Developing Criteria and Indicators of Community Managed Forests as Assessment and Learning Tools: Objectives, Methodologies and Results

Nicolette Burford de Oliveira
with Cynthia McDougall,
Bill Ritchie,
Herlina Hartanto,
Mandy Haggith and
Titiek Setyawati

CIFOR
CENTER FOR INTERNATIONAL FORESTRY RESEARCH
THE JOHN D. AND CATHERINE T. MACARTHUR FOUNDATION
IDRC CANADA
USAID

Developing Criteria and Indicators of Community Managed Forests as Assessment and Learning Tools: Objectives, Methodologies and Results

The research results of 3 field tests of Ecological, Managerial, Socio-economic Criteria and Indicators of Sustainability and Equity of Community Managed Forests, undertaken in consultation with forest communities in Central Province, Cameroon, West Kalimantan, Indonesia and Pará, Brazil

Nicolette Burford de Oliveira
with Cynthia McDougall,
Bill Ritchie,
Herlina Hartanto,
Mandy Haggith and
Titiek Setyawati

Based on the work of
Patrick Nde Shiembo, Anne Marie Tiani and Michael Vabi (Cameroonian test)
Retno Mariani, Satyawan Sunito and Gusti Muhammad Hatta (Indonesian test)
Marli Maria Mattos, Rui Murrieta and Carlos Peres (Brazil test)

CIFOR
CENTER FOR INTERNATIONAL FORESTRY RESEARCH
THE JOHN D. AND CATHERINE T. MACARTHUR FOUNDATION
IDRC CANADA
USAID

Printed by SMT Grafika Desa Putera, Indonesia

Photos by

- Brian Belcher
- Carmen Garcia
- Christian Cossalter
- Christophe Kuhn
- Manuel Ruiz Pérez
- Patrice Levang

Published by
Center for International Forestry Research
Bogor, Indonesia
Mailing address: P.O. Box 6596 JKPWB, Jakarta 10065, Indonesia
Tel.: +62 (251) 622622; Fax: +62 (251) 622100
E-mail: cifor@cgiar.org
Website: http://www.cifor.cgiar.org

with support from
The MacArthur Foundation (MAF)
The Ford Foundation (FF)
The Swiss Development Corporation (SDC)
The International Development Research Centre (IDRC)
The European Union (EU)
United States Agency for International Development (USAID)

Contents

List of Tables

List of Boxes

Acknowledgements

So many people have made valuable contributions to this report that it is not possible to mention them all individually here. We wish to express our deep gratitude for the generous spirit with which the inhabitants of the forest communities Eyek II and Akak/Bitetele (Central province, Cameroon), Bedigong and Darok (Sanggau, West Kalimantan, Indonesia) and Cachoeira do Maró and São Pedro (Santarem municipality, Pará, Brazil) participated in the testing and development of the C&I presented in this report. Those who worked especially closely with the communities, as facilitators to help them articulate and communicate their ideas to strangers, also deserve special thanks. They are Geraldine Ngum (Cameroon), Kuswandono (Indonesia) and Nice Lobata and Livaldo Silva (Brazil).

The members of the interdisciplinary teams involved in the CIFOR tests played an essential role in focusing the contents of this paper for which I am similarly grateful. They are Patrick Shiembo, Michael Vabi and Anne Marie Tiani who composed the Cameroonian team; Retno Maryani, Gusti Muhammed Hatta and Satyawan Sunito, the Indonesian team; and Marli Maria Mattos, Rui Murrieta and Carlos Peres, the Brazilian team.

We are grateful for useful comments on previous drafts of this report received from CIFOR research staff Lini Wollenberg, Ravi Prabhu, Matthew Corless and John Poulsen. Mandy Haggith and Bill Ritchie also provided very helpful suggestions for the structuring of the report and valuable insights on the C&I and methodologies discussed. Yvonne Byron deserves considerable credit for her editorial support of the whole report, as does Ani Kartikasari for her copy editing. Gideon Suharyanto designed the cover and section dividers. Rahayu Koesnadi and Phil Macoun provided endless hours of support and encouragement. Cynthia McDougall edited, coordinated and enabled the final genesis of the work.

This paper has been made possible with the institutional support of CIFOR and our site collaborators: the GTZ–Indonesian Ministry of Forestry-funded Social Forestry Development Project (Sanggau, West Kalimantan); FORDA (Bogor, Indonesia); ONADEF (Cameroon); WWF–Cameroon; the Rural Workers Union, Santarem, and Projeto Saude e Alegria, Santarem, Brazil; the assistance of all of which proved immensely valuable. Last, but not least, our thanks go the Ford Foundation, the Swiss Development Corporation, the MacArthur Foundation, the International Development Research Centre (IDRC), The US Agency for International Development (USAID) and the European Union for morally and financially supporting the C&I for Community Managed Forests research.

This report represents the views and opinions of the author(s), and has not undergone a formal CIFOR peer review process.

Executive Summary[1]

1. Developing Criteria and Indicators of Community Managed Forests as Assessment and Learning Tools

This report explores criteria and indicators (C&I) for monitoring and assessing the sustainability of community managed forests (CMFs), and offers some insights to methodological tools and conceptual approaches for C&I development. It does so by analysing and reporting on the results of tests of criteria and indicators for CMFs carried out by the Center for International Forestry Research (CIFOR) and its partner institutions in three countries between March 1997 and February 1998.

The research was initiated originally in response to the recognition of the high potential value of C&I to organisations and policy makers concerned with rural development and its integration with national policy frameworks. Equally, institutions such as forest certification bodies, which work to promote the economic viability of community forest management, also generated demand for greater understanding of C&I in community forest contexts. The research was intended to explore the potential value of C&I to forest communities, their partners and their representative organisations as a means to legitimise and enhance management, including the strengthening of control over forest resources and facilitating the equitable distribution of the costs and benefits of forest management.

The three C&I for CMF tests involved six forest communities and their partners, and were located in Central province, Cameroon, the Amazonian state of Pará, Brazil, and West Kalimantan, Indonesia.[2] Each test took approximately one month to complete, and was led by an interdisciplinary team of in-country specialists. The core teams – each made up of an ecologist, a social scientist and a forest management specialist – field tested the C&I in collaboration with community members at the test sites and partner institutions. This local involvement was an essential element of the research process. Facilitators were recruited to enable the active participation of community members in the critical appraisal of the C&I. Each field test was followed by a three-day workshop at which the emergent 'draft' C&I were subjected to a final review by a wider audience of academics, policy makers, representatives of local and national non-governmental organisations, and representatives of other forest communities. A total of 756 statements of principles, criteria, indicators and verifiers were generated by the tests: 246 in Indonesia; 218 in Cameroon; and 292 in Brazil.

The final outcomes of the research include an evaluation of C&I testing processes and C&I for CMF development methodologies, as well as an analysis of the C&I for CMF themselves. The former are introduced in this report, and elaborated in greater detail in Burford de Oliveira (1999) and Ritchie *et al.* (2000). The latter is described in depth in this report, and a practical synthesis and example are offered in Ritchie *et al.* (2000).

The comprehensive coverage of issues related to the sustainability of CMFs hopefully makes this report a valuable reference, not only for those interested in implementing C&I for

---

[1] Compiled by Nicolette Burford de Oliveira and Cynthia McDougall.

[2] The communities were: Cachoeira do Maró and São Pedro (Pará, Brazil), Akak/Bitetele and Eyek II (Central province, Cameroon) and Bedigong and Darok villages (Sanggau, West Kalimantan). We express our gratitude and recognise the lead contribution of the community members in generating the insights in this report. This work would have been impossible without their participation and contributions.

CMF, but also for a number other users and purposes. These might range from: researchers or policy makers analysing intersectoral impacts on CMFs; to practitioners assessing and developing collaborative CMF initiatives; to development planners and project managers evaluating or planning initiatives; to professors seeking guidance on incorporating community forestry into academic and technical curricula for rural development, forestry and anthropology students. This report is complemented by its two sister CIFOR reports mentioned above – one of which offers reflection on the C&I for CMF research and C&I development from the perspective of *local participation* (Burford de Oliveira 1999). The other is an initial draft of a manual or guide for *implementing CMF C&I* (Ritchie *et al*. 2000). All feedback on these reports is welcome.

2. Background on CIFOR C&I Research

From *Assessing the Sustainability of Forest Management to Adaptive Co-Management*

The C&I for CMFs research was initiated in 1997 under CIFOR's project 'Assessing the Sustainability of Forest Management'. It continues to be linked to prior and ongoing CIFOR C&I research for commercial forest management units in the newly initiated CIFOR research programme 'Local People, Devolution, and Adaptive Co-Management (ACM)**'**.

a) The starting point: developing and testing C&I for sustainable forest management in (commercial) Forest Management Units (FMUs).

This research was undertaken in response to a high demand for consistent and cost-effective C&I for assessing timber management for certification purposes. It began by developing methodologies to test the relevance and utility of some of the more widely applied existing sets of C&I for commercial timber production in natural forest areas. Five tests of pre-existing C&I were undertaken in forest management units in the Ivory Coast, Brazil, Indonesia, Austria and Germany.[3] These tests were conducted by interdisciplinary teams, involved field testing of C&I, and took approximately one month each to complete.

b) Expanding the scope: developing and testing C&I for CMFs[4]

The research on C&I for commercial forest management units revealed an inadequacy in most existing C&I sets in their evaluation of *social impacts* or *equity* issues in forest management. A strong need for greater understanding of the social dimensions of forest management by forest stakeholders and policy makers was identified in general. In addition, the specific issues of commercial forestry effects on local livelihoods, conflict of interests between commercial forest managers and local forest inhabitants, and the distribution of costs and benefits between these forest stakeholders were highlighted. In response to these needs, CIFOR's research project on 'Assessing the Sustainability of Forest Management' identified two areas of priority C&I research:

1. The development of C&I for assessing the wider significance of social relations between commercial forest management and other forest stakeholder groups, including forest communities that occur within or adjacent to forest concession areas.
2. The development and testing of C&I for community managed forests.

[3] See Prabhu *et al*. (1996).
[4] See Burford de Oliveira *et al.* (1999).

The latter of these two components is the subject of this report. (See CIFOR Criteria and Indicator Toolbox Series, Tools No. 2, 4, 5, 6, 7 & 8 for information, the C&I and methods relating to the first priority area). CIFOR expanded its focus and undertook the testing of C&I suitable for CMFs at community sites in Brazil, Cameroon and Indonesia. Like the FMU tests, these tests were conducted by interdisciplinary teams, each composed of an ecologist, a forest management specialist and a social scientist. The intention was originally for this component to provide an independent perspective of community forest management, to parallel that of forest concessions located in uninhabited areas. Needless to say, as has been found with nearly all commercial forest concessions, community managed forests rarely operate free from the influence or presence of other forest interest groups.

3. Research Objectives

The objective of the C&I for CMF tests was to develop C&I that reflect the dynamic trends determining the sustainability of the test site CMFs. Conflicting trends often operate continuously, simultaneously promoting and inhibiting sustainability. Identification of these trends is an initial step towards understanding the dynamic pressures governing sustainability. Analysis of these site-specific C&I sets (and trends) creates a basis for the identification of elements of CMF sustainability and indicators of movement towards or away from sustainability more generally. Additionally, the tests were intended to lay the preliminary groundwork for C&I for CMF development and assessment methods and tools.

The tests aimed to take into account the assessment/monitoring interests, needs and capabilities of a wide range of potential C&I for CMF users, such as diverse local forest managers (including illiterate or semi-literate forest farmers) and their representative organisations (e.g., farmers' associations, etc.), non-governmental organisations, other CMF partners (e.g., departments of forestry, donor organisations and development projects) and policy makers.

With this in mind, each test aimed to:

- Identify key issues that affect the sustainability of forest management by the community, and generate (ideally minimum) sets of principles, criteria, indicators and verifiers (P, C, I & Vs) for assessing the ecological, forest management and social dimensions of these key issues.[5] The intention was to draw on P, C, I & Vs from existing sources when possible, as well as to develop new ones as necessary.
- Examine the rationale and assumptions behind C&I selected, adapted or developed.
- Assess the extent to which the C&I developed specifically for assessing the test site can be extrapolated to CMFs in diverse geographic locations (i.e., generalizability).
- Critically review and improve the methodologies, including participatory appraisal methods, used to test and develop the C&I, and recommend methodological refinements and alternatives for future C&I for CMF development.

The participation of local community members was encouraged during various research phases to better ensure:

- accuracy of information regarding factors influencing sustainability;
- the inclusion of 'C&I' (or informal monitoring mechanisms) already used or desired by members of the community;

[5] Members of the test team were thus asked to formulate and test C&I for assessing all aspects of forest management or use represented at their test site, including those connected with hunting and fishing, non-timber forest products (NTFPs), shifting cultivation within the forest, forest service functions and the social dimensions of forest interventions.

- local peoples' critical appraisal of the C&I (i.e., contributing to the actual utility and appeal to local people as C&I users); and
- the creation of a commonly understood and appreciated vocabulary of C&I and 'sustainability reference points' (i.e., to enhance the likelihood of assessment results leading to appropriate and well-coordinated responses from the different forest actors).

The final comparative analysis of the more than 700 P, C, I & V generated by all the tests sought to:

- identify the common C&I that were proposed on all three tests; and
- consider the wider significance of the various C&I proposed (i.e., what they reveal about CMFs and sustainability, and thus the degree to which they are generalizable).

This analysis is outlined in detail in this report (see also an overview in Ritchie *et al.* 2000).

4. The Context: CMF and C&I

Communities and community managed forest systems are immensely diverse and complex. Interestingly, although they are viable systems and significant in their own right, CMFs have tended to be perceived in development planning and theory through the lenses of, or as constructs or extensions of, other natural resource or development foci. In academia, for example, the social and natural sciences are perceived as lenses through which to view CMFs. Timber, agriculture and education sectors and policies, likewise, all offer umbrellas which with to embrace CMF issues. But perspectives that look 'out onto the world from within CMFs', have historically been deemed largely irrelevant or redundant. This widespread reluctance to perceive community managed forestry as a field in its own right is evidenced, for example, by the virtual absence until recently, of community forestry as an independent subject in the curricula of tertiary forestry and rural development courses.

Over the last few decades this has gradually been changing. The traditional approach to government-assisted community development, wherein the community was cast as the passive 'recipient' of assistance, and which was designed with little local consultation, has given way to more active community participation in decision making processes. This shift has allowed community-based perspectives to emerge as foci around which development initiatives can be coordinated. Community forest management systems are similarly being found increasingly worthy of being the prime focus of applied, interdisciplinary research.

The results of the C&I for CMF tests thus add to a growing body of research articulating a new perspective and resilient framework for understanding and enhancing CMF systems. Each of the C&I sets generated by the tests represent attempts at a synthesis of issues, concepts and perspectives related to the CMF system. More importantly, the sets can be understood to 'map' an enormous and dynamic 'territory' or 'network' of internal social and biophysical pathways, junctures and leverage points of communities, as well as interfaces with the external world. The value of the understanding generated is, furthermore, enhanced by the C&I development process of pooling and integrating diverse knowledge, perspectives and disciplines.

Criteria and indicators thus offer more than a simple 'litmus test' of whether or not a CMF is sustainable. They are diagnostic tools which assist users in identifying and exploring the fundamental elements of individual (and unique) CMFs, the linkages between the internal and external elements of a CMF system, and the cause and effect relationship of these elements (and actions) to sustainability and social justice. This makes them potentially powerful problem-solving tools.

5. Methodologies: C&I Development for CMF

Many of the methodological elements used for the C&I for CMF tests were developed and tested during previous CIFOR tests of C&I for commercial timber management (Prabhu *et al.* 1996).[6] All C&I, for example, were organised into a hierarchical framework of Principles, Criteria, Indicators and Verifiers.[7] In addition, the tests were designed around an iterative process of C&I refinement, involving a four-stage 'filtering' process. The filters helped eliminate redundant, ambiguous and/or difficult or costly to apply C&I. Each filter provided a new set of opportunities for improvement as well as introducing new C&I.

The four filters used in the C&I for CMF test are identical to those employed on the earlier CIFOR tests of C&I for commercial timber management.

Filter 1. The selection of C&I from existing Base Sets (or guidelines)

For each test, the interdisciplinary team members – an ecologist, a social scientist and a forest manager – were presented with the same Base Sets or guidelines.[8] (The Base Sets varied from one test to the next – a deviation from the Phase 1 methodology). The team members *individually* selected those C&I from the Base Sets which they thought relevant to the assessment of CMFs from their own disciplinary perspective, and developed additional ones for important issues not covered by the Base Sets. It resulted in three preliminary subsets of C&I (one for each discipline: ecology, socio-economics and technical management), each organised according to the hierarchical framework outlined in Box 1.

Filter 2. Team revision of initial C& I subsets

This filter consisted of an initial interdisciplinary *team* revision of the first C&I subsets, and produced improved draft C&I sets.

Filter 3. Field testing of the C&I for CMF draft sets

C&I for CMF field testing involved formal and informal assessment by interdisciplinary team members and members of the local communities over a period of 10-14 days. Community members' active participation in C&I development and selection was enhanced in some cases by the support of trained facilitators. This filter produced the third version of C&I for CMF subsets.

Filter 4. C&I for CMF review in concluding workshop

The C&I for CMF subsets were subjected to a fourth review by participants at the concluding workshops. Participants of the workshops included local, regional and national government representatives, academics and representatives of NGOs, as well as community members from the test site. The workshop participants were asked to assess the applicability of the C&I selected to other (non-C&I test site) CMFs with which they were familiar.

---

[6] As elaborated in the Methodology (Introduction) section of this report, the need to keep a similar methodology for the purpose of later comparisons meant that the tests, although participatory, were not as community-driven as would have been ideal. The current CIFOR C&I for CMF research framework is now more able to implement a more community-driven research approach.

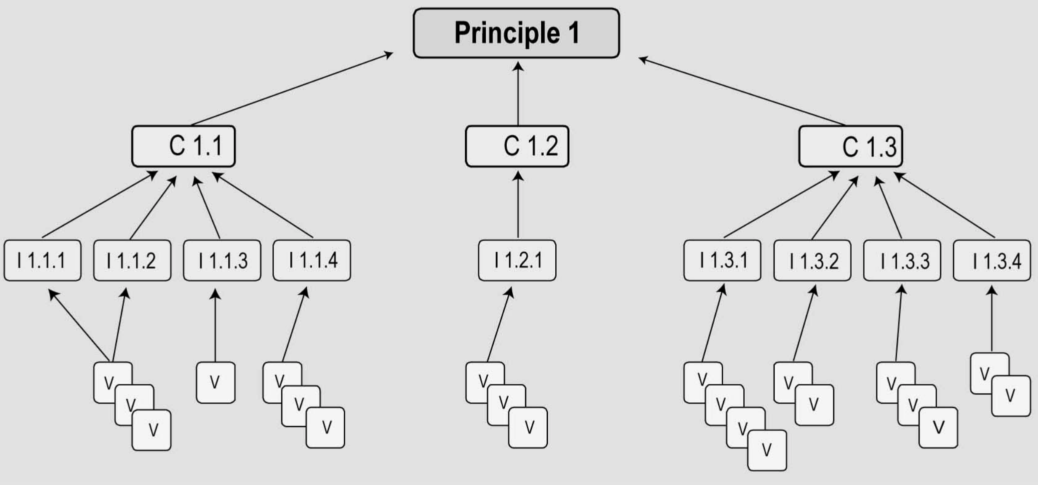
[7] Members of the research team were given the Tropenbos hierarchy (Lammerts van Bueren and Blom 1997) as a reference, as well as definitions from CIFOR and examples from other sources. Examples of the CIFOR hierarchy and definitions are available in CIFOR's reference *The CIFOR Criteria and Indicators generic template* (CIFOR C&I Team 1999).

[8] The selection of Base Sets and guidelines (which included Lammerts van Bueren and Blom 1997 as a reference for a C&I heirarchy) is presented in Annex 5 of this report.

Following the Cameroonian workshop, the Forest Management C&I subset was subjected to a final fifth review by the forest management specialist. Some of the Brazilian and Indonesian team members also made final amendments to their C&I subsets following the workshops but on a lesser scale.

In line with the objectives, the C&I development methodologies were assessed, and the contents of the final C&I sets were compared and analysed to identify commonalities and the broader significance (meaning and generalizability) of the C&I to CMF systems and monitoring. Additionally, the significance of associations or linkages between C&I (i.e., C&I 'complexes') was also examined.

Box 1: Hierarchical Structure



6. Outcomes: The C&I for CMF

Criteria and indicators reveal key points of complex scenarios; much like pixels lighting up at different points, the information and knowledge they provide gradually 'fill the space of the unknown' in a CMF context. The emerging image is one that constantly changes, reflecting a changing reality. The C&I generated from the field tests therefore cannot possibly cover all aspects affecting sustainability and social equity for all CMFs for all time. Their cautious comparison however does reveal themes and patterns of significance.

Provided below is a very brief synopsis of some of the key issues which emerged.

Ecology C&I

C&I on ***ecosystem integrity, biodiversity, watershed management, hunting, forest structure*** and ***natural regeneration*** were developed by all the test teams. ***Soil considerations*** and the ***protection of endangered species*** are stressed most by the Indonesian ecology subset. The Cameroonian ecology subset includes detail on ***hunting strategies*** and the ***impact of agricultural systems*** (including pest management methods) on forest sustainability. Its address of the forest-related ***psychological and physical well-being of the human population*** is perhaps broadest, extending into forest provisions for cultural and aesthetic uses. Additionally it includes quite a large number of C&I for evaluating ***local fishing practices*** which, at the Cameroonian test site, are of marked economic significance, especially to women.

The largest number of C&I on ***fishing*** is, however, to be found in the Brazilian ecology and forest management sets. ***Hunting*** is covered in most detail by the Brazilian ecology set; this coverage also differs from the Cameroonian approach in that the former dwells on quantification while the latter emphasises methods and processes. The Brazilian ecology set also includes a comparatively large number of C&I to investigate ***forest fragmentation patterns and processes***, ***water quality*** and ***the conservation role of forest reserves***.

The ***causes and incidence of forest fires*** are substantially elaborated upon by the Brazilian ecology and the Indonesian and Brazilian management subsets. Complexes of C&I for the assessment of ***local NTFP harvesting and processing methods*** occur in the Cameroonian and Brazilian ecology and forest management subsets, and in the Indonesian management subset.

Forest Management C&I

C&I of ***sustained yield harvesting strategies*** occur in all the management subsets. The most explicit references to ***matching management methods with resource capacity*** appear in the Brazilian and Indonesian management subsets (the former examines it via the issue of zoning). The Indonesian management C&I highlight ***locally employed forest technologies***, a topic approached from a complementary angle by the accompanying social subset. References to technologies are comparatively weak in the other country sets. The Indonesian management subset also provides the most detailed C&I of ***agroforestry***, presumably because of the widely recognised economic importance of the tembawang and rubber gardens at the test site communities.

The Brazilian and the Cameroonian management subsets give prominence to the ***assessment of destructive extraction methods***. Setting the Cameroonian management subset apart is a C&I complex on the ***integration of diverse forest-dependent economic activities***. This subset also includes C&I on ***demographic trends*** and ***forest conversion to agriculture***, as well as a number for ***assessing the significance of agricultural systems to forest and biodiversity conservation***. These issues are addressed from slightly different angles by the Cameroonian ecology subset. The Indonesian management C&I make no reference to natural forest conversion, but inquire into the ***conversion of agroforests to agriculture***. Both the Brazilian and the Cameroonian management subsets provide various C&I on the ***timing and frequency of forest interventions and harvesting activities.***

Several C&I about ***forest product marketing*** and ***forest farmer cooperatives*** appear in the Brazilian management subset, as does a complex of C&I for assessing ***community forest monitoring and patrol activities***. These latter issues are also partially addressed by some of the Cameroonian management C&I about ***community resistance*** to the appropriation of their forest resources by external interest groups.

Compared to the other management subsets, the Brazilian one places special emphasis on the ***evaluation of timber management***, including C&I on issues such as ***cutting cycles, directional felling, height of tree stumps, liberation treatments*** and ***forest roads***. It stresses evaluating management strategies in terms of their ***financial implications***. This contrasts with several of the Indonesian management C&I which give more explicit priority to ***ecological considerations*** in the assessment of timber extraction. Comparison of the Brazilian and Cameroonian management subsets reveals another dichotomy – the content of the former implies a focus on ***market integration***, while the latter centres on ***the stability of a more closed, traditional economic system*** based more on reciprocal transactions.

