly regarding the landscape and Multi Criteria Decision Analysis.
- Herwasono Soedjito, CIFOR-BRF Site Manager/Scientist; has field experience in human and forest ecology.
- Ho Wei Seng (Universiti Kebangsaan Malaysia, Forest Research Institute of Malaysia), geneticist; has research experience in the impact of logging on genetic diversity.
- Ian Paterson, Oxford University and CIFOR; has experience in plant root physiology.
- Isabella Nobili, University of Padova, Italy, forester; has a particular interest in certification issues.
- John Poulsen (Team Leader), CIFOR; is the coordinator of CIFOR's biodiversity C&I efforts.
- Robert Basiuk, environmental scientist; has experience in the natural resource use and management field as well as in tourism .

- Tini Gumartini, CIFOR, forester; has field experience in biodiversity conservation.
- Yurdi Yasmi, CIFOR, forester; has past CIFOR field test experience, particularly regarding The CIFOR Criteria and Indicators Generic Template and CIMAT.

Local Communities

- Steve Rhee, Yale University (School of Forestry and Environmental Studies); who tried to find out the possible linkages between criteria, indicators and verifiers and local communities.
- Bpk Irang, Local Representative from Merap.
- Bpk Paulus, Local Representative from Kenyah.
- Bpk Awang, Local Representative from Punan.

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Annex III. Diary of Activities

Day 1 (1 September 1999)

Trip to Balikpapan-Tarakan. All participants left Jakarta for Balikpapan early in the morning on 1 September, and then arrived at Tarakan in the afternoon. We stayed overnight at Tarakan Plaza Hotel, where we held a preliminary meeting in the evening. Each participant was asked to explain what his or her expectations were of the field test.

Day 2 (2 September 1999)

Trip to Bulungan Research Forest. The whole day was spent reaching Bulungan Research Forest Camp (Seturan Camp): four hours on a boat along the Malinau River, two hours for lunch in Malinau village, and then a drive along the concession road. Before we arrived at Seturan Camp in the evening, we stopped briefly at Long Loreh village, where the participants were expected to gain some understanding of the local community.

Day 3 (3 September 1999)

Discussion session, Seturan Camp. The first discussion session was opened by John Poulsen, who introduced the background and scope of the field test. Art Klasson continued the discussion with a brief presentation about the main activity conducted in BRF—reduced impact logging (RIL). A representative from PT. Inhutani II, Aldi Abdillah, gave a brief talk about the company's activities and its interest in the C&I activity, as the company is preparing for eco-labelling in 2000. Representatives from the Adaptive Co-Management (ACM) Project briefed the participants on their project that initiates in 1999 (Herlina Hartanto), and on CIMAT (Herry Purnomo and Yurdi Yasmi). This first session was closed by brief presentations from Ian Rowland on Forest Stewardship Council concerns and from Steve Rhee on the local communities. The second session discussed the objectives and methods of the field test and then closed with the agenda for the field test being accepted. It was decided that the field test would focus on three key elements (Water Quality, Forest Structure, and Forest Landscape); the participants divided into three according groups to review the criteria, indicators and verifiers as listed in the CIFOR Criteria and Indicators Generic Template (the Generic Template).

Day 4 (4 September 1999)

Discussion session, Seturan Camp. The discussion started by revisiting the proposed agenda and comments from the previous day and then proceeded to a working group discussion.

Day 5 (5 September 1999)

Field excursion, Seturan Camp. We visited an area that has been logged with conventional logging and also with the RIL technique that CIFOR has recently applied in collaboration with PT. Inhutani II.

Day 6 (6 September 1999)

Working group and plenary session, Seturan Camp. Plenary discussion focused on updating, analysing, and revisiting the criteria, indicators and verifiers that had been reviewed by each group.

Day 7 (7 September 1999)

Working group, field visit, and plenary session, Seturan Camp. One group went to the field to fieldcheck the list that had been developed the day before, while the others continued the group discussion.

Day 8 (8 September 1999)

Trip back to Malinau. We left Seturan Camp for Malinau in the morning and stayed overnight in Malinau. In the evening, Steve Rhee gave a presentation based on his three days of extensive interviews with the three local communities and his field visit.

Day 9 (9 September 1999)

Trip back to Balikpapan. We arrived in Dusit Hotel, Balikpapan in the afternoon.

Day 10 (10 September 1999)

Plenary session, Balikpapan. Each group presented their final version incorporating the comments previously made by the other groups. Constraints, recommendations, and future research were also discussed.

Day 11 (11 September 1999)

Draft report writing, Balikpapan

Day 12 (12 September 1999)

Trip back to Jakarta

Annex IV. Water Quality : Details of criteria, indicators and verifiers

Verifiers V.2.1.7.1 There is no significant change in the abundance and diversity of aquatic organisme

Justification	Aquatic organisms (including benthic macroinvertebrates and fish) are sensitive to change in water quality
Relevance to management	The use of benthic macroinvertebrates has relevance because the techniques for sampling them tend to be simple and quite cheap, and may exclude the need to measure chemical composition Fish may be more appropriate in some situations
Achievable/practical	Yes (see point 2) The use of fish monitoring will depend on forest type, and particular management situation
Appropriate spatial scale	Annual cutting block for insects FMU for fish
Accuracy	Must take into account spatial and temporal variations (need baseline)
Data quality (repeatability)	Sampling of aquatic organisms can be repeated over time
Methods	For insects: • Pond net/Surber grab Identification key/chart (at least to family level) • Magnifying glass For fish: • Netting • Electrofishing
Inputs by forest managers: • Expertise • Information • Equipment • Time	Trained staff (short-term training), qualifications: high school or above; In general, inputs may be more • Identification key; reference books intensive for fish monitoring • See point 7 above • Quick
Inputs by third-party assessors: • Expertise	• Ability to interpret changes in insect or fish populations and forest management impacts; ability to undertake similar testing for crosschecking

• Information	• Results of forest manager's ongoing monitoring, copy of company's procedures controlling monitoring, literature on target species and understanding of their sensitivity to forest management activities
• Equipment	• Can be borrowed from forest manager
• Time	• Can be less than one hour if satisfied with FMU's own reports, or 1–2 days to undertake re-testing
Easy to interpret	Yes for insects and fish (with the right expertise)
Tolerable change	Needs further research/longer baseline
Can data be authenticated?	Easy to repeat but there will be temporal variation
What do managers think?	Not checked

Verifier V.2.1.7.2 There is no significant change in the chemical composition of water in streams or other water bodies.

Justification	• ease of measurement • change in chemical composition in water is one of the major effects of logging in some forest types (e.g., boreal, coniferous)
Relevance to management	• site-specific • long-term monitoring over whole FMU, rather than just one-off assessments • needed for Environmental Impact Assessment (in an Indonesian context)
Achievable/practical	• the procedure is well documented • may be costly • needs highly trained staff • external laboratory analysis likely • can be simplified
Appropriate spatial scale	FMU as a whole
Accuracy	Depends on technique, from very high to low
Data quality (repeatability)	Depends on resources and techniques used
Methods	Range from pH paper through to complicated chemical analysis by external labs
Inputs by forest managers: • Expertise	Depends on techniques used; at its most simple, untrained staff can collect water for analysis by an external laboratory

• Information • Equipment • Time	• Depends on techniques used • Depends on techniques used • Generally fairly quick—even for most complicated techniques, FMU staff would only be involved in periodic sample collection
Inputs by third-party assessors: • Expertise	• Need to understand significance of any changes taking place in water chemistry. Should be able to undertake testing if necessary
• Information	• Company's written procedures for monitoring, results of monitoring, any lab reports available
• Equipment	• Water testing equipment. May need own sophisticated equipment for onsite testing if FMU does not own this
• Time	• Quick
Easy to interpret	Highly trained staff required
Tolerable change	Further research needed
Can data be authenticated?	Relatively easy to authenticate especially if the samples are sent out to an independent (or certified) laboratory for analysis.
What do managers think?	Indonesian managers are used to using water monitoring for measuring impacts of forestry, and chemical measurements are part of the EIA prior to logging activities. However, little use is made of this technique thereafter. This is a widely used verifier in boreal forests.

Verifier V.2.1.7.3 There are no significant changes in the decomposition rate in the water in streams and/or other water bodies.

Justification	ease of measurement influence of the nutrient cycle, which in turn can affect whole ecosystem health
Relevance to management	• needs long-term assessment • relatively cheap • good for long-term monitoring programmes
Achievable/practical	Yes. (site-specific—leaf from abundant species)
Appropriate spatial scale	Annual cutting block and FMU as a whole
Accuracy	Yes, but site-specific
Data quality (repeatability)	Yes, data collection can be repeated over time
Methods	• leaf bag • more accurate to use oven to dry the leaf • methods that are more qualitative and simpler are possible
8. Inputs from forest manager:	
• Expertise	Basic training for the staff
• Information	Checklist/baseline information
• Equipment	Depends on the technique used: can be simply leaf bags, or may need an oven
• Time	Relatively quick (several weeks, depending on site)
9. Inputs from third-party assessors:	
• Expertise	Ability to interpret changes in the decomposition capacity of water with regard to forest management practices
• Information	FMU's written monitoring procedures, results of monitoring, literature
• Equipment	Uncertain
• Time	Review of documents
10. Easy to interpret	Not particularly easy—affected by water quality and light input
11. Tolerable change	Needs further research/baseline data
12. Can data be authenticated?	Difficult—many variables affect decomposition
13. Management comments	As a completely new technique, this may not appeal very much to forest managers. However, as a quite easy technique, it may appeal to them if they are considering long-term monitoring programmes.

Verifier V.2.1.7.4 There is no significant change in streamflow.

