The CIFOR Criteria and Indicators Generic Template

2 The Criteria & Indicators Toolbox Series

Designed and Printed by AFTERHOURS +62 21 8306819

Photography
African Giraffe by Christian Cossalter
Pandanus Moss Forest by Alain Compost
NTFP Trader in Mfoundi, Cameroon by Manuel Ruiz Pérez
White Flower by Alain Compost

The authors wish to acknowledge the contribution of Ms Rahayu Koesnadi to quality control of this manual.

ISBN: 979-8764-29-3

Published by
Center for International Forestry Research (CIFOR)
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with support from
The European Commission
Under Budget Heading B7-6201 relating to 'Tropical Forests'
Brussels, Belgium

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Eschborn, Germany

United States Agency for International Development (USAID)
Washington D.C., USA

C&I Toolbox Series

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C&I Tool No. 2

The CIFOR Criteria and Indicators Generic Template

CIFOR C&I Team

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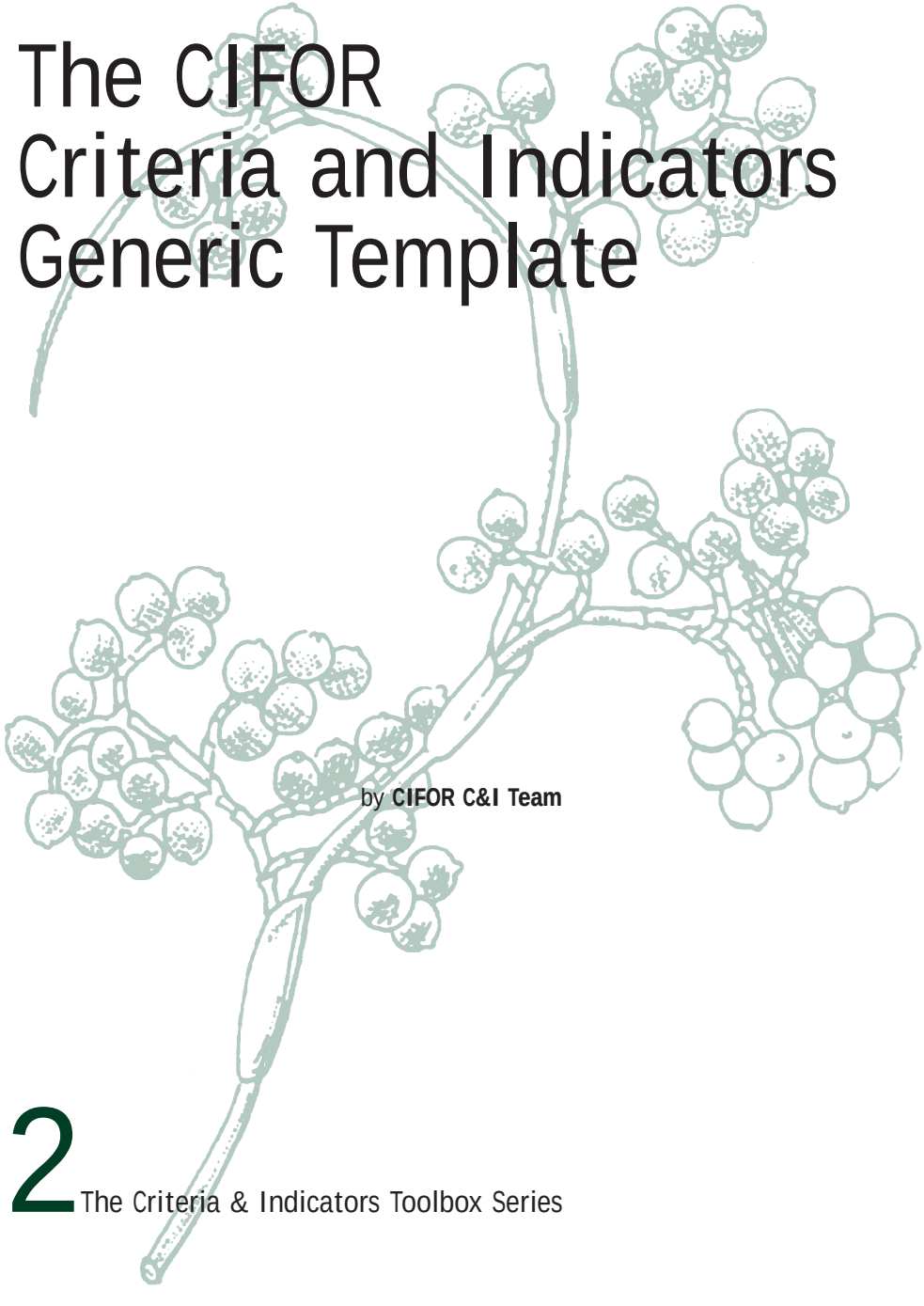
C&I Tool No. 10

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

The CIFOR Criteria and Indicators Generic Template



by **CIFOR C&I Team**

2 The Criteria & Indicators Toolbox Series

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ACKNOWLEDGEMENT

Who are the CIFOR C&I Team?

This compilation of criteria and indicators reflects the current state of our understanding at CIFOR on what constitutes a good starting platform for C&I development at the local level. This set is, therefore, a reflection of all contributions made so far through the CIFOR C&I tests (chronological order) in Germany, Indonesia, Cote d'Ivoire, Brazil, Austria, Cameroon, the United States of America; our research on social C&I (in Indonesia, Cameroon, Trinidad and Brazil); research on biodiversity C&I (in Indonesia and Cameroon); conceptual work on economic C&I; research on multi-criteria analysis and a pseudo-certification inspection of a logging concession (in Central Kalimantan, conducted by Smart Wood and SGS-Forestry). Directly or indirectly, all the people involved in this research have contributed to the knowledge included in this set of C&I. The final selection of the C&I was however made by a team consisting of Ravi Prabhu, Carol Colfer, Cynthia McDougall, Herlina Hartanto, Tim Boyle and Yurdi Yasmi. The responsibility for giving the document its final shape was Yurdi Yasmi's, his efforts need special acknowledgement.

We would like to point out that since this compilation was made a second test of C&I in Brazil has taken place. In a future update, we hope to include these results and also consider the four tests of C&I in forests managed by local communities (in Indonesia, Cameroon and Brazil), tests of plantation C&I (in India and Indonesia) and other relevant research that is currently underway or is planned. Thus, the Generic Template is always to be understood as a work in progress.

The Authors

1 Introduction

1.1 – WHAT IS MEANT BY A 'GENERIC TEMPLATE'

This document provides a comprehensive set of criteria and indicators (C&I) for sustainable forest management based on CIFOR's research. This research was conducted by interdisciplinary teams of experts in large-scale natural forests managed for commercial timber production in Indonesia, Côte d'Ivoire, Brazil and Cameroon, with additional sites in Germany, Austria and USA.

Our use of the term *'generic template'*, for these C&I is intended to prevent them being confused with an ideal and universally applicable set of C&I. In terms of the scope of applicability ('generic to what?'), we envisage this template to be used primarily for tropical natural forests managed for commercial purposes. In later work, we will incorporate results from our research on C&I for tropical plantations and community-managed forests. Although this set of C&I targets species-rich forest in the humid tropics, we have also tested this set in a natural temperate forest in Boise, Idaho (USA) and found that the majority of C&I were applicable in varying degrees. These results support the feasibility of developing a future template that may be applicable to both tropical and temperate zones.

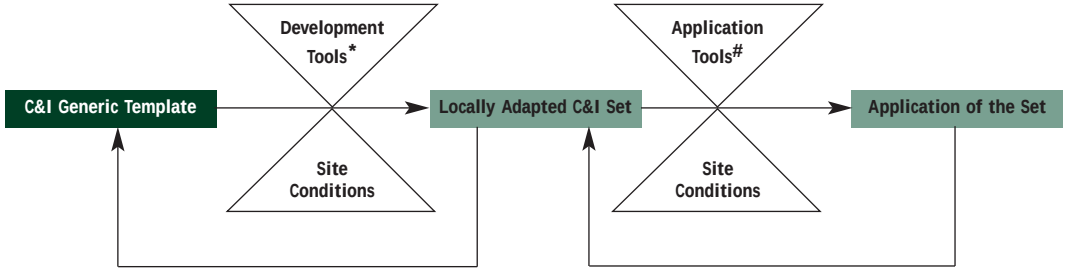
Through use of the term 'generic', we also intend to emphasise that the C&I in this set can be modified and customised to comply with local conditions. They could, therefore, be used both as a flexible set that is adaptable to all types of forest situations, and as an operational 'mother' set to be used by CIFOR's proposed CIMAT system (C&I Toolbox Series No. 3).