Social C&I

All the social subsets contain C&I on ***security of land tenure and usufruct rights, forest resource access***, ***decision making processes*** and ***conflict resolution mechanisms***, as well as C&I that either directly or indirectly address ***forest management cost-benefit distribution patterns***. The Brazilian and, to a lesser extent, the Indonesian social subsets include C&I that explicitly relate to ***communally owned resources***. All the social subsets direct inquiry into ***the significance of local knowledge systems to current forest management methods*** by including numerous references to the ***reproduction and evolution of knowledge***. Most of the Indonesian social C&I on knowledge relate more to the ***quantity and content of formal education***. They aim to explore whether, and how, formal education aids the reproduction and evolution of traditional knowledge systems – a critical line of inquiry in light of the rate at which traditional practices and knowledge are being sidelined with the introduction of new ideas and technologies.

The Brazilian social C&I on ***workers' rights, working conditions*** and ***employment relations*** provide a good complement to the Brazilian management C&I on ***market integration***. They embrace the ***history of labour allocation*** as well as ***relations with external actors, labour legislation*** and ***slave labour***. No direct mention of these issues occurs in any of the other subsets. The Brazilian social C&I on ***community political organisation*** also represent a focus not found in any other set. It is among the Brazilian social C&I that we find the most explicit references to ***forest dependence*** (direct and indirect), including issues as diverse as ***family planning***, ***food consumption patterns, the protection of cultural heritage sites*** and ***the transmission of traditional knowledge***. Many of these issues are dealt with by the other countries' sets, but in different C&I contexts, or 'complexes'.

The ***compatibility of state laws and policies with local management strategies and controls*** is most thoroughly explored by the Cameroonian social C&I. Some C&I in the Indonesian and Brazilian social subsets do, however, concern similar matters, e.g.***, how government policies relate to local forms of land use*** and ***community participation in the planning of government-supported development programmes***.

C&I on Community Participation

The Indonesian C&I contains the most detailed and explicit references to ***assessing the participation of community members in local affairs and politics and in government community development initiatives***. However, several statements relating to ***collective action*** and ***collaboration between community members*** occur in the Cameroonian social and forest management subsets. In addition, the Brazilian social subset includes some C&I on ***community participation in the planning and monitoring of management interventions***. All the country sets include several C&I that refer to ***diverse groups' participation***, e.g., groups (or 'categories') defined according to interests, age or gender. In contrast, only very few statements single out a particular interest or minority group, and nearly all of those that do so focus on women's participation in debates. This explicit recognition of women (in contrast to general reference to other forms of diversity) created some concern regarding the sets' ability to capture the interests and special needs of other minority, oppressed or poorly represented groups or categories of people within the communities.

7. Observations: C&I development and application, and the role of local knowledge

The C&I for CMF tests generated some key insights about C&I for CMF development and application, as well as about the role of local knowledge in the development of C&I.

7.1 Lessons about C&I for CMF development and application

The C&I for CMF tests aimed to both develop C&I for CMF 'prototypes' in each community (i.e., a *minimum* set of C&I necessary to assess the overall sustainability of the CMF site),[9] and to contribute to the development of a 'generic'[10] C&I for CMF set if possible and desirable.

---

[9] To satisfy the 'minimum' requirement, only those C&I that are the most relevant, powerful, easy to use and cost effective qualify.

[10] The term 'generic' should not be understood to imply a characteristic of 'blanket applicability without modification'. In CIFOR usage, a 'generic' set of C&I is meant to provide a base, or skeleton, C&I framework that is modified to suit each local circumstance. This also applies to the CIFOR C&I Generic Template for Forest Management Units (CIFOR C&I Team 1999).

Such a set was envisioned as providing a basis for comparable, and yet site relevant, assessments of sustainability across different CMF sites. This goal was heavily debated on all three tests.

A number of lessons relating to these aims and other C&I issues were learned and/or confirmed by the test experiences and discussions.

1) There is some degree of generalizability in C&I for CMF sustainability

Comparative analysis of the C&I for CMF across sites indicated that some types of C&I do have generalizable relevance (across *geographical* and *time* scales). Critical, however, is the fact that this is not consistently true for all C&I (or C&I types). Many *descriptive* indicators, for example, are likely to be of wider geographic relevance than are *prescriptive* indicators. Clearly, the pervasiveness of certain CMF elements or phenomena (e.g., NTFP use) is a key determinant of the degree to which it is 'generically' applicable. However this issue is not straightforward or easily addressed. Large aggregate indicators (that may obscure contributory factors) may *appear* generic, because the variation at lower levels of aggregation is overlooked, yet they are not truly generalizable. These observations are further considered in the Discussion section of this report.

2) C&I sets need to be tailored to their users: perspectives & 'complexes'

The field test methodologies of the C&I for CMF were based on the earlier CIFOR C&I for FMU methodologies. This meant that although the tests incorporated a participatory element to the tests, they still inherited the 'expert-based teams' backbone of the earlier approach. While this provided the necessary 'scientific' perspectives on sustainability, it also introduced certain biases in perspective and C&I organisation (or C&I 'complexes'). The basic organisation of C&I along the lines of traditional academic or scientific disciplines (i.e., ecology, social and forest management), is incompatible with the earlier allusion to the need to 'look out on the world from within CMFs', rather than imposing external perspectives. While the research constraints necessitated this approach, actual C&I for CMF development and application by communities or communities and partners does not. In these circumstances, organising the C&I into 'complexes' that reflect internal CMF realities is an important foundation of practical and useful monitoring systems. (see Ritchie *et al.* 2000, for examples of community-based organisation of C&I 'complexes', using the C&I generated in these CIFOR tests.)

3) C&I need to be tailored to their users: content and collection

The contents of a minimum set of C&I needs to be tailored to each new site. A 'generic' set of C&I is a powerful starting point, and a tool to enhance the utility, breadth and meaning of a monitoring system – not a 'ready to go', 'off the shelf' C&I set for all sites. The C&I need to be adapted to the *local social and biophysical context*. Equally, the 'ideal mix' of C&I would necessarily reflect the information needs and data collection abilities of the C&I user group at that site. An indicator that is powerful and cheap to use in the hands of an ecologist, may be useless to the forest farmer who lacks the technology or tools for collection. Some relatively 'weak scientific' indicators may be desirable because they fit readily into regular farmer activities and collectively provide sound, and understood, information. Because farmers can use and measure the indicators, they can contribute more to local management and empowerment than perhaps could more 'scientifically informative' C&I.

4) Local ownership of the C&I is key

Points 2 and 3 above underscore another fundamental, yet potentially misunderstood or overlooked key issue. Underlying these points is the fact that the 'users' of the C&I sets themselves necessarily need to play a key role in the C&I development process. Other stakeholders may support, or even catalyse this process, but if the 'users' (i.e., in the test cases, communities) do not have a strong sense of ownership over the development process then successful implementation is extremely unlikely.

5) C&I sets themselves will evolve and improve over time

Beyond changes in local circumstances and influences, C&I development and monitoring involve experimental processes and generate incremental knowledge (both about a situation and about *how to understand* a situation). The shared learning involved in developing and applying C&I will itself demand an evolutionary adjustment and improvement in the C&I sets over time. This, again, acts as a reminder that a generic (or in the case of the test sites, a 'minimum prototype') set of C&I would always need to be adapted – not only geographically, but also temporally.

7.2 Observations relating to local knowledge

A few key points observed related to C&I and the role of local knowledge. These include:

- The more knowledge that exists on a variable, the easier it becomes to identify the most powerful, easy and cheap to use indicators for the capture of its relevance to sustainability. Local people usually possess a great deal more knowledge about the local resource base, community natural resource rules and regulations, etc., than do outsiders. This makes local knowledge essential to development of useful C&I.
- C&I that reflect local knowledge are more likely to be understood by the local community. This is of fundamental importance if local forest farmers/managers are to be the users (and beneficiaries) of the C&I.
- If non-local actors (e.g., policy makers, academics, etc.) use or attempt to develop C&I whose meaning is not locally understood, then transparency is reduced and a mistrust by local people can result. This can potentially diminish local interest and cooperation, and thus ultimately reduce the reliability of results and attainment of C&I-related objectives.

Furthermore, the following insights emerged regarding knowledge and local vulnerability:

- While holding vast knowledge on some issues, local people in all sites appeared to lack extensive knowledge on:
  - natural phenomena that are not visible or easily observed. These include aspects of natural processes that are otherwise familiar to local people.
  - the delayed consequences of new developments, e.g., commercial exploitation by outsiders. Being without precedent, consequences are often unanticipated, unless there is another source of information.
  - the full nature of their external context, i.e., outside factors such as economic and social policies or regional/national political interests, that influence community affairs. Local people's capacity to respond constructively to change is restricted by the extent to which they perceive and understand the external origins of some local experiences.
- The knowledge deficits (described above) can severely handicap the effects of local community endeavours to negotiate with outside interest groups. As information relates to power, these knowledge deficits can endanger access of forest communities to benefits and control over resources. Experiences in the C&I test communities, and those known to them, reflect impoverishment, disempowerment and demoralisation related to trends of resource appropriation from outside communities, which evolved in contexts of informational disequilibrium.

8. Applications and directions for future research

This research is part of a larger learning process. It is not 'complete', nor does it present an undisputable 'truth' about CMFs and C&I. Undoubtedly there are gaps that need further research and there are certainly issues in which alternative explanations and/or reasoning exist beyond what is included here. Our hope is that, nonetheless, the report is successful in highlighting a range of issues and relationships, as well as relevant C&I, which will be useful in engendering further learning, and in the practical application of C&I in CMFs.

In terms of immediate application, community-based groups and partners might consider adapting one of the generated C&I sets included here, and/or select C&I from the three sets, as part of their own assessment process. This report should provide some in-depth insights, background and hopefully wisdom on many key CMF issues for this type of practical application. Additionally, this report is complemented by its sister research report on *Participation in C&I Processes* (Burford de Oliveira 1999). The third publication in this set is a manual or *Guide to Developing and Implementing C&I for CMF Monitoring Systems*. It draws from and synthesises the research experience to date, to outline possible strategies and C&I for CMF 'complexes' for participatory monitoring of CMFs.

This phase of the research also highlighted a number of other priority research areas and ideas. Further field research is needed to clarify, refine understanding, and enhance the generalizability of the C&I for CMF generated. At a very practical level, more work is needed on the C&I produced from this research in terms of adapting language[11] and the organisation of the C&I complexes (i.e., shifting from a disciplinary perspective to more a community-based perspective on organisation), as well as identifying and filling in gaps that exist in the C&I. This work is already under way at CIFOR in the exploration and participatory action research application of frameworks of C&I for CMF. These C&I sets may be drawn from the field test sets, but they will move away from organization along disciplinary lines, and they will be intended for adaptation to local contexts by local users.

At a more conceptual level, more field research and accompanying analysis is needed to further the understanding of the conditions under which C&I are relevant and informative. This will help pave the way for simpler and more efficient application of C&I by users, by informing both C&I base sets themselves and adaptation methodologies. Another important avenue for possible future research is to further investigate the merits of different conceptual perspectives or frameworks for organising complexes of C&I in order to accurately reflect local perceptions. As has been initiated in the CIFOR draft C&I for CMF manual (Ritchie *et al.* 2000), developing complexes of interdisciplinary C&I around selected local themes might be a more useful approach than separating issues into disciplinary C&I subsets, as was done in these tests. This could be explored through participatory action research initiatives in communities.

Finally, the research increased awareness of how C&I development methods and applications can create opportunities for shared learning between and within stakeholder groups (see also Burford de Oliveira 1999). Our preliminary research results indicate the powerful nature of processes that pool diverse knowledge bases such as local and traditional wisdom held by communities with 'scientific' and/or other stakeholder knowledge. Such knowledge-sharing processes may not only exchange knowledge, but contain scope for the creation of new knowledge through cross-fertilisation of the wisdom contributed by different groups. The potential role for C&I as a tool in creating constructive dialogue, and ultimately collaboration, among stakeholders needs further investigation.

[11] A limitation of the C&I for CMFs tests has been the academic bias of the C&I developed and the academic reporting style used. In their present form of presentation, the results of the tests are inaccessible to the vast majority of forest inhabitants in the tropics.

References (Executive Summary only)

Burford de Oliveira, N. 1999. Community participation in developing and applying Criteria and Indicators of sustainable and equitable forest management. CIFOR Project Report. CIFOR, Bogor, Indonesia.

CIFOR C&I Team. 1999. The CIFOR Criteria and Indicators generic template. Criteria & Indicators Toolbox Series No. 2. CIFOR, Bogor, Indonesia.

Lammerts van Bueren, E.M. and Blom, E. 1997. Hierarchical framework for the formulation of sustainable forest management standards. Principles, Criteria and Indicators. The Tropenbos Foundation, Wageningen, the Netherlands.

Prabhu, R., Colfer, C.J.P., Venakateswarlu, P., Tan, L.T., Soekmadi, R. and Wollenberg, E. 1996. Testing Criteria and Indicators for the sustainable management of forests: Phase 1 Final Report. CIFOR Special Publication. CIFOR, Bogor, Indonesia.

Ritchie, B., McDougall, C., Haggith., M. and Burford de Oliveira, N. 2000. Criteria and Indicators of sustainability in community managed forest landscapes : An introductory guide. CIFOR, Bogor, Indonesia.

SECTION I

INTRODUCTION

Chapter 1.
Introduction: Testing and Developing Criteria and Indicators for Community Managed Forests

SECTION I

INTRODUCTION

Chapter 1.
Introduction: Testing and Developing Criteria and Indicators for Community Managed Forests

Chapter 1.
Introduction: Testing and Developing Criteria and Indicators for Community Managed Forests[1]

1.1 Research Overview

This report presents and discusses in depth the results of three tests of Criteria and Indicators (C&I) for assessing the social, ecological and management aspects of Community Managed Forests (CMF) undertaken by CIFOR and partners. The tests, conducted between March 1997 and February 1998, focused on six forest communities located in Central Cameroon, Indonesia (West Kalimantan) and the Brazilian Amazonian State of Pará, respectively (henceforth be referred to as the 'test sites')[2].

The C&I for CMF tests aimed to identify C&I that could be used by various forest interest groups, including forest communities themselves, to assess the sustainability of forest resources and management at the test and other CMF sites. C&I included those for the assessment of ecosystem health, technical forest interventions, and the distribution of costs and benefits associated with CMF. Special efforts were made to encourage the participation of the forest community at each test site, in order to ground the C&I sets in local realities. As a result of this kind of exchange between local peoples, researchers and others, the C&I testing and development processes helped different forest stakeholder groups better understand how their respective ideas and interests interrelate. Furthermore, this led to the development of more diverse C&I, and C&I that are more widely acceptable because they match the needs and user capabilities of different interest groups.

C&I which are understood and accepted by local communities can be used by them to monitor their own performance as natural resource managers, make better decisions about future courses of action, and effectively communicate the local impact of forest-related policies, laws and projects. Through participation in C&I development and implementation processes, a commonly understood vocabulary of C&I and reference points may be agreed within and amongst groups of stakeholders. This may help ensure that the results of on-going monitoring or assessment produce appropriate, coordinated responses from the different forest actors to the changing patterns of resource use and conditions.

Each test lasted approximately one month and was undertaken by an interdisciplinary team consisting of a social scientist, an ecologist and a forest management specialist in consultation with the local forest community[3]. The teams were all composed of in-country scientists. Each test included 10-14 days of field checking C&I at the test sites to verify their relevance to local conditions. Each test ended with a workshop where the proposed C&I were reviewed by an audience of government policy makers, academics, residents of other forest communities, and NGO representatives. In total, the tests generated 756 statements of principles, criteria, indicators and verifiers; 246 in Indonesia, 218 in Cameroon and 292 in Brazil.

---

[1] This chapter written by N. Burford de Oliveira

[2] The communities were: Cachoeira do Maro and São Pedro (Pará, Brazil), Akak/Bitetele and Eyek II (Central Province Cameroon), and Bedigong and Darok villages (Sanggau, West Kalimantan). We express our gratitude and recognise the lead contribution of the community members in generating the insights in this report. This work would have been impossible without their participation and contributions.

[3] On the Brazilian test, an anthropologist was appointed instead of a social scientist.

These tests were part of Phase II of CIFOR's project 'Assessing the Sustainability of Forest Management'. Phase I of this project was concerned with the development of methodologies to test the utility and applicability of some of the more widely applied existing C&I sets developed for timber production in natural forest areas (Prabhu *et al.* 1996). In Phase II the focus was extended to testing and developing C&I for the sustainability of other forest management types including plantation and community forest management.

This report outlines the research and tests' objectives and the methodologies used to achieve them. We present and discuss the results of our comparative analysis of the methodologies and C&I tested and developed at the three sites, as well as our main observations about the participation of the local population in the processes involved. We share some of our ideas on methodological adaptations and additions that could assist community participants play a more leading role in C&I development in the future. Additionally, we look into some possibilities for different user groups to adapt and/or apply the tested C&I and methodologies.

1.2 The Need for Community Managed Forest Monitoring and Assessment

Sustainability of CMF and non-timber forest product (NTFP) production systems is commonly challenged by a multiplicity of factors.[4] Many of these challenges should be understood in the context of rapid and new patterns of change over the past few decades causing the destabilisation of an increasing number of traditional forest communities. The natural resource use systems of many of these communities had apparently previously evolved into 'equilibrium' states, which were flexible enough to respond satisfactorily to slow and gradual change.[5] Furthermore, pressure on renewable resources tended to be partly checked by high human mortality rates, leading to low population growth. In most cases, pressure was also mitigated by splinter groups establishing new communities elsewhere, or by a transhuman or nomadic lifestyles. The sustainability of surviving forest communities, however, is rapidly and increasingly threatened by factors including population growth, a growing demand for agricultural land and forest products, and/or the incursion of mining and commercial timber logging.

This situation has turned attention to how local people may secure a satisfactory standard of living and yet maintain a healthy environment through the rational use, management and protection of forest resources. In order to do so, they (and other actors such as the state) need to be able to accurately assess CMF trends and conditions, and the phenomena affecting sustainability. This type of assessment has historically, however, been costly and difficult to implement because of the complexity of the methodologies. This all pointed to the need to devise affordable and effective approaches and tools that can facilitate, systematise and reduce the cost of:

- assessing factors contributing to the positive attributes of CMF systems;
- elucidating the nature of the challenges to CMF sustainability; and
- exploring how, and with what degree of success, communities set about overcoming these challenges over time.

By undertaking the above, CMF monitoring and assessment (C&I) may facilitate the channelling of support to management methods, circumstances, trends and attitudes conducive to sustainability. How this may occur at the community level is evident, through improving local understanding and feedback to management. It may also create opportunities for dialogue amongst

---

[4] These challenges not only complicate management, but also CMF certification as well.

[5] Most hunter gatherer forest communities it appears however, depended for their survival on at least some exchange with other groups including agriculturalists and/or traders (Hart & Hart 1986, Headland 1987).

collaborative or neighbouring managers and enhance sustainability this way. It is equally relevant however at the level of policy. Policy makers and legislators can only create laws and policies to secure conditions positively associated with sustainable CMF systems to the extent to which they are aware of such conditions. Where the needs of traditional sustainable resource use systems has been lost, or the importance eclipsed by change, clearly and logically framed information and knowledge about their state of transformation is important to ensure that change is not inappropriately imposed from above, but that it progresses smoothly, departing from the experience of local people.

The decision to conduct research on C&I for CMF arose in response to a growing interest in:

- the importance of the role of traditional/indigenous forest management in forest conservation;
- the fragile position of local peoples in a changing global environment;
- the trend of devolution of forest management responsibilities to local communities; and
- the prospects for enhancing forest management and local livelihoods by certifying CMF and CMF products (timber and non-timber forest products [NTFPs]).

Several of the organisations that spearheaded the development of commercial timber and forest management certification (such as the Forest Stewardship Council and the Rain Forest Alliance's Smart Wood programme) are now showing an increasing interest in expanding into the development of certification for CMF systems. A number of major research initiatives relating to CMF assessment have been recently launched, by the FAO, WWF and the IIED, amongst other organisations (see Markopoulos, 1998 and 1999, and DAI, 1998). This research report, while unique in its experience and insights, aims to complement these other initiatives.

1.3 Research Goals and Objectives

There exist normally many conflicting trends that operate continuously to simultaneously promote and inhibit sustainability. The overall **goal** of this research was to address this dynamic and complex situation by enabling the improvement of stakeholders' understanding of sustainable CMF and their ability to create policy and/or manage (or support management) sustainably at the community level. The more specific **objectives** of the research was to develop C&I that would capture these overall dynamic trends at the test sites, and identify movements towards or away from sustainability. As explained later, the tests then expanded from these original objectives to also explore methodologies, issues of participation, and the potential role of C&I as a communication tool.[6]

With this in mind, at the site level, each specific C&I test aimed to:

- identify key issues that affect the sustainability of forest management by the community, and compile three reference subsets of principles, criteria, indicators and verifiers (P, C, I & Vs) for assessing the ecological, management and social dimensions of these issues;
- examine the rationale and assumptions behind the C&I selected, adapted or developed;
- assess the extent to which the C&I developed specifically for assessing the test site can be extrapolated to CMFs in diverse geographic locations (i.e., generalizability); and

[6] These are outlined in the CIFOR research publications by Burford de Oliveira (1999) and Ritchie *et al.* (2000).

- critically review and improve the methodologies, including participatory appraisal methods, used to test and develop C&I and recommend methodological refinements and alternatives that can further facilitate interactive community participation in developing and applying C&I for CMF.

The definitions of P, C, I & V and the conceptual hierarchical framework used are outlined in Box 1.1 The intention was to include P, C, I & V from existing sources when possible, as well as to develop new ones as necessary, keeping in mind the ultimate goal of C&I which might be applicable to diverse CMF scenarios. Each test was initially intended to generate the 'minimum' number of C&I needed to assess the sustainability of CMF, however this proved challenging. The C&I developed were intended to match the assessment and monitoring needs and capabilities of a wide range of interest groups, including forest managers (in this case, mostly forest farmers many of whom are illiterate or semi-literate), project planners and policy makers.[7]

Within the site level tests (including workshops), the participation of local community members was strongly encouraged on many levels to better ensure:

- the capture of important local information on factors influencing conditions or trends that support or oppose sustainability;
- the inclusion of monitoring processes or criteria already used or created by members of the community;
- local people's participation in a critical appraisal of the C&I (enhanced transparency may result in more widely accepted and, hence, more useful C&I); and
- the creation of a commonly understood and appreciated vocabulary of C&I, and sustainability 'reference points', to enhance the likelihood of assessment results leading to appropriate and well coordinated responses from different forest actors to changing patterns of forest resource use and conditions.

In order to meet the overall research objectives and goal, the comparative analysis of the more than 700 P, C, I & V generated by the site specific C&I tests sought to:

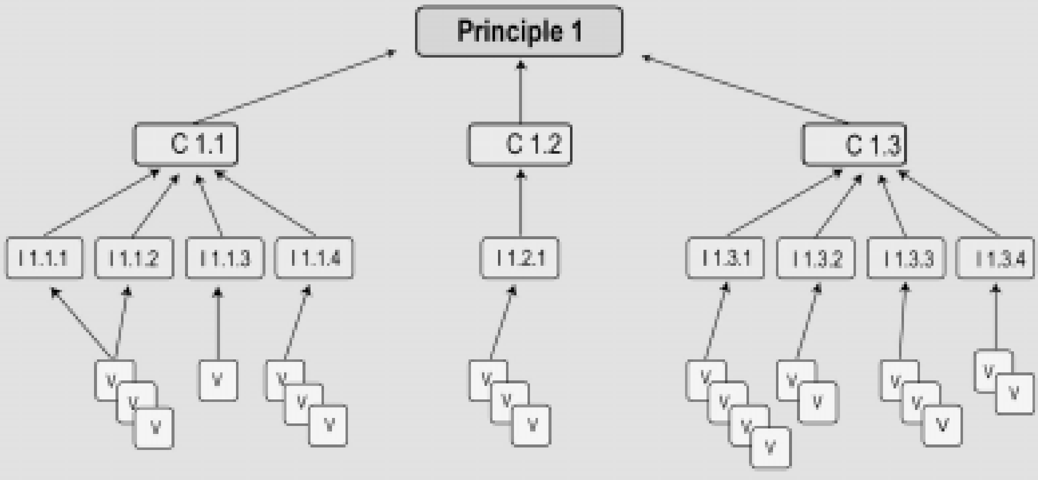
- identify the common C&I that were proposed on all three tests; and
- consider the wider significance of the various C&I proposed (i.e., what they reveal about CMFs and sustainability, and thus the degree to which they are generalizable).