Justification	Water level and flow velocity are easy to measure/detect In Indonesia, water monitoring equipment is required by law—equipment is available Change in streamflow is one obvious impact of logging
Relevance to management	Yes; concession management can be held directly responsible for changes in streamflow—management can take action against it.
Achievable/practical	Yes; data can be obtained from water monitoring station or direct observation
Appropriate spatial scale	Varied from annual cutting stock to RKL (5-year management plan) to FMU
Accuracy	Yes
Data quality (repeatability)	Yes
Methods	• Direct observation • Water monitoring equipment
Inputs by forest managers: • Expertise	• Data collection requires low expertise; in an Indonesian context data analysis from SPAS requires some training
• Information	• Procedures for operating equipment
• Equipment	• Water monitoring equipment can be expensive
• Time	• Data can be obtained automatically from water monitoring station but more time is required for data analysis
Inputs by third-party assessors: • Expertise	• Understanding of significance of streamflow
• Information	• FMU's procedures, monitoring results, literature
• Equipment	• Can be provided by FMU managers
• Time	• Quick
Easy to interpret	Water level is affected by other factors such as increased rainfall, etc. so it is more difficult to interpret
Tolerable change	Normal water level and water flow need to be determined through monitoring
Can data be authenticated?	Yes
What do managers think?	Not much

New Verifier V.2.1.7.5 There is no significant increase in sedimentation.

Justification	The major effect of logging have high impacts on biodiversity, local communities, etc. Easily managed by improved forest management Easy to monitor
Relevance to management	See above
Achievable/practical	Yes, a number of relatively cheap methods exist, and are reliable if undertaken at the correct location.
Appropriate spatial scale	Annual felling coupe is the most appropriate, but those areas recently logged, say over the last 10 years, should also continue to be monitored. Sedimentation downstream of the annual felling coupe (FMU level) should also be monitored.
Accuracy	Sufficiently accurate, bearing in mind natural variation
Data quality (repeatability)	Yes
Methods	• Sediment load measurements • Visual assessment (spotchecks) of sedimentation on river beds, etc.
Inputs by forest managers: • Expertise	• Direct observation needs low expertise; quantitative approach needs staff with some training
• Information	• Written procedures
• Equipment	• Cheapish; sampling grid and camera (?) for direct observation; simple lab equipment for quantitative methods
• Time	• Quick for data collection; sample + data processing may take some time
Inputs by third-party assessors: • Expertise	• Not much
• Information	• FMU manager's procedures and documentation of sedimentation events; local community comments
• Equipment	• None (camera?), or conductivity testing equipment if quantifiable results wanted
• Time	• Generally quick, but community interviews may be lengthy

Easy to interpret	Relatively easy, but needs a baseline and understanding of other causes of sedimentation
Tolerable change	Zero tolerant at annual felling block, but more tolerable change further downstream because there other factors that affect sedimentation.
Can data be authenticated?	Difficult as any sedimentation may be removed quite quickly by river currents.
What do managers think?	Good idea. Directly related to management. Easy. Cheap. Can do.

New Verifier V.2.1.7.6 Chemicals, fuel, oil and liquid non-organic waste are not leaked into streams and other water bodies.

Justification	Should be part of good forest management Could improve cost effectiveness through less wasteful practices Spillages can be highly damaging to water environments
Relevance to management	• See first two points above. • Might be required under national law
Achievable/practical	Very
Appropriate spatial scale	Point source but potential FMU-level effects
Accuracy	N/a
Data quality (repeatability)	N/a
Methods	Review of waste, fuel management procedures, etc. Review of staff training on related issues Spotchecks
Inputs by forest managers: • Expertise • Information • Equipment • Time	 • Medium to high (reasonably briefed staff) • Widely available literature, national regulations • Minimal • Medium to high
Inputs by third-party assessors: • Expertise • Information	 Field experience of managing waste, fuel etc Written company procedures for handling, company records, complaints

• Equipment • Time	Little (camera?) Half a day
Easy to interpret	Easy to interpret by direct observations and spotchecks
Tolerable change	Zero tolerance
Can data be authenticated?	Yes, easily.
What do managers think?	Good idea, easy to do, cheap, etc

New Verifier V.2.1.7.7 There is no blockage of streams leading to ponding.

Justification	Should be part of good forest management Will reduce damage to roads
Relevance to management	See point one above
Achievable/practical	Very
Appropriate spatial scale	FMU
Accuracy	N/a
Data quality (repeatability)	N/a
Methods	Spotchecks
Inputs by forest managers: • Expertise • Information • Equipment • Time	 • Low for monitoring, but needs better roadbuilding and maintenance • Widely available literature, national regulations • Managers already have the right equipment • Does not take any longer to make good roads than to make bad roads
Inputs by third-party assessors: • Expertise • Information • Equipment • Time	 • Field experience of roading • Written company procedures for roadbuilding, company records • Little (camera?) • One day
Easy to interpret	Easy to interpret by direct observations and spotchecks

Tolerable change	Zero tolerance
Can data be authenticated?	Yes, easily.
What do managers think?	Good idea, we know we should be doing it anyway

Annex V. Forest Structure : Details of criteria, indicators and verifiers

Verifier V.2.1.2.1 All diameter size classes of harvested and unharvested trees are maintained.

Justification	The future continuity of biodiversity and the structure of the forest are maintained To ensure interdependencies of species are sustained (some species depend on tree species of specific size) To ensure all tree species are maintained in future stands
Relevance to management	Not directly (specifically contradicts any policies to eliminate non-commercial species) Contradicts the TPTI system. However, relevant for concessionaires targeting specific size classes of commercial species
Achievable/practical	Yes Within guidelines addressing utilisation parameters
Appropriate spatial scale	Individual harvesting units
Accuracy	Data required No more than required for forestry inventories
Data quality (repeatability)	Crude, but requires accuracy in species identification.
Methods	Basic inventory, including standsampling and census Operational inventory More explicit pre-inventory information required
Inputs: • Expertise • Information • Equipment • Time	 Improved field identification More explicit inclusion of non-commercial species in basic inventory As per standard inventory Will require more time than standard inventory
Easy to interpret	Yes Based on forestry assessment Pre- and post-harvesting
Tolerable change	Locally defined
Can data be authenticated?	Yes through additional inventory, subjective post-harvesting assessment

V.2.1.2.3 Frequency distributions of leaf size and shape are maintained within natural variation.

(To be removed)

Justification	representative of change in vegetation and diversity of vegetation But - other direct methods exist
Relevance to management	None
Achievable/practical	Achievable but not practical
Appropriate spatial scale	
Accuracy	
Data quality (repeatability)	
Methods	
Inputs: • Expertise • Information • Equipment • Time	
Easy to interpret	No, not meaningful
Tolerable change	
Can data be authenticated?	

New Verifier V.2.1.2.4 **At least 10% of mother trees (of commercial species) above harvesting size are left as seed trees (or until further research proves otherwise) (for dioecious species, the percentage should be double).**

Justification	Maintain diversity in structure, persistence of seed trees, species dependant on large trees, preservation of habitat Sustainability
Relevance to management	Currently done but often only with defective trees. Ensure potential regeneration of harvested species. Needed for sustainability. Very relevant in cases of uniform stands (limited diameter class) e.g. Agathis forests
Achievable/practical	Yes Requires conscious action and involvement (trees selected for protection) Controlled felling teams and procedures.
Appropriate spatial scale	FMU Harvesting unit, possibly defined by dispersal methods
Accuracy	Must be guaranteed across harvesting unit (depends on control of the felling team).
Data quality (repeatability)	Inventory quality Possible need for more accurate spatial component
Methods	Standard inventories Trees need to be marked for identification/protection during inventory
Inputs: • Expertise • Information • Equipment • Time	 Inventory qualities Dioecious species are known, listed and information is made available As per inventory As per inventory Improved logging techniques
Easy to interpret	• Yes—based on inventory
Tolerable change	• Clearly defined
Can data be authenticated?	• Yes—field check

Verifier V.2.1.2.5 The elements of forest structure are protected (e.g., tallest trees, fig trees, fruit trees, hollow trees, (wild fruit trees), lianas, natural understorey maintenance, etc.).

Justification	Maintain biodiversity through maintaining full range of habitats and resources as far as possible (could be broken down into several verifiers depending on site specifics).
Relevance to management	Currently not practised but must be made relevant to protect biodiversity.
Achievable/practical	Yes to a helpful degree Will probably require detailed inventories and training of field crews.
Appropriate spatial scale	Operational level of FMU
Accuracy	Inventory type General inspections
Data quality (repeatability)	Crude/observation
Methods	Observations Formal and semi-formal Inventory level would be helpful
Inputs:	
• Expertise	Minimal
• Information	Inventory/observations—Guideline required (national/regional policy—needs to be classified)
• Equipment	Low
• Time	Inventory-based, but requiring somewhat more information than the standard inventory.
Easy to interpret	Yes provided guidelines in place
Tolerable change	Elements protected provided this is compatible with planned and approved forestry operations
Can data be authenticated?	Yes—observations/field visits
Management comments	

Verifier V.2.1.2.7 The distribution of aboveground biomass does not show significant change as compared to undisturbed forest.

Justification	
Relevance to management	
Achievable/practical	
Appropriate spatial scale	
Accuracy	
Data quality (repeatability)	
Methods	
Inputs: • Expertise • Information • Equipment • Time	
Easy to interpret	
Tolerable change	
Can data be authenticated?	
Management comments	

New Indicator I.2.1.8 Presence of undesirable vegetation types is controlled (includes undesirable local vegetation).

Justification	Prevent forest being converted to undesirable vegetation (locally or area-specific definition to be determined by stakeholders) Prevent threat to regeneration of native flora and fauna.
Relevance to management	Yes
Achievable/practical	This is a requirement for sustainable forestry Basic C&I
Appropriate spatial scale	FMU Harvest unit
Accuracy	Sufficient to identify problem
Data quality (repeatability)	Crude/observations
Methods	Observations Inventory Aerial photo/remote sensing
Inputs: • Expertise • Information • Equipment • Time	Various Wildlife surveys
Easy to interpret	Yes Depends on the intensity of the inventory.
Tolerable change	There should be a negligible increase or significant decrease of undesirable species.
Can data be authenticated?	Yes
Management comments	Depends on need Not yet applicable

New Verifier V.2.1.8.1 Canopy openness is managed to control undesirable vegetation types.