'Generic' also implies that this C&I template can be employed by a variety of user groups, such as certification bodies, government officials, donors, forest managers, project managers and scientists.

1.2 – RATIONALE FOR THE CREATION OF THE 'GENERIC TEMPLATE'

The C&I outlined in this document are not intended to be used as a tool to directly assess either the sustainability of forest management practices or the performance of a *particular forest management unit* (FMU). Rather, they are intended to provide users with a *'starting platform'* to formulate a more locally sound set of C&I. Thus, the adoption of the complete set is not mandatory. Once adapted, however, the set can be used for a variety of applications, which include assessment of management, management planning, and implementation.

The following figure illustrates how the generic template is conditioned to a local situation by the C&I tools we provide, as well as by specific site conditions. A second set of tools would enable the application of these locally adapted C&I for various purposes.



* e.g. C&I Toolbox Series No. 1, 2
\# e.g. C&I Toolbox Series No. 5, 6, 7

1.3 – JUSTIFICATION

Global concern regarding the extensive destruction of forest areas has led to national and international initiatives to create and test C&I for sustainable forest management. CIFOR, as one of the principal research institutes involved in C&I development, concluded after extensive research that it is unlikely that an individual C&I set could be universally applicable. It was also considered equally unlikely that C&I developed at national and regional levels will be applicable at the forest management unit (FMU). As a result, a need for the development of a comprehensive C&I set that could be adapted to specific site conditions was identified.

In response to these concerns, and recognising the unfeasibility of attempting to develop site-specific C&I for each FMU, CIFOR has formulated a C&I set that serves as a '*starting platform*.' In this context, we foresee that the generic template will constitute an essential component of sustainable forest management.

1.4 – STRUCTURE

The C&I set in this document are organised along two major 'axes':

1. The 'vertical' axis pertains to a hierarchical framework of principles, criteria, indicators and verifiers (P, C, I & V).

2. The 'horizontal' axis divides the C&I into four major areas of concern: policy, ecology, social aspects, and the production of goods and services.

1.4.1 VERTICAL AXIS

The sets of C&I within this document are structured in the hierarchical levels of principle, criterion, indicator and verifier (P, C, I & V). This scheme provides a consistent and coherent framework to achieve, level by level, the goal of sustainable forest management.

We have used the following definitions:

Principle

A fundamental truth or law as the basis of reasoning or action. Principles in the context of sustainable forest management are seen as providing the primary framework for managing forests in a sustainable fashion. They provide the justification for criteria, indicators and verifiers. Consider that principles embody human wisdom. Wisdom[1] 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.

Criterion

A principle or standard that a thing is judged by. A criterion can, therefore, be seen as a 'second order' principle, one that adds meaning and operationality to a principle without itself being a direct measure of performance. Criteria are the intermediate points to which the information provided by indicators can be integrated and where an interpretable assessment crystallises. Principles form the final point of integration. In addition to considering criteria to be second-order principles, they are also to be treated as reflections of knowledge. Knowledge[1] 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.

Indicator

An indicator is any variable or component of the forest ecosystem or management system used to infer the status of a particular criterion. Indicators should convey a 'single meaningful message'. This 'single message' is termed information[1]. It represents an aggregate of one or more data elements with certain established relationships. It is important to understand that indicators, in the sense they are used here, are not to be mistaken as conditions for fulfilment of a criterion, nor are they to be understood as a mandatory set of rules, guidelines of prescriptions. Rather, they are a series of messages that require interpretation and cross evaluation before they can satisfactorily inform an assessment of forest management, social or forest condition.

Verifier

Data or information that enhances the specificity or the ease of assessment of an indicator. The fourth level of specificity, verifiers, provide specific details that would indicate or reflect a desired condition of an indicator. They add meaning, precision and usually also site-specificity to an indicator. They may define the limits of a hypothetical zone from which recovery can still

safely take place (performance threshold/target). On the other hand, they may also be defined as procedures needed to determine satisfaction of the conditions postulated in the indicator concerned (means of verification).

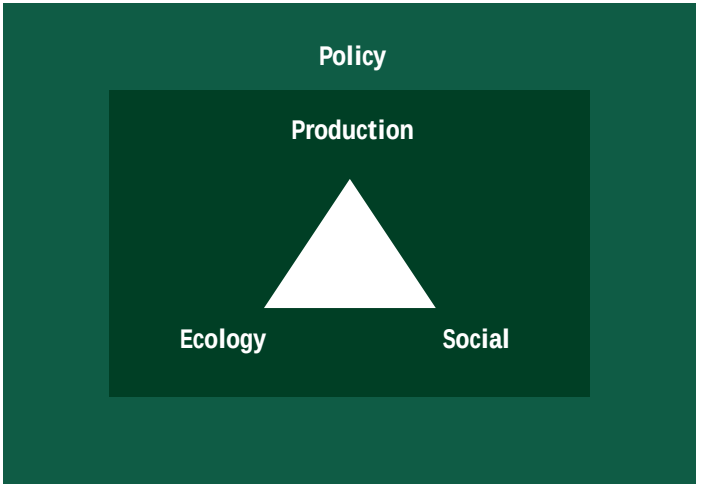
Note: In the Tropenbos[2] terminology these might be classified as sub-indicators.

1.4.2 HORIZONTAL AXIS

The horizontal axis of the generic template includes four main areas of concern; policy, ecology, social, and production of goods and services. Following is a brief description of each component.

a. *Policy*. The C&I set pertaining to policy in the generic template is concerned with policy at both a national and FMU level. To achieve sustainable forest management, both the policy and institutional framework need to be conducive to this goal affecting, as they do, the management at the FMU. Thus, this principle must take precedence over the others. C&I included in this set were generated from CIFOR's tests completed during Phase I of the C&I project (1994–1996). However, this should not mask difficulties related to the assessment of these C&I, because of issues of sovereignty, authority or control.

The following figure shows the relation between policy and other aspects in the generic template.



b. *Ecology*. The ecology set of C&I originated mainly from research by CIFOR on indicators for conservation of biological diversity in managed forest systems. This research was carried out within a conceptual framework that focused on processes that maintain adequate levels of biodiversity in sustainably functioning landscapes as being the most cost-effective approach to assessing biodiversity. The research is a 'work in progress', thus, the C&I suggested here will be subject to further improvement. However, they have been tested under field conditions in Indonesia, Cameroon and USA.

The C&I associated with ecology are organised in a hierarchical structure, moving from the landscape scale to genetic. The methodology for in-field application is to start the assessment from the very broad scale (landscape) and then proceed to more specific levels. If at any particular level, (e.g. habitat), conclusions can be made regarding the impact of forest management on biodiversity, then it is not necessary to continue the assessment at other hierarchical levels (e.g. species).

It is important to clarify at the outset that the ecology-related C&I have not been conceived as a mandatory set requiring application in entirety. Rather, they have been organised in such a way that indicators follow an order of decreasing importance for assessment and verifiers provide alternative models of cost and information quality for the actual verifiers. These verifiers will be locally developed based on these models.

The genetic components of this set constitute very advanced C&I for the FMU level. Anticipating potential obstacles with their implementation due to either insufficient expertise or equipment, CIFOR provides two types of verifiers; genetic verifiers that requires laboratory testing, and demographic verifiers which do not. Specific methodology for assessment is provided in the C&I resource book (C&I Toolbox Series No. 4).

Biodiversity can be conserved at different levels. The indicators and verifiers presented here assume that the objective of management would be to maintain biodiversity at the highest level in commercially managed natural tropical forests. Should this for some reasons not be the case, the standard might be lowered by selecting a baseline other than 'natural variation' or 'undisturbed forest'.

c. *Social*. The social C&I set cover three major principles which concern intergenerational access to resources, rights and means to co-manage forest equitably, and health and culture of the stakeholders.

For this section, we provide a simple scoring system for the assessment of human well-being (details provided in Salim *et al*. 1999). We use three categories of scoring which indicate the degree to which the indicator is fulfilled.

d. *Production of goods and services*. This set was developed to facilitate the attainment of the principle that the yield and quality of forest goods and services within an FMU must be sustainable. Historically, this principle has been the driving force for any forest management unit striving for long-term productivity and benefits.

These C&I highlighted that, in order to accomplish sustainable forest management, it is essential for all stakeholders involved in the operation of the FMU to consider the land agreement acceptable. Moreover, the management plan and objectives, management implementation, and monitoring system are critical components that must be instituted.

Again, as the purpose of this set is to enable the local modification and adaptation of C&I, the assessment methods we provide are optional and to be used only if the set or subset of the C&I are suitable to the site conditions of a particular FMU.