Some groups that we believe will find the results of this research initiative useful include:

- Forest communities and their representative organisations
- NGOs concerned with community forestry and/or rural development
- Government forestry, land use and conservation departments
- Policy makers and legislators
- Education specialists/practitioners (in teaching professions or curriculum development)
- Certification bodies
- Project planners, coordinators, and donor organisations
- Forestry research institutions.

[7] Despite this goal, the strong presence of scientists in the team may have biased the emergent C&I towards C&I that are more appropriate to their assessment needs than that of local peoples. This is explored in the analysis, and attempted to be redressed in the C&I for CMF Guide based on this work (see Ritchie *et al.* 2000).

Box 1.1 Definitions Used during the C&I Tests for Community Managed Forests[8]



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

[8] These are the definitions which were used by members of the test teams, and were the basis for definitions used with communities. For slightly simpler definitions, see Ritchie *et al.* (2000).

1.4 C&I for CMF Monitoring in Brief

C&I can be used to generate baseline information and to monitor change. Baseline information is an essential point of departure for monitoring the future impact of management and distribution strategies. Both baseline information and information obtained through monitoring can be applied to decision making and planning processes. Below, a brief outline is given of the uses of baseline information, of C&I and monitoring, and of community participation in C&I monitoring.

Baseline information

C&I-guided assessments can generate baseline information about the existing situation and its contributing factors. Some of this information will be historical and will improve understanding of the trends out of which current circumstances evolved. Historical insights can also increase appreciation of factors that, within the local context, are relatively stable or have contributed to the maintenance of stable states. Baseline data facilitates drawing some conclusions on the social and ecological acceptability of conditions and circumstances in later periods. It can help make basic comparisons between situations of different sites and their respective prospects. Often it is possible to recognise from baseline information alone how a reorientation of resources or the introduction of new technologies has affected or could affect sustainability.

Monitoring

C&I are useful monitoring tools. Monitoring, where assessments are made at predetermined intervals, is critical for adapting management practice, policies and educational programmes to community needs in ways that allow continuing integrity or rehabilitation of the natural resource base. It can reveal policy impacts and changes in indigenous authoritative control over forest management. From monitoring results, adaptations can be decided upon to raise performance standards to the requirements for the certification of CMF products.

From a practical perspective, C&I can assist monitoring by:

- providing information on what needs to be monitored;
- organising and simplifying monitoring procedures; and
- providing a framework for participatory monitoring which leads to knowledge exchange, joint learning and knowledge development.

The quality and usefulness of assessment results depends on the quality of the procedures and tools used to generate them. Using C&I that have been verified as unambiguous, clearly relevant to the assessment objective and easy to evaluate, increases the likelihood of accurate, easy to interpret results. However, many indicator values only become meaningful if threshold levels or standards against which to judge them exist. Where such standards are missing, C&I can identify the need for their development.

Community participation in monitoring

If communities are fully involved in designing and implementing monitoring schemes and applying the information obtained to decision making, than there is a greater chance that monitoring will enable them to evolve:

- traditional best management practices; and
- more equitable social processes for distributing forest resource management costs and benefits among community members.

Furthermore, both local traditional and scientific knowledge is needed to adequately understand which factors interact and how to determine the sustainability of forest management. Traditional environmental knowledge often encompasses a deep awareness of the causes or conditions associated with trends affecting sustainability. For instance, the ecological buffering capacity of a traditional forest exploitation range may be best understood within a user community that has the benefit of hindsight. Local knowledge, in such cases, is of critical relevance to assessment processes, and should therefore itself be the object of some evaluation during the C&I development phase.

Finally, participatory monitoring also promotes the communication of results (either within the community, or between the community and other stakeholders if it is collaborative monitoring). This opens the way for subsequent coordination of participants' diverse activities in response to the results of monitoring.

1.5 Selection of Test Sites

The criteria used for test site selection in effect determined those management objectives for which C&I would be developed. The criteria therefore also partly determined the future users and applications of the C&I tested and developed.

Broad site selection criteria were chosen to maximise the likelihood of detecting general similarities between sites and yet allow the distinctive features of specific sites to be recognised. The option of focusing on community-directed commercial timber management in natural forest was considered during the early planning stages. This was dismissed because of a lack of representative sites available in the test countries. While several cases were found of communities planning timber management activities, usually with some NGO support, they were not operational. As this made the critical component of field testing C&I impossible, they did not suit the purposes of the tests.

The final criteria used to select the sites were that the community was:

- located in the lowland tropical rainforest zone;
- highly forest-dependent;
- engaged in natural forest management (formally or informally), and possibly other forms of forest management;
- in terms of presence and/or time of occupation, easily regarded as being the major stakeholder in what it considers to be its forest resources;
- still in possession of strong traditions that have 'stood the test of time';
- perceiving relatively light threats to its forest resource base; and
- developing its organisational capacity to counter perceived threats to forest access.

Thus, the major focus was on traditional methods of community forest management in areas where outside interference is currently minimal. However, there was considerable evidence of recent outside logging concerns operating in forest at the Brazilian and Indonesian test sites. In the Brazilian case, the outside party was a large commercial timber company that had constructed a timber mill adjacent to the São Pedro community (one of the test site communities) and ran most of its operations with imported labour. The company had left the community some months before the test took place, allegedly at the community's insistence. At the Indonesian test site of Darok, a small group of Chinese coffin makers had been buying up the community's stocks of ironwood (*Eusideroxylon zwageri*) over the last few years. They had also been expelled by the community some months before the test took place.

The emphasis on local forest interventions led to the formulation of C&I able to clarify the strengths and weaknesses of evolving traditional management systems. Such C&I could supply critical information to forest management monitoring or decision making processes whether these be undertaken by community forest managers, policy makers or other influential interest groups. In originally opting for sites outside official logging concessions we sought to avoid the complicated task of differentiating between the causes of impacts attributable to the forest community and those associated with external third parties. In fact, the problem of differentiating between what lies within and beyond the community's control, *vis-à-vis* the impact of forest interventions, was faced on all tests. However, we believe the problem was minimised because our site selection criteria centred the tests on sites where the local, traditional community continues to consider itself to be the main forest stakeholder group.

In each region two communities were selected to form the test site. For each test, the two communities comprising the site belonged to the same ethnic group, used similar methods of resource exploitation and, although not always neighbours, were known to each other (see Box 1.2 for further details of the test sites).

Involving two communities per site made it easier to take into account several intercommunity considerations in the development of C&I. Intercommunity considerations likely to be particularly relevant to the sustainability of CMF include those concerning:

- agreements reached between neighbouring villages about the distribution of forest access rights and responsibilities;
- implications of intercommunity relations and practices for the evaluation of landscape variables indicative of biodiversity maintenance;
- organisation at intercommunity level to raise awareness of and address threats posed by the encroachment of external forest interest groups;
- comparative appraisal of the impact on forest resources of variables such as population size and growth, community size, infrastructure and rural development in general; and
- how increased pressure on resources, attributable to the greater size, accessibility or development of a community, affects the distribution of costs and benefits resulting from forest use.

Box 1.2 The CIFOR C&I for CMF Test Sites

All but one of the communities have migrated to and settled in their present locations since the turn of the century. The only exception to this is the Indonesian community of Darok which reportedly established its current location approximately 120 years ago, also ending a traditionally semi-nomadic way of life.

São Pedro (Arapiuns river) and Cachoeira de Maró (Maró river), mid-Amazon basin, Pará, Brazil

These 'Caboclo' riverine communities of mixed European and Indian descent possess a strong indigenous cultural heritage. Both were established after 1900. They practise shifting agriculture. Cassava, their most important staple crop, is processed into flour, small surpluses of which are shipped to markets. Many resident families have small rubber plantations. The communities' forest includes some widely scattered Brazil nut groves. It is also relatively rich in a number of other useful NTFP species. Small boat-building enterprises use timber, fibres and resins from the forest. These are private concerns of skilled local boat makers who train apprentices. The felling of trees and their conversion into planks is still largely done with axes. Hunting and fishing are both important activities, with many community members specialising in one or the other.

Over the past decade large areas of forest adjacent to the Arapiuns river and its tributaries have been heavily exploited by logging companies. One company's activities profoundly affected São Pedro and Cachoeira de Maró slightly. The inhabitants of São Pedro experienced a boom and bust in employment opportunities offered by the company and suffered the depletion of timber stocks on their lands. News of this reached communities upstream (in the direction of the major company's planned logging routes) who subsequently united with São Pedro to drive all timber companies out of their region. The Rural Workers' Union and other local NGOs are helping several communities along the Arapiuns river system, including São Pedro and Cachoeira de Maró, develop a proposal for the creation of a legally gazetted extractive reserve.

Box 1.2 continued

Bedigong and Darok, Sanggau district, West Kalimantan, Indonesia

Land-Dayaks of these villages are Christians, although they retain some of their traditional beliefs. Legislation introduced in 1965, following the coup of President Sukarno, required all Indonesian citizens to adopt one of six officially recognised religions. Signs of adherence to alternative faiths courted police and military rebuke that often culminated in violent oppression (Mulder 1998). Residence in traditional Dayak longhouses was interpreted by government officials as indicative of adherence to outlawed faiths and therefore actively discouraged. This resulted in most longhouses being dismantled and their inhabitants taking up residence in such wooden 'family'-sized houses as now house the inhabitants of the test site villages. As shifting cultivators, the villagers' main economic crop is rubber grown in small stands.

The villages are amongst those famed for their Tembawang Forest Gardens. These gardens, planted on agricultural plots about to be abandoned, are, when established, generally much richer in useful forest species than the natural forest. Their dominant species is tengkawang (*Shorea macrophylla*), a tall forest tree producing commercially valuable, oil-yielding, ellipe nuts, whose local economic importance is second to that of rubber. Other locally important forest products are honey, rattan, wooden shingles for roofing and ironwood (*Eusideroxylon zwageri*). Many of the villagers speak only their native Dayak dialect. In the larger village of Darok, some established tembawang gardens have been converted to irrigated rice paddies.

The villages are among the 61 that belong to an intercommunity cooperative organisation set up with the assistance of the Social Forestry Development Project, a collaborative venture between the Indonesian Ministry of Forestry (now Forestry and Estate Crops) and the German government. The cooperative is developing small-scale forest-based enterprises and is about to implement a forest management plan for an area of natural forest which, adjacent to Bedigong, belongs to Darok. The costs and benefits of this will be distributed among participants from all member communities. Management of the cooperative will eventually become the full responsibility of the member communities.

The villages of Eyek II and Akak/Bitetele, *arrondissement* of Endom, Central province, Cameroon.

These Bantu Bulu villages are located in a forest-rich region that was last logged-over several decades ago. Two recent attempts by logging companies to access the area were successfully challenged by the communities. The communities came into being in the 1920s, when ancestors of their present inhabitants reached the area after decades of slow migration across the country. Weak infrastructure keeps them relatively isolated from the market economy and reinforces their comparatively high dependence on the forest for subsistence. As shifting cultivators, many families also have small plots of coffee and/or cacao trees. Since the mid-1980s these perennial cash crops have suffered neglect due to falling prices, a consequence of which has also been a reduction in the rate of forest and fallow conversion. The villagers regularly hunt and fish, and gather NTFPs from the forest such as foods, wrapping leaves, medicines, fibres, building materials and materials for the local manufacture of crafts. NTFPs of special local importance include rattan and raffia, wrapping leaves and several fruits and spices including bush mango (*Irvingia gabonensis*), moabi fruits (*Baillonella toxisperma*) and kernels from *Ricinodendron heudelotii*. Under the authority of the village chiefs, notables and leaders, these villages have developed rules/laws and regulations to mediate the flow of forest-derived benefits.

Inhabitants of both villages belong to the community-based Federation of Village Groups SOLIDAM ('Solidarité pour le developpement des villages d'Akak à Melan'). Created in 1990 SOLIDAM has a membership of about 800 individuals drawn from 11 neighbouring villages over an area of approximately 385 km^2. It has received assistance from several Cameroonian NGOs, and more recently from the World Bank GIF programme and WWF-Cameroon, to develop environmental, agricultural, health and income-generating projects.

1.6 Organisations

Each test was conducted in collaboration with one or two partner organisations who had an amicable working relationship with the communities at the test sites. They were also selected on the basis of their interest in this project's final outputs and the likelihood that they would in fact use the outputs.

On the Cameroonian and Brazilian tests, locally run intercommunity organisations were collaborators. In Brazil this was the Santarem branch of the Brazilian Rural Workers' Trade Union (STR). Its President accompanied the team throughout the test in the role of facilitator. STR-Santarem operates at the municipal level and maintains close ties to its regional and national parent bodies. However, virtually all its membership resides in the rural areas and the President himself grew up in a forest community. Since early 1997 STR-Santarem has supported a group of approximately 20 communities in the Arapiuns valley, including those of the Brazilian test site, in their endeavours to create a legally recognised Extractive Reserve. Residents of the test site communities found their involvement in the test very useful as it led them to consider in some detail the broader implications of establishing and managing an Extractive Reserve.

On the Cameroonian test, the collaborating local organisation was the Federation of Village Groups '*Solidarité pour le developpement des villages d'Akak à Melan*' (SOLIDAM). Our institutional collaborator was WWF-Cameroon who is executing a project within the SOLIDAM catchment area to assist communities produce management plans for obtaining legal 'Community Forests'. The two villages in our Cameroonian test site are located within the SOLIDAM area. WWF-Cameroon has been actively contributing to research coordinated by WWF-International on the development of C&I for environmental projects. Through its participation in the C&I for CMF test, it was envisaged that WWF-Cameroon would draw on the CIFOR results while engaged in other activities oriented towards the development and application of C&I.

No community-based organisation formally collaborated on the Indonesian test. However, two official institutions – the Indonesian Forest Research and Development Agency (FORDA) and the Social Forestry Development Project (SFDP) – were involved. FORDA conducts its own research on community managed forests and social forestry, some of which has focused on C&I for planning and monitoring of social forestry projects. We felt the C&I for CMF test could complement FORDA's research, and be a basis for its future studies.

The German government-assisted Social Forestry Development Project, in partnership with the Indonesian Ministry of Forestry (now Forestry and Estate Crops), has been developing a commercial timber management plan to be implemented by a cooperative of Dayak communities in the Sanggau district, West Kalimantan. Residents of the Indonesian test site communities belong to this cooperative. All profits from the timber sales will be under the cooperative's control for distribution and reinvestment. The forest management plan had not become operational by the time of the test. Hence, C&I were not tested in direct consideration of it. However, the C&I generated for the assessment of on-going people-forest interactions at the site will help clarify the likely impacts of the timber management plan. They will also fulfil a useful role by providing information for fine-tuning the management plan to better integrate it with existing patterns of forest and land use, and to make it more understandable to local people.

1.7 C&I Testing and Development Methodologies

1.7.1 Composition of the Test Teams

The tests were conducted by interdisciplinary teams, each composed of an ecologist, a forest management specialist and a social scientist. The only exception was in the Brazilian test where an anthropologist was selected instead of a social scientist. All team members had previous experience in either community forestry or rural community development in forested regions.

The interdisciplinary focus helped to raise awareness during the testing process of how C&I concerned with different issues relate to each other in the overall structure of sustainability.

The disciplinary specialists were asked to:

- apply professional scientific judgement to assess the significance of field observations and the contributions of the communities to the testing and development of C&I (this was initially done independent of, and then in consultation with, members of the communities);
- work as part of an interdisciplinary team, periodically discussing and comparing work to remove duplications; and
- play a major role in guiding/structuring community inputs and drawing on their professional experience in Participatory Rural Appraisal (PRA) and interviewing techniques.

While community members at the test sites participated in the development and selection of C&I, the final decision about which C&I to accept ultimately remained with the specialist team members.

1.7.2 The C&I Base Sets

CIFOR Phase 1 C&I research (Prabhu *et al.* 1996) tested five base sets that at the time represented the 'state of the art' of C&I for the assessment of sustainable forest management, especially timber management. This approach conferred some extra structure to the testing exercise by building it on already well-considered and 'packaged' C&I. The original intention was to fully adopt the Phase 1-tested methodologies for the CMF tests as well, but this underwent some reconsideration for two main reasons. First, very few comprehensive 'state of the art' C&I sets developed for community managed forests existed at the time. Those we encountered were developed around management objectives, socio-political contexts and natural resource bases as diverse as Amazonian extractive reserves and Turkish forest villages. Secondly, a substantial proportion of their contents appeared to be relevant only to those regions for which they had been developed. Thus, testing their relevance to the CMF test sites would on each test have entailed the consideration and subsequent rejection of many, but different irrelevant issues. This, it was felt, could detract from the more important task of identifying the community issues, and capturing the negative and positive aspects of the variables relevant to local sustainability.

We were similarly reluctant to restrict ourselves to the testing of the Phase 1 base sets because a narrow focus on C&I sets developed primarily for commercial timber production could be seen to imply community/forest interactions merit evaluation only in the light of, or in comparison with, commercial timber management. Heavy reliance on such sets as points of reference could distort perceptions of the relative importance of issues connected with CMF. While these arguments were considered valid, the proposed approach was justified on two grounds and, therefore, not totally eliminated. First, such Base Sets could serve as examples of different types of C&I that other institutions and initiatives have developed for diverse contexts. This could help the test team members appreciate how widely these initiatives vary in their coverage of issues and detail sought, and the different approaches that can be adopted to organising C&I into integrated sets. Secondly, it would create some opportunity for evaluating the relevance of the base sets to a range of substantially different contexts. Furthermore, maintaining some consistency with Phase 1 methodologies would enable later analytical comparison between commercial and CF monitoring and sustainability.

With these considerations in mind, the C&I for CMF test team members' were asked to select C&I from the base sets to compose their *initial* disciplinary subsets for testing. The team members were alerted to the possibility that the Base Sets might bear little relation to issues prioritised by the local communities. They were asked to remedy any such deficiencies with the development of additional C&I. Furthermore, to maximise the number of potentially relevant C&I that team members could chose from, for each test C&I sets whose content *seemed* to most closely address the test site's conditions, were provided for testing. Therefore, the Brazilian Base Sets included the C&I set developed for extractive reserves in the Amazonian State of Acre, another set developed around the Amazonian forest products Brazil nuts and rubber and the CIFOR Phase 1 Brazil test results; the Cameroonian test started with CIFOR Phase 1 Ivory Coast test results (the nearest 'African' example) amongst its base sets; and the Indonesian test base sets included the CIFOR Phase 1 Indonesian test results and the Lembaga Ecolabeling Indonesia (LEI) C&I set. What may have been lost by not keeping the base sets constant across test sites, was made up for by the gains obtained from guiding the testers towards the development of C&I that capture the factors most instrumental in determining sustainability *at their test sites*. Whereas the Brazilian and Indonesian teams were each presented with three Base Sets, the Cameroonian team of the first test was presented with ten sets. Many of these ten sets, however, were short and consisted of management assessment guidelines rather than P, C, I & V. This high number of Base Sets was found to draw too much attention from any single base set and was, therefore, reduced on subsequent tests.

Some of the base sets were tested on more than one test. The Turkish Forest Village C&I set, because of its focus on communities, was included for testing on the Brazilian and Indonesian tests (we were unaware of its existence at the time of the Cameroonian test). The CIFOR Phase 1 Brazil and Indonesian test results were tested on the Cameroon test. The C&I set for Brazil nuts and rubber tested on the Brazilian test was also tested on the Indonesian test as rubber was an important cash crop at the Indonesian test site.

None of the test teams had access to the results of the tests of C&I for CMF that had already been completed. This was to prevent them from being influenced by each others' ideas and ways of perceiving sustainability. Where necessary, methodological improvements were made in the later tests, although these were minimal. The most significant amendment was the revision of the **C&I Justification Form** after both the Cameroonian and Indonesian tests.

1.7.3 The Use of the Conceptual Hierarchical Framework of P, C, I & V

The test team members were asked to formulate and organise their P, C, I, V into a hierarchical framework. To do so, team members drew primarily on definitions and concepts found in the Tropenbos manual *Hierarchical Framework for the Formulation of Sustainable Forest Management Standards* (Lammerts van Bueren and Blom 1997) as well as CIFOR explanations (and reference to other C&I example sets [Appendix 5])[9]. The hierarchical framework is diagrammatically presented in Box 1.1.

The hierarchical framework used has some conceptual limitations. Its two-dimensional aspect and four-hierarchical levels were recognised during the tests' planning phase as too narrow for capturing the complex, dynamic relationships between factors determining sustainability or the lack thereof. However, this weakness was considered to be more than offset by the benefits derivable from its ease of use. Since it was used to structure C&I tested on previous CIFOR tests for commercial timber management, its retention also facilitates the comparison between C&I proposed on other CIFOR tests for different management objectives.

[9] One of the key differences between the CIFOR and Tropenbos approaches to C&I frameworks is that the Tropenbos framework is a P, C & I framework, and views Verifiers as a *means* of verification, whereas CIFOR employs verifiers as the *pieces of information* or *data* which verify an indicator (and uses 'Methods' as the means of verification) (CIFOR 1999). The C&I sets resulting from the CMF tests in this report include a mix of both - indicating the need for clarity on this point.

1.7.4 The C&I Selection and Screening Process

i) Overview

Many of the methodological elements used during the tests of C&I for CMF had been developed and tested during previous CIFOR tests of C&I for timber production in natural forests at the Forest Management Unit level (Prabhu *et al.* 1996). This includes the iterative process of C&I refinement, which consisted of four reviews (referred to as 'filters') of each disciplinary C&I subset. The series of filters helped to eliminate redundant, comparatively ambiguous and/or difficult or costly to apply C&I. Each filter provided a new set of opportunities for refining C&I and introducing new C&I statements.

> **Filter 1.** The selection of C&I from existing (or guideline) base sets (Annex 2). The base sets used varied between tests (section 1.7.2). At this initial phase the team members were also encouraged to propose any new C&I they thought important that were not present in the base sets. This first filtering process, carried out by each of the test team members individually, resulted in three preliminary subsets of C&I (one for each discipline: ecology, socio-economics and technical management).
>
> **Filter 2.** This filter was the initial interdisciplinary team revision of the first C&I subsets produced. The subsets amended as a result of this revision were those taken to the field for testing in consultation with community members.
>
> **Filter 3.** The third filter was the field testing of C&I. This was undertaken by the test teams in consultation with the forest interest groups within the local community over a period of 10-14 days. The communities were encouraged to constructively contribute to C&I development and selection. The C&I that were accepted after this filtering process made up the third version of subsets, i.e., those presented at the start of the concluding workshop.
>
> **Filter 4.** The C&I subsets were subjected to a fourth review by participants at the concluding workshop. The workshop participants were asked to assess the wider applicability of the C&I selected as relevant to the test site conditions, bearing in mind the characteristics of other CMF with which they were familiar.

Following the Cameroonian workshop, the Forest Management C&I subset was subjected to a final, fifth review by the forest management specialist. Some of the Brazilian and Indonesian team members also made final amendments to the C&I subsets following the concluding workshop but on a lesser scale.

Each specialist completed a 'Justification Form' for each P, C, I & V they chose to include in their discipline's C&I subset (Annex 3). The specialist recorded on this form relevant input and observations made by community members, as well as the level of understanding and agreement to it among community members. A brief explanation of the relevance of each C&I to the test site conditions was also included.

Various elements of the previously tested methodologies (e.g., the filters and Base Sets) were kept in the CMF tests to make later comparison of C&I proposed for different forest management objectives possible. However, the nature of CF meant that the CMF tests also demanded a more open-ended approach. This led to a more even-spread of emphasis across the testing of existing C&I and the development of new ones based specifically on the special characteristics of CMF at the test sites (as described in 1.7.2). In contrast to CIFOR's C&I tests for commercial timber management, the CMF tests also paid more attention to facilitating the participation of the test site communities.

ii) Preparation of C&I Discipline Specific Subsets for Field Testing (Filters 1&2)

Before the test started, the team members were supplied with a Briefing Folder that contained their Terms of Reference, a brief description of the test site, a paper explaining the Tropenbos hierarchical conceptual framework and the base sets. Individuals then went through the first step of the exercise (Filter 1) at their home base. Interdisciplinary teamwork thus commenced after each specialist had already decided upon an initial elimination of elements from the base sets. In most cases, the discipline specialists had by then already developed a number of C&I to compensate for what, in their opinion, constituted limitations in the base sets with respect to the characteristics of CMF.