Justification	To control undesirable vegetation and to limit changes in vegetation 'composition'
Relevance to management	Yes for sustainable forestry
Achievable/practical	Yes Harvesting unit level
Appropriate spatial scale	Harvesting units FMU
Accuracy	Visual Recognition of problem
Data quality (repeatability)	Crude, but can be refined or qualified using densiometers. Observations
Methods	Observations/densiometers Inventory (post-harvesting)
Inputs: • Expertise	Existing inventory skills and knowledge of undesirable/unacceptable species
• Information	Inventory
• Equipment	Existing inventory
• Time	Post-harvesting inventory
Easy to interpret	Yes
Tolerable change	Should be negligible
Can data be authenticated?	Yes by field visits
Management comments	Cost control factor economics sometimes overrule

New Verifier V.2.1.8.2 Exotic species are not invading

Justification	To prevent transformation of forest habitat
Relevance to management	Yes
Achievable/practical	Yes—may require definite action appropriate to area
Appropriate spatial scale	FMU Harvesting unit
Accuracy	Measurable spatial extent
Data quality (repeatability)	Crude Observation
Methods	Observation Inventory
Inputs: • Expertise • Information • Equipment • Time	 Existing inventory—knowledge increase of problem potential Potential problem species—national database and policy Existing inventory Long-term monitoring
Easy to interpret	Yes provided probable species are recognised
Tolerable change	Should be negligible
Can data be authenticated?	Yes by field visits
Management comments	Identification difficult—limits in manpower

New Verifier V.2.1.8.3 Species not native to the site are not introduced or planted in the FMU if there is a threat of their spreading.

Justification	To prevent introduction of future problems
Relevance to management	Yes
Achievable/practical	Yes—requires knowledge of threat and some policy
Appropriate spatial scale	FMU
Accuracy	Absolute
Data quality (repeatability)	Absolute
Methods	Clear regulation and guidelines—enforced Surveys and monitoring
Inputs: • Expertise • Information • Equipment • Time	 Knowledge of problems and non-native species Guidelines and international database of problems Management Full-time monitoring
Easy to interpret	Yes
Tolerable change	Should be none
Can data be authenticated?	Yes by field visit
Management comments	Depending on need Not yet applicable

New Indicator I.2.1.9 No native/indigenous species are eliminated by activities in the FMU.

Justification Relevance to management Achievable/practical Appropriate spatial scale Accuracy Data quality (repeatability) Methods Inputs: • Expertise • Information • Equipment • Time Easy to interpret Tolerable change Can data be authenticated?	It is essential that biodiversity is maintained in the FMU

New Verifier V.2.1.9.1 Protected species are known to all actors in the FMU.

Justification	Difficult to regulate otherwise
Relevance to management	Yes—if incorporated, enforced and informed
Achievable/practical	Yes
Appropriate spatial scale	FMU and areas outside the FMU (surrounding villages)
Accuracy	Absolute according to laws and policies (allowances for technical problems owing to knowledge gaps)
Data quality (repeatability)	Clearly designated or verging on caution (e.g., when taxonomy unclear)
Methods	Inventory Third-party assessments Interviews etc. Surveys of local markets
Inputs: • Expertise • Information	 Normal inventory skills—taxonomic skills, Published lists of protected species, brochures, posters etc. for local villages.
• Equipment • Time	N/a Spotchecks/surveys
Easy to interpret	Yes
Tolerable change	N/a
Can data be authenticated?	Yes—spotcheck
Management comments	No problem Known but control difficult?

New Verifier V.2.1.9.2 Protected species are not hunted or collected.

Justification	Management should be made aware of their role in biodiversity protection
Relevance to management	It should be
Achievable/practical	Yes
Appropriate spatial scale	FMU
Accuracy	Absolute as legally required
Data quality (repeatability)	Knowledge of preservation and legal requirements/policy
Methods	Spotchecks (wherever) Local markets
Inputs: • Expertise • Information • Equipment • Time	 Knowledge of species where taxonomy required Clear legal statement/guidelines None Brief checks
Easy to interpret	Yes
Tolerable change	N/a
Can data be authenticated?	Yes

New Verifier V.2.1.9.3 Non-specific hunting methods are not allowed in the FMU by concession staff (e.g., snares, traps, poisoning, explosives).

Justification	Non-selective methods can eliminate vulnerable species
Relevance to management	To become so in management plan
Achievable/practical	Yes
Appropriate spatial scale	FMU
Accuracy	N/a
Data quality (repeatability)	N/a
Methods	Spotchecks Camp checks Forest checks Interviews and local people
Inputs: • Expertise • Information • Equipment • Time	 Statements of what is required by camp manager None Limited
Easy to interpret	Yes
Tolerable change	N/a
Can data be authenticated?	Yes

New Verifier V.2.1.9.4 According to available information sources, no known species have been eliminated.

Justification	Maintaining species is essential for maintaining biodiversity
Relevance to management	Indirect—useful for checking
Achievable/practical	Reasonable level limited by information collection methods
Appropriate spatial scale	FMU
Accuracy	Limited by information available
Data quality (repeatability)	Limited
Methods	Interviews Inventories Visiting scientists Market checks Trading records
Inputs: • Expertise • Information • Equipment • Time	 Based on available info Limited None
Easy to interpret	Yes but depends on source of info
Tolerable change	N/a
Can data be authenticated?	Yes
Management comments	Second variation Possible to note changes

Criterion C.6.3 Forest management plan is comprehensive.

New Indicator I.6.3.7 National and regional conservation policies have been incorporated in the forest management plan.

Justification	Planning has to be compatible with conservation requirements
Relevance to management	Yes. To define operational activities and objectives
Achievable/practical	Yes, should be, if direction recognised
Appropriate spatial scale	FMU
Accuracy	Not applicable
Data quality (repeatability)	Not applicable
Methods	Review of documentation
Inputs: • Expertise	relevant documentation, ability to read and comprehend the policies.
• Information • Equipment • Time	assessment data inventories
Easy to interpret	Yes
Tolerable change	Defined within management plan
Can data be authenticated?	Yes, presence in management plan
Management comments	The camp manager already has the references but these are kept in the main office away from the FMU

New Indicator I.6.3.8 **Areas and elements of biodiversity importance have been identified and included in the forest management plan. Identification to include global, national and regional stakeholder concerns.**

New Verifier V.6.3.8.1 **Comprehensive biodiversity requirements with spatial referencing and operational terms and activities are included in the management plan (locally determined).**

Justification	To ensure careful planning through inclusion in management plan To set framework for the rest of the biodiversity C&I
Relevance to management	Manager has to incorporate in management plan. E.g. Agathis tree preserved for second cut
Achievable/practical	Achievable as general statement to be incorporated in FMP Conceivably could be done
Appropriate spatial scale	The whole FMU
Accuracy	Dependant on what is identified and/or required
Data quality (repeatability)	Not applicable
Methods	Crossreference to policies at national and regional level Crossreference to other reference source e.g. WWF surveys etc. indicating presence of special biodiversity More study needed Inventory
Inputs: • Expertise	Planning officer (regional), consulting group to assess and access potential information sources.
• Information	Survey, policies info, past surveys, Forest Management Inventory.
• Equipment	Low equipment involvement
• Time	Included in FMI
Easy to interpret	Based on National/Regional goal
Tolerable change	Not applicable/defined by plan
Can data be authenticated?	Yes

Criterion C.6.4 **Implementation of the management plan is effective.**

New Verifier V.6.4.5.3 **Roads are planned and constructed by personnel qualified to do these tasks.**

Justification	To minimise erosion To reduce environmental impact
Relevance to management	Yes—lots
Achievable/practical	Yes
Appropriate spatial scale	FMU
Accuracy	Precise according to plan—but readily assessed
Data quality (repeatability)	High quality—but simple to assess
Methods	As per conventional road planning and construction Ensure appropriate scale topographic maps
Inputs: • Expertise • Information • Equipment • Time	 As per needed Maps (appropriate scale topographic maps) Proper roadbuilding equipment No extra time involved
Easy to interpret	Yes, to a trained engineer
Tolerable change	Yes, where change is justified on engineering and environmental grounds
Can data be authenticated?	Yes, site visit
Management comments	This is generally handled by the road construction division of the concession holder.

New Verifier V.6.4.5.4 Bridges and culverts are in place and are maintained to be viable for long-term usage.

Justification	Prevent stagnant water and ponding Minimise erosion Minimise long-term threat Maintain water quality
Relevance to management	Yes
Achievable/practical	Yes—follow the plan
Appropriate spatial scale	FMU Operational units Individual water courses
Accuracy	High
Data quality (repeatability)	High for planning
Methods	Improved ground operational skills
Inputs:	
• Expertise	Trained/adequate engineering ability
• Information	Planning documents
• Equipment	Construction equipment as available
• Time	As per operational
Easy to interpret	Yes
Tolerable change	N/a
Can data be authenticated?	Yes—site visits
Management comments	Economic considerations

Verifier V.6.4.3.3 Areas of specific conservation status are clearly demarcated and recognised by all actors.

Justification	Protected status needs to be recognised if it is to be relevant
Relevance to management	Yes—if they are made responsible for these protected areas
Achievable/practical	Yes
Appropriate spatial scale	Unit of conservation status
Accuracy	Surveyed to acceptable precision <+/- 10m
Data quality (repeatability)	Clear marking in the field
Methods	Check marking Check accuracy (mapped areas marked) Interview staff and local communities etc. (do they recognise status?)
Inputs: • Expertise • Information • Equipment • Time	 Basic Basic maps, statement of status to compare GPS optional Spotchecks probably sufficient
Easy to interpret	Yes, (or the boundaries have not been clearly marked and/or recognised).
Tolerable change	True or false
Can data be authenticated?	Yes, spotchecks

Annex VI. Forest Landscape : Details of criteria, indicators and verifiers

Verifier V.2.1.1.1 Adequate spatial information (maps, aerial photographs/ satellite images) are available.