All the C&I reported in this document have resulted out of research conducted by CIFOR and its research collaborators during the period August 1994–October 1998.

1.5 – LINKS

In the generic template, we define two types of links among the items; direct and indirect links. Direct links between verifiers indicate verifiers are essentially measuring the same thing, and can therefore be used to cross check the reliability of the data collected albeit from a different viewpoint.

Indirect links, in the ecology section, are where two verifiers are correlated. For example, forests that are structurally more complex tend to have higher species richness. So, while structural complexity is not an alternative measure of species richness, it can be used to provide a broad expectation of the species richness likely to be encountered.

For other sections, direct links refer to very close links (with few steps to get from one to the other). Therefore, it can be seen as a continuum i.e. the information provided by a particular verifier or indicator can be used directly or with minimal manipulation by another verifier or indicator. Indirect link means the information can not be used directly, however knowledge about this information may be important to forming a more complete judgement on another indicator.

1.6 – HOW TO READ THIS DOCUMENT

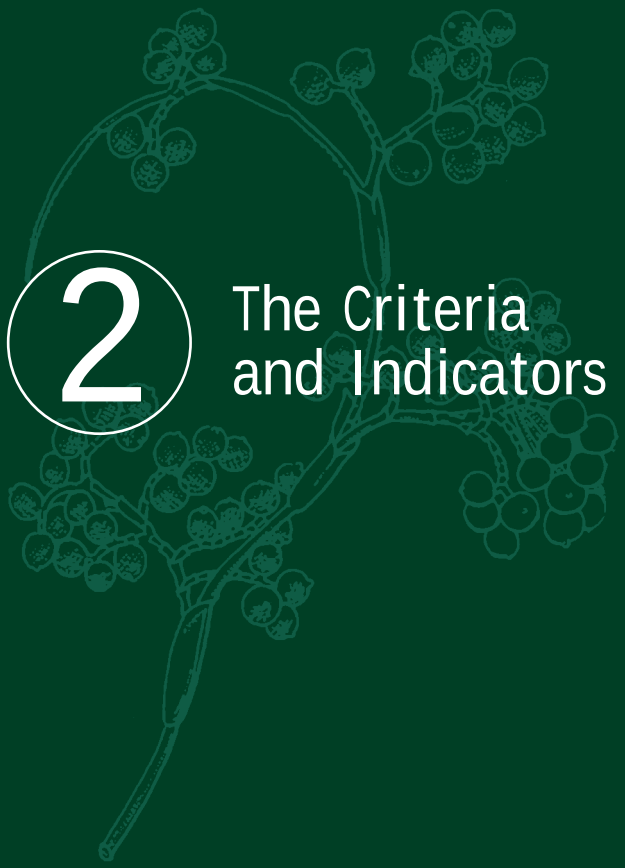
This generic template is to be perceived as a 'starting platform' by which users can formulate locally sound C&I to assist the pursuit of sustainable forest management. The adoption of each complete set of C&I, therefore, is not obligatory. More detailed information on C&I, including methodology for field-testing, is provided in additional CIFOR documents.

To ensure that this document is accessible to a variety of user groups, a glossary is provided in the annex. The terms included have been demarcated within the text through the use of Italics.

End notes

1 Definition based on the four basic entities in Information Theory (Liang 1994)

2 Lammerts van Bueren, E.M and Bloom, E.M. 1997. Hierarchical Framework for the Formulation of Sustainable Forest Management Standards. Tropenbos Foundation, Wageningen.



2 The Criteria and Indicators

2.1 – POLICY

P.1	**Policy, planning and institutional framework are conducive to sustainable forest management[1]**
C.1.1	**There is sustained and adequate funding for the management of forests**
I.1.1.1	Policy and planning are based on recent and accurate information
I.1.1.2	Effective instruments for inter-sectoral co-ordination on land-use and land management exist Link to I.1.5.4
I.1.1.3	A *Permanent Forest Estate* (PFE), which includes both protection and *production forests* and is the basis for sustainable management, exists and is protected by law
I.1.1.4	There is a regional land use plan (or PFE) which reflects the different forested land uses, and gives attention to such factors as population, agriculture, conservation, environmental, economic and cultural values
I.1.1.5	Institutions responsible for forest management and research are adequately funded and staffed
C.1.2	**Precautionary economic policies exist** Link to C.6.4
I.1.2.1	Reserve funds for potential damages are available (performance bond) Link to I.6.3.6
I.1.2.2	Anti-corruption provisions have been implemented
C.1.3	**Non forestry policies do not distort forest management**
I.1.3.1	Absence of agricultural sector incentives for production expansion
I.1.3.2	Absence of price controls on domestic food production
I.1.3.3	Absence of price controls on fuel oils
I.1.3.4	Absence of distorting resettlement policies
I.1.3.5	Absence of distorting exchange rate over or under-valuation

C.1.4	**A functioning buffer zone exists**
I.1.4.1	Low level of conflict at *Forest Management Unit* (FMU) boundary
I.1.4.2	Local respect for FMU boundary
I.1.4.3	Forest management (e.g. company, concession) has demonstrated attempts to protect FMU boundaries
C.1.5	**Legal framework protects access to forest and forest resources**
I.1.5.1	Security of *tenure* is clear and documented
I.1.5.2	Existence of non-confiscatory land use policy
I.1.5.3	Existence of property rights for exploited non-timber forest products (NTFPs) (e.g. fuel wood)
I.1.5.4	Land tenurial prerequisite policy does not discriminate against forestry
I.1.5.5	Efficient equivalence log price/export log price
I.1.5.6	Transparent system of concession allocation
C.1.6	**Demonstrated reinvestment in forest-use options**
I.1.6.1	Absence of excessive capital mobility (promoting 'cut and run')

2.2 – ECOLOGY

P.2.	**Maintenance of *Ecosystem Integrity***
C.2.1	**The processes that maintain biodiversity in managed forests (FMUs) are conserved.** Link to P.3
I.2.1.1	*Landscape* pattern is maintained[2] Linkage to V.6.4.8.1
V.2.1.1.1	FMU compiles information on areal extent of each vegetation type in the *intervention area* compared to area of the vegetation type in the total FMU
V.2.1.1.2	Number of *patches* of each vegetation type at the FMU is maintained within natural variation[3]
V.2.1.1.3	Largest *patch size* of each vegetation type is maintained within *critical limits*[3]
V.2.1.1.4	Area weighted *patch size* is maintained within *critical limits*[4]
V.2.1.1.5	*Contagion index* of the degree to which vegetation types are aggregated, is maintained within *critical limits*[4]
V.2.1.1.6	*Dominance* of patch structure does not show significant change as compared to unlogged site[3,4]
V.2.1.1.7	*Fractal dimension* of patch shape is maintained within *critical limits*[4]
V.2.1.1.8	Average, minimum, and maximum distance between two patches of the same *cover type* are maintained within natural variation[4]
V.2.1.1.9	*Percolation index*, specifying landscape 'connectedness', is maintained within *critical limits*[4]
V.2.1.1.10	Linear measures of the total amount of *edge* of each vegetation type exist
V.2.1.1.11	Amount of *edge* around the largest *patch* does not show significant change as compared to undisturbed forest[3]
I.2.1.2	Change in diversity of habitat as a result of human interventions are maintained within *critical limits* as defined by natural variation and/or regional conservation objectives Linkage to V.6.4.8.1
V.2.1.2.1	*Vertical structure* of the forest is maintained within natural variation Direct link to V.2.1.2.2; V.2.1.2.5; V.2.1.5.3 Indirect link to V.2.1.3.3; V.2.1.4.2; V.2.1.4.3
V.2.1.2.2	*Size class* distribution does not show significant change over natural variation Direct link to V.2.1.2.1; V.2.1.2.4; V.2.1.2.5; V.2.1.2.7; V.2.1.5.3 Indirect link to V.2.1.3.3; V.2.1.4.2; V.2.1.4.3

V.2.1.2.3 *Frequency distributions* of leaf size and shape are maintained within natural variation
Direct link to V.2.1.3.1; I.2.1.4
Indirect link to V.2.1.3.3; V.2.1.4.2; V.2.1.4.3

V.2.1.2.4 *Frequency distribution* of phases of the *forest regeneration cycle* is maintained within *critical limits*
Direct link to V.2.1.2.2; V.2.1.2.5; V.2.1.2.6; V.2.1.3.1

V.2.1.2.5 *Canopy openness* in the forest *understorey* is minimized[5]
Direct link to V.2.1.2.1; V.2.1.2.2; V.2.1.2.4