During the first day of teamwork the conceptual and methodological bases of the testing exercise were explained. Working definitions for some terms were provided and the proposed schedule of activities presented. Additional information was given about the test site. The following 3-5 days of teamwork were devoted to an interdisciplinary team review of the C&I compilations proposed by each of the team members (Filter 2). Where possible, maps and literature on the test site were provided and people with special knowledge of the sites invited to give a briefing. By the end of this period, further modifications had been made to the sets through the elimination or alteration of existing C&I and the development of new C&I. In most cases, a substantial redistribution of C&I among the three subsets had taken effect.

iii) Fieldwork (Filter 3)

The 10-day period of fieldwork concentrated on two types of interrelated information collection and verification methods to help identify the most relevant C&I. These were:

- field checking to establish the scientific relevance of proposed C&I; and
- checking proposed C&I against local inhabitants' interpretations of field conditions, and comparing the proposed C&I with the C&I used by local inhabitants to interpret field conditions.

Field visits were accompanied by villagers. A number of randomly selected kitchens, farms, fallow, secondary and natural forest land areas within the two focal villages were visited (Box 1.3). The team members and villagers discussed their interpretations of field observations. This was to clarify the relevance of C&I and of information from different sources to the assessment of site conditions**.**

To facilitate on-going interdisciplinary collaboration, the team members were asked to work together in alternating pairs. On most days, they assembled in the evening to review and compare notes and progress, and in the morning to plan and coordinate activities for the forthcoming day or two.

Box 1.3 Locations for the Cameroonian Test

Natural (Original) Forest

Chosen Definition: *Old growth forest that has never, as far as is known, been cleared for agriculture or settlement purposes but that may have been logged in the past and be subjected to NTFP harvesting.*

In areas of natural forest, information was gathered on fishing, hunting and the tending and harvesting of non-timber forest products. The species, different strata, canopy openings, age class distributions of tree species, condition of swamps and slopes, and general state of the forest were observed. Indications of past exploitation, such as old logging tracks and tree stumps, were noted. The species were compared with those in fallows and secondary forests in terms of type, frequency and luxuriance. The visits to natural forest helped clarify the community members' attitudes towards the forest.

Secondary Forests Chosen Definition: *Fallows in the advanced stages of ecological succession which have regained many attributes of the natural original forest, but whose species composition and morphological strata nonetheless continue to differ in several aspects.*

The species composition of secondary forests was assessed and compared with that of areas classified as fallows. Typical species included oil palm (*Elaeis quineensis*) and umbrella trees (*Musanga cecropioides*). Large diameter trees of the latter species indicated the maturity of secondary forests. Information was collected on the rate of conversion of secondary forest into farm land and the occurrence of locally protected soil-improving tree species. Consideration was given to the sustainability aspects of site preparation and cropping methods applied to areas of secondary forest.

Farms Chosen Definition: *Land cultivated by village inhabitants with food and cash crops, mainly with the use of shifting agricultural technologies.*

On farm visits information was obtained through observation and, in some cases, measurement (casual estimation of farm sizes and distances between crops and mounds, etc.). Data were collected on cropping patterns, seasonality, farm tools, ownership rights, crop varieties and yields, the number of farms and farm size in relation to family size, farm boundaries/boundary species and the length of fallow periods. All these factors were considered in terms of their impact on the natural forest. Explanations provided by accompanying villagers for observations made on their farms *in situ*, facilitated the testing and development of C&I.

Fallows

Chosen Definition: *Areas where cultivation was abandoned 1-10 years ago*. Newly abandoned farm fields to fields abandoned as long as seven years ago were visited. Reasons for abandoning cultivation were established as were the species composition and usefulness of fallows in various stages of regrowth. The natural regeneration of economic species and species indicative of recuperated soil fertility was particularly noted.

Family Kitchens and Dwellings

In family homes people were interviewed about the harvesting and uses of forest foods, medicines and materials found in the kitchen and other rooms. House construction materials (such as clay, poles, corrugated iron sheets, leaves, materials used to tie poles into place) were observed to determine the approximate ratio of forest materials to substitutes used. The use of forest materials in the making of furniture was noted.

Village meetings and individual interviews

The team members were asked to choose their own methods for encouraging interactive participation. During the field testing phase, structured information gathering PRA and focused interviewing techniques were used. Considerable spontaneous, open-ended exchange of information also took place between the communities and the teams. The main methods used to generate information from villagers were:

- participatory rural appraisal exercises (PRA);
- key informant or informal interviews; and
- 'focus group' discussions.

These methods ensured that extensive directed and open-ended interviews and exchanges of views took place. By talking with key informants in the presence of many villagers at large meetings, it was possible to witness the cross checking of information among the villagers themselves. However, large meetings can sometime inhibit individuals from providing certain types of information which they think might arouse the disapproval of some of those present. More 'on the spur of the moment' forms of encouragement were used to engage different interest groups such as farmers, forest product harvesters, women, men, youth, elderly, village chiefs and other segments of village society.

More in-depth, semi-structured interviews were conducted with key informants or 'local experts' by the specialists individually with reference primarily to their own disciplines. Additionally, several semi-structured interviews were held with small groups of villagers who shared a particular interest or skill (village policy making, coordination of village-based development initiatives, agriculture, forest product gathering, hunting, etc.).

This degree of community participation in the testing and development process represents a novel activity. While it was anticipated that the community would be able to convey important knowledge about their natural resource use systems, there was less certainty as to what the implications of this knowledge would be for directing the course of enquiries. There was also uncertainty as to whether meaningful participation would be possible in such a short time span.

Explaining Principles, Criteria, Indicators and Verifiers

Underlying concepts and terms were explained as much as possible to all participants involved in the tests. Community members at the sites were given simple definitions and examples of P, C, I & V.

Generally they had little difficulty understanding the word 'principle' to mean a *universal law* or *ideal* as perceived by the individual, i.e., something of far-reaching consequence and fundamental importance.

A 'criterion' was described as an important *issue*, *goal* or *desire* that is associated with the fulfilment of the law or ideal represented by a principle. Local people had some difficulty differentiating between principles and criteria. The members of the test teams sometimes had similar difficulties.

The concept of an 'indicator' was the most readily understood. An indicator was explained to be a *sign*, *symptom*, *attribute* or *ingredient* of a state, attitude, circumstance or change, by which its cause, purpose, effect or character may be described or better understood. Many different types of indicators exist. Simple examples can be used as illustrations: a high temperature in a child is indicative of illness; falling yields may indicate declining soil fertility, drought or pest attack; mould is a symptom of decay.

It was explained that several types of signs can be identified. Some types of signs that community members can identify are given in Box 1.4 together with examples of indicator categories into which they fall, including the pressure-state-response categories proposed for monitoring by the OECD (Bakkes *et al.* 1994).

Local people had no difficulty in recognising different types of signs. However, it was felt that asking them to systematically classify indicators (as pressure, response, state, etc.) would unnecessarily complicate the exercise and therefore was not attempted.

Box 1.4 Signs and Corresponding 'Indicator Classifications'

- **Signs that certain events are likely to happen.**

  Example: Converting young fallows to agriculture indicates more work for women and less for men (Brazilian CIFOR test site communities).

  Corresponding indicator classifications: **Predictive indicators** where reliable cause and effect relationships are known to exist.

- **Signs of whether the way in which something has been or is being done is appropriate**.

  Example: Fire management strategies, rubber tapping methods and equipment, voting procedures that indicate the efficiency and appropriateness of how specified objectives are being fulfilled. In our examples the strategies and methods are taken as 'signs' of how something is done.

  Corresponding indicator classifications: **Process indicators**.

- **Signs of whether alternatives, remedial or compensatory measures are required**.

  Example: Number of chain saws/shot guns owned, size of agricultural clearings, i.e., the objects/actions (i.e., harvesting equipment and intensity) that cause impact or stress and are a determinant of scale of impact.

  Corresponding indicator classifications: **Pressure indicators.**

- **Signs that a condition or situation is improving or deteriorating in response to pressure or to a change in the form of a new intervention, decision or attitude**.

  Example: Yield response to intercropping; change in forest fire hazard attributable to a new fire management strategy; the change in distribution patterns resulting from a decision taken; social response to an innovative idea (adaptation, indifference, rejection), etc.

  Corresponding indicator classifications: **Response indicators**.

- **Signs of suitability for a particular course of action or intervention.**

  Example: Soil type, forest structure, size of forest area or organisational structure.

  Comparable indicator classifications: **State indicators, descriptive indicators**.

Transition from 'field testing' to the 'workshop review'

Following the field testing phase, the team members were given a couple of days to revise the contents of C&I subsets, complete the C&I 'Justification Forms' and prepare presentations for the final workshop.

Six villagers from the test site were invited to participate in each workshop. These people were selected partially on the basis of their outgoing personalities and self-confidence, to help ensure they would contribute to discussions at the workshop. Leading up to the workshop, they worked together with a facilitator to prepare their own presentations on matters they believed affect forest sustainability in their area. The facilitator on each test was asked to avoid as far as possible influencing the content of the community participants' presentations.

iv) Workshop Review (Filter 4)

Each workshop took the form of a 'peer review' of the C&I produced during the test. The workshop represented the last C&I filtering process. In addition to disseminating information about the C&I testing process and its objectives, the workshops were intended to:

- remove ambiguous C&I from the proposed sets;
- select the most relevant, easy to measure and cost-effective of the proposed C&I; and
- assess the applicability of C&I identified as relevant to the test site's conditions, to other community managed forest situations with which the workshop participants were familiar.

The workshops averaged 25-30 additional participants invited from local, regional and national government departments, academic institutions and NGOs, including representatives of CIFOR's collaborating institutions. Also attending the Brazilian workshop were several forest farmers from other communities in the same region as the test site. In particular, organisations known to have an active interest in developing and using C&I for CMF were invited.

The workshops commenced with presentations by the community participants and the test team members. All participants were then divided into groups to review the proposed C&I. At the Cameroonian and Brazilian workshops, the three groups set up were unidisciplinary, matching the discipline of the C&I set they were assigned to review. At the Cameroonian workshop two groups were initially formed for each discipline. Early in the proceedings the two social groups were combined, as were the two ecology groups. Due to the large number of foresters present, two forest management groups were maintained throughout the workshop. At the Indonesian workshop, three multidisciplinary review groups were formed – each of which focused on reviewing C&I for one discipline. All the review groups included at least one of the test site's inhabitants.

The form of participation in the workshops by community members was considered on a case by case basis for each test, along with the options available for facilitating participation. Several community members gave presentations at the workshops about what factors they think strongly affects sustainability. They also actively participated in the review groups set up during the workshops to critically appraise the proposed C&I. On each test a skilled facilitator was hired to offer guidance and support.

1.7.5 Post Test Analysis: Identification of Commonalities Across Sites

After the completion of the three tests, the final C&I sets produced were compared for commonalities. First, we sought to identify the C&I that appeared the final sets of all three tests. Then the C&I common to two of the tests' results were separated from those that were test-specific.

The C&I were classified into topic categories using key words and/or taking into account their conceptual content[10]. This allocation of C&I into categories was often based on assumptions concerning the meaning intended by the discipline specialists. Sometimes it was not possible to be sure whether the specialists were in agreement on the precise meaning of words such as

[10] Although the analysis drew on the information related in the Justification forms, the number of Justification Forms filled in on each test was so vast (because of the number of transformations that many of the C&I underwent over the stages of the iterative process) that it was not possible to analyse the contents of all these forms systematically. However, our review of the C&I results draws on observations recorded in the Justification Forms. These forms are being retained by CIFOR for future reference, should there be interest in tracing the development of some of the C&I generated by the tests.

'institutions', 'organisations', 'norms', 'rules', 'regulations'. Nor was it clear to which extent different words were used interchangeably. Matched C&I should therefore be regarded as being of similar rather than identical meaning.

In the process of matching isolated statements no consideration was given to their contextual significance within the C&I set, i.e., deriving from how they relate to other C&I within the hierarchy. This was seen as a limitation. In reviewing the test results, we therefore also consider the significance of bundles or complexes of C&I developed around specific topics and how the C&I of these complexes derive their significance through their relationships with each other[11].

[11] The C&I included in *the Introductory Guide to Criteria and Indicators of Sustainability in Community Managed Forests* (Ritchie *et al*. 2000) in fact are regrouped around CMF-oriented themes.

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

CHAPTER 2.
INTRODUCTION TO RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

Chapter 2. Introduction to Research Results: Criteria and Indicators of Sustainability in Community Managed Forests[12]

A community managed forest C&I assessment can be likened to a landscape painted with the spectrum of colours provided by the C&I selected. There is not just one way of interpreting and representing a landscape; seen through different eyes, it will be perceived and thus be painted differently. The C&I included in the sets are not the 'whole truth' or necessarily the most important C&I from *all* perspectives; their rationale and validity is not unquestionable. This is as it should be, not only because of the nature of sustainability, but also because this research initiative penetrates uncharted terrain. The insights provided into the methodological approaches used and the C&I generated, are intended to stimulate further thought and inquiry, and provoke greater participation in C&I debates, especially where these focus on CMFs and NTFPs. The aim has been to expose some of the complexity underlying CMFs, while at the same time enabling their understanding. This is achieved through facilitating the identification of the multiple threads which are common across CMFs, yet which have been woven into different patterns in each unique environmental and socio-political contexts.

The vast number of Principles, Criteria, Indicators and Verifiers generated throughout the filtering processes (756 in total) negates the possibility of documenting in this report all of the changes and permutations each of the C&I subsets underwent at each stage of the filtering process. Nor, in fact, would such detail offer the most valuable analysis. Instead, the following sections of this report draw on the processes, discussions, and documentation at each of the various stages[13] to explore and examine the C&I generated, as well as contextualise them through background literature review and research.

All these C&I sets emerged through the application of the four iterative 'filtering' stages of the testing methodology (see Section 1 of this report). While the three final subsets generated by the Brazil test are exactly those reviewed and amended by the workshop review groups (the fourth filter), the final Cameroonian *ecology* subset was slightly modified by the team ecologist following the workshop. The final Cameroonian *forest management* subset underwent a major transformation by the Cameroonian forest management specialist following its amendment by the workshop management review group. The final *ecology* subset of the Indonesian test is that which was agreed by the workshop ecology review group. Its final *social* and *forest management* subsets, however, include substantial additional adaptations made following the workshop review by the relevant team specialists.

Note:

In order to facilitate the use of this text, we have included shaded columns entitled "Comments and observations on C&I attributes" throughout the Results section. We have included many extra observations in these columns; we have also included additional blank space as well to enable and encourage the reader to add their own notes and insights!.

---

[12] This chapter written by N. Burford de Oliveira

[13] The earlier versions of the C&I subsets, and the C&I Justification Forms used by the teams have been retained by CIFOR for reference purposes.

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

CHAPTER 3.

BACKGROUND TRENDS IN COMMUNITY MANAGEMENT OF FORESTS

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

CHAPTER 3.

BACKGROUND TRENDS IN COMMUNITY MANAGEMENT OF FORESTS

Chapter 3.
Background Trends of Community Managed Forests[14]

In our review of the final sets of C&I proposed by the test teams we took the following into account:

- The rationales that can be offered to justify the acceptance of individual and complexes of C&I (with reference to the Justification Forms completed by the discipline specialists, among other things);
- Debate concerning the C&I that took place between different groups involved in the C&I development process, including the discipline specialists, community members, members of the collaborating organisations, other collaborators and the workshop participants;
- The conditions and evidence of management observed at the test sites;
- Reports submitted by the discipline specialists and other collaborators; and
- Literature on CMF to clarify the relevance of some C&I, build upon controversial issues raised by debates during the tests and help assess the gaps in coverage of the C&I sets created.

These facets of the testing experience brought into focus some conditions and trends that we believe are typically relevant to the dynamic structure of traditional forms of CMF, or explanatory of forces that strongly influence this structure. These conditions and trends could be more accurately described as gradients or continua. At each point along a continuum a different configuration of factors shapes the opportunities and constraints governing sustainable forest resource management and its social dimensions. Major conditions and/or trends detected were:

- **Diversity and multiple use** (e.g., roles and skills, economic diversification, habitat diversity and biological diversity)

  Gradient: Heterogeneity – homogeneity
- **Collective action and the implications of community size**

  Gradient: Small – large communities
- **The transformation/capitalisation of rural economies**

  Gradient: Traditional subsistence (gift) economies – capitalist market- based economies

Although not comprehensive, the three gradients are extensive and overlapping, and their relevance was clear in the conditions encountered at the test sites. We highlight these gradients here in the belief that their understanding will assist in the appreciation of the changing contexts of CMF across diverse geographical settings (i.e., the diversity of settings against which the C&I have to be assessed). Sustainability manifests itself temporally and, therefore, the need to recognise change and its impact on sustainability is paramount.

In the following subsections we explore these conditions or trends and gradients, and their related C&I, in more detail.

[14] This chapter written by N. Burford de Oliveira

3.1 Diversity and Multiple Use

Diversity is a recurrent theme in all the C&I sets developed during these tests. It appears in connection with the landscape, species and species associations, their functions, products and services, and the heterogeneity of the community in terms of forest user groups. The C&I furthermore acknowledge the great potential of local social institutions to forge links between the various forms of diversity to sustain the flow of forest benefits to individuals, groups and the community at large, and maintain the resource's productive capacity.

3.1.1 Diversity and traditional forest subsistence systems

Two features of natural tropical rainforests appear to be powerful determinants of community forest utilisation patterns in these areas: 1) the forest's high species diversity and 2) the low spatial frequency of its individual species. The ratio between the number of species and the number of individuals per species in a given unit area is known as the '*diversity index*'[15] (Odum 1959 cited in Ooi Jin Bee 1993). At the Brazilian and Cameroonian test sites, in particular, this index appeared to be a significant determinant of how people utilise and manage forest resources (Box 3.1).

Because of the high diversity index of tropical rainforests, food resources are likely to be widely and sparsely distributed. However, plant biomass makes a much greater contribution to total biomass than does animal biomass. Some academics have inferred this to mean that, historically, forest plants have played a much more important role in the diet of hunter-gatherers, at least in terms of volume, than have forest animal species (Ooi Jin Bee 1993). However, edible plant species are sometimes rare, making a very small contribution to the total plant biomass. The natural scarcity of edible species in tropical rainforests has been suggested as an explanation for the low human population density in these areas (Richards 1993).

From the species diversity of tropical rainforests, individuals and households obtain a wide range of plant and animal products with which they directly satisfy a variety of needs. This diversity typically promotes the emergence of specialists within the village context, including basket and mat weavers, herbalists, canoe builders, architects, carvers, hunters, fishers and fruit gatherers. These groups of specialists rely on each other to retain intact the forest habitats upon which their sought-after species depend. In this way, the forest's ecological diversity can be seen to foster collaboration, or at least interdependence, between forest user groups (Box 3.2). The forest also provides intangible benefits to the community as a whole. These include those resulting from watershed protection, i.e., the maintenance of terrestrial biodiversity, and the regulation of stream flow to maintain fish stocks and supplies of relatively clean drinking water. Their mutual importance to individuals, households and specialised groups further stimulates collaborative effort in regulating forest interventions.

Collaboration in multiple use sometimes occurs spontaneously in response to the complex array of opportunities and limitations imposed by the diverse forest resource base. Often, however, it is orchestrated by social organisations whose role is to manage the production and distribution of forest benefits and to preserve the regenerative capacity of the forest's resources. The Indonesian test's social scientist considered broad-based participation in community organisations to be an important criterion for the effective channelling of forest management costs and benefits among community members. He proposed that it is through participation in decision making processes that the functions of these organisations are best defined and gain support. Each forest interest group within the community, by contributing its specialised knowledge of the forest to these organisations, contributes to the community's collective capacity to accommodate diverse requirements.

[15] The index refers to both flora and fauna species.

Box 3.1 Strategies to adapt to natural scarcity

One common determinant of forest interventions in the lowland tropics seems to be the natural scarcity in rainforests of many medium- to large-sized mammals as well as of individuals of most tree and many herbaceous species (Lathrap 1968 cited in Ooi Jin Bee 1993; Gross 1975; Headland 1987). Faced with this scarcity, sustainable harvesting is often given priority by forest inhabitants with an interest in minimising collection costs. Below are some examples of labour efficiency and 'collection cost' reduction mechanisms that are common at some of the test site communities and that can be equated with sustainable practice.

- Maintenance of useful forest trees and plants close to homesteads to minimise energy expended on harvesting expeditions. This is often achieved by:
  - ♦ protecting useful trees and plants during the conversion of forest to cultivated land-uses. At the Cameroonian test site, for example, useful tall forest trees are often protected when forest is converted to shifting agriculture.
  - ♦ discriminating against the conversion of forest comparatively rich in useful species. Farmers at the Brazilian test site commonly seek to clear forest areas relatively poor in useful species. Clearance of certain vegetation formations that perform important ecological functions is avoided. Tabocal bamboo groves, for example, are generally protected because of their role as sites of refuge for game animals.
- Careful timing of extractive and management activities to obtain a desired biological or environmental response, thereby optimising returns to labour. In Cameroon, good timing of land clearance operations was stressed as it influences the effectiveness of agricultural fires, the efficient use of labour and crop yields. C&I of seasonal controls for hunting and the extraction of NTFPs were formulated on all tests. In Brazil, many local inhabitants take into account lunar, as well as seasonal, considerations when planning agricultural, fishing or forest harvesting activities.
- Use of non-destructive harvesting techniques. Local understanding of 'good' versus 'bad' harvesting and tending practices is often sophisticated, e.g., for hunting, fishing, honey gathering, the collection of lianas and rattans, bark removal, latex tapping and logging. Although aware of the short-term benefits of burning low vegetation around the base of Brazil nut trees, inhabitants at the Brazilian test site understand the practice to be destructive in the long term and, therefore, advise against it.
- Insistence on matching raw forest products to their most appropriate uses in order to maximise the quality and life span of end products, and thus lower replacement rates. In Cameroon, this was noted with respect to care given to using only mature rattan and raffia in local house construction and furniture making. Local people at the Cameroonian test site also stressed that durable timbers should be used for crafting canoes and mortars.
- The alleviation of harvesting pressure on individual trees by reducing the number of harvesting occasions that inflict plant tissue wounds. In the Cameroonian test, the importance of storage and processing techniques was emphasised with this in mind.

Obviously, these strategies are not *always* adopted, and how closely they are followed depend upon related conditions. Their relative impact has to be assessed within a broader context.

Box 3.2 Forest Management C&I of multiple use – Cameroon Test

Rarely can forest interest groups survive in isolation. They have to reach accords regarding inevitable competition and trade-offs between their interests. This led to the proposal of the criterion ‘***Different forest users and interest groups coexist harmoniously’*** and its indicator ‘***User groups’ interests are complementary and do not adversely compete’***. This can be verified by the division of labour and the interdependence of forest user groups within the village setting. Interdependence was clearly evident in the SOLIDAM zone. There the management of the natural forest helps to protect forest streams from siltation. These streams contain fish sought by fishers who use nets and fishing baskets woven with cane and other raw materials carefully harvested from the very same forest. When the fish is caught, it is dried with fuelwood also gathered from the forest. The dried fish are placed into containers also woven from fibres and canes from the forest, before they are transported to urban markets. This illustrates that a wide range of forest products, usually harvested by different groups, is used in the procurement, processing and dispatching of fish. Such long chains of operation show how the interests of individual groups depend on each other and, therefore, on the protection of the global value of the forest. They are of significance to the development and testing of C&I for assessing or reporting on the sustainability of CMFs. Along these chains occur linkages and trade-offs between factors of socio-economic, ecological and forest management importance, many of which have multiple implications for future sustainability. When well studied, these chains or pathways can be useful in establishing more specific qualitative and quantitative measures of sustainability.

3.1.2 C&I: multiple use

Management for multiple benefits, including products and services, appeared as a principle for forest management in the Cameroonian and Brazilian sets (Box 3.3). It is also conceptualised in one or more criteria in all the forest management and social C&I subsets. Moreover, the concept of multiple use is implied through associations between the C&I within each set. Regulation of competing interests to fairly cater for multiple social and ecological requirements is addressed under the Indonesian social principle ‘***Economic gains do not compromise ecological integrity’***. This principle is supported by C&I on the ‘***Optimisation of the local agroforestry system and tembawang forest gardens’***. In the Cameroonian forest management subset the regulation of competition is addressed by the criterion ***‘Different forest users and interest groups of forest products coexist harmoniously’*** for which one of the indicators given is ‘***The interests of the various community forest user groups complement each other and do not adversely compete’***.

Box 3.3 C&I on multiple benefits

<u>**Cameroonian Test - C&I examples from the Forest Management set**</u>

Principle: Most members of the village community recognise and seek to maintain the global value of their forest as determined by its multiple uses and services.

Criteria:

- The villagers have sufficient knowledge of the composition and distribution of different forest types.
- The natural forest’s role in community health care is being consciously preserved.
- Different forest user and interest groups of forest products coexist harmoniously.
- Villagers participate with other stakeholders in the protection of timber resources in their communities.