Justification	Resource maps are the basic data for all management activities. Forest landscape level changing can be monitored by series of related maps	
Relevance to management	In Indonesia, a forest concession has an obligation to have satellite-based map every two years and aerial photograph based map every five years.	
Achievable/practical	Vegetation maps should be available at the concession office.	
Appropriate spatial scale	FMU	
Accuracy	Easy to identify the availability, possession and use of those maps. It must be relatively accurate (e.g., good roadbuilding)	
Data quality (repeatability)	All related maps approved by legal institutions. Consistent in scale and version and updated whenever necessary.	
Methods	Checking the interpretation maps, source data (image/photo), and field checks of locations and groundtruth data.	
Inputs: • Expertise • Information • Equipment • Time	Forest management: • B.Sc. in forestry/ geography/land use planning • Maps, aerial photos, satellite images • Stereoscope, GPS • A halfday and conducted by one person	Certification body: • B.Sc. in forestry /geography/land use planning • - • Stereoscope, GPS • A halfday and conducted by one person
Easy to interpret	Easy to check whether they have the maps.	
Tolerable change	Not applicable	
Can data be authenticated?	Yes, the maps can be checked with their supply company.	
Management comments	Relevant to the concession activities	

Verifier V.2.1.1.2 Variation within the full range of natural vegetation found in the FMU should be maintained.

Justification	Avoidance of total loss of individual types of habitat/vegetation. Markets for forest product change over time. Maintaining balance gives forest manager access to all markets. Pest management easier in heterogeneous forest.	
Relevance to management	Silvicultural systems based on selective cutting forbid concessions to carry out clear cutting	
Achievable/practical	All vegetation type presences can be visited and identified.	
Appropriate spatial scale	FMU Harvesting unit	
Accuracy	By groundchecking its map, the accuracy is presumably high. If interpretation is correct, will require clear identification of types.	
Data quality (repeatability)	Depending on initial vegetation map quality. Repeatability easy	
Methods	Check the management plans Check the maps (vegetation maps), and carry out groundchecking. Make maps, do botanical surveys and data manipulation. Periodic monitoring.	
Inputs:	Forest management	Certification body
• Expertise	• B.Sc. in forestry/botany/taxonomist/basic map reading skills	• B.Sc. in forestry/botany/taxonomist/basic map reading skills
• Information	• Maps and groundchecking data/result of surveys/ written procedures	• Written procedures
• Equipment	• GPS, compass and car	• GPS and compass
• Time	• One week, conducted by one person	• One week, conducted by one person
Easy to interpret	Easy to observe all vegetation type presence. No loss of variation of natural habitat.	
Tolerable change	Detectable	
Can data be authenticated?	Yes, check the map through groundchecking	
Management comments	Relevant to the concession activities	

Verifier V.2.1.1.9 Mobility of wildlife should be facilitated by corridors and minimised barriers.

Justification	To maintain mobility of native species throughout the landscape. Secondary benefits of corridors, e.g., erosion control Increase genetic variation in the landscape	
Relevance to management	Corridors existing is indication of proper management planning.	
Achievable/practical	The existing corridors can be visited and identified. Corridors easily shown on operational plan and maps. The design of corridors will depend on the species present.	
Appropriate spatial scale	FMU	
Accuracy	By looking at the maps and visiting the field, the accuracy is high	
Data quality (repeatability)	Depends on vegetation map quality and groundchecking.	
Methods	• Check management plan • Map observation • Groundchecking • Wildlife survey	
Inputs: • Expertise • Information • Equipment • Time	Forest management • B.Sc. in Forestry/Ecology/Zoology • Maps and groundchecking data • GPS and car • Approximately 2 days (depending on number of corridors and their accessibility)	Certification body • B.Sc. in Forestry/Ecology/Zoology • groundchecking data • GPS • Approximately 2 days (depending on number of corridors and their ccessibility)
Easy to interpret	The presence of corridors and whether they comprise virgin forest or not. Check the utility.	
Tolerable change	Detectable. No deviation from management plan.	
Can data be authenticated?	Yes, they can be checked on the maps through groundchecking.	
Management comments	Relevant to concession activities.	

Indicator I.2.2.2 Ecologically sensitive areas and features should be identified and protected (water sources, caves, riverbanks, etc.).

Justification	Human intervention can destroy that area. Some of these target areas may be economically important now or in the future. Fundamental to conservation.	
Relevance to management	Important for proper planning In Indonesia, the concession holder has an obligation to protect these areas according to the TPTI/RKL (Environment Management Plan).	
Achievable/practical	The existing ecologically sensitive areas can be visited and identified Part of management plan	
Appropriate spatial scale	FMU	
Accuracy	By looking at the map and visiting them in the field, the accuracy is high.	
Data quality (repeatability)	Depends on the baseline survey, vegetation map quality and groundchecking. Ecological sensitivity can change over time.	
Methods	Map observation Groundchecking Surveys Physical protection and management Local interviews	
Inputs: • Expertise • Information • Equipment • Time	Forest management • B.Sc. in Forestry/Ecology • Maps and groundchecking data • GPS, car, GIS and field equipment • Approximately 6 days	Forest management • B.Sc. in Forestry/Ecology • Groundchecking data • GPS and field equipment • Approximately 6 days
Easy to interpret	Ecologically sensitive areas can be checked easily as to whether they comprise virgin forest or not. Follow the management plan The usefulness of these areas needs long-term monitoring	
Tolerable change	Detectable Follow the plan	
Can data be authenticated?	Yes, they can be checked on the maps through groundchecking	
Management comments	Relevant to concession activities.	

New Verifier V.2.1.1.12 Virgin forest reserve areas (biodiversity areas, seed stands etc.) should be located as representatively as possible, and as far as possible from settlements.

Justification	Reserve virgin forest is needed for conserving gene pools and for research and medicinal discovery. Protection of currently unused forest products and services for the future. The precautionary principle Good biodiversity conservation.	
Relevance to management	Surely good for proper planning In Indonesia, the concession holder has an obligation to provide virgin forest reserve areas according to government rules	
Achievable/practical	The existing virgin forest reserve areas can be visited and identified. In the management plan	
Appropriate spatial scale	FMU	
Accuracy	By looking at the map and visiting them in the field, the accuracy is high. Appropriate forest reserves depend on expert interpretation.	
Data quality (repeatability)	Depend on vegetation map quality and groundchecking.	
Methods	Map observation Groundchecking Surveys Mapping	
Inputs: • Expertise • Information • Equipment • Time	Forest management • B.Sc. in Forestry/Ecology • Maps, groundchecking data, survey result • GPS, GIS, car and field equipment • Approximately 2 days	Certification body • B.Sc. in Forestry/Ecology • Maps, groundchecking data, survey result • GPS, GIS, car and field equipment • Approximately 2 days
Easy to interpret	Virgin forest reserve areas can be checked easily as to whether they comprise virgin forest or not.	
Tolerable change	Detectable. No deviation from the management plan	
Can data be authenticated?	Yes, they can be checked on maps through groundchecking	
Management comments	Relevant to concession activities.	

Annex VII. Social Issues : Report

Local People and their Criteria and Indicators: A Preliminary Glimpse at Local Perceptions of the Surrounding Environment.

Please do not cite without permission
By
Steve Rhee[1]

September 26, 1999

Introduction

This report is based on my participation in the twelve-day Criteria and Indicators workshop held in Malinau Subdistrict, Bulungan Regency, East Kalimantan Province, Indonesia that began on September 1, 1999. The primary objective of the workshop was to refashion the existing biodiversity Criteria and Indicators, especially the respective verifiers, to facilitate, as much as possible, their use by concessionaires and certification bodies.

The purpose of my participation in the workshop was not directly related to the primary objective of the workshop; my task was to initiate research into the desirability of developing an analogous set of Criteria and Indicators to be used by local communities, viz, is it possible or worthwhile to develop a set of Criteria and Indicators (C&I) for sustainable forest management that can be implemented by and which are useful to local communities.

The two questions asked in this research initiative are as follows:

- What environmental factors are important to local people and why?
- What are the linkages between these factors and the C&I discussed and improved during the C&I workshop?

The justification of this research is that CIFOR is considering crafting a set of C&I for sustainable forest management to be used by local communities such that they themselves can systematically monitor those aspects of the environment that they find important.

Socioeconomic Context

In the subdistrict of Malinau[2] , four Dayak ethnic groups reside within the area of the PT. Inhutani II concession and its operational area—the Lundaye[3] , Kenyah,

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[1] I would like to thank John Poulsen for providing me the opportunity to join the field test team, and also Lini Wollenberg and Carol Colfer for their helpful comments on the first draft of this report.

[2] Malinau has recently become a Regency, which will then be separated into three subdistricts. The official status change in Malinau will occur in October 1999.

[3] Also called Putuk, but I have been informed that this term is often considered derogatory.

Merap and Punan. This report focuses on the Kenyah, Merap and Punan, who are all swidden agriculturists. In addition to practising slash and burn agriculture, the Kenyah, Merap and Punan hunt wild boar, deer and other animals, with wild boar being the prized catch; maintain gardens for vegetables, fruits and cash crops (coffee and cacao); and harvest forest products such as *gaharu*[4] (*Aquilaria* spp.), rattan, forest fruits and building materials. They are aware of market mechanisms and engage in market economy, although they grow the majority of subsistence crops, e.g., rice, sago and various vegetables.