V.2.1.2.6 *Other structural elements* do not show significant change
Direct link to V.2.1.2.4; V.2.1.2.5; V.2.1.2.7; V.2.1.6.1; V.2.1.6.3; V.2.1.6.5

V.2.1.2.7 The distribution of *above ground biomass* does not show significant change as compared to undisturbed forest[4]

I.2.1.3 Community *guild* structures do not show significant changes in the representation of especially sensitive guilds, pollinator and disperser guilds

V.2.1.3.1 Relative abundance of seedling, saplings and *poles* of canopy tree species belonging to different regeneration guilds does not show significant change as compared to undisturbed forest
Direct link to V.2.1.2.3; V.2.1.2.4; V.2.1.6.1; V.2.1.6.3; V.2.1.6.5

V.2.1.3.2 The abundance of *selected avian guilds* is maintained within natural variation[5]
Direct link to V.2.1.4.3

V.2.1.3.3 The abundance of nests of social *bees* is maintained within natural variation
Indirect link to V.2.1.2.2; V.2.1.2.3

V.2.1.3.4 The abundance of seed in key plant species does not show significant change as compared to undisturbed forest[4]
Direct link to V.2.1.3.5; V.2.1.3.6; V.2.1.4.3

V.2.1.3.5 Fruiting intensity in known bat-pollinated tree species does not show significant change as compared to undisturbed forest[4]
Direct link to V.2.1.3.4

V.2.1.3.6 The abundance and activity of terrestrial *frugivorous mammals* is maintained within *critical limits*[4]
Direct link to V.2.1.3.4

V.2.1.3.7 The diversity of forest floor *invertebrate* communities does not vary significantly between logged and undisturbed forest
Direct link to I.6.4.3

I.2.1.4	The richness/diversity of selected groups show no significant change[6] Direct link to I.6.4.3
V.2.1.4.1	*Species richness* of *prominent groups* is maintained or enhanced
V.2.1.4.2	Number of different birdcalls do not vary significantly as compared to unlogged site[4] Indirect link to V.2.1.2.2; V.2.1.2.3; V.2.1.2.4
V.2.1.4.3	Number of large butterfly species is maintained within natural variation Direct link to V.2.1.3.2; V.2.1.3.4 Indirect link to V.2.1.2.2; V.2.1.2.3; V.2.1.2.4
V.2.1.4.4	Numbers of species removed from the forest for sale in local markets
V.2.1.4.5	Lists of selected groups of species, compiled by acknowledged experts, do not show significant change
V.2.1.4.6	Temporal change in species richness is not significant[4]
V.2.1.4.7	Time series of the ratio of composition of mature forest species to secondary growth species shows no significant change[4]
V.2.1.4.8	The spatial diversity of selected groups is maintained within natural variation
I.2.1.5	Population sizes and *demographic* structures of selected species do not show significant change, and demographically and ecologically critical life-cycle stages continue to be represented
V.2.1.5.1	The absolute population size of selected species is maintained within natural variation
V.2.1.5.2	Temporal change in the population size is not significant
V.2.1.5.3	Tree age or structure does not show significant change as compared to undisturbed forest[6] Direct link to V.2.1.2.1; V.2.1.2.2
V.2.1.5.4	Population growth rate does not show significant change as compared to undisturbed forest[6]
V.2.1.5.5	Spatial structure of population is maintained within natural variation
I.2.1.6	The status of decomposition and *nutrient* cycling shows no significant change Linkage to V.6.4.8.1
V.2.1.6.1	Standing and fallen dead wood does not show significant change as compared to undisturbed forest[6] Direct link to I.2.1.2; V.2.1.2.6; V.2.1.3.1; V.2.1.6.2
V.2.1.6.2	State of *decay* of all dead wood does not show significant change as compared to undisturbed forest[6] Direct link to V.2.1.6.1

V.2.1.6.3	Abundance of small *woody debris* does not show significant change as compared to undisturbed forest[6] Direct link to V.2.1.2.6; V.2.1.3.1; V.2.1.6.2; V.2.1.6.4
V.2.1.6.4	Depth of litter/gradient of decomposition does not vary significantly between undisturbed and logged sites[4] Direct link to V.2.1.6.3; V.2.1.6.6
V.2.1.6.5	Abundance of *decomposer organisms* is maintained within natural variation[4] Direct link to V.2.1.2.6; V.2.1.3.1
V.2.1.6.6	*Decomposition* rate on the forest floor does not show significant change[4] Direct link to V.2.1.6.3; V.2.1.6.4
V.2.1.6.7	*Soil conductivity* and *pH* do not show significant change as compared to unlogged site[4]
V.2.1.6.8	*Soil nutrient levels* are maintained within *critical limits*[4]
I.2.1.7	There is no significant change in the quality and quantity of water from the catchment Direct link to V.6.4.8.1
V.2.1.7.1	Abundance and diversity of *aquatic organisms* is maintained within critical limits Direct link to V.2.1.7.3
V.2.1.7.2	*Chemical composition* of stream water does not show significant variation as compared to unlogged forest[4]
V.2.1.7.3	*Decomposition* rate of the stream water does not show significant change as compared to unlogged forest[4] Direct link to V.2.1.7.1
V.2.1.7.4	*Stream flow* does not show significant change as compared to the flow in the unlogged site[4]
C.2.2	***Ecosystem* function is maintained**
I.2.2.1	No chemical contamination to *food chains* and *ecosystem* Direct link to V.6.4.8.1
I.2.2.2	Ecologically sensitive areas, especially buffer zones along watercourses, are protected
I.2.2.3	Representative areas, especially sites of ecological importance, are protected and appropriately managed
I.2.2.4	Rare or endangered species are protected
I.2.2.5	*Erosion* and other forms of soil degradation are minimised

C.2.3	Conservation of the processes that maintain genetic variation[7]
I.2.3.1	Levels of genetic diversity are maintained within *critical limits*
Demographic verifiers:	
V.2.3.1.1	Census number of *sexually mature individuals* is above critical absolute values
V.2.3.1.2	Census number of reproducing individuals is above critical absolute values Direct link to V.2.1.3.4; V.2.1.3.5
V.2.3.1.3	Coefficient of *phenotypic variation* is higher or not significantly different from reference population
Genetic verifiers:	
V.2.3.1.4	Number of *alleles* is maintained
V.2.3.1.5	*Gene* diversity is maintained
V.2.3.1.6	Genetic variation is maintained
I.2.3.2	There is no directional change in genotypic frequencies
Demographic verifiers:	
V.2.3.2.1	Phenotypic shifts show no significant change
V.2.3.2.2	Age/size class shifts show no significant change Direct link to V.2.1.2.2; V.2.1.3.1; V.2.1.4.7; V.2.1.5.1; V.2.1.5.3; V.2.1.5.5
V.2.3.2.3	Environmental shifts show no significant change
Genetic verifiers:	
V.2.3.2.4	Genotypic frequency shifts show no significant change
V.2.3.2.5	Marker frequency shifts show no significant change
V.2.3.2.6	Genetic mean shifts show no significant change
I.2.3.3	There are no changes in *gene flow*/migration
Demographic verifiers:	
V.2.3.3.1	Physical *isolation* shows no significant change Direct link to V.2.1.1.5; V.2.1.1.6; V.2.1.1.9
V.2.3.3.2	Mating *isolation* shows no significant change Direct link to V.2.1.1.5; V.2.1.1.6; V.2.1.1.9

V.2.3.3.3 Seed *dispersal* shows no significant change

V.2.3.3.4 Pollen *dispersal* shows no significant change

Genetic verifier:

V.2.3.3.5 *Gene flow* shows no significant change

I.2.3.4 There are no changes in the mating system

Demographic verifiers:

V.2.3.4.1 Parental pool size shows no significant change

V.2.3.4.2 Seed germination shows no significant change

V.2.3.4.3 Pollinator abundance is maintained

V.2.3.4.4 Sex ratio is maintained

Genetic verifiers:

V.2.3.4.5 Out-crossing rate shows no significant change

V.2.3.4.6 Correlated mating shows no significant change

2.3 – SOCIAL

P.3.	**Forest management maintains or enhances fair intergenerational access to resources and economic benefits**
C.3.1	**Local management is effective in controlling maintenance of, and access to, the resource** Direct link to P.2 Indirect link to C.1.5; V.2.1.3.4; V.2.1.4.1
I.3.1.1	Ownership and *use rights* to resources (inter and intra-generational) are clear and respect pre-existing claims Direct link to I.1.1.4; I.2.1.1; I.2.1.2; I.2.1.4; C.1.5; I.3.3.1; I.4.2.1; I.6.2.1 Indirect link to I.1.1.2; I.2.1.3; I.1.5.1; I.3.1.2; I.3.1.4; I.3.1.5; I.4.2.2; I.4.2.4
I.3.1.2	Rules and *norms* of resource use are monitored and successfully enforced Direct link to I.1.1.3; C.1.5; I.2.1.1; I.2.1.2; I.2.1.4; C.6.4 Indirect link to I.2.1.3; I.3.1.1; I.3.1.3; I.3.1.5; I.4.2.1; I.4.3.1
I.3.1.3	Means of conflict resolution function without violence Direct link to I.1.4.1; I.3.2.1; I.3.2.4; I.4.3.1 Indirect link to I.4.1.2; I.4.1.3; I.4.2.4; I.4.2.5; C.7.2
I.3.1.4	Access to forest resources is perceived locally to be fair Direct link to I.3.2.1; I.4.3.1 Indirect link to C.1.5; I.4.2.4; I.4.2.5
V.3.1.4.1	Access of small timber operators to timber concessions Indirect link to I.1.5.4
V.3.1.4.2	Access of non-timber users to non-timber forest products Indirect link to C.1.5
I.3.1.5	Local people feel secure about access to resources Direct link to I.1.1.4; I.2.1.1; I.2.1.2; I.2.1.4; I.2.1.6; I.3.3.1; I.3.3.5; I.4.2.4; I.4.2.5; I.4.3.1 Indirect link to C.1.5; I.1.5.1; I.2.1.3; I.3.3.2; I.4.1.1; I.4.1.2; I.4.1.3; I.6.1.1
C.3.2	**Forest actors have a reasonable share in the economic benefits derived from forest use** Indirect link to I.6.6.4
I.3.2.1	Mechanisms for sharing benefits are seen as fair by local communities Direct link to I.3.1.1; I.3.1.2; I.3.1.3; I.3.1.4 Indirect link to I.1.1.4; I.3.1.5; I.3.2.2; I.3.2.3; I.3.2.4; I.4.2.4; I.5.3.2
I.3.2.2	Opportunities exist for local and forest-dependent people to receive employment and training from forest companies Direct link to I.5.2.3 Indirect link to I.2.1.1; I.2.1.2; I.2.1.3; I.2.1.4; I.3.2.1; I.3.2.3; I.5.2.1
V.3.2.2.1	The number of local people employed in forest management (disaggregated e.g., by gender, ethnicity, etc.)

I.3.2.3	Wages and other benefits conform to national and/or International Labour Organisation (ILO) standards Direct link to I.1.1.5; I.5.2.3 Indirect link to I.3.2.2
I.3.2.4	Damages are compensated in a fair manner Direct link to I.1.2.1; I.3.1.2; I.3.1.3; I.3.1.4 Indirect link to I.3.1.5
V.3.2.4.1 Number of people affected by off-site impacts, without compensation	
I.3.2.5	The various forest products are used in an optimal and equitable way
C.3.3	**People link their and their children's future with management of forest resources**
I.3.3.1	People invest in their surroundings (i.e., time, effort, and money) Direct link to C.1.6; I.3.1.5; I.5.1.1
I.3.3.2	Out-*migration* levels are low Direct link to I.5.1.2 Indirect link to I.3.3.6; I.5.3.3
I.3.3.3	People recognise the need to balance number of people with natural resource use Direct link to I.5.1.2 Indirect link to I.2.1.2; I.3.3.1; I.3.3.2; I.3.3.4; I.3.3.5; I.3.3.6
I.3.3.4	Children are educated (formally and informally) about natural resource management Direct link to I.5.3.3 Indirect link to I.3.3.1; I.3.3.3; I.3.3.6
I.3.3.5	Destruction of natural resources by local communities is rare Direct link to I.3.1.2; I.3.1.3; I.4.3.1; I.5.1.1 Indirect link to C.1.4; I.1.4.3; I.3.1.4; I.3.3.1; I.3.3.3; I.3.3.4; I.3.3.6; I.5.3.3
I.3.3.6	People maintain spiritual or emotional links to the land Indirect link to I.3.1.5; I.3.3.1; I.3.3.2; I.3.3.3; I.3.3.4; I.3.3.5; I.3.3.6

P.4.	**Concerned *stakeholders* have acknowledged rights and means to manage forests cooperatively and equitably**
C.4.1	**Effective mechanisms exist for two-way communication related to forest management among *stakeholders***
I.4.1.1	> 50% of timber company personnel and forestry officials speak one or more local language, or > 50% local women speak the national language used by the timber company in local interactions Indirect link to I.4.1.2; I.4.1.3
I.4.1.2	Local *stakeholders* meet with satisfactory frequency, representation of local diversity, and quality of interaction Direct link to I.1.1.2 Indirect link to I.3.1.3; I.4.2.1; I.4.2.4; I.4.2.5; I.4.3.1
I.4.1.3	Contributions made by all *stakeholders* are mutually respected and valued at a generally satisfactory level Direct link to I.3.1.3; I.4.3.1 Indirect link to I.4.1.1; I.4.1.2
C.4.2	**Local *stakeholders* have detailed, reciprocal knowledge pertaining to forest resource use (including user groups and gender roles), as well as *forest management plans* prior to implementation**
I.4.2.1	Plans/maps showing integration of uses by different *stakeholders* exist Direct link to I.1.1.2; I.1.1.4; I.3.1.1; I.5.3.2 Indirect I.4.1.3; I.4.2.2; I.4.2.3; I.4.2.4: I.4.2.5; I.6.1.1
I.4.2.2	Updated plans, baseline studies and maps are widely available, outlining logging details such as cutting areas and road construction, and include temporal aspects Direct link to I.6.2.1 Indirect link to I.4.2.1; I.4.2.4; I.4.2.5; I.6.4.3
I.4.2.3	Baseline studies of local human systems are available and consulted Direct link to I.5.3.1
I.4.2.4	Management staff recognises the legitimate interests and rights of other *stakeholders* Direct link to I.3.1.1; I.4.2.1; I.5.3.2 Indirect link to I.4.1.3; I.4.2.5
I.4.2.5	Management of NTFP reflects the interests and rights of local *stakeholders* Direct link to I.2.1.4; I.3.1.1 Indirect link to I.1.1.2; I.1.1.4; I.2.1.7; I.4.1.3; I4.2.1; I4.2.4; I.5.3.2
C.4.3	**Agreement exists on rights and responsibilities of relevant *stakeholders***
I.4.3.1	Level of conflict is acceptable to *stakeholders* Direct link to I.1.4.1; I.3.1.3; I.3.2.4; I.3.3.5 Indirect link to I.3.1.1; I.3.1.4; I.4.2.4

P.5.	**The health of forest actors, cultures and the forest is acceptable to all *stakeholders*[8]**
C.5.1	**There is a recognisable balance between human activities and environmental conditions**
I.5.1.1	Environmental conditions affected by human uses are stable or improving Direct link to I.2.1.1; I.2.1.2; I.2.1.3; I.2.1.4; I.2.1.5; I.2.1.6; I.3.1.5; I.3.3.1 Indirect link to I.1.1.3; I.3.3.3; I.3.3.5; I.5.1.2
I.5.1.2	In-*migration* and/or natural population increases are in harmony with maintaining the forest Direct link to I.2.1.1; I.2.1.2; I.2.1.4; I.3.3.2; I.3.3.3 Indirect link to I.1.1.4; I.1.5.3; I.2.1.3; I.3.1.5; C.4.2; I.5.1.1; I.5.2.2
C.5.2	**The relationship between forest management and human health is recognised**
I.5.2.1	*Forest managers* cooperate with public health authorities regarding illnesses related to forest management Direct link to I.2.1.6 Indirect link to I.2.1.4; I.3.2.3
I.5.2.2	Nutritional status is adequate among *local populations* Direct link to I.2.1.2; I.2.1.4; I.4.2.5 Indirect link to I.2.1.1; I.5.1.1; I.5.2.1; I.5.2.3
I.5.2.3	Forest employers follow ILO work and safety regulations and take responsibility for the forest-related health risks of workers Direct link to I.3.2.2; I.3.2.3; I.3.2.4 Indirect link to I.5.2.2
C.5.3	**The relationship between forest maintenance and human culture is acknowledged as important**
I.5.3.1	*Forest managers* can explain links between relevant human cultures and the local forest Direct link to I.2.1.2; I.2.1.4; I.4.1.1 Indirect link to I.2.1.3; I.4.1.2; I.4.1.3; I.5.3.2; I.5.3.3
I.5.3.2	*Forest management plans* reflect care in handling human cultural issues Direct link to I.4.1.2; I.4.2.3; I.5.3.1 Indirect link to I.4.1.1; I.4.1.3; I.4.2.1; I.4.2.5; I.5.3.3
I.5.3.3	There is no significant increase in signs of cultural disintegration Direct link to I.2.1.1; I.2.1.2 Indirect link to I.2.1.3; I.2.1.4; I.2.1.6; I.2.1.7; I.3.1.5; I.3.3.1; I.3.3.2; I.3.3.3; I.3.3.4; I.3.3.5; I.3.3.6; I.5.3.1; I.5.3.2