Box 3.3 Continued

Indonesian Test - C&I examples from the Forest Management set

Principle : Sustained yield of Tembawang forest gardens and natural forest.

Criterion 1 : Natural forest is maintained for its productive and environmental values.

Indicators:

- Productivity of natural forest is maintained.
- Conversion to other land uses is restricted.
- Traditional conservation concepts support the maintenance of biological and ecological diversity.

Brazilian Test - C&I examples from the Forest Management set

Principle : There are multiple uses of natural resources, including the extraction of timber and non-timber forest products, agricultural activities and fishing, and these uses are sustainably integrated.

Criterion 1 : Natural resources offer a vast range of social, economic, cultural and environmental goods and services.

Indicators:

- Existence of multiple use-based forms of management of ecosystems and natural resources.
- Existence of zones defining areas for different intensities of use in accordance with their potential.
- Understanding of the qualitative and quantitative capacity of natural resources used and managed (in production and economic terms).

3.2 Collective Action and the Implications of Community Size

The word 'collective' hardly appears among the C&I developed. This is surprising given that many people associate CMF with collective action. Sometimes it is even thought of as a qualifier of CMF. Several of the C&I complexes that were formulated will, however, generate information from which a great deal concerning collective action can be deduced. There are at least three interconnected facets to the concept of collectivity:

1) the willingness of all individuals within a group to contribute to the creation of public goods by foregoing personal gains;
2) everyone participating in the same activity (including decision making, conflict resolution or rule enforcement) to pursue a common goal; and
3) people taking on complementary roles in order to pursue a common goal.

3.2.1 C&I: collective action

Exemplary of the first facet of collectivity is the Cameroonian forest management verifier '***Villagers exploit raw materials in a sensible and frugal manner to ensure the sustainability of local cottage industries'.*** (This assumes all villagers comply with this statement and not just those who benefit directly from employment provided by the cottage industries). The Cameroonian social criterion '***Access to community forest commons is regulated through collective action and support***' has a similar focus. Each of these statements requires examining whether, in the common interest, people forego the greater private profits that they could obtain from over-harvesting resources. We must, however, recognise that sacrifices made may be partly imposed by regulations, and therefore not wholly representative of the individual's willingness.

The Indonesian forest management and social subsets are particularly rich in C&I for assessing participation in common activities (the second facet of collectivity). The Indonesian ecological verifier '***Spontaneous objection or response of any community member to anyone who uses the (protected) area***' and the Brazilian social indicator '***Active community participation in the conception and monitoring of agroforestry resource management systems***' also deal with participation. From the Cameroonian set, the social indicator '***Response to calls by village heads and opinion leaders for collective action against intruders, e.g., forest exploiters and non-community members***' and the verifier '***Collectively organised patrols***' (the only two statements from the three tests that contain the word 'collective') address villagers' involvement in or commitment to common activities.

The third facet of collectivity is founded on the concept of social cohesion and unification arising through the coordination and integration of diverse objectives and activities. It embraces the trade-offs collectively made and supported to secure harmonisation of interests and activities. It is portrayed by the Cameroonian forest management indicator '***The interests of the various community forest user groups complement each other and do not adversely compete***', and verifier '***Interdependence between direct and indirect forest user groups***'. Such indicators and verifiers of interdependence and complementarity lead assessments towards establishing the consequences of change in attitudes or actions. They can be thought of as 'foundational' I&V for appraising the compensatory adaptations of people to the new constraints and opportunities presented by changing circumstances.

3.2.2 Community size and its influence on the potential for collective action

Community size can be a significant determinant of the types of rules and norms needed to control resource exploitation. The larger the community the more difficult it becomes for individuals to maintain sufficient contact and communication with each other to make collaboration agreements and collectively design and enforce strategies and regulations for their common good (Baland and Platteau 1996).

Another consideration related to community size concerns the cost-benefit ratio of the individual's contribution to managing common resources for the creation of public goods. Baland and Platteau (1996) argue that the sacrifices the individual has to make to assume a fair share of management responsibilities are increasingly undercompensated as the number of beneficiaries grows. The more people who receive benefits from collaborative common resource management, the smaller their individual shares are liable to be in relation to the size of their required contribution to the production and protection of public goods. That is, the individual's personal gain from cooperation makes up an increasingly smaller proportion of the common good, as more people benefit. Their sacrifices (i.e., abstinence from free-riding behaviour) appear progressively greater by comparison. Therefore in larger communities, where the responsibility for common resource management is more widely diffused, reliance on voluntary cooperation is more likely to fail in the protection of the sustainability of common resources.

The potential for sustainable collective resource management thus appears to be positively correlated to community 'smallness'. Baland and Platteau (1996) theorise convincingly that community size is a more powerful determinant of collective action than is its social homogeneity. Empirical evidence strongly supports their theory.

The C&I generated by the tests most directly concerned with community size are those that deal with population growth and its control. However, most of these C&I reflect a broader concern – that of the capacity of the resource base to satisfy community demands in the long-term. There is nothing to suggest the test teams considered the influence of community size on community members' willingness to cooperate in the management of common resources. However, some measure of community size is needed against which to assess the successful of CMF systems in overcoming or exploiting the constraints and opportunities conferred by size. How communities manage to thrive under constraints, or overcome them, affects the sustainability of their forest resources. Therefore, C&I on certain key community characteristics (i.e., size, location along river, distance from markets, etc., most of which are either fixed or not amenable to modification by the community in the short-term) are needed for process and outcome variables to be assessed in relation to local potential. That is to enable measures of performance and achievement to be interpreted in the context of local capacity and incentives. Few C&I were generated to describe key fixed variables in the field tests; this may have been because the specialists were encouraged to concentrate on formulating C&I on variables under the community's control.

3.3 The Transformation/Capitalisation of Rural Economies

In the social sphere, the test results relate to trends typical of communities moving from more isolated, traditional, subsistence economies to economies more integrated in the mainstream economy and culture.

Christodoulou (1993), for example, describes land and forest resource allocation patterns in traditional African communities and the manner in which these patterns were transformed into capitalist rural economies. Traditionally, a family that cleared land and subsequently cultivated the cleared land could claim exclusive use, but not ownership, of the area for itself and its descendants. It was the birth right all community members to receive enough land to meet the subsistence needs of his or her nuclear family. Access to land was tied to its use. Normally, when farmers left the community, they were required to give up their rights of land access. However, usually they retained the right to receive land for cultivation upon their return to the community. Gradually this led to the formation of a constellation of land unit groups associated with different descent groups. Out of this development grew a need for more coherent, unified approaches to protecting and defending land belonging to the wider kinship group of early inhabitants. Simple land administration bodies emerged to fill this need. Their authority often had a religious basis and paid heed to ancestral spirits. As the community grew in size and complexity, more complicated hierarchical authoritative and administrative structures developed and mergers with wider quasi-state powers sometimes occurred to regulate the affairs of the wider kinship group (ibid.).

Forest farmers have been stimulated into producing greater market surpluses by the growing opportunities for trade with outsiders. Surpluses of forest goods are often more profitable compared to agricultural surpluses because production costs are close to nil, and because part of the costs of extraction from common, open-access forest is externalised and borne by the community (Wilkie and Godoy 1997). Preference tends therefore to be given to the trade of forest goods taken from open-access forest, e.g., large bush meat mammals, animal skins and nuts that have a relatively high price to transport cost ratio (ibid.). Empirical evidence abounds that, adding to the threat this commercial forest harvesting pressure poses to the forest, there is an accelerating rate of forest conversion to accommodate higher agricultural surplus production. Increases in the scale of agricultural production and the introduction of cash crops have brought about wage labour and the demise of mutual forms of assistance.

3.3.1 Consequences of rural capitalisation

The capitalisation of forest communities' traditional subsistence systems can be observed as a salient trend in many corners of the globe (Christodoulou 1990: Otsuka 1998). The trend has many interlinked consequences, two of which appear to be particularly applicable. Firstly, the capitalisation of the primary sector increases competition for land and, hence, the number of large land holdings and the number of landless rural inhabitants. As a result, in many of what may still be referred to as forest communities, customary tenure is secured for only a minority by registration. Most forest farmers face increasing uncertainty *vis-à-vis* their access to natural resources.

Out of this first consequence the second arises: a pool of cheap labour comprised of the forest farmers displaced from their holdings by competition. The global increase in the rural landless population (both numerically and as a proportion of the total rural population) is known to be positively correlated with the growth of rural poverty (Christodoulou 1990). The rural landless rank amongst the socio-economic groups most vulnerable to exploitation and coercion. They are susceptible to debilitating reliance on unequal dependency relationships for securing their immediate survival needs. In the Amazon region they are easily locked into the client-patron relationships that typify timber production along the large Amazonian rivers and their tributaries (Marcus Oliveira, pers. comm.). Their predicament widens the applications of C&I on participation, distribution and fairness, introducing new dimensions in addition to those characteristic of comparatively closed and self-sufficient traditional forest communities.

The drive to increase marketable surpluses makes economies of scale an attractive proposition. Modern technologies are commonly employed to hasten achievement of this aim. They are also used to increase the efficiency of hunting and forest product harvesting. Irrespective of whether they are employed to manage or convert forest resources, their socio-economic impact tends to be divisive (Reddy 1998). Only the relatively wealthy can afford modern technologies. Their use makes production more lucrative, thus increasing the wealth of those already relatively wealthy. This accentuates inequality in purchasing power, skewing the demand structure so that desires of the wealthier are catered for, while less importance is attributed to the needs of those whose purchasing power is too weak to exert much demand. The purchasing power of poorer people is, moreover, eroded by technologies that permit greater economies of scale, undermine the profitability of traditional forest-based industries, and reduce the employment these once provided as wage labour becomes redundant. These developments are potent recipes for social instability. They commonly culminate in rural violence or rural-urban migration as the increasingly poor inhabitants seek to overcome their poverty. In contrast, by virtue of their low cost and energy intensity, traditional technologies do not generally mitigate against equality of resource access.

The capitalisation of forest communities nearly always has a profoundly destabilising effect on their customary authority. With reference to processes of capitalisation and government promotion of social reorganisation in Minangkabau communities in south-west Sumatra, Otsuka (1998) concludes that ‘no matter how strong the top-down social and administrative hierarchies were, the customary authority could form a social norm to avoid corruption and malpractice of administrative leaders, followed strongly by communities’. As land tenure arrangements became increasingly institutionalised, the new administrative powers became less concerned with fulfilling the needs of the community than with satisfying their own interests.

Both in Brazil and Indonesia, the less isolated of the two communities that made up each of the test sites was the one more integrated and actively reliant upon the external economic order. In each case the less isolated community was the larger of the two, and it appeared to enjoy higher agricultural and forest product prices. However, the forest resources of these larger communities *were very obviously more degraded*. There was less forest remaining for conversion, and the more highly prized and valuable forest products had been reduced to scarcity over recent decades. The larger of the two Brazilian communities now relies on timber imported from more remote communities to run its small-scale boat building industry, whereas previously this industry drew on local timber stocks. Other forest materials such as lianas used in house construction are now also increasingly being imported by the larger, more accessible community from smaller communities in more remote areas.

3.3.2 C&I: the transformation of traditional forest subsistence economies

The important influence of rural capitalisation on equity, and therefore on social sustainability, was most clearly addressed by the Brazilian team, especially by the Brazilian social scientist's C&I on wage remuneration, labour laws and freedom from coercion. These were grouped under the criterion '***Workers' rights and conditions are appropriate and at least considered just in employment relations between community members and external actors, concerning the use of agroforestry resources***'. Included is the indicator '***Salaries and benefits are appropriate in relation to the tasks performed***' and its verifier '***Community members have basic workers' documentation and access to legal benefits***'. Another indicator given for the criterion is '***Absence of under-payment and the exploitation of child and female worker***' for which the verifiers '***Pertinent labour legislation is enforced***' and '***The history, structure and allocation of labour within the community over recent decades***' are provided. The application of some of these I&V is potentially problematic, especially where they can be mistakenly perceived to equally apply to traditional and capitalist forms of labour application. Unpaid labour, in the traditional context, might be acceptable when remuneration is in kind. In the capitalist context it is unlikely to be acceptable.

C&I in the Brazilian social subset relating to freedom of movement are also grouped under the above criterion. Among them is the indicator '***Absence of slave labour***' for which the given verifiers are '***Liberty to come and go***' and '***No economic coercion or submission***'. A further indicator supporting the criterion is '***The right of collective negotiation between the community, its representatives, and external actors is guaranteed***', supported by the verifier '***Contemporary histories of relations with external actors and the negotiation mechanisms used by external actors***'.

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

CHAPTER 4.

ECOLOGICAL INTEGRITY, LANDSCAPE, AND HUMAN-NATURAL SYSTEMS INTERFACES

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

CHAPTER 4.
ECOLOGICAL INTEGRITY, LANDSCAPE, AND HUMAN-NATURAL SYSTEMS INTERFACES

Chapter 4. Ecological Integrity, Landscape and Human-Natural Systems Interfaces[16]

4.1 Overview

4.1.1 Introduction to the Section

Recent years have seen a move towards assessing the appropriateness of community forest management in terms of its significance to landscape sustainability, and not just to the sustainability of the forest stand.[17] This section embraces this approach and thus explores issues of ecological integrity, as it relates to landscape and human natural system interfaces. It examines the C&I generated during the test for the assessment of habitat diversity (or 'landscape mosaic') and forest structure. The wider significance of these issues to biodiversity conservation and cultural survival is also discussed. Among the C&I considered are those related to:

- the underlying causes of forest conversion (area decline) and fragmentation, e.g., population growth and the spatial dynamics of agriculture and its expansion;
- the implications of the forest-agriculture interface to biodiversity and the landscape mosaic;
- outcomes of forest fragmentation, e.g., changes in forest mosaic, water regimes and effects on soil resources; and
- measures to contain forest conversion and fragmentation processes, i.e., protected areas, designated forest reserves and land use zones.

4.1.2 Background and C&I

The scale of forest conversion, and the fragmentation patterns it creates, manifests itself in the landscape. The full impact of forest conversion depends on the habitat types affected, their size and their location in relation to each other. These things along with edaphic, typographic and climatic factors, set down constraints and create opportunities for human resource exploitation.

The landscape of CMF is formed by 1) natural elements and forces and 2) human interventions. The diversity resulting from natural forces is intrinsic, in contrast to that caused by human intervention which is imposed. However, this categorisation is over-simplistic, the divide blurred, in fact, by the notion that human ecology and its health are natural phenomena and that, therefore, humanly induced diversity is also natural.

In combination, intrinsic and imposed diversity give rise to cultural landscapes. Cultural adaptations of (and to) these landscapes reflect the constraints and opportunities presented by intrinsic diversity. Maintaining cultural diversity is often seen as being as important as maintaining biodiversity since much empirical research suggests socio-cultural reproduction and the maintenance of existing biodiversity are closely interdependent (Hladik *et al.* 1996). This proposition was debated on several occasions during the tests. It was agreed that biodiversity supports self-sufficiency in many traditional community contexts, and that cultural reproduction in such cases depends on biodiversity maintenance, at least to some extent.

---

[16] This section was written by N. Burford de Oliveira with H. Hartanto and T. Setyawati.

[17] The value of appraising CMFs in the context of their landscape interactions has gained increasing recognition during the debate on the certification of CMFs and CMF products (Markopoulos 1998).

At the landscape level, the two conditions highlighted as fundamentally indicative of biological forest sustainability during the C&I tests were:

- the retention of a continuous forest canopy; and
- the landscape mosaic.

The Brazilian and Cameroonian tests generated more C&I that explicitly refer to the landscape or to landscape variables such as habitat diversity and mosaic than did the Indonesian test. However, many of the Indonesian C&I can be applied equally well at different area scales and could, therefore, also generate information on the landscape and the regional geographical context.

To illustrate the integrative and comprehensive nature of the C&I in this section, we offer by way of introduction the first ecological principle in the Brazilian set: '***CMF does not compromise the biological diversity or the ecological integrity of the forest landscape or of the terrestrial and aquatic ecosystems therein contained or adjacent***'. This principle broadly embraces the overall integrity of all terrestrial and aquatic ecosystems. It contains five criteria (Annex 3) to evaluate key, large-scale processes of change operating at the forest landscape level. The I&V allocated to these criteria cover the:

- rate of primary forest to agricultural land conversion;
- overall forest structure, continuity and fragmentation;
- effect of habitat fragmentation on forest heterogeneity and habitat diversity;
- history and hazard factors of forest fires;
- maintenance of riparian corridors and flooded forest habitats; and
- physical, chemical and biological integrity of aquatic ecosystems (lakes and rivers).

These C&I can be used to assess the overall conservation status of the entire forest ecosystem (including terrestrial and aquatic habitats), the integrity of the natural forest mosaic, and the forest's resilience to different types of anthropogenic disturbance.

4.2 Forest Structure and Biodiversity

This section offers some background to forest structure and biodiversity, relates it generally to the C&I produced, then gives specific examples of forest structure C&I as well as offering an analysis of some biodiversity-related C&I.

4.2.1 Background

Because of the close relationship between forest structure, biodiversity and fragmentation, many of the C&I for assessing these conditions overlap or closely resemble each other (Tables 4.1, 4.2 & 4.3).

The intactness and extent of overall forest structure at the landscape level are good indicators of conditions for biodiversity and sustainability. Many species' growth rates and even survival depends on conditions such as the shade and support provided by the forest's structure. Each plant and animal species has its functions in the forest ecosystem, including a contribution to the creation of other species' habitats. The long-term protection of this integrity is covered by the Indonesian ecology criterion ***'The forest ecosystem's capacity to regenerate is assured'***. The greater the ecosystem's biodiversity, the more effectively it functions to support a living environment**.** Plant-animal relationships are highly complex and many still poorly understood. It is known, however, that although animals usually comprise only a small proportion of any of an ecosystem's biomes, they are very important ecosystem regulators through their roles as pollinators, predators and seed dispersers (Leaky and Lewin 1995). Thus, the Indonesian ecology C&I subset includes for the above quoted criterion the indicator ***'Animal habitats are maintained or restored'***. Humans are known to often play an active role in instigation of species extinction cascades, by way of over-harvesting animals and/or by destroying habitats.

Vegetation structure can indicate not only the plant species composition of an area but also how its flora species community interacts with the physical resources available. Vegetation determines the habitat and food sources for animals. A number of studies have shown a strong relationship between plant and animal diversity (MacArthur and MacArthur 1961; Karr 1968; Johns 1986; MacArthur and Peer 1992). The complexity of lowland tropical forests, in terms of plant species and structure, allows the coexistence of many animal species with different specialisations. For example, primate diversity is highly dependent on the availability of leaves, fruits and seeds from certain types of tree species. It is therefore also determined by the heterogeneity of habitat (Terborgh 1983; Johns 1986; Johns 1992). Thus floristic composition and structure largely determine richness of fauna species. Changes in biodiversity, as Leaky and Lewin (1995) observe, are not only about the exit and entry of individual species. They are 'collective' system changes that reflect a reorganisation and orientation of their remaining and new component parts which creates new relationships, interactions and outcomes.

The tropical rainforest canopy is usually divided into several strata, each of which has its own complement of plant and animal species. Although animals move between strata, each strata constitutes the preferred habitat of a different group of species. Additional divisions occur within each strata with the effect of increasing niche diversity. Each of these niches is a unique environment needed to sustain the existence of specific organisms or species. Within some species communities, developments lead to the creation of extra niches that are then filled by a recruitment of additional species into the community (Ricklefs and Schulter 1993). Forest structure must therefore be maintained to sustain, or allowed to develop to increase biodiversity.

Alterations in the natural habitats incur changes in resident plant and animal communities and their relative population densities, and sometimes result in the elimination of many species. A smaller number of 'generalist' species (including weeds or pest species such as grasses, rats and squirrels) whose less restricted diet confers upon them wider tolerance ranges, are able to adjust and benefit from such changes, increasing their populations to invade vacated or newly created habitat niches. Generally, the more specialised an animal's diet, the more vulnerable it is to suffering as a result of forest disturbance.

An example relating to this generalist-specialist continuum is the set of descriptions Bedigong residents, in West Kalimantan,gave of the hornbill's specialised feeding and nesting habits. Sightings of hornbill in forest surrounding Bedigong have become increasingly rare in recent years. Some local people believe that this bird, which is sacred to them, has become locally extinct due to habitat destruction (hunting hornbills is taboo among Dayaks). Forest species of the bird are quite sensitive to some forms of environmental disturbance. As local farmers explained, a specific characteristic of this species is its breeding habitat (Box 4.7). The females require large tree holes to nest, lay eggs and rear fledglings. This requirement led to hornbill being considered the most likely species to be threatened by timber logging (McClure 1968).

The hornbill does, however, have some capacity to adapt to environmental change and is unlikely to be disturbed by food shortages caused by a loss of high trees. Although such losses reduce their foraging substrata, they can meet their dietary protein and mineral needs with animal prey. The species is recognised as very mobile and travels considerable distances in search for food. Among Asian forest hornbills, fig trees that are often comparatively common, and have been considered especially important for territorial hornbills. In some areas hornbills have been observed to respond to disturbance of the middle forest stratum, by moving to the upper forest canopy layer. Provided some large trees with an abundance of fruit remain, they will rarely compete as a result of a decrease in the density of fruiting trees. Some hornbill species have a strong food preference for smaller fruiting trees. Should these trees be eradicated during logging operations, then their foraging group size is likely to decline. Therefore, while food availability may be a contributory factor limiting hornbill populations in logged forest, a reduction of breeding sites is likely to have a much greater negative impact on their population size (Kemp and Kemp 1975, Leighton, cited in Kemp 1985).

The consequences of structural disturbance of different degrees differ from site to site depending on species composition, soil fertility, original forest architecture and moisture regime. These factors together create the light requirements of existing flora species, and they determine how alterations to forest structure that affect light penetration, will impact upon these species (Reid *et al*. 1993). With an adequate vertical and horizontal forest structure, we may assume species populations can continue to thrive at least in relation to suitable existing habitat conditions. Even where some animal and plant species have been partially or wholly removed, *the most important precondition for ecosystem recovery and integrity is the retention of a continuous forest canopy cover.*

We here assume that any consequences of biodiversity erosion at the localised level of populations are less severe than those caused by degradation at the landscape or ecosystem scale. The cover of structurally undisturbed forests offers the best possible conditions for the retention of a vast proportion of the local flora and fauna and for the recovery of overexploited species. A relatively intact forest cover also guarantees adequate levels of natural ecosystem services in terms of long-term carbon storage pools and carbon sequestration, forest hydrology, and micro- and mesoclimatic interactions associated with forest evapotranspiration. These observations generated the Brazilian criterion '***A continuous and structurally undisturbed forest still offers the most satisfactory ecological conditions for the maintenance of local biodiversity and the sustainable use of forest resources***'.

4.2.2 C&I: Forest Structure

Compared to the I&V for this Brazilian criterion, the Cameroonian and Indonesian teams developed more detailed I&V which distinguish between horizontal and vertical forest structure (Table 4.1). The Cameroonian ecology set includes as a verifier of structure '***Diverse plant formations (succession) in the zones devoted to agricultural activities develop during the fallow period***'. The Indonesian forest management specialist, recognising diversity to be correlated to structure, included the indicator '***Vegetation structure in tembawang resembles that of natural forest***' in support of the criterion '***Diversity of agroforestry products in tembawang is maintained***'. On the Indonesian test, structural similarities between modified forest systems and natural undisturbed forest were said to enhance the compatibility between forest types, providing continuity of some habitat elements (niches). The more closely agroforestry or modified forest systems replicate the original forest's structure, the better they tend to be at performing the original forest's functions of soil and water resource protection.

Table 4.1 C&I: Forest Structure

Cameroon	Indonesia	Brazil
Criteria (ecology): • Natural regeneration is assured. ***Indicator:*** • The horizontal distribution of different plant forms (structure) shows a dynamism in the structure of the forest. ***Verifiers:*** • A dense stable forest (climax form) with a structure comparable with that of the original forest of the region. • Diverse plant formations (succession) in the zones devoted to agricultural activities develop during the fallow period. ***Indicator:*** • The vertical structure (terracing) in the primary forest is not disrupted. ***Verifiers:*** • Tree tops are tiered. • Trunk diameters vary. • The upper canopy is continuous. ***Indicator:*** • The abundance dominance consistency (distribution) and frequency of species is comparable to that of the original forest.	***Criterion (ecology):*** • Impacts on biodiversity are minimised. ***Indicator:*** • Vegetation structure is maintained. ***Verifiers:*** • The existence of all normal strata in the climax vegetation. • Basal area distribution is normal. ***Criterion (forest management):*** • Diversity of agroforestry products in tembawang is maintained. ***Indicator:*** • Vegetation structure in tembawang resembles that of natural forest. ***Verifiers:*** • Age classes and diameter distribution. • Tembawang produces timber species.	***Criterion (ecology):*** • A continuous and structurally undisturbed forest still offers the most satisfactory ecological conditions for the maintenance of local biodiversity and the sustainable use of forest resources. ***Indicator:*** • Proportion of primary and secondary forest within the CMF. ***Verifiers:*** • New annual agricultural land clearings and fires are done in areas of fallow regrowth rather than primary forest • Fallow periods are not being reduced over the course of time.