The Merap and Punan are the indigenous[5] inhabitants of the region covered by the PT. Inhutani II concession, with many Punan also being resettled from the farther upland regions of the Malinau and Tubu Rivers to the lowlands. Many Punan were resettled to an area near Malinau called Respen, which is a resettlement area a short boat ride away from the market town. The Government of Indonesia established this resettlement area in the early 1970s to house the Punan, who were strongly requested to move from their indigenous upland environment[6] . The Kenyah of Long Loreh, which is the village I am most familiar with, migrated to the region on their own volition in 1971 from the Bahau River in the region of Kayan Mentarang. Other Kenyah in the area also arrived in the region in the 1970s, which was a period of general resettlement actively promoted by the government. The Kenyah in Long Loreh refer to themselves as Kenyah Lepo Ke; other Kenyah subgroups in the area are Uma Long in Setulang and Batu Kajang and Uma Lasan in Setarap.[7]

This report is partially informed by my 1.5 months of fieldwork in Long Loreh[8] , which is located in the subdistrict of Malinau and within the PT. Inhutani II concession. The village is 66 km south of Tanjung Lapang (PT. Inhutani II office) and 22 km north of CIFOR's Bulungan Research Forest camp. I lived with a local Kenyah family in the village for the duration of my fieldwork. I have a strong grasp of Indonesian, but had no knowledge of the local languages upon my arrival.

Long Loreh consists of four villages, each of which has a dominant ethnic group; Kenyah, Merap and Punan[9] reside there, with the Kenyah consisting of more than 50% of the total local population of 1171 individuals. Administratively, the village of

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[4] Gaharu is the resinous heartwood that results from a fungal infection (Cytosphaera mangifera) in some species of Aquilaria and is primarily exported to India and Middle East to be used in perfumes and incense.

[5] I define indigenous here in terms of the rhetoric used by the various ethnic groups in conveying to me the duration of their residence in the region. Merap and Punan speak in terms of residing in the area since time immemorial.

[6] Punan who have not moved to the resettlement areas and who have decided to remain in the uplands have not received any government assistance with respect to standard infrastructure and services that are normally provided to citizens.

[7] Lini Wollenberg (personal communication) provided information concerning other Kenyah subgroups.

[8] Long Loreh will become one of the three subdistricts.

[9] There are two Punan groups in the area of Long Loreh, each defined by the river that they originally were most dependent upon, hence there are Punan Tubu and Punan Malinau. Although they are from the same ethnic group, there are cultural and linguistic differences.

Long Loreh consists of the four villages of Long Loreh, Pelancau, Bila Bekayuk and Sengayan. The Kenyah are considered the best rice farmers, the Merap the most expert fishermen, and the Punan the most adept gaharu collectors. All three ethnic groups, however, participate in swidden agriculture, fishing/hunting, and forest product collection. Fishing is done using nets and fishing rods, and hunting is carried out primarily with the use of blowpipes and dogs[10] .

Timber companies have been operating in the area surrounding Long Loreh since 1976 and the mining company, PT. Bara Dinamika Muda Sukses, has been operating in the area since 1991.

Method

In addition to participating in the workshop, I conducted three days of intensive interviews with three local community members, each of whom represented a different Dayak ethnic group residing in the subdistrict of Malinau, viz, Kenyah, Merap and Punan. This report also includes data from fieldwork I conducted in the village of Long Loreh.

Two of the informants—the Kenyah and Merap individuals—are from Long Loreh and are considered village leaders; both previously held the position of Village Head. The Punan person is from Respen; he is originally from the uplands of the Tubu River. Over the three-day period, I conducted semi-structured interviews with these three individuals; questions concentrated on water quality, landscape uses and the importance of forest for local people. This three-day period also included a halfday forest walk through lowland and upland forest, as well as both forest logged conventionally and that logged using the reduced impact logging (RIL) method. These three individuals were neither identified nor selected through a systematic process; the main, if not only, criterion was that each individual represented a different ethnic group.

This report is also informed by Irma Gomez Gonzalez's Master's thesis ‘Indigenous Management of Forest Resources in East Kalimantan, Indonesia: The Role of Secondary Forests’, which was based on fieldwork in Long Loreh from April to October 1998.[11] Gonzalez provides a detailed report of the species and land use practices that are important to the local people of Long Loreh, specifically the Kenyah and the Punan of the Malinau River. All Latin names for species are taken from Gonzalez's report.

[10] During my fieldwork in Long Loreh, I noticed numerous people using rifles to hunt, but the local informants were unwilling to discuss this. Dogs are bred and valued highly for their adept hunting skills. This is especially true amongst the Punan.

[11] I strongly encourage those with an interest in the specific species important to local livelihood practices to read Irma's report. More extensive on the topic of important species to Kenyah is Carol Colfer's Beyond Slash and Burn: Building on Indigenous Management of Borneo's Tropical Rain Forest.

The C&I discussed and refashioned during the workshop were separated into three broad categories: Water Quality, Forest Structure, and Forest Landscape. Given that one of the objectives of my research was to seek out linkages, I have subdivided this report into the categories used during the workshop. Each subsection consists of a discussion of local community perceptions and the possible linkages of these perceptions with the C&I recrafted during the workshop.

Water Quality Issues

The waterways that wind their ways in a dendritic pattern through the region of East Kalimantan are critical to the local people. For the people living within the PT. Inhutani II concession, these rivers have been, until recently, the primary avenues of transportation[12]. Moreover, the rivers provide food for local villagers and are a source of drinking and bathing water. Using fishing rods and nets[13], villagers catch fish, soft-shell turtle, shrimp and eel from the rivers; fish is by far the most common type of aquatic food source. The Punan informant listed 18 different types of fish[14] to be found in the region; none of these species have been entirely depleted, but they are definitely less commonly caught. Fish is available year round, with different types of fish being available depending on level of sedimentation, viz, there are species that are commonly caught in clear water and those that are frequently caught when the water is murky. When the water is clear, fruit is commonly used as bait.

The Merap person commented that in recent years it has been very difficult to catch a substantial amount of fish: it may take one or two days to catch 0.5 kg of fish, whereas 5 or 6 kg could previously be caught in one to two hours. He attributed this to a population increase in the area, increased pollution of the rivers, and the use of more damaging fishing techniques such as dragnets and poison. In addition to increased sedimentation and pollution, there has also been a notable increase in river flow and rapids (giram), precipitated by logging along the banks of the rivers and the use of the rivers to transport logs[15]. The effect on the fish population was

[12] With the entrance of logging companies generally and the mining company (PT Bara Dinamika Muda Sukses) specifically, local people have become more dependent on ground transportation, viz., free rides from logging and mining vehicles to and from fields, as well as to other villages and the main market, Malinau.

[13] Gonzalez noted the active cultivation of tuba (Derris elliptica), a plant locally used as a fish poison; hence, local informants emphasizing the use of rods and small nets is not entirely accurate. Moreover, Lini Wollenberg (personal communication) has commented on use of electric current (strum) by Dayak in other regions; the informants did not mention this, nor did I observe or hear about this during my fieldwork.

[14] Punan terms for the 18 types of fish are as follows: tengo, laorong, dudun, kalu, taui, pakin, mujuk, daulom, sukai, lalang, teluh, senimbi, telakai, putet, teran, alap, toping, and purut. This list is not comprehensive, but merely illustrative. Lini Wollenberg (personal communication) mentioned that, in the Bahau region, Kenyah listed at least 30 types of fish. An extensive study of all the fish known in the Malinau area is needed.

[15] Carol Colfer (personal communication) has mentioned that rapids are normally associated with a lowering of the water flow/level. The use of the term giram requires further investigation.

not mentioned, but the primary concern with respect to the increased number of rapids is the danger they pose to people who use the river for transport.

With respect to use of water, local community representatives highlighted sedimentation as a critical issue. Clear water is considered healthier for drinking, bathing and washing clothes; fishing is also considered easier in clear water. Heavy rain causes rivers to become murky, and whereas rivers would previously become clear in a day or two, rivers now remain murky for one or two weeks. Moreover, during dry periods rivers, frequently remain murky, whereas they were previously consistently clear. Also, local informants noted that when meranti (Shorea spp.), kapur (Dryobalanops beccarii) and keruing (Dipterocarpus cornutus) fall into waterways, the leaves, resin and bark cause the river to turn black and this sometimes kills fish.

In early February 1999, a flood devastated the village of Long Loreh and other villages in the vicinity, destroying homes and gardens; the homes in Long Loreh that withstood the flood show watermarks reaching roof level. Local people are accustomed to minor annual flooding that rarely enters the village, but the flood in February 1999 was considered far beyond the norm. In 1971 and 1979, severe flooding also struck the village of Long Loreh, but the February 1999 flood is considered the most extreme—one informant noted that the 1999 flood exceeded the level of the 1979 flood by 4 m. Local informants speculated various causes, but I have yet to come across any definitive explanation.

Possible Linkages between Water Quality C&I and Local Concerns regarding Water

- Local community observations concerning the increased frequency and duration of murky river water address and reinforce the verifier that addresses the sedimentation of rivers.
- Local community members did not mention anything about the chemical composition of water, yet the decrease in fish supply noted by local community members is perhaps an indication of change in certain elements or compounds in the water. Identification of all species commonly found and the monitoring of their abundance may be useful. Moreover, both Lini Wollenberg and Carol Colfer have mentioned the use of electric current as a means of fishing, suggesting that, in addition to changes in the chemical composition of water, fishing techniques may be contributing to a diminishing fish supply. Teasing out the effects of chemical composition vis-à-vis unsustainable fishing techniques is a difficult and necessary research need.
- Local people did not mention aquatic insect species, but, again, an understanding of the species found in the rivers and their population fluctuations may indicate the abundance of certain aquatic insect species.
- Much like the water quality–monitoring group, local community members are quite concerned about the perceived increase in streamflow and rapids.

This, of course, not only increases the danger to local community members, but also affects aquatic life.

- Water quality is a critical issue for local people and, if I am not mistaken, is understudied in Malinau.

Forest Structure

Local people use various types of forest for different purposes and examine structure of forest to indicate the probability of finding various forest products. Local people, however, rarely enter an unfamiliar region to harvest forest products—more accurately, they have an intimate knowledge of the surrounding environment from traditional knowledge of the region passed down through generations, and hence know areas in which there is a high probability that certain products will be found. For the Kenyah, who are migrants to the area, the Merap and Punan greatly facilitated their understanding of the local environment.