2.4 – PRODUCTION OF GOODS AND SERVICES

P.6.	**Yield and quality of forest goods and services are sustainable**
C.6.1	**Forest management unit is implemented on the basis of legal title on the land, recognised *customary* rights, or clear lease agreements**
I.6.1.1	Documentary evidence of the agreements with local communities under which management is entitled to manage the forest exists
I.6.1.2	Information on the identity, location and population of all indigenous and traditional peoples living in the vicinity of the management area or claiming *customary rights* to the management area exists
I.6.1.3	Evidence or statements from the representative organisations of local indigenous or traditional communities defining the extent of their territories exist, and include maps
C.6.2	**Management objectives are clearly and precisely described and documented**
I.6.2.1	Objectives are clearly stated in terms of the major functions of the forests, with due respect to their spatial distribution Direct link to C.6.1; C6.3; C.6.4 Indirect link to C.6.5
C.6.3	***Forest management plan* is comprehensive**
I.6.3.1	A comprehensive forest *management plan* exists
V.6.3.1.1	Maps of resources, management, ownership and inventories are available Direct link to C.6.1; C.6.2; C.6.4; C.6.5
V.6.3.1.2	The management plan looks beyond the second cutting cycle Direct link to C.1.6; C.6.2; C.6.4 Indirect link to C.6.1; C.6.5
I.6.3.2	Management take place with appropriate involvement of the *stakeholders* and takes into account all the components and functions of the forest, such as timber production, NTFP, ecology and well-being of *local populations* Direct link to C.4.2; C.6.1; C.6.2; C.6.4 Indirect link to C.6.5
V.6.3.2.1	There is evidence of inclusion of *local population* in the management plan design Direct link to I.6.2.1; I.6.4.3; I.6.4.9
I.6.3.3	Yield regulation by area and/or volume is prescribed Direct link to C.6.1; C.6.2; C.6.4; C.6.5
V.6.3.3.1	Allowable annual cuts, minimum exploitable diameter, and maximum number of trees to be harvested per hectare are specified Direct link to I.6.2.1; I.6.3.4; V.6.3.1.1; V.6.3.1.2; I.6.3.6; I.6.4.1; I.6.4.7 Indirect link to I.6.4.3; I.6.5.4

I.6.3.4	*Silvicultural systems* are prescribed and are appropriate to forest type and produce growth Direct link to C.6.2; C.6.4; C.6.5 Indirect link to C.6.1
V.6.3.4.1	Interventions if applied, are highly specific to the individual tree level, instead of to species or whole stand Direct link to I.6.2.1; V.6.3.1.1 Indirect link to I.6.3.3
V.6.3.4.2	Tree growth rates (at a monitored site) are not declining Direct link to I.6.2.1; V.6.3.1.2; I.6.3.3; I.6.4.1; I.6.5.1 Indirect link to I.6.5.5
V.6.3.4.3	*Enrichment planting*, if carried out, should be based on indigenous locally adapted species
I.6.3.5	Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact Direct link to C.6.2; C.6.4 Indirect link to C.6.5
V.6.3.5.1	Harvesting standards are explicit and cover key issues Direct link to I.6.2.1; I.6.3.1; I.6.3.3; I.6.3.4; I.6.4.3; I.6.4.5; I.6.4.6 Indirect link to I.6.4.9; I.6.5.2
V.6.3.5.2	Harvesting codes are comparable with FAO standards for best forest management Direct link to I.6.2.1; I.6.3.2; I.6.3.3; V.6.3.1.1; I.6.3.4; I.6.3.6; I.6.4.3 Indirect link to I.6.4.4; I.6.4.5; I.6.4.9; I.6.4.6; I.6.4.7; I.6.5.1; I.6.5.2; I.6.5.5
V.6.3.5.3	Guidelines for rational harvesting of NTFP are defined and put into practice Direct link to I.6.2.1; I.6.3.1; I.6.3.2; I.6.4.3 Indirect link to I.6.4.9
I.6.3.6	Management plan is periodically submitted to revision Direct link to C.6.1; C.6.2; C.6.4 Indirect link to C.6.5
V.6.3.6.1	Management plan is approved by the appropriate authority such as minister in charge of the forest Direct link to I.6.2.1; I.6.3.3; I.6.3.5; I.6.4.3 Indirect link to I.6.4.1
V.6.3.6.2	The management plan is revised and approved regularly, e.g. every five years Direct link to I.6.2.1; V.6.3.1.1; I.6.3.3; I.6.3.5; I.6.4.3; I.6.4.1 Indirect link to I.6.5.2

C.6.4	Implementation of the management plan is effective
I.6.4.1	The forest unit is zoned into areas to be managed for various objectives Direct link to C.6.1; C.6.2; C.6.3 Indirect link to C.6.5
I.6.4.2	Boundaries are marked in the field Direct link to C.6.1; C.6.2 Indirect link to C.6.3; C.6.5
I.6.4.3	Inventory of all forest uses and products are available Direct link to C.6.1; C.6.2; C.6.3; C.6.5
V.6.4.3.1	Pre-harvest inventory is satisfactorily completed according to national standard Direct link to I.6.2.1; I.6.3.2; I.6.3.3; V.6.3.1.1; I.6.3.4; I.6.3.5; I.6.3.6; I.6.4.1; I.6.4.2; I.6.4.3; I.6.5.4 Indirect link to I.6.5.1; I.6.5.2
V.6.4.3.2	NTFP and their uses are identified Direct link to I.6.2.1; V.6.3.1.1; I.6.3.2; I.6.3.5; I.6.4.9
I.6.4.4	Workers and staff have adequate training to implement management Direct link to C.6.2 Indirect link to C.6.3; C.6.5
I.6.4.5	Infrastructure is laid out prior to harvesting and in accordance with prescriptions Direct link to C.6.2; C.6.3 Indirect link to C.6.1; C.6.5
V.6.4.5.1	Rational infrastructure required for logging is made permanent Direct link to I.6.2.1; V.6.3.1.1; I.6.3.3; I.6.3.5; I.6.4.3; I.6.4.6; I.6.4.9 Indirect link to I.6.3.4; I.6.3.6; I.6.4.2
V.6.4.5.2	Road and track network within the FMU is minimised Direct link to I.6.2.1; I.6.3.1; I.6.3.2; I.6.4.6 Indirect link to I.2.1.1; V.2.1.1.9; I.2.1.7; V.2.1.7.2; V.2.1.7.4; I.2.2.5; I.6.3.3
I.6.4.6	Low *residual stand* damage Direct link to C.6.2; C.6.3; C.6.5 Indirect link to C.6.1; I.6.3.5
V.6.4.6.1	Reduced impact logging specified /implemented Direct link to I.6.2.1; V.6.3.1.1; I.6.3.2; I.6.3.5 Indirect link to I.6.3.3
V.6.4.6.2	Logging activities are suspended during periods of heavy rain Direct link to I.2.2.5; I.6.2.1; I.6.3.5; I.6.4.7
V.6.4.6.3	*Skidding* damage to the stand and soil is minimised Direct link to I.6.2.1; I.6.3.5; I.6.4.3; I.6.4.5; I.6.4.7 Indirect link to I.2.2.5; I.6.3.3

I.6.4.7	Rehabilitation of degraded and impacted forest is undertaken in accordance with a code of practice Direct link to C.6.2; C.6.3; C.6.5 Indirect link to C.6.1
I.6.4.8	Absence of significant *off-site impacts* such as on down stream water quality/quantity, infrastructure etc.
V.6.4.8.1	Number of official complaints, court cases etc.
I.6.4.9	Systems for production and transformation of forest products are efficient Direct link to C.6.2; C.6.3 Indirect link to C.6.5
V.6.4.9.1	No sawn logs remain rotting in the forest, at landings or the port Direct link to I.6.3.5; I.6.4.5
V.6.4.9.2	The volume output is maximised at each step of the wood processing chain Direct link to I.6.3.3; I.6.4.3
V.6.4.9.3	Sawmill wastes are utilised for vertically integrated units[9]
V.6.4.9.4	Recovery rates for each line of products (within the 1st and 2nd transformation) bear comparison to regional or international rates[9]
V.6.4.9.5	Wide ranges of NTFPs are effectively marketed[9] Indirect link to I.6.3.5
V.6.4.9.6	Utilisation of secondary and lower grade species
V.6.4.9.7	High use-rates of local wood processing capacity[9]
C.6.5	**An effective monitoring and control system audit's management's conformity with planning**
I.6.5.1	*Continuous Forest Inventory* (CFI) plots are established and measured regularly Direct link to C.6.3; C.6.4 Indirect link to C.6.2
I.6.5.2	Documentation and record of all forest management and forest activities are kept in forms that enable monitoring Direct link to C.6.2; C.6.4 Indirect link to C.6.3
I.6.5.3	*Worked coupes* are protected (e.g. from fire, encroachment and premature re-entry) Direct link to C.6.1; C.6.2; C.6.4 Indirect link to C.6.3