4.2.3 C&I: Biodiversity and Species Richness

Comments and observations on C&I attributes

The criterion in the Indonesian ecology subset '***The forest ecosystem's capacity to regenerate naturally is ensured***' is supported by the indicator '***Species richness is maintained***' (Table 4.2). Species richness must be measured on a standard per unit area basis to obtain assessments of different sites that are comparable. For a given location, the larger the area, the more likely it is to contain a greater number of species. Comparisons are further facilitated if species richness is measured for different habitats (ecozones and ecotones). Variations in the composition of species richness provide some insights into the environmental adaptability of specific species. If habitats are differentiated, it should also be possible to draw inferences about variation in species richness for remnant habitats and the landscape as a whole.

Verifier

Sufficient numbers of key species in various growth stages

To make monitoring practical and economic, the Indonesian ecologist maintained that a few 'key' (indicator) species have to be identified. From observations of changes in the vigour or numbers of these species, inferences can be drawn about other changes in the species community. Correspondingly,

Relevance and Ambiguity: 'Key species' and 'indicator species' are often used as interchangeable terms. However, the term 'key species' is sometimes given a broader interpretation to mean species that play a crucial role in maintaining the overall integrity of the ecosystem intact. This interpretation, it has been argued, renders the term useless.

The important point regarding indicator species, is the need to be precise regarding what they are indicative of. Only if this is stated, can the indicator or verifier stand on its own. Otherwise it would have to be seen in the context of a higher level statement.

included in his subset is the verifier '***Sufficient numbers of key species in various growth stages***' for the criterion '***The capacity of the forest ecosystem to regenerate naturally is ensured***'**.** Reid *et al.* (1993) recommend that species indicative of this include those with extensive range requirements, ones whose survival confers protection on the habitats of smaller-ranging species, and ones that are especially sensitive to ecological change, i.e., endemics with highly restricted ranges and animal species that are specialist feeders with restricted ranges. Variations in ecosystems, however, mean it will rarely be appropriate to use the same indicator species in different geographical locations.

The controversy concerning the usefulness of the concept of 'key' or 'keystone' species (see Scott Mills *et al.* 1993) was not discussed on any of the tests. Species differ with respect to conditions associated with their well-being, and their ability to adjust to change, with some species suffering more quickly and with more easily observable responses from forest disturbances. A study by Thiollay (1991) in Guianan forests showed that most understorey insectivore bird species are adversely affected by disturbance. Babblers (Timaliidae), that are insectivorous specialist feeders, were found to decline sharply after logging and have been used as indicators of forest regeneration in West Malayan rainforest (Wong 1985).

Table 4.2 Selected C&I: Biodiversity

Cameroon	Indonesia	Brazil
Criterion (ecology): • Biodiversity is conserved. ***Indicator:*** • Spatial organisation which preserves biodiversity. ***Criterion (ecology):*** • Natural regeneration is assured. ***Indicator:*** • The abundance dominance consistency (distribution) and frequency of species is comparable to that of the original forest. ***Criterion (forest management):*** • The co-existence and/or co-evolution of farming fallow and forest management systems maintains or increases biodiversity. ***Indicator:*** • The landuse system is integrated, consisting of a diversity of sub-systems that ensure overall biodiversity is relatively high compared to that of any one of the sub-systems. ***Verifier (social):*** • Changes in availability of useful plants and animal species.	***Criterion (ecology):*** • Impacts on the forests biodiversity are minimised. ***Indicator:*** • Endangered plant and animal species are protected. ***Verifiers:*** • Agreement among community members not to hunt certain animal species. • No signs of protected plants and animals on markets. ***Criterion (ecology):*** • The forest ecosystem's capacity to regenerate is assured. ***Indicator:*** • Animal habitats are maintained or restored. ***Verifiers:*** • Sufficient numbers of key species in various growth stages. ***Indicator:*** • Species richness is maintained. ***Criterion (forest management):*** • Diversity of agroforestry products in tembawangs is maintained. ***Indicator:*** • Species and genetic diversity is maintained.	***Criterion (ecology):*** • A continuous and structurally undisturbed forest still offers the most satisfactory ecological conditions for the maintenance of local biodiversity and the sustainable use of forest resources. ***Indicator (ecology):*** • Processes of fragmentation and conversion of primary habitats must be contained so as not to result in biodiversity erosion and the local or regional extinction of species. ***Principle (ecology):*** • The ecological integrity of the forest is maintained in terms of a relatively complete assemblage of reptiles, birds and mammals.

4.3 Forest Conversion, Fragmentation and Biodiversity

This section covers some background on forest conversion, fragmentation and biodiversity, as well as the related C&I.

4.3.1 Background

Only a crude separation of C&I related to forest structure and forest fragmentation is possible. Processes of forest fragmentation reflect obvious structural disturbance on the horizontal plane. They alter the landscape's habitat composition. Compared to intact forest systems, fragmented forest and, particularly isolated forest patches, are comparatively poor in biodiversity (Schelhas and Greenberg 1996). Commonly fragmentation causes the local extinction of the original forest species so that fragments will contain fewer original species than remaining expanses of continuous forest (Zuidema *et al.* 1996). However, compared to other degraded elements of the already fragmented landscape in which they occur, they are often rich in biodiversity. In human landscapes, ranging from the well-managed to the severely degraded, forest fragments and corridors continue to perform very important social and ecological functions. In contrast to other components of the landscape, they continue to provide habitats for a large number of plant and animal species, acting in some cases as the primary habitat for these species, or as 'stepping-stone' resources for local or long-distance migratory organisms (Greenberg 1996).

As fragmentation progresses and the size of forest patches continues to diminish, an increasing number of forest plant and animal species are threatened or driven into local extinction. The forest fragments lose pollinating and seed-dispersing species. This initiates further cycles of species impoverishment. Over the years, the residual species community becomes increasingly less functional. Moreover, fragmentation and structural damage make forests more susceptible to forces like invasion by aggressive pioneer species and wildfires. These pose additional threats to the regeneration of original species.

From a production perspective, for the potential of community managed natural forest to be maintained, the forest area must not be allowed to contract below a certain size determined by the relative abundance of the sought after forest products. In a few isolated cases the abundance of all valuable products may be such that large-scale deforestation could take place before returns to forest product harvesting, using currently available technologies and energy sources, start to fall.

4.3.2 C&I: Landscape Mosaic

The general consensus on all three tests was that biological and landscape diversity jointly determine habitat diversity and the multiplicity of natural resource use options. These forms of diversity should therefore be assessed together with C&I of the nature of the multiple uses to which forest resources are locally put (see Box 4.1 for selected C&I in Landscape Mosaic). The impoverishment of biodiversity narrows down the use-options.

Box 4.1 Selected C&I: Landscape Mosaic

From the Brazilian ecological C&I subset:

Criterion: The preservation of a mosaic of natural habitats maintains the natural complementarity of species occurrences.

Supporting indicators:

- Among the various types of natural habitats occurring within the region, the rarest (or least extensive) in the forest landscape are strongly protected from conversion to agriculture.
- Forests along river and stream banks are protected from clear felling to preserve hydrological functions and for biodiversity conservation. Legal minimum of keeping 50 m of forest along rivers and streams, is upheld.

  Supporting verifiers:

  - Quantification of the continuity and width of remaining riverine forest.
  - Description of how upland and flooded (*igapo*) forest areas are integrated into the successional mosaic resulting from shifting agriculture.
  - Most important catchment areas within watersheds, and especially forests along rivers and streams, are maintained relatively intact especially upstream from villages.

From the Cameroonian ecological C&I subset:

Criterion: Biodiversity is preserved.

Supporting indicators:

- Spatial organisation (of habitats) which preserves biodiversity.

  Supporting verifiers:

  - Agricultural activities are localised around the habitation zones in a radius of about 3 km.

4.3.3 C&I: Forest Fragmentation & Conversion

The Brazilian team proposed assessing biodiversity at the landscape level from two perspectives, habitat fragmentation and landscape mosaic. The C&I in the Cameroonian forest management and Indonesian ecological subsets differ contextually. In both cases, however, the view emerges that, maintenance of landscape diversity coupled with limited structural forest disturbance and fragmentation is important for the conservation of biodiversity (Table 4.3).

Large, continuous areas of forest are needed to maintain the ecological functions of forests. In the Cameroonian forest management subset this concern is raised to the level of a principle; ***'Forest conversion to accommodate agriculture and social change does not place undue pressure on the natural resource base'.*** Similar concerns support the Brazilian ecological criterion '***The process of habitat fragmentation does not compromise the maintenance of biological diversity at the forest landscape level***', and forest management criterion '***Agricultural practices are undertaken in a manner aimed at minimising their impact on the forest***'.

Table 4.3 C&I: Forest Fragmentation

Cameroon	Indonesia	Brazil
Principle (forest management): • Forest conversion to accommodate agriculture and social change does not place undue pressure on the natural resource base. ***Criterion:*** • The rate of natural forest conversion is low. ***Indicator:*** • The reduction in area covered by natural forest over a given time. ***Verifier:*** • Between 60-75% of the total community land constitutes natural forest and 25-35% makes up farm, fallow and secondary forest.	***Indicator (ecology):*** • Drastic land cover change is prevented. ***Verifier:*** • There is a land use plan for the village area, drawn up and formalised by the community. ***Indicator (ecology):*** • Animal habitats are maintained or restored. ***Indicator (forest management):*** • Conversion into ladangs (shifting agriculture) is restricted. ***Verifiers:*** • Community members must request community permission to convert. • Areas permissible for conversion (to agriculture) exist. ***Indicator (forest management):*** • Conversion into tembawangs is restricted.	***Criterion (ecology):*** • The process of habitat fragmentation does not compromise the maintenance of biological diversity at the forest landscape level. ***Indicator:*** • Processes of fragmentation and conversion of primary habitats must be contained so as not to result in biodiversity erosion and the local or regional extinction of species. ***Verifiers:*** • Islands of relic primary forest occurring within the successional forest mosaic are preserved. • The fragmentation of the forest landscape caused by shifting agriculture results in a successional mosaic that has a relatively high connectivity with areas of primary forest through natural habitat corridors.

4.3.4 C&I: Assessing the Rate of Forest Conversion

Comments and observations on C&I attributes

Verifier:

Between 60-75% of the total community land constitutes natural forest and 25-40% makes up farm, fallow and secondary forest.

Relevance:

This indicator offers large margins. In forest poor areas these margins may be unrealistic. The ratio of natural forest to other landuse types gives a useful scale against which to evaluate the significance of management strategies. However, the indicator is insensitive to the differential needs of habitats depending on their relative rarity or sensitivity.

An indicator from the Cameroonian forest management set is '***The reduction in area covered by natural forest over a given interval of time***'. The forest conversion rate provides more insight into the impact of conversion than does an indicator such as **'*Percentage forest cover*'**. The latter supplies a baseline value against which future measurements of cover can be compared. However, the Cameroonian test did not generate this indicator, but the semi-prescriptive verifier '***Between 60-75% of the total community land constitutes natural forest and 25-40% makes up farm, fallow and secondary forest***'. This stipulates a minimum forest cover requirement against which to evaluate the acceptability of forest cover change.

The Brazilian ecology subset contains the indicator '***Proportion of primary and secondary forest within the Community Managed Forest***'. These sorts of ratios, if calculated at regular intervals, can reveal the rate of change in forest cover and which forms of land use are replacing forest cover.

4.4 Factors Promoting Forest Conversion

Basically, the members of the testing teams agreed that assessing the sustainability of CMFs requires evaluation of the major threats to forest area. These commonly include demographic factors (migration patterns and internal birth rates), the expansion of agriculture (subsistence and cash cropping and pasture formation), and road construction. (The latter, by providing better access to markets and land, have encouraged migration into forested areas, and stimulated increases in the production of marketable surpluses of extracted and cultivated products.) Frequently it is a collection of interrelated factors that conspire to reduce forest area (Kaimowitz and Angelsen 1998). The coverage of the test generated C&I that specifically refer to forest conversion is, however, restricted to population growth and agriculture, both of which can significantly affect patterns of forest fragmentation and the composition of the forest mosaic at the landscape level.

4.4.1 Population Growth, Migration and Settlement

i) Population Growth and Migration

Population growth was identified as a major determinant of the rate of deforestation on the Cameroonian and Brazilian tests. Factors regulating population size in forest communities are liable to vary substantially from one region to the next.

Until recent times, population growth was kept in check by, compared to today's standards, high infant mortality rates. Improved access to modern medical assistance has changed this. Some of the rural population increase in less-developed countries has been absorbed by urban livelihood opportunities. However, economic recession is now compelling many urban immigrants to return to the rural areas. The need to provide for returnees increases the pressure to convert forest for agricultural production. At the time of the tests, this was proving a burden for many forest communities in Cameroon.

Only one statement, a social verifier '***Access to and female use of family planning and contraceptives***' was generated by the Brazilian test to assess population growth. This was in spite of the Brazilian social scientist having repeatedly stressed that family planning is one of the most critical factors affecting the future of community forests. Demographic variables in the Cameroonian set are addressed by one forest management indicator and three supporting verifiers (Box 4.2), but there was no reference to family planning.

Although the social verifiers ***'Property inheritance patterns'*** and ***'Clear rules on inheritance'*** from the Cameroonian and Indonesian sets respectively were not conceived in connection with regulation of population growth, they can indicate traditional population growth controls and demographic trends affecting forest conversion. For instance, in many contemporary Caboclo communities, only a few family offspring inherit their parents' land or receive permission to convert new forest areas to agriculture. The parents commonly invest in education for their other offspring to compensate them for not inheriting land. These children upon completing their schooling are expected to seek gainful employment elsewhere. Such strategies help to regulate land pressure.

ii) Settlement Patterns and Forest Fragmentation

One variable not explicitly acknowledged during the tests as influencing fragmentation and mosaic development processes, was 'community settlement patterns'. The significance of this variable may have been overlooked, since a comparison of diverse settlement patterns is needed to make it evident.

Box 4.2 C&I: Population and Migration Controls
(Cameroonian forest management subset)

Principle: **Forest conversion to accommodate agriculture and social change does not place undue pressure on the natural resource base.**

Criterion: **The rate of forest conversion is low.**

Supporting indicator:

- Provisions are made to resettle new entrants and immigrants into villages without causing undue pressure on the natural forests.

  Supporting verifiers:

  - Very little or no access consideration is made by the village authorities to settle new entrants and immigrants in the natural forest directly.
  - Number of new entrants who establish farms in the natural forests is known and controlled.
  - Migration trends.

4.4.2 Agricultural Expansion

i) Overview

In the CMF context, agricultural activities are often the most prominent agents of fragmentation. The patchwork of areas of abandoned shifting cultivation plots in different stages of forest succession displays a dynamic image of forest fragmentation constantly changing in space and time. Social factors have been found to sometimes strongly affect the spatial and temporal dynamics of shifting cultivation. Observations by Browder (1996) of the evolution of forest mosaics resulting from shifting cultivation in Rondonia revealed that, as the families of the pioneer settlers aged, their children grew up and left home causing a dramatic fall in the availability of family labour. The reduced family labour pool translated into a marked decline in the incidence of primary forest clearance and the size of agricultural plots. Furthermore, population growth tends to exponentially accelerate the expansion of agriculture for subsistence and cash cropping, and encroachment into natural forest areas.

Agricultural expansion was seen by most of the test team members as a catalyst for forest fragmentation and area contraction. Processes of fragmentation alter the pattern of forest mosaics, and the evolution of forest mosaics was thought to largely depend upon the types of agricultural systems and practices used. On each of the tests C&I were developed to measure the rate at which agriculture advances into natural forest areas. Indicators and verifiers in the Indonesian set inquire into community restrictions imposed on the conversion of forest to shifting agricultural land, and the permission an individual must seek before opening up new agricultural plots in forest. The Indonesian set also inquires into measures such as intensification and training, being undertaken by the community to curtail agriculture's encroachment into forest.

ii) C&I: Agricultural Expansion

Comments and observations on C&I attributes

Verifier

Mapping of vegetation cover for different years using satellite images.

Ease and cost of use:
If the aim is to verify changes in size of land holdings or agricultural clearings, images taken shortly after land has been cleared are required. On images taken at other times differentiation between crops and young fallows may be impossible. Distinguishing between mature forest and advanced forest regrowth can be impossible irrespective of the time of year when images are taken.

Given these limitations and the high cost of satellite images, relying on farmers information may be a more feasible way of assessing changes in the size of agricultural clearings or holdings. There may, however, be unwillingness of the part of farmers to provide this information.

The Brazilian set includes the prescriptive indicator *'**The size of annual agricultural land holdings is not increasing annually**'.* This indicator is preferable to that of change in the total area covered by agricultural holdings. This is because it allows assessment of the extent to which forest clearance is attributable to population growth (i.e., more families with more holdings of, however, a similarly small size) rather than to changes in land potential or agricultural practice. Whether or not changes in holding size are acceptable would have to be substantiated on a site-by-site basis with a range of other socio-economic and technical C&I. The Brazilian team cited satellite image interpretation as a verifier of changes in the average size of agricultural land clearings; *'**Mapping of vegetation cover for different years using satellite images**'*. Such images can be useful for verifying other landscape variables such as percentage of forest cover.

The Indonesian test team held the opinion that the rate of agricultural land expansion has to be curbed to enhance the long-term survival prospects of natural forest and tembawang forest gardens. Reducing the rate of forest conversion to agriculture when the population is growing, or the demands for marketable surpluses are increasing, requires changing cropping patterns or farming methods or both. Switching from shifting cultivation to permanent agricultural systems may sometimes be an option. Therefore the Indonesian social subset contains the criterion '***Permanent agriculture is developed where socio-economic conditions allow***' with the supporting indicator '***Evidence of training in permanent agriculture***'. Verifiers of the suitability of training focus on its coverage of appropriate on- and off-farm technologies. Peoples' ability to put training into practice is influenced by many factors including agricultural support services, agricultural credit and accessible agricultural inputs. These variables feature as verifiers for the indictor related to training.

4.5 The Forest–Agriculture Interface, Biodiversity and the Forest Mosaic

4.5.1 Overview

Beyond the direct impact of agricultural expansion, there was some initial controversy within the test teams about whether C&I for CMFs should inquire into forest farming practices. Some thought that to do so would make assessment processes unwieldy. They felt considerations should not reach beyond the features of boundaries between forest and other types of land use, and controls over negative externalities. These limits proved difficult to define in detail, especially with regard to shifting agriculture. All the tests generated a substantial number of C&I to address the dynamic characteristics of shifting cultivation and agroforestry and, to a lesser extent, other types of agricultural activities such as livestock rearing and perennial cash crop production.

The C&I for agriculture basically assume it has a two-fold impact on the sustainability of CMFs. First, in forest areas, the spatial expansion of agriculture nearly always brings about increased forest conversion (see above section 4.4). At the test sites forest conversion was virtually only undertaken for agricultural purposes. By reducing the natural forest area, harvesting pressure is concentrated on a decreasing population of harvestable species. At the test sites, agricultural expansion was found to be closely correlated to demographic factors, access to markets for surplus production and to agricultural inputs (e.g., seed, credit, etc.).

Secondly, as addressed in this section, CMFs' sustainability was thought to depend on how well agricultural activities are integrated into a broader system of multiple land use. Attention thus turned to the dynamic characteristics of the agriculture–forest interface – namely its spatial and temporal characteristics and how these are affected by different activities (Box 4.3). Agricultural intensification and the use of low impact techniques, although encompassing some irreconcilable activities, were both identified as important for sustainability, albeit under different conditions. The general consensus on all tests was that subsistence shifting agriculture based on best local practice causes minimal forest conversion can be regarded as sufficiently ecologically benign to be acceptable.

Box 4.3 Selected C&I: Minimising the Impact of Agriculture on Forest Integrity and Health

<u>**From the Brazilian forest management subset**</u>:

Indicator:

- Application of low-impact treatments and husbandry methods (in the control of pests and diseases, pruning, etc.).

  Supporting verifiers:

  - Adequate use of pesticides (correct dosage, use of protective equipment, adherence to use instructions, etc.).
  - Knowledge and application of alternative agricultural practices.

<u>**From the Cameroonian forest management subset**</u>:

Indicator:

- Farmlands are cleared (slashed and burnt) just before the rainy season so that crops are planted at the right time.

  Supporting verifiers:

  - Farmlands are cleared (slashed and burnt) just before the rainy season so that crops are planted at the right time.
  - Signs of bad timing or delays in land preparation, such as waste of prepared land and yield losses.
  - Attention paid to climatic and seasonal factors in the timing of agricultural fires.

Box 4.3 Continued

Indicator:

- During farm site preparation, valuable trees are protected (including fertilising trees).

  Supporting verifiers:

  - Controlled use of fire in site preparation.
  - Many timber, non-timber and other high-value plant species are present on farm, fallow and secondary forest land.

Indicator:

- Fallow periods are long enough to permit recuperation of soil fertility.

  Supporting verifiers:

  - Species indicative of soil fertility are commonly found in fallows and secondary growth areas.
  - No unacceptable long-term declines in crop yields.

  - Crops and cropping rotations make efficient use of soil fertility.
  - Mixed cropping and cropping sequences help ensure food security throughout the year and make provisions for crop failure.

<u>From the Indonesian social subset</u>:

Criterion: Permanent agriculture is developed where socio-economic conditions allow.

Indicator:

- Evidence of training in permanent agriculture.

  Supporting verifiers:

  - Training in appropriate on-farm technology.
  - Training in appropriate off-farm technology.

Indicator:

- Agricultural support systems exist.

  Supporting verifiers:

  - Agricultural inputs are available.
  - Agricultural credit is available.

4.5.2 C&I: Spatial Dynamics of Agriculture

In theory, shifting cultivation, and those who practice it, can harmoniously coexist with the forest over long periods, provided the human population does not exceed the forest's carrying capacity.

Comments and observations on C&I attributes

Indicator:

Clearance of primary forest for agricultural land use is being avoided.

Relevance:

High.

Value-judgement:

None. However, people's avoidance of forest clearance can be traced to different motives, and certain limited clearing may, in fact, lead to activities which limit future clearing. It remains questionable, therefore, whether a negative reading for this indicator is categorically indicative of unsustainability.

The Cameroonian forest management criterion '***Agricultural land clearing is largely confined to fallow and secondary forest***' closely resembles the Brazilian forest management indicator '***Clearance of primary forest for agricultural land use is being avoided***'. However, the latter adds the notion of conscious decision-making by introducing the word 'avoided'. How much primary forest clearance can be stemmed depends, among other things, on the productivity of other forms of land use. It is a matter for judgement, how much forest conversion should be permitted to establish well-managed cash crops. Cameroonian test site inhabitants said the introduction of cacao and coffee in the 1960s was responsible for the greatest wave of deforestation in their area to date. These crops now stand neglected due to price declines on the world market. At the time of their establishment a different future was envisaged. As it happened, the forest was in this instance replaced by crops whose socio-economic significance failed to meet expectations and, whose production, therefore, unexpectedly proved to be unsustainable.

4.5.3 Shifting Agriculture, Agroforestry and Biodiversity

i) Shifting Agriculture

Shifting cultivation, as practised at the test sites, was generally seen as part of a cyclic pattern of forest succession growth. Soils enriched by forest plants and animals are cleared, then cropped until their fertility declines. Thereafter they are left to revert to forest and new forest soils are cleared for cultivation. The forest mosaic is thus continuously changing spatially over time. Commonly people enrich exhausted fields with economically valuable perennial species to continue receiving some benefits from these otherwise abandoned fields. This has culminated in some parts of the forest containing an unusually high diversity of useful species (de Jong, 1997).[18]

[18] Domesticated species including agricultural crops and livestock are usually overlooked in biodiversity assessments (Reid *et al.* 1993).

The plant and animal diversity that exists in a forest impacted by harvesting, fire, and soil disturbances is dependent on the species inhabiting the forest and the associated rates of species colonisation (Walker 1994; de Graff and Miller 1996). Patterns of forest succession induced by shifting cultivation potentially increase genetic diversity. They, therefore, support principles of sustainability and biodiversity conservation.