During the halfday forest walk, local community members made numerous observations that indicate not only that forest structure is critical to their livelihoods, but also that there may be similarities between the biodiversity C&I pertaining to forest structure and their own concerns regarding forest structure. The local informants commented on the wasted logs that PT. Inhutani II had felled but not extracted. The 'waste'[16] of trees is disconcerting to local people for two reasons: first, the loss of trees due to intentional felling and/or tree fall damage necessarily diminishes the abundance of fruit available in the forest. Some fruits such as durian (*Durio zibethinus*) and buah lai (*Durio* spp.) are normally collected by local communities, but, more importantly, the loss of fruit means that fewer animals will be attracted to the area, and local people will therefore have more difficulty hunting. Secondly, many of the wasted trees could be used productively by local people, but the logging concession does not generally allow this. The regulation concerning this issue is ambiguous; as it stands, the site manager of PT. Inhutani II allows limited extraction by the local community on a case-by-case basis.

Another aspect of forest structure that is critical to local people is the abundance of various types of rattan; at least five types are commonly used by local people. The three most important are rotan sega' (*Calamus caesius*), uei seringan (*Daemonorops sabut*) and uei bala' (*Daemonorops histrix*)[17] . Rotan sega' has commercial value and is cultivated in gardens on a limited scale by local villagers. Logging in the area definitively diminishes the abundance of various rattan species due to the cutting of all climbers in a region of forest to be felled[18]. Rattan is of vital importance to local livelihoods in that local communities construct many products

[16] 'Waste' here is placed in quotation marks here because this may not be at all wasteful from the perspective of the concession. Local people used the term 'sayang' (a shame/pity) when referring to these felled trees.

[17] These terms are Kenyah.

[18] Carol Colfer (personal communication) has mentioned that the cutting of climbers depends on individual logging companies. The extent of this regulation requires investigation.

from rattan, such as mats and baskets. Moreover, the selling of rattan provides cash income to local people. In addition to rattan and fruits, other forest products harvested by local people include gaharu, resins from trees such as mata kucing (*Dimocarpus longan*), and trees for building materials (specifically ulin (*Eusideroxylon zwageri*), meranti (*Shorea* spp.), kapur (*Dryobalanops beccarii*) and keruing (*Dipterocarpus cornutus*)).

Another service that forests provide to local people relates to rice fields. Traditional Dayak swidden agriculture requires the limited opening of forest to cultivate dry rice fields. The soil in forest and the nutrients provided by burning the felled trees provide fertile land for rice cultivation. Swidden agriculturists generally employ a rotation system, whereby they open a new rice field annually and then return to the original rice field, depending upon the quality of the soil; it is a system of agriculture that is simultaneously extensive and intensive. Hence, they do not continually open forest, which is a serious misperception amongst those who are unfamiliar with Dayak life ways. A family of five or six individuals may need one hectare of rice field annually, and so may require a total of anywhere from four to eight hectares of land for rice[19]. When choosing forest to open for a rice field, local informants mentioned that they do not examine the soil directly, but rather look at the types of vegetation—both under and overstorey—to assess whether the area will yield a good harvest. They use the following species as indicators: Tree species include *benuang*[20] (*Anthocephalus chinensis*), *baiyur*[21], and manggris (*Koompassia excelsa*), and understorey growth includes taro or keladi (*Colocasia esculenta*). Gonzalez also notes that, for selecting secondary or fallow forest for establishing rice fields, indicator plants include acang (I*pomea* spp.), pisang hutan (*Musa* spp.), rumput labuna (a vine) and kayu putih (P*alaquium calaphyllum*).

During the forest walk through lowland and upland forest, local informants commented that the distinction had importance for them in terms of livelihood practices. Local informants commented that most animals they hunt, which include wild boar, deer, monkey, and gibbon, sleep in upland forest and forage for food in lowland forest. Their explanation for this is that upland forest provides easier escape from predators.

With respect to forest products, local informants mentioned that there is a higher probability of finding gaharu in upland forests and that this gaharu is generally of higher quality. The higher quality of the gaharu at higher altitude is due to the cooler climate. In total, there are three types of gaharu, two of which are found in the

[19] The use or area measures is deceiving in that local community members do not use this measure, but rather employ a measure based on productivity, viz., how much rice they normally plant and the expected yield. Also, please see footnote 23 for a more information on area required for rice fields.

[20] This is a Kenyah term; I found no Indonesian equivalent.

[21] I have been unable to locate the Latin name for this, and after consulting Lini Wollenberg, I surmise this may be an error on my part. I leave the name in for the person who conducts a follow-up study.

uplands[22]. Other indicators of a high probability of gaharu include dense moss in the area and hard, black rocks in the nearby streams. Moreover, in general, the various species of rattan grow better in lowland forest, although most species may be found in upland areas. The Punan person mentioned that one of the larger rattans, rotan sega', grows better in mountainous areas due to soil conditions.

The local people are highly dependent upon and have an intimate knowledge of various types of forest, the species to be found in those forests, and the multitude of benefits that these species have for local people.

Possible Linkages between Forest Structure C&I and Local Concerns

- The Forest Structure group emphasised the need to maintain existing biodiversity. Comments and observations from local community also support this to a certain extent. Local community members employ a diverse portfolio of livelihood practices that are directly dependent upon the biodiversity found in the surrounding forest. Perhaps, however, local individuals would not share a concern over conserving a specific species for the same reasons as the C&I, but the local community is well aware of the importance of the existing biodiversity.
- In gleaning the Forest Structure C&I, it seems that there is a strong emphasis on maintaining pre-harvest integrity of forest. This is precisely what local community members have conveyed to me in both the three-day interview sessions as well as during my fieldwork period. The local rationale for maintaining the existing vegetation is that it provides great benefit to local people by providing the aforementioned goods and services.
- Local people also maintain the same concern regarding seed trees/parent trees and the necessity of planning for regeneration. For example, when harvesting rattan, local people only harvest rattan that is quite old, leaving the maturing rattan for future harvests and regeneration. Moreover, Gonzalez notes that local people consider two factors important to regeneration: the survival of the seeds of certain species underground; and, the role of wild animals to disperse seeds from surrounding forest.
- Invasive or non-native species, however, may be a point of contention. Conversations and interviews with local people indicate they are not concerned with keeping out non-native species; actually, they support the introduction of invasives or non-natives, as long as these species are of use to them, either for subsistence or cash income. Examples of this are the local desire to cultivate oil palm (*Elaeis guineesis*) and the already established planting of citrus trees and cacao that are not native to the area. It is critical to local people that local vegetation provides tangible benefit[23] .

[22] In her report, Gonzalez notes that there are only two species of gaharu trees; local informants during this research period explicitly stated that there were three. The two Gonzalez notes are lelah (A. malaccensis), which is the lowland sort found near waterways, and tengon (A. beccarinana), found upland and of better quality.

[23] This may override or even explain the aforementioned claim by local informants that they support the maintenance of existing biodiversity.

- The way local people conceptualise the age and condition of forest requires further examination and is critical to the idea of whether CIFOR should develop community-oriented C&I. Within forest science, debates concerning the concept of 'primary forest' and 'secondary forest' illustrate the assumptions that are maintained within these concepts. Local people also conceptualise forest age and condition according to their own categories. An understanding of this local conceptualisation is fundamental to deciding whether and/or how to develop community-oriented C&I. For example, Gonzalez notes that, amongst Kenyah, secondary forest is one that has, at some time in the past, irrespective of how long ago, been put into rice production. Hence, what an ecologist may consider primary forest may be considered, according to the aforementioned Kenyah criteria, secondary forest. A more nuanced understanding of local conceptualisations and the assumptions that inform these conceptualisations is critical. To assume that local people and the forest science community share the same conceptualisations is to have failed before one has begun.

Landscape

Swidden agriculturists generally, and local Dayak specifically, maintain a diverse portfolio of livelihood practices that translates into multiple land use practices. In an exercise conducted with the three local informants, I asked each of these individuals to draw a sketch map of how each would use 50 ha of fertile land, assuming that many of the constraints currently placed on them by the Government of Indonesia and companies operating in the area were lifted[24] .

Current land use practices that I observed during my fieldwork in Long Loreh include the following: dry rice fields, fruit/vegetable gardens, cash crop gardens (primarily coffee and cacao, and to a lesser extent rattan), primary and secondary forest, fallow fields that may or may not be planted with crops. It should be noted here that distinct spatial and temporal boundaries with respect to these various land uses might not be apparent or appropriate.

For example, 'gardens'may be inside forests, integrated into forest or perhaps may even look like forest to those who are unfamiliar with the region. Much misunderstanding of Dayak agricultural/livelihood practices has resulted from this misperception of land use practices. Notions of 'garden' differ drastically between

[24] Implementing this exercise was difficult and probably of limited usefulness. The Dayak people that I have become acquainted with are eminently pragmatic—there is most often some tangible benefit to any activity they carry out. Part of the difficulty in carrying out this exercise was that I was asking them to remove themselves from the current milieu of constraints, but it was difficult for them not to bring up some government regulation or company prohibition that would impede their use of 50 ha. Moreover, '50 hectares of good land' seemed to have little meaning to them, since the way they would use the land is intimately tied to the microclimate of that patch of land. When asking them about specific uses drawn up on their maps, they consistently emphasized the need to scrutinize that piece of land to determine the appropriate land use.

Dayak and non-Dayak; Dayak land use practices are much more fluid and integrated compared to those of contemporary intensive agriculturists. Many of the issues surrounding land tenure claims are founded on this fundamental difference of concepts such as garden, field, forest and ownership. Gonzalez also reiterates the point that it is necessary to understand the fluidity of landscape uses among the people of Long Loreh. Her discussion of *pulong* is instructive in this regard: '*Pulong*' means 'island' in Kenyah Lepo ke' (the Kenyah of Long Loreh) language, and it is the term used for referring to patches of forest that are being actively managed, combining the cultivation of a wide variety of trees and plants with the protection and maintenance of selfsown species. There can also be a *pulong* of fruit trees, in the case of a group of fruit trees that are protected in the primary forest; or a *pulong* of primary forest, in the case of the protection and maintenance of a specific area of primary forest; or it can refer to another group of trees 'as long as there are several trees in it' (p. 49).