I.6.5.4	Tree marking of seed stock and potential crop trees is practised Direct link to C.6.3; C.6.4 Indirect link to C.6.2
I.6.5.5	Results derived from monitoring and research, as well as any additional scientific and technical information, are incorporated into the implementation and revision of the management plan Direct link to C.6.4 Indirect link to C.6.2; C.6.3
C.6.6	**Equitable distribution and presence of economic rent[10]**
I.6.6.1	Estimated government *rent* capture
I.6.6.2	Estimated operator (manager) *rent* capture
I.6.6.3	Estimated forest local dwellers *rent* capture

End notes

1 The criteria and indicators listed under principle (P.1) deal with issues that are largely outside the control of the local forest managers, but nonetheless have an important influence on the outcomes of management at the FMU level.

2 Not all the verifiers specified within each indicator need to be adopted, decisions depends upon the specific condition of the FMU in question.

3 The terms 'natural variation', 'critical limit', 'unlogged site', and 'undisturbed forest' are used to set baselines. If these baselines are too high then other suitable baselines can be substituted such as 'successfully regenerated forest' or 'well managed forest'.

4 These verifiers are being subjected to a program of rigorous testing by CIFOR and its collaborators. Updates on the results will be posted regularly on CIFOR's web page at URL: http://www.cgiar.org/cifor.

5 Dependant on the type of forest and management objectives.

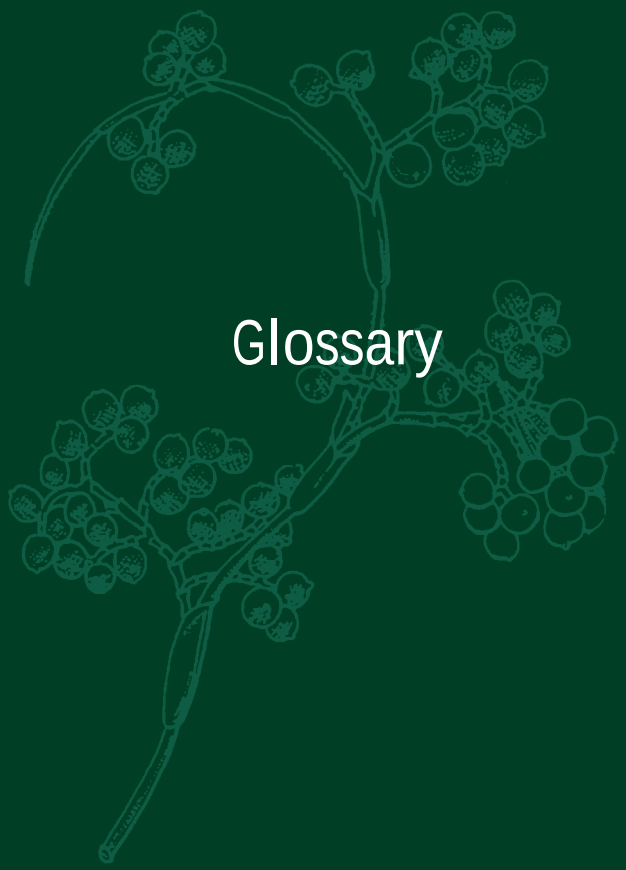
6 Legitimate comparisons can be to undisturbed forest, regional conservation criteria or management objectives that do not conflict with regional conservation interest.

7 This criterion, while important, will usually be considered for monitoring or assessment only on sites that are sensitive and/or of high biological value.

8 This principle and its associate subordinates are being subjected to a program of rigorous testing by CIFOR and its research collaborators. Updates on the results will be posted regularly on the CIFOR's web page at the URL: http://www.cgiar.org/cifor.

9 Optional, depending on local conditions such as vertical integration.

10 Criterion and its subordinate are being subjected to a program of rigorous testing by CIFOR and its research collaborators. Updates on the results will be posted regularly on CIFOR's web page at URL: http://www.cgiar.org/cifor.



Glossary

Above Ground Biomass	The biomass of all elements on the forest ground such as trees, shrubs, lianas, etc.
Age Class	Age class is defined as the classification of stands in a forest into a series of ages.
Allele	A form of gene, typically seen in pairs, one on each homologous chromosome within a diploid cells nucleus.
Aquatic organism	Fauna that reside under or on water.
Avian	Of or like birds, which are members of the class Aves.
Bees	Bees are pollinating insects belonging to the Hymenoptera family.
Biodiversity	The variability among living organisms and the ecosystem of which they are part.
Biomass	The total mass (at any given time) of one or more species per unit of space (species biomass) or of all the species in biotic community (community biomass).
Canopy Openness	The percentage area of the forest floor that is not covered by tree crown.
Chemical Composition	Chemical composition is the chemical constituents of an entity.

Community	The collection of species that inhabitat a specific site or ecosystem (with or without interaction/scale undefined)
Contagion Index	The contagion index measures the extent to which land covers/ vegetation types are clumped or aggregated.
Continuous Forest Inventory (CFI)	Continuous forest inventory is a timber sampling system that provides for periodic re-measurement of specific stands or plots to reveal the forest status and change over time.
Cover Type	Cover type refers to the form (and type) of vegetation coverage in the forest such as shrubs, trees and herbaceous plants.
Critical Limits	This term is identical with thresholds that refer to a limit below or above which sustainable forest management is unlikely to be achieved.
Customary Rights	Customary rights are rights of individuals or groups founded upon customary, long continued practices and usage.
Decay	[See Decomposition, below].
Decomposer Organism	An organism that utilises dead plant or animal material for nutrients and energy and, in the process, breaks them down both physically and chemically into simpler organic molecules. The process leads to the recycling of organic materials in the ecosystem. Decomposers include earthworms, mushrooms and other fungi, and bacteria.

Decomposition	The process by which plant and animal organic matter is physically broken down and converted into simpler chemical substances, resulting in the production of carbon dioxide, water and the release of energy.
Demography	A term referring to the study of birth rates, death rates, age distributions, and size of populations. It is a fundamental discipline within the larger field of population biology and ecology.
Dispersal	Dispersal is the movement of young organisms (usually juvenile animal or plant propagates) out of their natal area. Among many plants and smaller animals, especially invertebrates, dispersal may be within a single ecosystem, but for larger, more mobile organisms it will often involve landscape-scale movement.
Dominance	Dominance is a landscape measure of the frequency of occurrence of a single vegetation type in the landscape.
Drift	Change in gene and genotypic frequencies in small populations due to random process.
Ecosystem	Ecosystem is the biotic and abiotic components of an environment that interact to produce a flow of energy and cycling of nutrients. Ecosystems are extremely difficult to define practically, because of high variation, temporal change, and lack of discreteness.
Ecosystem Integrity	Ecosystem integrity is defined as the ability to support and maintain a balanced, integrated, adaptive biological community hav-

	ing a species composition, diversity and functional organisation comparable to that of natural habitat in the region.
Edge	The point at which dissimilar plant communities (different vegetation types, successional stages, or vegetative conditions) meet.
Enrichment Planting	Planting activity on logged areas utilising commercial species in order to increase the economic value of a forest.
Erosion	The wearing away of the land surface by running water, wind, ice, or other geographical agents, including such processes as gravitational creep.
Felling	The act or process of severing a standing tree and preparing it for extraction.
Food Chain	The hierarchy of trophic levels or feeding sequences in an ecosystem through which energy flows. Within the food chain, the organisms that are interrelated in their feeding habits feed upon organisms that are lower in the chain, and, in turn, are fed upon by organisms higher in the chain.
Forest Management Plan	Forest management plan is a base document used to describe how the forest management unit will be managed.
Forest Management Unit (FMU)	An FMU is defined as a clearly demarcated area of land covered predominantly by forests, managed to a set of explicit objectives and according to a long-term management plan.