The Indonesian team highlighted the fact that many species can be improved by cross-breeding with their wild relatives. The potential value of forest genetic resources for improving tropical agriculture and silviculture, the team maintained, is substantial. Genetic tree improvement programmes usually generate stable selection processes, channelling efforts to regenerate forests with genotypes that are superior in some respect (Kimmins 1987). Natural variation provides a wide range of possibilities for creating products with desired genotypes. It thus offers possibilities for altering the genetic composition of domesticated plant and animal communities, adding to incentives to sustain forest species complements and gene pools of domesticated species, varieties, landraces and cultivars evolved from forest species.[19] As the majority of inhabitants at all the test sites were found to prioritise food production, one might have expected C&I on the genetic diversity of food crops to have been formulated on the Brazilian and Cameroonian tests as well as on the Indonesian test.

ii) C&I: Biodiversity and Agriculture/Agroforestry Land Use Systems

Comments and observations on C&I attributes

Acknowledging the significance of agricultural and agroforestry systems to biodiversity, the Cameroonian forest management specialist created the criterion '***The co-existence and/or co-evolution of farming, fallow and natural forest management systems maintains or increases biodiversity***'. This criterion and its supporting indicator and verifier (Box 4.4) assume that biodiversity is a function of landscape diversity and that this is affected by human intervention. The specialist believed that human forest modifications, such as those caused by shifting cultivation, alter biodiversity by intentionally or inadvertently introducing agricultural and pioneer species. By integrating farming, fallow and natural forest management systems, he argues biodiversity can be increased. Substantial evidence suggests biodiversity tends to be relatively high in areas that span ecotones as compared to neighbouring areas that do not (Bossel and Bruenig 1992). Theoretically, this is just as likely to apply to areas that span forest margins.

[19] The number of crop or livestock varieties does not necessarily indicate genetic diversity. According to Reid *et al.* (1993), if all the varieties are recently descended from a common ancestor, then the genetic diversity among them may be relatively low. Information of the lineage of the varieties can be obtained by calculating a coefficient of kinship or parentage for the various varieties (*ibid*). Referring to findings of Falconer (1981), Reid *et al.* explain that this coefficient indicates the probability of a pair of alleles drawn at random from the same locus in two individuals will be autozygous (identical by common descent). The lower the coefficient, the greater the genetic diversity.

Criterion

Diversity of agroforestry products in tembawangs is maintained.

This is a prescriptive statement. It overrules certain economic objectives (e.g. profit maximising and reaping economies of scale) where these conflict with its fulfilment.

In contrast to biodiversity in general, the more specific issue of genetic diversity is the subject of only one statement: the Indonesian forest management indicator '***Species and genetic diversity is maintained***' of the criterion '***Diversity of agroforestry products in tembawangs is maintained***'. The Indonesian test team pointed out that all domestic plants and animals were originally derived from the wild. Genetic diversity reduces agricultural risk, especially in shifting cultivation systems, by providing pest resistance, adaptations to climatic and soil variations, and a range of physiological plant attributes that can be matched to household technological and labour endowments. The variable therefore holds some significance for the household economy. Intercropping genetically diverse species and varieties can result in more efficient use of soil nutrient and moisture reserves and prolong the continuous cropping period, developments that can help to slow down the rate of forest conversion to agriculture.

Box 4.4 C&I: Biodiversity and Landscape Diversity (forest management, Cameroon)

Criterion: **The co-existence and/or co-evolution of farming, fallow and natural forest management systems maintains or increases biodiversity.**

Supporting indicator:

- The land use system is integrated, consisting a diverse subsystems that ensure overall biodiversity is relatively high compared to that of any one subsystem.

  Supporting verifier:

  - Exotic species do not pose a threat in natural forests.

4.6 The Maintenance of Water and Soil Resources

4.6.1 Overview

Water and soil are basic resources whose quality and quantity determine the capacity of an ecological system to produce and sustain biomass (Lightfoot *et al.* 1993). In both cases, their localised use has potentially wider geographic consequences. Both are affected by forest cover and ground cover that perform multiple functions of watershed protection, nutrient cycling and soil erosion control, as well as providing microhabitats for soil fauna and mycorrhiza. The more forest cover is restricted to high altitude or sloping areas, or to poor, erosion-prone soils, the more critical local communities are likely to perceive the need for protection of forest functions to be. At the Indonesian village Darok, for instance, people stressed that the forest remaining on mountain tops is vital for regulating irrigation waters for rice paddies. Forest cover plays a particularly important role in maintaining ground cover. Ground cover, which refers to soil cover, such as the litter layer, root mat, woody debris, etc., plays a very important role in directly protecting forest soils from surface erosion (Brown 1985; Wiersum 1985; Bruijnzeel 1990).

4.6.2 Water Resources Management

C&I related to water resources were developed during all tests. Water is essential for the survival of all living beings; dirty or polluted water, however, causes diseases in humans, terrestrial and aquatic animals. An efficient labour force depends on reliable supplies of fresh and clean drinking water. Clean, unobstructed streams and lakes are needed to maintain fish stocks. For the Brazilian test site communities, fish is an important source of protein. The Indonesian test site residents are critically dependent upon reliable volumes of irrigation water for rice production. Everywhere fluctuations in groundwater and soil moisture levels affect harvest yields and the preservation of biodiversity.

i) C&I: Watershed and River Bank Management

Comments and observations on C&I attributes

Verifier

Description of how upland and flooded (igapo) forest areas are integrated into the successional mosaic resulting from shifting agriculture.

Generalisability:

The geographic relevance of this verifier is more restricted than that of the criterion '*The preservation of a mosaic of natural habitats maintains the natural complementarity of species occurrences*' it supports. The tendency for indicators and verifiers to be more sitespecific than criteria, implies indicators and verifiers are more important tools for improving understanding of CMF systems. However, sometimes the scope of indicators and verifiers can lessen or increase the specificity of a criterion.

Indicator

Water sources are protected.

Generalisability:

In contrast to the above verifier, this indicator is of generic relevance, given its wide, general topic.

Ease of assessment:

It can easily be evaluated by local inhabitants. Natural resource scientists acquainted with the area should have no difficulty with its assessment.

Water and soil, being essential to all forms of life and nutrient cycling, are of primary importance to biodiversity conservation. Their ecological utility is largely defined by the nature of their association. This association or relationship is mediated by the influence of forest cover and mosaic. It is addressed by the Brazilian ecology criterion on forest mosaic '***The preservation of a mosaic of natural habitats maintains the natural complementarity of species occurrences***' (Box 4.5). The I&V supporting this criterion mostly concern water courses and their protection for biodiversity conservation. By including the verifier '***Description of how upland and flooded* (igapo) *forest areas are integrated into the successional mosaic resulting from shifting agriculture***', the Brazilian ecology subset promotes the integrated assessment of water resource management at the landscape level.

In the Indonesian ecology subset, water and soil management are most closely linked by the bringing together of the indicators '***Water supplies are protected***', '***Water and soil quality are maintained to secure the ecosystem's sustainability***', and '***Soil erosion is minimised***' under the criterion '***Preservation of critical ecosystem functions***'.

All the teams created at least one indicator or verifier on the protection of vegetation along riverbanks. In the Brazilian case, the relevant indicator '***Forests along natural watercourses are protected from clear felling to preserve hydrological functions and for biodiversity conservation. Legal minimum of keeping 50 m of forest along rivers and streams is upheld***' (ecology), refers to compliance with the law. The Indonesian ecology subset's equivalent is the verifier '***Vegetation cover along river banks is maintained***'. In the Cameroonian ecology subset, the equivalent is also a verifier: '***Permanent plant cover upstream and on the banks of water courses***'. We interpret the C&I on the protection of riverine vegetation as being intended to embrace all sections of water courses including their headwaters, and this is why the Brazilian and Cameroonian teams thought additional C&I relating to the protection of water sources such as springs, were unnecessary. The Indonesian ecology specialist, however, created the indicator; '***Water sources are protected***'**,** which heads the verifier concerned with riverside vegetation.

Verifier:

Permanent plant cover upstream and on the banks of water courses.

Ease of assessment:

The size of the river has some bearing on this. Regarding communities situated far down stream on large rivers, accurate assessment is likely to depend on the reliability and detail of, as well as access to, existing studies on conditions upstream.

Indicator:

Rules that ensure fair distribution of irrigation water where there *are paddy fields*.

Ease of assessment:

In cases where communities exist downstream, we need to take into account whether the community's water distribution rules aim to ensure water supplies downstream are not unduly restricted or polluted by the water consumption methods they allow. Rule enforcement would also have to be evaluated to assess whether rules that are good in theory actually contribute towards achieving sustainability.

The emphasis on protecting vegetation along streams (buffer strips) or prohibiting high impact activities in these zones is supported by a number of scientific findings on the important role of buffer strips in protecting water quality and stream ecosystems (Clinnick 1985; Osborne and Kovanic 1993). These include maintaining stream temperature, protecting streams against bank erosion, and trapping sediment and nutrients before they enter streams. The effectiveness of buffer strips in protecting streams greatly depends on their width: the ideal width depending in turn on various factors including slope gradient and soil type/erodibility. Adequate width of buffer strips will significantly reduce the impact of upland activities.

Despite this significant reduction in impact, upstream watershed protection is often still a sufficiently urgent that it needs to be singled out for assessment. Because the influence of soil and water variables commonly extends well beyond natural forest boundaries, special attention is warranted to capture spatial variations and the externalities of site-specific forest resource management methods. The effect of watershed management on water quality and quantity downstream demonstrates the geographically overarching nature of water resources, i.e., they cannot be wholly assessed within the confines of a community's forest area. Virtually identical verifier statements referring to upstream protection of waterways occur in the Cameroonian and Brazilian ecology subsets: '***Permanent plant cover upstream and on the banks of water courses***' (Cameroon); and '***The most important catchment areas within watersheds, and especially forests along rivers and streams, are maintained relatively intact especially upstream from villages***' (Brazil).

Although no explicit reference is made to upstream-downstream considerations in the Indonesian set, the matter is indirectly addressed by I&V in the social subset on irrigation water distribution. However, we assume these I&V are limited to the regulation of water volume. Included are the indicator '***Local organisations manage the irrigation system***' and the verifier '***Water is equally distributed among the irrigated fields***'. The issue of water distribution is also approached from another angle elsewhere in the Indonesian social subset, under the criterion '***Customary law and other regulations ensure fair access to community natural resources and fair distribution of their products among community members***'. Related to this are the indicator '***Rules that ensure fair distribution of irrigation water where there are paddy fields***' and the verifier '***Participatory planning and building of irrigation works***'. Their assessment, in addition to establishing whether upstream-downstream water controls are adequate (i.e., to ensure sufficient water and the distribution of equitable volumes to paddy fields located at increasing distances downstream and inland), will enhance understanding of any conscious effort to design and administer water controls. In

Darok, people expressed extreme concern about having a regular supply of irrigation water. Despite poor sanitation conditions at the village, they are much more concerned about the availability of irrigation water than they are about having a supply of clean drinking water.

Box 4.5 Selected C&I: Management of Water Resources

<u>From the Cameroonian ecology C&I subset:</u>

Criterion: **Biodiversity is conserved.**

Supporting indicator:

- Water quantity and quality are maintained or improved.

  Supporting verifiers:

  - Controlled use of pesticides and chemical fertilisers.
  - Permanent plant cover **upstream** and on the banks of water courses.
  - Clearing of dams and barriers on water courses after fishing.

From the Indonesian ecology C&I subset:

Criterion: Preservation of critical ecosystem functions.

Supporting indicator:

- Water sources are protected.

  Supporting verifiers:

  - Vegetation cover is maintained along river banks.
  - Absence of any activity affecting vegetation along water courses.

Supporting indicator:

- Water and soil quality are maintained to secure the ecosystem's sustainability.

  Supporting verifiers:

  - No use of poison in catching fish.
  - Exposure of bare soils is minimised.
  - No evidence of other activities that cause water pollution.

From the Brazilian ecology C&I subset:

Criterion: The preservation of a mosaic of natural habitats maintains the natural complementarity of species occurrences.

Supporting indicator:

- Forests along natural water courses are protected from clear felling to preserve hydrological functions and for biodiversity conservation. Legal minimum of keeping 50 m of forest along rivers and streams is upheld.

  Supporting verifiers:

  - Quantification of the continuity and width of remaining riverine forest.
  - Description of how upland and flooded (*igapo*) forest areas are integrated into the successional mosaic resulting from shifting agriculture.
  - The most important catchment areas within watersheds, and especially forests along rivers and streams, are maintained relatively intact especially upstream from villages.

ii) C&I: Seasonally Flooded Forest

Comments and observations on C&I attributes

Indicator:

Maintenance of flooding regimes, the productivity of river channels and of natural processes that sustain aquatic animals and plants (physicalintegrity).

Ease of Assessment:

Fluctuations in flooding regimes are often instigated upstream. On large rivers this can be at great distances (thousands of kilometres) from the CMF being assessed. This circumstance makes it difficult to differentiate between local and external effects. While it does assess 'sustainability', this fact makes it a poor indicator of community management practice.

Close to the Brazilian test site communities, there are seasonally flooded *igapo* forest areas. Because these areas are relatively small in the local context, they constitute a 'rare' aquatic habitat that provides important spawning grounds for many fish species. The fruits of *igapo* trees and the detritus of their biomass are important food sources for many fish, some of which disperse the seeds of *igapo* and other riverine tree species during their migrations. The Brazilian ecology subset includes several C&I that were developed with the protection of *igapo* in mind. Some of these are presented in Box 4.6. Included is the indicator '***Maintenance of flooding regimes, the productivity of river channels and of natural processes that sustain aquatic animals and plants (physical integrity)***'. This indicator is weakened by its being a compound measure, requiring the assessment of a number of constituent elements. Application of one of the verifiers given for this indicator, '***No deforestation of flooded forest in headwater regions***' may be difficult in some cases. The headwaters may be located at a great distance from the forest community whose management practices are being assessed or monitored. This means that information on conditions at the headwaters could be difficult to obtain, especially by local residents.

The other indicator related to *igapo* is '***Seasonally flooded forests are key feeding sites for fish and turtles and are therefore subject to only minimal levels of structural disturbance***'. The verifier for this indicator (Box 4.6) seeks evidence of the conversion of flooded forest, especially for agricultural purposes. Given the importance of *igapo* to local communities as a fishing resource, they are often less likely to be converted to agriculture than they are to be damaged, sometimes severely, by out of control agricultural fires.

In the Cameroonian forest management set, the indicator '***Swamps and other fragile ecosystems are not unduly disturbed during the rainy season***' addresses similar concerns. However, the indicator would be suboptimal if applied to the assessment of *igapos* as the most critical forms of disturbance they suffer (fire damage, conversion to agriculture and over-fishing) are usually inflicted during the dry season.

Box 4.6 C&I: Flooded Forest Areas (Brazilian Ecology Subset)

Criterion: Maintenance of the ecological integrity of all the aquatic ecosystems (rivers, streams, lakes etc).

Supporting indicator:

- Maintenance of flooding regimes, the productivity of river channels and of natural processes that sustain or subsidise aquatic animals and plants (physical integrity).

  Supporting verifiers:

  - Alterations in water transparency and temperature.
  - No deforestation of flooded forest in headwater regions.
  - Occurrence of abnormal levels of sedimentation of lakes, rivers and streams.

Criterion: The exploitation of fishing resources does not lead to the demographic or economic extinction of fish and turtle populations.

Supporting indicator:

- Seasonally flooded forests are key feeding sites for fish and turtles and are therefore subject to only minimal levels of structural disturbance.

  Supporting verifiers:

  - No evidence of conversion of flooded forests to other vegetation formations, through activities associated with shifting cultivation, can be observed despite the greater fertility associated with floodplain soils.

iii) C&I: Sedimentation of, and Obstructions in, Watercourses and Water Bodies

Comments and observations on C&I attributes

Verifier:

Occurrence of abnormal levels of sedimentation of lakes, rivers and streams.

Ease of assessment:

Early detection is likely to require costly, scientific methods and accurate tracing of the origins of any problem detected may be hard in areas with high, upstream population density. Referral to soil management methods may be useful, if measures to prevent further sedimentation problems are to be introduced.

The sedimentation of watercourses was the subject of at least one C&I statement resulting from each test. The Brazilian ecology subset offers as a verifier of the maintenance of flooding regimes and of the productivity of river channels in the statement ‘***Occurrence of abnormal levels of sedimentation of lakes, rivers and streams***’. The Brazilian forest management subset includes the verifier for low-impact timber exploitation techniques ‘***Observation of measures to control/minimise erosion, compaction and siltation of watercourses during the construction and utilisation of (forest) roads***’. In the Indonesian ecology subset, ‘***There is little sedimentation***’ appears as a verifier of the indicator ‘***Soil erosion is minimal’*** that supports the criterion ‘***Water supplies are protected’***. The Brazilian forest management subset and the Indonesian ecology subset both link erosion to water quality. We can anticipate most of the C&I developed on these issues to be of broad geographic relevance.

Indicator:

Clearing of dams and barriers on water courses after fishing.

Relevance:

A slight modification to shift the emphasis onto obstacles to watercourses rather than fishing would increase the indicator's relevance across a greater diversity of sites.

***Ease of Assessment*:**

This indicator concerns what is likely to be a seasonal practice. Ideally it should be applied when the practice is in season.
Out of season, extra care must be taken to assemble reliable information on it.

A more site-specific indicator from Cameroon is **'*Clearing of dams and barriers on water courses after fishing*'**. This would apply only to sites where fishing techniques are similar to those used at the Cameroonian test site.

iv) C&I: Water Quality

Comments and observations on C&I attributes

Indicator:

Watersheds and waterways are protected in the interests of community health.

Generalisability:

Everywhere it is important to establish the motives communities have to protect natural resources. Stronger and greater numbers of motives are usually manifest in greater collective commitment to resource protection.

At the *verifier* level, several statements were generated at all three test sites that reflect community dependence on water and aquatic resources. The statements include ones that relate to a variety of measures (minimising water pollution, controlling sedimentation, etc.) to ensure water quality for community health. The *indicators* related to water, however, are more varied. Only one links the conservation of water resources with the community's health: '***Watersheds and waterways are protected in the interests of community health***' (Cameroonian forest management set). It supports the criterion '***The natural forest's role in community health care is being consciously preserved***'. Water influences health in many fundamental ways, such as by sustaining the productivity of terrestrial and aquatic habitats in fish protein for human consumption. It also is a medium for the transmission of water-borne diseases and toxic compounds. Water thus affects resource management through possible impairment of management capacity due to illness from contaminated water. Although it was not so explicitly stated on the other tests, an indicator such as the Cameroonian one above would seem to be of global relevance.

Verifier:

Controlled use of pesticides and chemical fertilisers.

Value-judgement:

Some people strongly argue that adverse health effects of chemical pesticides and fertilisers are heavily compensated for by increases in food production and improved health attributable to better diet. Others claim that this argument is unethical and that alternative solutions to food shortages exist where there is government commitment to rural development. Many hold the view that chemical farm inputs should be phased out altogether. This verifier leaves open the question of degree of control required.

For assessing water pollution and its control, the Indonesian team developed three verifiers; '***No use of poison in catching fishes***', '***Exposure of bare soils is minimised***' and '***No evidence of other activities that cause water pollution***' (Box 4.5). The Cameroonian ecology indicator '***Water quantity and quality are maintained or improved***', and its supporting verifier '***Controlled use of pesticides and chemical fertilisers***' for the criterion '***Biodiversity is conserved***', point to similar issues.

Some of these Indonesian and Cameroonian examples regard community actions and behaviour as indicative of water quality. On the Cameroonian test, village women explained how, with the introduction of coffee and cacao some decades ago, the use of agrotoxins to kill fish *en masse* for sale at trading centres and urban markets became known. At one point this use of agrotoxins became so widespread that it posed a great threat to the women's dependence on fish as a source of protein for their families. Through consultation with their village chiefs, elders and notables, the women said they were able to reduce the incidence of this practice. It is now formally prohibited by village authorities. This account given by the women could positively substantiate the verifier '***Controlled use of pesticides and chemical fertilisers***', although other supportive evidence of controlled use would be desirable. These sorts of communications from community members may partially explain why some indicators are more human behaviour-oriented than others.

Verifier:

Contamination (of water) from *E. coli* of faecal origin.

Cost and feasibility of application:

This verifier can only be detected through a standard laboratory procedure (coliform test). The test is comparatively expensive, a factor which makes the verifier difficult for the community to use unaided. Furthermore, special sampling techniques are required for which community members would need instruction. The verifier could be replaced by the monitoring of more indirect proxy indicators. These could include measures taken to prevent *E .coli* contamination of streams such as improving sanitation. The effectiveness of these measures could be verified by monitoring sanitation conditions and the incidence of symptoms of *E. coli* disease within the community.

The issue of water quality was treated in most detail by the Brazilian team's ecologist. He proposed the following six verifiers that do not appear in any of the other sets:

v. ***Alterations in water transparency and temperature.***

v. ***Transparency, odour and taste of water.***

v. ***Occurrence of algal blooms and abnormal fish mortality***.

v. ***Contamination from* E. coli *of faecal origin.***

v. ***Drastic alterations in water pH.***

v. ***Occurrence of neurological and other health problems that indicate contamination with heavy metals or pesticides.***

Like the Cameroonian indicator '***Watersheds and waterways are protected in the interests of community health***', some of the above Brazilian verifiers are of direct concern to human health. None of them were actually evaluated at the Brazilian test site. We suspect they reflect the understanding and concerns of the Brazilian ecology specialist that go beyond the community to other regions where chemical agricultural water pollutants (causing algal blooms and pesticide contamination) and heavy metal contaminants in water (traceable to mining operations), occur. It is unclear to what extent the development of these verifiers reflects the communities' awareness or concerns either about water quality or about the consequences of stream pollution to human and ecosystem health.

Although some of the Brazilian verifiers address phenomena not evidenced at the test site, their application at similar sites could lead to interesting findings. Take the example of the verifier *'**Occurrence of neurological and other health problems that indicate contamination with heavy metals or pesticides**'*. No signs of activities that might contaminate water sources with heavy metals were detected at the Brazilian test site. The Arapiuns watershed is spared from the mercury pollution that has severely affected other nearby rivers, including the Tapajos, into which the Arapiuns flows. But, in the past some inhabitants of communities located along the Arapuins river have undertaken temporary work in mining areas elsewhere. A few returned to their communities having contracted mercury poisoning. This revealed that care is needed to trace health problems back to their correct geographical origins.

Although the occurrence of neurological and other health problems can serve as indicators of heavy metal and pesticide contamination, there is a need to include other indicators that can detect contamination risk at earlier stages, before the symptoms of contamination are evident. Such indicators could focus on controls on the use of toxic chemical compounds (as the aforementioned Cameroonian verifier *'**Controlled use of pesticides and chemical fertilisers**'* does) and on aquatic organisms as biomonitors of contamination. The choice of aquatic organisms for monitoring will affect both the reliability of the results and to what extent the community can itself undertake the monitoring and interpret the results without outside assistance.

4.6.3 Soil Fertility and Management

i) Overview

On all tests, forest soils supporting agriculture were seen as natural capital from which socio-economic benefits can be accrued, as well as a resource whose modification by agricultural practice, influences the forest's future species composition and productivity. The demands shifting cultivation makes on forest soils were thought to affect the quality and rate of forest succession growth. Some of the verifiers relating to soil fertility for agriculture inquire into the appropriateness of land use allocations.

In Table 4 we presents the C&I generated by the tests that are of direct relevance to soils or soil fertility. A large number of these C&I concern agriculture.