Dry rice fields necessarily shift; at best, decent yields can be obtained from the same field for two consecutive years, after which another field must be used or forest opened for a rice field. Local informants mentioned that, if a field is used consecutively for several years, certain ferns (*paku kading*) and grasses *(rumput belanda*) begin to grow and prevent the use of that field for rice for years. Hence, it is important that one field is not overused and is provided four to eight years of 'rest'[25]. Fields that were used as rice fields may remain fallow or be transformed into gardens; this decision is based on the vegetation that is sprouting as well as on individual needs. Many fruits such as langsat (*Lansium domesticum*) and durian (*Durio zibethinus*) are taken from forests and then planted in gardens; others such as citrus trees are planted directly into gardens.

Through the exercise conducted with the three informants, current land use practices, as well as those they hope to engender were made explicit. Local informants expressed desires: to use parcels of land to keep livestock such as pigs, chickens and cows; to cultivate wet rice[26], tree species *(meranti* and *kapur*), oil palm, rattan or other cash crops; and to maintain *hutan simpanan* and *hutan lindung*. '*Hutan simpanan*' translates as 'saved (or preserved) forest' and would be owned by one person. This forest would be used to harvest forest products such as rattan, to hunt animals, and to retrieve building materials, and would act as a

[25] Lini Wollenberg (personal communication) has mentioned that, in the Bahau region, swiddens can be 30 to 50 years old. This dramatic contrast requires immediate study since it implies a clear sign of either labor shortage or land availability problems. Further, Carol Colfer (personal communication) relayed that, among the Kenyah, she has observed and documented that normal fallow periods range from 12 to 20 years and that the motivation for the Kenyah to suggest short fallow periods may have to do with fear about outsiders' views that they are using too much land.

[26] The desire to cultivate wet rice is informed by two immediate factors: the perception that wet rice is less labor intensive and that wet rice cultivation provides an avenue to resolve land conflicts between local communities and the timber company. Perhaps more importantly, converting to wet rice may be motivated by three decades of being told by the government that their traditional farming method is 'primitive' and that wet rice is 'civilized'.

'bank' for future rice fields for their children. The '*hutan lindung*' would be a communally-managed protected forest that would not be used for rice fields and would not be a source of forest products; the only activity that would take place there would be hunting.

I would like to note here that, during my—albeit brief—period of fieldwork in Long Loreh, I asked numerous individuals about the existence of a protected forest. The Kenyah established a protected forest, but many people did not abide by the regulations. The Punan maintain a communally-managed protected forest, but it is far away from where they currently reside. Because of the current high market price of *gaharu*, there have been many problems in maintaining forests that are traditionally claimed.

Possible Linkages between Landscape C&I and Local Concerns

- The Landscape group emphasises maintaining existing vegetation types; the local community also emphasises this point (see discussion in Forest Structure).
- With respect to ecologically sensitive areas such as riverbanks and water sources, the local community has expressed noticeable changes in and concerns regarding these ecologically sensitive areas. Much depends upon how 'ecologically sensitive area' is defined.
- The idea of forest reserves to maintain biodiversity is intimately linked to, if not the same idea as, local community notions regarding protected forests.
- Wildlife corridors address the concerns expressed by the local community over the loss of animals to hunt. Community members also have a strong grasp of the migration patterns of certain species such as wild boar. Corridors would be of direct importance to them because they facilitate the migration of those species they hunt.

Conclusions and Recommendations

The research informing this report and much literature concerning the life ways of swidden agriculturists indicate that they use their own set of criteria and indicators in deciding efficient and sustainable land use practices. These criteria and indicators, however, may not fit the set of criteria and indicators crafted by CIFOR for concessionaire-level forest managers. Many of the existing C&I promote both the maintenance of the existing biodiversity and the aversion to transforming the types and distribution of biodiversity. Local community criteria and indicators may not share these same goals; indeed, the planting of non-native citrus trees and the desire to plant cash crops, such as oil palm, indicate that local communities favour transforming the landscape, as long as there is potential benefit. In this sense, the suitability of existing C&I for local communities is questionable.

Moreover, this report attempts to show that the way local communities perceive forest may drastically differ from the CIFOR-crafted C&I. Biodiversity and the health

of the environment are important to local people because both provide tangible benefit to local communities. Local Dayak communities in this area are not 'ecologically noble savages,' i.e., maintaining the health of the forest for the sake of preserving biodiversity itself, but rather view the local environment as a 'bank'for themselves and their children. Hence, the local communities desire to maintain biodiversity because this provides them with substantial, tangible benefits. Although this report suggests that there are similarities between what the local community and the C&I consider 'signal' and 'noise' with respect to monitoring the health of a forest, it remains unclear whether the lens through which each perceives the environment is similar. This report only provides a springboard to begin research on this issue.

I suggest that, if CIFOR is interested in developing a set of C&I to benefit and be used by the local communities, it is best to further examine how local communities conceptualise the forest, so as to capture the assumptions that structure their perceptual grid. CIFOR can then establish how differently or similarly local communities value forest with respect to the existing C&I; without a fine-grained understanding of these perceptual grids, one is missing the proverbial forest for the trees. Further, when establishing verifiers, I suggest that, unless CIFOR is committed to training local community members and paying them, CIFOR needs to develop verifiers that can be measured by existing local livelihood practices. To ask local community members to implement tests or procedures that they normally would not undertake is to add to their workload—something that should be paid for.

As the next step when CIFOR is deciding the desirability of developing a set of community-oriented C&I, I suggest that CIFOR conduct a thorough review of the data collected across CIFOR programmes that have carried out research in the area concerning the aspects of the environment that local people consider valuable. CIFOR has collected a large amount of data from the people of Long Loreh concerning the value of the local environment; a comprehensive review of all the data collected needs to be undertaken for several reasons.

First, a thorough understanding of what has been collected and understood thus far will maximise the limited time available to CIFOR researchers, and maximise the time local community members devote to working with CIFOR.

Moreover, when conducting such a review, CIFOR will be able to tease out the contradictions and gaps in the data that need to be addressed, which will then lead to a more nuanced understanding of the lens through which the local community understands the environment. This more nuanced understanding will enable CIFOR not only to fill in gaps in knowledge and to settle contradictions, but also to critically analyse why gaps and contradictions exist. More important than resolving contradictions is understanding why they exist. Local community members have had frequent contact with CIFOR and may employ certain forms of rhetoric that they feel may benefit them in working with CIFOR. For example, it was only during

this field test period that local people expressed their cohesion or unity across ethnic groups. During my 1.5 months of fieldwork, the expression of difference between ethnic groups was more commonly expressed, and I observed an explicit lack of cohesion between ethnic groups. As another example, during this field test, local informants informed me that, when they find gaharu, they attempt to extract that part of the tree that is infected, leaving the tree standing in hopes that it will recover. In Gonzalez's report and during my previous fieldwork, local people consistently informed me that they fell the tree and do not leave it standing. The importance of attempting to triangulate information from local informants is not necessarily to obtain the 'true' answer, but rather as a means of understanding how and why these contradictions arise.

This report attempts to convey what the local community finds important in the environment and why, and to provide linkages between how local community assesses the health of a forest and how the existing biodiversity C&I do. The justification for the research is that CIFOR is considering developing a set of C&I to be used by and to be of benefit to the local community. I hope that the information and analyses provided in this report are useful in making that decision. Again, the information I provide here is merely a springboard for discussion and future CIFOR research initiatives.

Annex VIII. Principles and Criteria for Forest Stewardship

Revised March 1996, edited October 1996

PRINCIPLE 1: COMPLIANCE WITH LAWS AND FSC PRINCIPLES

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

1.1 Forest management shall respect all national and local laws and administrative requirements.

1.2 All applicable and legally-prescribed fees, royalties, taxes and other charges shall be paid.

1.3 In signatory countries, the provisions of all binding international agreements such as CITES, ILO Conventions, ITTA, and Convention on Biological Diversity, shall be respected.

1.4 Conflicts between laws, regulations and the FSC Principles and Criteria shall be evaluated for the purposes of certification, on a case-by-case basis, by the certifiers and the involved or affected parties.

1.5 Forest management areas should be protected from illegal harvesting, settlement and other unauthorised activities.

1.6 Forest managers shall demonstrate a long-term commitment to adhere to the FSC Principles and Criteria.

PRINCIPLE 2: TENURE AND USE RIGHTS AND RESPONSIBILITIES

Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established.

2.1 Clear evidence of long-term forest use rights to the land (e.g., land title, customary rights, or lease agreements) shall be demonstrated.

2.2 Local communities with legal or customary tenure or use rights shall maintain control, to the extent necessary to protect their rights or resources, over forest operations unless they delegate control with free and informed consent to other agencies.

2.3 Appropriate mechanisms shall be employed to resolve disputes over tenure claims and use rights. The circumstances and status of any outstanding disputes will be explicitly considered in the certification

evaluation. Disputes of substantial magnitude involving a significant number of interests will normally disqualify an operation from being certified.

PRINCIPLE 3: INDIGENOUS PEOPLES' RIGHTS

The legal and customary rights of indigenous peoples to own, use and manage their lands, territories, and resources shall be recognised and respected.

3.1 Indigenous peoples shall control forest management on their lands and territories unless they delegate control with free and informed consent to other agencies.

3.2 Forest management shall not threaten or diminish, either directly or indirectly, the resources or tenure rights of indigenous peoples.

3.3 Sites of special cultural, ecological, economic or religious significance to indigenous peoples shall be clearly identified in cooperation with such peoples, and recognised and protected by forest managers.

3.4 Indigenous peoples shall be compensated for the application of their traditional knowledge regarding the use of forest species or management systems in forest operations. This compensation shall be formally agreed upon with their free and informed consent before forest operations commence.