Forest Manager	A forest manager is the person or group principally responsible for activities in the forest management unit.
Forest Regeneration cycle	The vegetation phases includes seedlings, saplings, poles and mature trees
Fractal Dimension	Fractal dimension is a landscape metric that uses parameter-to-area calculations to provide a measure of complexity of patch shape.
Formal Rights	Formal rights are rights based on international and national laws and agreements recorded in writing.
Frequency Distribution	A graphical, tabular, or mathematical representation of the manner in which the frequencies of a continuous or discrete random variable are distributed over the range of its possible values.
Frugivorous Mammals	Mammals whose diet is primarily constituted by fruit.
Gene	The basic functional unit of inheritance responsible for the heritability of particular traits.
Gene Flow	The movement of genes through or between populations as the result of out-crossing and natural selection.
Genotype	Genotype is the genetic constitution of an organism or genetic constitution for a particular trait.

Genotype Frequency	The percentage of individuals in a population that possess a specific genotype or that share a stated aspect of genotype.
Guild	A group of species or organisms which use the same environmental resources in the same way.
Habitat Diversity	Habitat diversity is the number of different types of habitats within a given area.
Hierarchical Framework	A hierarchical framework describes hierarchical levels (P, C, & I) to facilitate the formulation of a set of parameters in a consistent and coherent way. It describes the function of each level as well as the common characteristics of the parameters appearing on a particular level.
Intervention Area	The area in the forest which is affected by human activities for instance; logging activities, hunting, extracting NTPP, etc.
Invertebrate	Animal without backbones includes all animals except those in the phylum Chordata
Isolation	Absence of energy or gene flow among populations because of distances (geographic barrier). Isolation of populations may lead to genetic differences among the populations, which might lead to formulation of sub-species or new species.
Landscape	Landscape is a mosaic of habitat types occupying a spatial scale intermediate between an organism's normal home range size and its regional distribution. Landscapes are usually large areas encompassing several ecosystems or habitats, consisting of a

mosaic of forests, grasslands, agricultural areas, water bodies, and human settlements.

Local Population

Local population is defined as the current population of a specified geographic area, and includes indigenous and traditional populations, as well as populations from colonisation and spontaneous settlements.

Migration

Migration, as used in the ecological set of C&I, is the seasonal movement of animals between two areas. These movements are driven by seasonal changes in the availability of resources, particularly food, or by seasonal changes in animals' needs for different resources. Humans may also migrate, sometimes for similar reasons.

Non Timber Forest Product (NTFP)

All biological materials other than timber extracted from forests for human use. These include foods, medicines, spices, essential oils, resins, gums, latex, tannins, dyes, ornamental plants, wildlife (product and live animals), fuel-wood, and raw materials—notably, rattan, bamboo, small wood and fibres.

Norm

A norm is the reference value of an indicator and is established for use as a rule or as a basis for comparison. By comparing the norm with the actual measured value, the result demonstrates the degree of fulfilment of a criterion and of compliance with a principle.

Nutrient

Any substance that is required for the nourishment of an organism, providing a source of energy or structural components.

Off-site impacts	The effects originating from an agent of change (e.g. logging practices) that act upon systems located outside of a prescribed boundary area (e.g. FMU).
Other structural elements	Other structural elements of an ecosystem or landscape refer to shrubs, vines, grasses, geophytes, ferns and other herbs, woody and non-woody lianas, epiphytes, etc.
Out Cross	A cross, usually natural, to a plant of different genotype.
Patch	A patch is a small part of the whole landscape, which differs from its surroundings, and usually composed of a discrete areas of relatively homogeneous environmental conditions.
Patch Size	The unit area measure of the patch, normally defined as m^2, ha, etc.
Percolation Index	Percolation index is the measure of connectedness of a landscape from one edge to the other.
Permanent Forest Estate (PFE)	A permanent forest estate encompasses both public and private lands, which are kept under permanent forest cover. Included in PFE is land to be protected, land for nature conservation, and land for the production of timber and other forest products.
pH	A measure of the concentration of hydrogen ions in a solution, indicating neutrality (pH 7), acidity (less than 7), or alkalinity (greater than 7).

Phenotypic variation	The variation existing in observed traits of an organism, resulting from an interaction of its genotype and its environment.
Pole	A pole is the stage of coniferous tree development between sapling and small saw-timber.
Pollination	Pollination is the transport of pollen to the ovary. For most trees, pollination is accomplished by air currents. However, some important forest components require insect pollinators, which transport pollen more efficiently than wind.
Population	The number of organisms of the same species inhabiting the same area, that potentially interbreed and share a common gene pool.
Precautionary Principle	Precautionary principle is action undertaken to prevent possible incidences of environmental or other damage, without waiting for scientific proof of possible cause or effect of such damage.
Production Forest	Production forest refers to the area of natural and plantation forest within PFE that is designated to be managed for productive purposes in perpetuity.
Prominent Groups	An association of species which constitute the majority of a given sector. Alternatively groups that have been identified as being important for conservation in a regional conservation strategy.

Regeneration	Regeneration is defined as the renewal of a forest or stand of trees by natural or artificial means, or the stand of young trees under 1.3 meters high that results.
Rent	In forestry, economic rent is most easily understood as the difference between product values and timber harvesting cost.
Residual stand	The trees/crops of commercially valuable species or potentially commercially valuable species that remain.
Selected Avian Guild	[See Avian and Guild, previously defined]
Sexually mature individuals	Individuals within a population that are biologically able to engage in reproductive activities.
Silviculture	Silviculture is the art and science of manipulating forest stands to achieve human objectives, including the production of various goods and services. Basic concepts underlying the establishment, tending, and harvest of forest stands were established at the beginning of this century.
Silvicultural System	The process by which the crops making up the forest are tended, removed, and replaced by new crops, resulting in the production of crops of distinctive form.
Size class	Size class refers to any intervals into which a range of diameters, e.g. of tree stems or logs, may be divided for classification and use.

Skidding	Terrain transport, in which logs are dragged to the landing, rather than suspended in the air or carried on a vehicle.
Soil Conductivity	Soil conductivity reflects the concentration of total dissolved inorganic ions in soil solution. It is usually measured with a conductivity meter and expressed in μS/cm.
Soil nutrient level	The identification, through laboratory techniques utilising chemical analysis, of the concentration of nutrients existing in a soil sample.
Species richness	Species richness/abundance is the distribution of the number of species and the number of individuals of each species in a community.
Stakeholders	Stakeholders can be defined as anyone having an interest in the forest. A typical list of stakeholders includes national citizens, consumers, forest officials, small-scale entrepreneurs, and forest workers.
Stream flow	Volume of water per unit time passing a fixed point in a stream.
Tenure	Socially-defined agreements held by individuals or groups (either recognised by law or customary norms) on the rights of access and the rules for use of either a land area or associated resources, such as individual trees, plant species, water, or animals.
Traditional Rights	Rights of indigenous or traditional people which (to present) have not been considered in a national and international con-

	text or have not (yet) been recorded, and which are based on the legal system of the individual cultures.
Understorey	The trees and other woody species growing under the canopies of larger adjacent trees and other woody growth
Use Rights	Rights for the use of forest resources that can be defined by local custom, mutual agreements, or prescribed by other entities holding access rights. These rights may restrict the use of particular resources to specific levels of consumption or particular harvesting techniques.
Vertical Structure	Referred to as vertical stratification, in which plants are arranged into several layers in the canopy.
Woody Debris	Woody materials scattered about or accumulated by either natural processes or human influence.
Worked coupes	A term that refers to a specific area of land that was harvested and is now monitored by the FMU to ensure that factors such as fire, encroachment, and pre-mature entry do not disrupt the flow of services that the area provides.

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This manual provides a comprehensive set of criteria and indicators (C&I) for sustainable forest management based on CIFOR's research. This research was conducted by interdisciplinary teams of experts in large-scale natural forests managed for commercial timber production in Indonesia, Côte d'Ivoire, Brazil and Cameroon, with additional sites in Germany, Austria and USA.

The use of the term 'generic template', for these C&I is intended to prevent them being confused with an ideal and universally applicable set of C&I. In term of the scope of applicability ('generic to what?'), it is envisaged that this template to be used primarily for tropical natural forests managed for commercial purposes. Use of the term 'generic' also emphasises that the C&I in this set can be modified and customised to comply with local conditions. They could, therefore, be used both as a flexible set that is adaptable to all types of forest situations, and as an operational 'mother' set to be used by CIFOR's proposed CIMAT system (C&I Toolbox Series No. 3). 'Generic' also implies that this C&I template can be employed by a variety of user groups, such as certification bodies, government officials, donors, forest managers, project managers, and scientists.

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