PRINCIPLE 4: COMMUNITY RELATIONS AND WORKERS' RIGHTS

Forest management operations shall maintain or enhance the long-term social and economic wellbeing of forest workers and local communities.

4.1 The communities within, or adjacent to, the forest management area should be given opportunities for employment, training, and other services.

4.2 Forest management should meet or exceed all applicable laws and/or regulations covering the health and safety of employees and their families.

4.3 The rights of workers to organise and voluntarily negotiate with their employers shall be guaranteed as outlined in Conventions 87 and 98 of the International Labour Organisation (ILO).

4.4 Management planning and operations shall incorporate the results of evaluations of social impact. Consultations shall be maintained with people and groups directly affected by management operations.

4.5 Appropriate mechanisms shall be employed for resolving grievances and for providing fair compensation in the case of loss or damage affecting the legal or customary rights, property, resources, or livelihoods of local peoples. Measures shall be taken to avoid such loss or damage.

PRINCIPLE 5: BENEFITS FROM THE FOREST

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

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

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

5.3 Forest management should minimise waste associated with harvesting and onsite processing operations and should avoid damage to other forest resources.

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

5.5 Forest management operations shall recognise, maintain, and, where appropriate, enhance the value of forest services and resources such as watersheds and fisheries. The rate of harvest of forest products shall not exceed levels which can be permanently sustained.

PRINCIPLE 6: ENVIRONMENTAL IMPACT

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

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

6.2 Safeguards shall exist which protect rare, threatened and endangered species and their habitats (e.g., nesting and feeding areas). Conservation

zones and protection areas shall be established, appropriate to the scale and intensity of forest management and the uniqueness of the affected resources. Inappropriate hunting, fishing, trapping and collecting shall be controlled.

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

a) Forest regeneration and succession.

b) Genetic, species, and ecosystem diversity.

c) Natural cycles that affect the productivity of the forest ecosystem.

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

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

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

6.7 Chemicals, containers, liquid and solid non_organic wastes including fuel and oil shall be disposed of in an environmentally appropriate manner at offsite locations.

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

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

PRINCIPLE 7: MANAGEMENT PLAN

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

7.1 The management plan and supporting documents shall provide:

a) Management objectives.

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

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

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

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

PRINCIPLE 8: MONITORING AND ASSESSMENT

Monitoring shall be conducted—appropriate to the scale and intensity of forest management—to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.

8.1 The frequency and intensity of monitoring should be determined by the scale and intensity of forest management operations as well as the

relative complexity and fragility of the affected environment. Monitoring procedures should be consistent and replicable over time to allow comparison of results and assessment of change.

8.2 Forest management should include the research and data collection needed to monitor, at a minimum, the following indicators:

a) Yield of all forest products harvested.
b) Growth rates, regeneration and condition of the forest.
c) Composition and observed changes in the flora and fauna.
d) Environmental and social impacts of harvesting and other operations.
e) Costs, productivity, and efficiency of forest management.

8.3 Documentation shall be provided by the forest manager to enable monitoring and certifying organisations to trace each forest product from its origin, a process known as the 'chain of custody'.

8.4 The results of monitoring shall be incorporated into the implementation and revision of the management plan.

8.5 While respecting the confidentiality of information, forest managers shall make publicly available a summary of the results of monitoring indicators, including those listed in Criterion 8.2.

PRINCIPLE 9: MAINTENANCE OF NATURAL FORESTS

Primary forests, well-developed secondary forests and sites of major environmental, social or cultural significance shall be conserved. Such areas shall not be replaced by tree plantations or other land uses.

9.1 Trees planted in natural forests may supplement natural regeneration, fill gaps or contribute to the conservation of genetic resources. Such plantings shall not replace or significantly alter the natural ecosystem.

9.2 The use of replanting as a technique for regenerating stands of certain natural forest types may be appropriate under certain circumstances. Guidelines on the acceptable intensity and spatial extent of tree planting will be addressed in national and regional forest stewardship standards to be approved by FSC. In the absence of such national or regional standards, guidelines developed by the certifier and approved by FSC will prevail.

PRINCIPLE 10: PLANTATIONS

Plantations shall be planned and managed in accordance with Principles and Criteria 1–9, and Principle 10 and its Criteria. While plantations can provide an array of social and economic benefits, and can contribute to satisfying the world's

needs for forest products, they should complement the management of, reduce pressures on, and promote the restoration and conservation of natural forests.

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

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

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

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

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

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

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

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

Principles 1-9 were ratified by the FSC Founding Members and Board of Directors in September 1994. Principle 10 was ratified by the FSC Members and Board of Directors in February 1996.

Annex IX. International and Intergovernmental initiatives

International and Intergovernmental Initiatives to Identify C&I for Sustainable Forest Management.

International initiatives

In 1990, guidelines for the sustainable management of natural forests were elaborated under the auspices of the International Tropical Timber Organization (ITTO). Based on this, ITTO published criteria for monitoring sustainability in tropical moist forests in early 1992. These were supplemented, in 1993, by guidelines for the establishment and sustainable management of planted tropical forest, and guidelines for the conservation of biological diversity in tropical production forests.

The CIFOR research project on testing criteria and indicators for the sustainable management of forests was initiated in August 1994. It initially focused on genetic diversity and only later on broader aspects of biodiversity. Fieldtesting has been an integral component of this effort. In the first phase (August 1994 – January 1996), the project sought to identify reliable, relevant and cost-effective C&I based on field evaluation of existing sets of Criteria and Indicators (C&I), namely Smart Wood (Rainforest Alliance, USA), Initiative Tropenwald (ITW, Germany), Woodmark (Responsible Forestry Standards, Soil Association, UK), The Deskundigenwerkgroep Duurzaam Bosbeheer (DDB, the Netherlands) and Lembaga Ekolabel Indonesia (LEI, Indonesia). In order to evaluate C&I under forest management unit (FMU) conditions in Germany, Indonesia, Côte d'Ivoire, and Brazil an interdisciplinary and iterative approach was followed. In the second phase of the project (August 1996–February 1998), a 'tool-box'approach was used to aid the sustainability assessment. C&I research at CIFOR covered almost all aspects related to forest management: biodiversity, genetic diversity, forests managed by local communities, forest plantations, and social aspects of forest. The results of the field tests in Germany, Indonesia, Côte d'Ivoire, Brazil and Austria showed considerable commonality on the relevance of C&I related to policy and legal frameworks, and ecological and production aspects of forest management. The tests also showed that more work is needed to make the conceptual framework of principles, criteria, indicators and verifiers more consistent and operational. It was in this light that the BRF Field Test was conceived and conducted.

Intergovernmental initiatives

The intergovernmental activities have been conducted mainly within the framework of a number of major international initiatives, including:

- The Helsinki Process ('The European Process on C&I for Sustainable Forest Management'), focuses on the development of criteria and indicators for European forests, including boreal, temperate and Mediterranean-type forests. The European countries have agreed upon 6 common criteria, 27 quantitative indicators, and a number of descriptive indicators for sustainable forest management.

- The Montreal Process (The Working Group on C&I for the Conservation and Sustainable Management of Temperate and Boreal Forest), was initiated as a follow-up to the Seminar of Experts on Sustainable Development of Temperate and Boreal Forest, organised in Montreal, Canada, in 1993. The initiatives deal with criteria and indicators in temperate and boreal forests outside Europe. The ten countries that had originally participated, plus an additional two, which had recently become involved, agreed on a set of 7 criteria and 67 indicators for sustainable forest management, identified for national implementation.

- The Tarapoto Proposal of C&I for Sustainability of the Amazon Forest, was adopted in February 1995 in Tarapoto, Peru. Within the framework of this initiative, 7 criteria and 47 indicators were identified and proposed for national-level implementation in the eight participating countries. Criteria and indicators were also identified for the forest management unit level (4 additional criteria and 22 additional indicators) and for the global level (1 additional criterion and 7 additional indicators).

- The UNEP/FAO, Expert Meeting on C&I for Sustainable Forest Management in Dry-Zone Africa, held in Nairobi, Kenya, in November 1995. The meeting identified 7 criteria and 47 indicators for the national level.

- The FAO/UNEP, Expert Meeting on C&I for Sustainable Forest Management in the Near East Region, held from 15-17 October 1996 in Cairo, Egypt. The Commission endorsed a set of 7 criteria and 65 indicators for national-level implementation.

- FAO, an Expert Meeting on C&I for Sustainable Forest Management in Honduras, in January 1997. The meeting, which launched 'The Central American/Lepaterique Process', identified 4 criteria and 40 indicators for the regional level, and 8 criteria and 52 indicators for the national level.

- The ATO Initiative, has developed its own initiative in identifying criteria and indicators for sustainable forest management through various field tests at forest management unit level. The idea is to develop a 'regional' set of C&I that could be suitably operational for the member countries to assist in

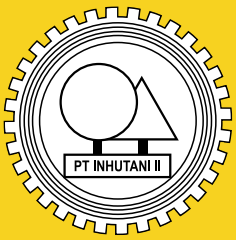
providing policy guidelines to a market-oriented mechanism that would improve the competitiveness of African timber on the world market in many ways, including through timber certification. Based on the result of the field tests, the draft of ATO criteria and indicators is evolving and there is now a need to synthesise the results and to produce the final set.

- The Pan European Forest Certification, a framework for the mutual recognition of national-level certification schemes, was officially launched in Paris on June 30, 1999. As stated in the PEFC Memorandum, the framework for certification criteria is based on the resolution of the Helsinki (1993) and Lisbon (1998) Ministerial Conferences on the protection of forests in Europe: six pan-European Criteria for sustainable forest management with 27 quantitative and descriptive indicators

- The World Conservation Union, in 1992 the World Resource Institute (WRI), The World Conservation Union (IUCN) and the United Nation Environment Programme (UNEP) released a Global Biodiversity Strategy which lays out a comprehensive plan of action to conserve diversity. They developed a minimum set of 22 indicators that organised into three categories; these are indicators to measure wild species and genetic diversity, indicators used to measure diversity at the community/habitat level and indicators used to assess domesticated species.











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