Most of the verifiers concerning soils, soil fertility, measures to maintain soil fertility (prevent soil erosion, nutrient leaching etc.) and local knowledge on soil types, are of global relevance. Two verifiers concerning soil of probably wide applicability were created on the Brazilian test; ***'Observation of measures to control/minimise erosion, compaction and siltation of watercourses during the construction and utilisation of forest roads',*** and ***'Fallow periods are long enough to permit sufficient accumulation of biomass'***. The first of these is limited to considerations linked to forest roads (Table 4.4). Why this verifier was not given a wider focus

Table 4.4 C&I: Soils and Soil Fertility

Cameroon	Indonesia	Brazil
Indicator: • Agricultural practices have short-term beneficial effects on the arable land, soils and trees. *Verifiers:* • Maintenance of sufficient soil cover after land clearance. • Increase in the quantity of organic matter in the soil by defoliation. *Indicator (forest management):* • Fallow periods are long enough to permit recuperation of soil fertility. *Verifiers (forest management):* • Species indicative of soil fertility are commonly found in fallows and secondary growth areas. • Crops and cropping rotations make efficient use of soil fertility. *Verifiers:* • Protection of fertilising trees during land clearance. • Making and using compost.	*Indicator:* • Water and soil quality are maintained to secure the ecosystem's sustainability. *Verifier:* • Exposure of bare soils is minimised. *Indicator:* • Soil erosion is minimised. *Criterion:* • Land use systems are located on suitable soils. *Indicator:* • Local knowledge on soil types and fertility/fallow vegetation. *Verifiers:* • Local names for different soil types. • Knowledge on vegetation/ species associated with soil fertility. • Application of knowledge (on indicator species) to the opening of new *ladangs* (shifting cultivation plots). *Verifier:* • Soil conservation technology is applied. *Verifiers:* • Minimal soil disturbance/ compaction during skidding and transporting timber. • No timber harvesting takes place in highly erodable areas.	*Verifiers (ecology)* • No evidence of conversion of flooded forests to other vegetation formations, through activities associated with shifting cultivation, can be observed, despite the greater fertility associated with floodplain soils. *Verifiers (social)* • Inclusion of 'Indian black soils' in the community reserve. • History of the use of 'Indian black soils' and areas of potential archaeological value. *Verifiers (forest management):* • Fallow periods are long enough to permit sufficient accumulation of biomass. • Observation of measures to control/minimise erosion, compaction and siltation of watercourses during the construction and utilisation of (forest) roads.

remains unclear. The other Brazilian verifiers mentioning soil refer to the conservation of flooded forest (highly fragile ecological areas) or to archaeological sites. The geographical applicability of these, especially of those referring to archaeological 'black soils', is more restricted.

A soil's physical and chemical properties are strong determinants of primary production capacity and of which species can thrive in an area. The dynamics of the life history variables of forest species ultimately depend on the fertility of forest soils. That is, we can expect species harvesting recovery rates to be directly correlated with levels of soil fertility and forest productivity; the more fertile the soils, the higher the productivity and recovery of harvested populations. Thus, we may expect nutrient-poor soils, such as those typical of the forests of Brazilian and Indonesian test sites, to be associated with lower vertebrate densities and biomass (i.e., lower game stocks) even in the absence of hunting pressure, and slower recovery rates from any given level of game offtake. However, as Dalsgaard *et al.* (1995) point out, the productivity of a system of a given capacity can be enhanced or diminished by management methods and the degree of resource exploitation, i.e., its capacity can be changed and this will, under a given management scheme, manifest in a corresponding change in productivity.

We now go on to review the C&I developed for soil suitability, soil protection measures, and soil fertility management, in this order, as it reflects a logical order for prioritising decisions on soil usage. The likelihood of low yields or erosion is minimised by selecting soils with appropriate properties. Soil fertility measures are of little long-term value if erosion controls are inadequate to prevent the loss of topsoil.

ii) C&I: Soil Suitability & Selection

Smyth and Dumanski (1993) state that "the interactions between environmental factors which determine 'suitability' at a given moment are largely the same as those which decide whether the same land use is 'sustainable' through a period of future time on the plot in question". Sustainability, they postulate, can "…be considered to be an extension in time of the concept of suitability".

Assessment of soil suitability for agriculture converges on two major considerations. One is the question of whether a soil's natural properties match the requirements of those crops to be planted in it (Box 4.7). The other consideration centres around the implications for the remaining forest ecosystem of using certain forest soils for agriculture. Preferential selection of forest soils for agriculture can deleteriously affect the forest's overall species richness and productivity (Box 4.8). Discriminating in favour of fertile forest soils for agriculture can gradually reduce natural forest cover to areas of poor soils where the forest's regenerative capacity is inherently low.

Box 4.7 C&I: Matching Soil Properties to Use Categories (Indonesian Forest Management Subset)

Principle: **For each land use system best practices of natural resource management are applied.**

Criterion: **Each land use system is located on suitable soil.**

Supporting indicator:

- Local knowledge on soil types, their fertility and that of fallow vegetation.

Supporting verifiers:

- Local names for different soil types.
- Knowledge on vegetation/species associated with soil fertility.
- Application of this knowledge in choosing areas for conversion into new *ladangs* (shifting cultivation plots).

Box 4.8 Some Implications of Agricultural Soil Preferences to Forest Conservation

The countryside surrounding the Indonesian test site villages is characterised by forest island relics dispersed across a steeply hilly landscape. These forest remnants largely coincide with the tops of ridges and, in lower lying areas, with patches of sandy soils. The local farmers favour clearing natural forest on water retentive and comparatively nutrient-rich clay soils, as these are the soils most suitable for rain-fed rice, the staple crop. However, according to them, this soil preference is contributing to the local extinction of one forest inhabitant, the hornbill. Once common to the area, the hornbill, according to local farmers, relies on clay soils within the forest to build its nests. The bird is sacred to the region's Dayak inhabitants who believe their race to have descended from it. Hence, the expansion of their agricultural lands, via its ecological impact, is undermining a pillar of their cultural identity.

Cassava is the staple crop of the inhabitants of the Brazilian test site communities. This crop, indigenous to Amazonia, makes exceptionally low demands on soil nutrient reserves, a circumstance widely believed to have enabled caboclo riberinhos to subsist on the extremely sandy and nutrient-poor soils that are dominant in the test site area. In fact, farmers say that cassava grows better on soils of converted fallow than on fresh forest soils; the latter are said to be too rich. This is in contrast to rain-fed rice that is said to perform best when planted as a first rotation crop on soils newly cleared of natural forest. This means that recent attempts in the region to encourage farmers to plant new, higher-yielding varieties of rice, are likely to increase the rate of natural forest conversion/deforestation.

Comments and observations on C&I attributes

Criterion:

Each land use system is located on suitable soil.

Assessment:

This requires knowledge on the soil properties and the ecology and nutrient requirements of the components of the various systems under given climatic conditions. Also needed is an understanding of how technologies are regulating the relationship between these factors.

Indicator:

Fallow periods are long enough to allow soil to recuperate.

The soil requirements of agricultural crops indicate soil selection pressure. Changes in crop choices are therefore of interest to the appraisal of forest sustainability. In Box 4.7 we present the Indonesian I&V concerned with the appropriateness of the match between soil types and land uses that accompany the criterion '***Each land use system is located on suitable soil***'. Forest soils suitable for agriculture can be regarded as those producing yields that are average for the desired crops when these are grown with appropriate, low technological inputs. A community's ability to select soils that are suitable for different crops can be assessed with the above criterion's indicator '***Local knowledge on soil types and fertility/fallow vegetation***'.

The Cameroonian and Brazilian forest management specialists accepted fallow length as indicative of whether soils are allocated to suitable purposes. This is made clear by their inclusion of the indicators '***Fallow periods are long enough to allow soil to recuperate***' (Cameroon) and '***Fallow periods are long enough to permit sufficient accumulation of biomass***' (Brazil). One verifier proposed for the Cameroonian indicator is '***Species indicative of soil fertility are commonly found in fallows and secondary forest***'. This assumes the assessor knows the relevant indicator species. The Indonesian verifiers '***Knowledge on vegetation/species associated with soil fertility***' and '***The application of this knowledge*** (i.e., that referred in the previous verifier***) to the opening of new***

Who can assess this:

Appropriate fallow length depends on the history of landuse at the site, especially the number and duration of previous cropping and fallow cycles, crops planted and pest attacks. Local knowledge is therefore vital to this indicator's low-cost, accurate assessment.

ladangs (shifting cultivation plots)', on the other hand, look for evidence of local knowledge on indicator species and the application of this knowledge.

The availability of soil nutrients for plant uptake is regulated by a variety of factors including soil pH and moisture content. Species indicative of soil fertility, therefore, include those that indicate soil-moisture content. Farmers at the Indonesian test site look out for the presence of a particular species of ant that they say indicates optimal soil moisture levels.

The matching of soils to uses and use intensities was not directly addressed by the Brazilian team. The closest they came to broaching this was through the development of the forest management indicator on zones '***Existence of zones (areas defined for different use intensities in accordance with resource potential)***'. If such zones exist, then some attention will be directed to soil properties. The associated verifier '***Verification of uses defined for different use intensities in accordance with resource potential***' will show whether soil properties are suited to soil exploitation modes.

iii) C&I: Soil Protection (i.e., Control of Erosion and Compaction)

Soil losses due to erosion and soil damage caused by compaction pose serious threats to forest ecosystems, the agricultural potential of forest soils, and the potential of cleared forest soils to support forest succession regrowth. As has already been noted, species composition and the forest's productive capacity are related to the soil. The poorer the soil's fertility, structure and topographical location, the more vulnerable the forest is to suffering consequences of disturbance. The need to conserve forest soils while they are being used for agriculture or during logging and related activities, is paramount to sustaining forest functions and biodiversity in the long-term.

Comments and observations on C&I attributes

Verifier:

Exposure of bare soils is minimised.

This verifier underlines the important role of soil cover in protecting soil from the impact of rain, which separates soil particles causing them to erode. Surface erosion will occur in greater magnitude if the soil is compacted.

The verifier can easily be assessed through visits to farms or harvested or otherwise disturbed forest areas. Soil exposure will vary according to the time elapsed since the exposure-causing event took place.

Verifier:

Increase in soil organic matter through defoliation (leaf litter).

The practice of burning slash to clear fields for shifting cultivation destroys a significant amount of leaf litter. Nonetheless, it sometimes still allows an adequately thick leaf litter layer to accumulate because many leaves are only singed and therefore fall to the ground. The verifier would have to be assessed together with I&V of fire intensities and management strategies.

The Indonesian and Cameroonian teams gave most consideration to variables connected with soil retention/soil erosion. The Cameroonian ecology subset has two verifiers concerning soil cover. The Indonesian ecology subset includes the indicator '***Soil erosion is minimised***' and the verifier '***Exposure of bare soils is minimised***' to deal with the topic in general. The Indonesian forest management specialist added the verifier '***Soil conservation technology is applied***'. Terracing, especially important in paddy fields on sloping land, and the creation of bunds are examples of soil conservation technologies. The latter was not seen at the Indonesian test site villages.

The Cameroonian ecology subset contains the verifiers '***Maintenance of sufficient soil cover after land clearance***' and '***Increase in soil organic matter through defoliation (leaf litter)***' for the indicator '***Agricultural practices have short-term beneficial effects on the arable land, soils and trees***'. These verifiers relate to a number of issues. They suggest land clearance methods should aim to maintain as much leaf litter on the ground as possible because it is an important source of nutrients and organic matter that improve soil structure. At the same time, they relate to the prevention of soil loss in a number of ways. The leaf litter cushions the impact of rain. As it decomposes into organic matter, it stabilises soil structure, acting as an adhesive for soil particles. Reducing organic matter has the effect of making soil particles more easily disaggregated and erodable.

Verifier:

Minimal soil disturbance/ compaction caused by skidding and transporting timber.

Verifier:

Observation of measures to control/minimise erosion, compaction and siltation of watercourses during the construction and utilisation of (forest) roads.

The above two verifiers underline the importance of controlling soil compaction along skid trails and logging roads as these are two major sources of soil erosion (Trimble and Sartz 1957; Brown 1985; Brunijnzeel 1990).

On the Indonesian test, two additional verifiers were formulated specifically for soil management within natural forest areas. Both are linked to timber harvesting. They are: '***Minimal soil disturbance/compaction caused by skidding and transporting timber***' (forest management), and '***No timber harvesting takes place in highly erodable areas***' (ecology). The forest management team member stressed the importance of organising forest product transportation to minimise soil compaction. Logging roads and skidtrails must be well designed. Debarking and conversion of stems into planks should ideally be done at the site of the felling. Cutting stems into planks within the forest is typically done in many traditional community forestry settings, and virtually always where there are no draught animals or mechanised transport available; not infrequently, children in pairs carry planks out of the forest on their heads.

The only Brazilian statement concerning erosion or soil cover is the forest management verifier '***Observation of measures to control/minimise erosion, compaction and siltation of watercourses during the construction and utilisation of (forest) roads***'. This verifies an activity (forest road construction and use) that has thus far not directly formed part of the communities' own forest resource management. The only exception to this being the indirect management role of the larger of the communities, São Pedro; by displaying no resistance to an external timber company's road construction in the community forest area, and even supplying the manual labour for this undertaking, São Pedro could be considered partially responsible for the poor management of their forest resources (albeit by third parties). The verifier could become more relevant to community forest management at the Brazilian test site at some future date. However, the likelihood of this in São Pedro is diminished by the outside logging company having removed virtually all timber stocks of economic value, thus leaving the community with little reason to construct forest roads in the foreseeable future.

iv) C&I: Soil Fertility Management

We have ranked erosion control as more important than soil fertility conservation, because soils must be kept in place if their fertility is to be conserved. Nonetheless, as noted above in connection with C&I on organic matter, soil fertility management can clearly reduce the erodibility of soils. Theoretically, good fertility management prolongs the period over which a piece of land is cultivated and so reduces the rate at which fallow, and in many cases forest, is converted to agriculture.

The C&I of relevance to soil fertility management reviewed here can be roughly divided into three categories:

- fertilising measures, other than fire, applied during land preparation and the cultivation period;
- the significance of fallows to soil fertility; and
- burning.

The first two are addressed in this section (4.6.3 iv); the issue of burning and fire management is dealt with in 'The Role of Fire in Agriculture' section (4.7.1).

All teams developed complexes of C&I that link soil fertility management and fallow periods.

a) C&I: Soil Fertilising Measures

Comments and observations on C&I attributes

Verifier:

Protection of fertilising trees during land clearance.

Generalisability:

It is of interest to know whether people recognise and seek to benefit from the fertilising value of trees – but this type of assessment would require the assessor to be knowledgeable on the fertilising properties of local trees. Outsiders rarely have this sort of knowledge.

Ease of assessment:

The contribution made to sustainability by this indicator's fulfilment is difficult to gage. Few claims regarding the soil fertilising properties of indigenous trees have been scientifically substantiated. There is evidence that the benefits of some exotic species shown to fertilise soil, e.g., through nitrogen fixation, are outweighed by undesirable consequences associated with their introduction, such as soil acidification and pest problems.

Specific mention of soil fertility management techniques is only made in the Cameroonian ecology and forest management C&I subsets. Of all the subsets, it is the Cameroonian ecology subset that places the most emphasis on organic fertilisers. The verifier '***Increase in the quantity of organic matter in the soil by defoliation***' and the indicator it relates to, '***Agricultural practices have short-term beneficial effects on arable land, soil and trees***', imply that a significant, positive relationship between agriculture and trees is possible. This relationship is further implied by the verifier '***Protection of fertilising trees during land clearance***' found in the same subset.

People from the Cameroonian test site villages listed many tree species that they believe enhance soil fertility. Commonly, these and other useful tree species are protected during land preparation. Caution is exercised when burning slash to prevent valued trees from being damaged by fire. Clearance of the rest of the forest or succession vegetation releases these trees from competition. This favours their growth and development, especially if, as is sometimes the case at the Cameroonian test site, they are then mulched for added protection after the fires have subsided. Evidence of such elaborate measures to protect trees on shifting cultivation plots was not encountered at the Indonesian or Brazilian test sites.

Indicator

Local knowledge on soil types, their fertility and fallow vegetation.

Relevance:

Everywhere people's ability to sustainably manage their natural resources will depend on their knowledge of those resources.

Assessment:

Knowledge deficits have to be understood in relation to their cause. Migrant forest farmers knowledge is often restricted to a degree depending on their length of stay in the area. In some rural areas, young people, aspiring to migrate to urban areas, are not interested in absorbing knowledge on their forest environment.

Another verifier included in the Cameroonian ecology set is '***Making and using compost***'. No evidence of these activities was actually witnessed at the Cameroonian test site, although the local inhabitants appeared knowledgeable about benefits of compost. The verifier, however, leads to some interesting insights – in some Shona villages in Zimbabwe, families can be regularly found making large compost heaps with leaf litter collected from local miombo woodland. They are thus, effectively, mining the woodland's fertility.

Common to some shifting cultivation systems are the practices of mulching with crop residues and using organic fertilisers such as animal dung. The feasibility of these practices often depends on local energy sources. Where cow dung is used for fuel because firewood is too expensive or inaccessible, its return to the soil is rare. Similarly, crop residues may be used for fuel or animal fodder. Another practice that partially determines both length of soil cover and the efficiency of soil nutrient use and recycling, is intercropping. Overlapping crop sequences will determine the availability of crop residues for mulching and how their contribution to soil cover is complemented by that afforded by the remaining standing crop.

None of the C&I sets systematically address these interrelationships. They may, however, be indirectly deduced from other C&I results. The only statement leading to the evaluation of the significance of cropping patterns to soil fertility occurs within the Cameroonian forest management subset. It is the verifier '***Crops and cropping rotations make efficient use of soil fertility***'. The verifier's main concern would appear to be the niche differentiation of crops included in the system. However, the use of crop residues as mulches and sources of soil organic matter and nutrients is clearly also relevant to the verifier's fulfilment.

The only two explicit Indonesian references to soil fertility are the indicator '***Local knowledge on soil types, their fertility and fallow vegetation***' and its supporting verifier '***Knowledge on vegetation/species and their association with soil fertility***'. These have already been discussed in the section dealing with soil suitability.

b) C&I: Fallow Length and Fallow Management

An increasing demand for fertile soils for agriculture is accelerating deforestation and creating a growing scarcity of forest land for conversion. Empirical research suggests this is causing the average fallow period to contract in many inhabited parts of the tropical rainforest zone. Inhabitants at the Cameroonian test site villages said this applies to their situation. Increasingly poor, less fertile soils that have been subjected to two, three or even four previous crop rotations, and to fallow periods of decreasing length, are being brought back into cultivation. Lower crop yields are obtained before soils are abandoned because of intensive depletion of soil nutrient reserves. Calculating the balance struck between changes in fertility takeoff (determined by factors including cultivation periods, choice of crops and crop niche differentiation) and fertility restoration rates (determined by factors including soil management and protection methods, fallow periods and fallow management) between successive periods of cultivation and fallow is complicated. However, this balance clearly affects the growth rate and composition of various stages of forest succession.

C&I about length of fallow period were developed on all tests. Some of these C&I have already been discussed. All tests also generated several C&I on major factors influencing fallow period, such as land availability, soil type, crop choice, cropping systems, timing of agricultural activities and access to information. Not all these C&I, however, mention fallows.

Comments and observations on C&I attributes

Indicator

Crops and cropping rotations make efficient use of soil fertility.

Who can best assess this:
Most agriculturists will recognise mismatches at the species level. Local farmers are, however, often more knowledgeable on which local crop varieties are least demanding of soil nutrients.

The only statement on fallow length generated by the Indonesian test was the social indicator '***Rules on ladang/shifting cultivation practices that ensure an appropriate fallow period***'. The Cameroonian forest management subset demands a more detailed assessment with the indicator '***Fallow periods are long enough to permit recuperation of soil fertility***' and its verifier '***Species indicative of soil fertility are commonly found in fallows and secondary growth areas***'. Another of this Cameroonian indicator's verifiers, '***Crops and cropping rotations make efficient use of soil fertility***', recognises the appropriateness of fallow length depends on a combination of factors, including the nutrient demands of the chosen crops (crop niche differentiation) and cropping methods which help to ensure efficient use of soil nutrient reserves.

4.7 The Role, Impact and Management of Fire

4.7.1 The Role of Fire in Agriculture

At all the test sites, burning is an important agricultural practice that serves multiple functions, one of the most important being that of fertilising the soil. Fire releases nutrients held in the forest or fallow vegetation into the soil in the form of the biofertiliser *ash*. Burning also increases the pH of acidic tropical soils, which helps make nutrients available for plant uptake. It furthermore makes more soil nutrients available to crops by destroying competitive weed species. Fire is the cheapest way of clearing and preparing land for cultivation. These attributes make it an essential management tool for poor rural farmers.

Extra observation on C&I attributes

Verifier:

Signs of bad timing or delays in land preparation, such as a waste of prepared land and yield losses.

Assessment:

Bad timing of land preparation activities leading up to the burning of slash, suggest the slash will not burn well. When this takes place, the area concerned is often not cultivated as it will produce very low yields. Abandoned, it generally turns into a dense vegetation thicket. Such thickets are an indicator of poor fire management.

Fire's role in sustaining agricultural production is acknowledged by the Cameroonian ecological verifier '***Mineral matter available from ash***' for the indicator '***Agricultural practices have short-term beneficial effects on arable land, soils and trees***'. Contents of the Cameroonian forest management subset are equally accepting of fire as an important agricultural input which must be managed both for the sake of sustaining crop yields and that of protecting adjacent areas. This is made apparent by some of the I&V under the Cameroonian forest management criterion '***The role of seasonality in the use of forest resources and in farming activities is (locally) recognised***'**:** the indicator '***Farmlands are cleared (slashed and burnt) just before the rainy season so that crops are planted at the right time***'; the verifier '***Signs of bad timing or delays in land preparation, such as a waste of prepared land and yield losses***'; and the verifier '***Attention paid to climatic and seasonal factors in the timing of agricultural fires***'.

At the Cameroonian test's concluding workshop there was agreement among ecologists, agronomists and community members that after slash has been burnt, remaining leaves, small twigs and branches should be piled around protected trees to serve as a mulch that will subsequently break down into a compost. Wood from felled trees should be collected for domestic firewood before the slash is carefully burnt to avoid damage to protected trees. There was, however, some disagreement between ecologists and community members on what constitutes appropriate fire management and intensity. Some of the ecologists present saw an ecological advantage to be gained from maintaining agricultural fires approximately one metre above the ground. This, they said, affords the soil microfauna (decomposers) a measure of protection and should theoretically result in greater soil fertility in the long term. However, many farmers do not favour superficial fires as they are less effective in eradicating pests and weeds. Much goes to suggest that most shifting cultivators predict their crop yields on the basis of how thoroughly the slash is burnt, and believe poor burns result in lower yields (Dove 1983, Sanchez 1976). Testimonies of forest farmers at the Cameroonian and Brazilian test site communities very much echoed this opinion.

Some controversy surrounds the long-term impact of fire on soil nutrient content, although fire is known to cause losses of carbon, nitrogen and sulphur to the atmosphere. Lack of clarity on this issue complicates drawing conclusions regarding the overall socio-ecological impact of agricultural fires.

4.7.2 Impacts and Management of Fire

i) Background

Fires are believed to be the most hazardous form of forest disturbance, since they directly increase tree mortality rates, destroy many animal food sources, instigate changes in species composition, cause soil temperature increases and precipitate losses of some soil nutrients.

Forest fires can create enormous age gaps of up to ten years or even more in the population structure of some of flora species, depending on these species' propensity for arrested growth. Additionally, fire causes the flowers, fruits and seeds of many species to abort, leading to their loss of a year's recruitment. More generally, forest modified by fire is an inhospitable environment for the regeneration of its indigenous species. New niches will have been created, many of which will be filled by invading species, so that the original forest's species composition will be changed. The social benefits accruable from the forest will be altered by such developments - some useful species will be wiped out while others may assume greater abundance.

Many rainforest species are intolerant to fire, especially those that have one or more of the following characteristics: thin bark, superficial roots, low density wood, and/or produce latex or exudates. Whereas thin bark readily burns to ash, latexes and saps cook inside trees engulfed by flames and coagulate. Settled forest communities usually grow some forest tree species in agroforestry home gardens. Often they will have established stands of domesticated or semi-domesticated economically valuable forest tree species. Many families at the Brazilian and Indonesian test site had established rubber-dominated stands (*Hevea brasiliensis)*. At the Brazilian test site, Cupuaçu (*Theobroma grandiflorum*) is an indigenous species commonly grown in agroforests or pure stands. Small-scale cacao plantations (*Theobroma cacao*) featured prominently at the Cameroonian test site. These are just a few of the species with economic potential that are highly susceptible to fire-kill. Failure to contain fire can therefore culminate in the destruction of major sources of livelihood developed from the forest gene pool.

Smoke from recent disastrous forest fires in East Kalimantan, Indonesia, during September 1997 was reported to have blacked out the sun, caused respiratory infections with long-term side effects in a large proportion of the population (especially children), and to have reduced food production and water supplies to such an extent as to cause millions of people to seek emergency food aid (Sahardjo 1998).

Community members at the Brazilian test site believed that commercial logging within their forest had increased the amount of brash within the forest. This has rendered the forest more flammable, made fires more intense and difficult to extinguish and, has consequently increased the number of trees killed by fire.

Assessment of forest fire incidence, the Brazilian ecology specialist proposed, should be geared towards establishing the average impact of forest fires on family holdings and community commons. This measure would absorb the consequences of accidental fires caused by irresponsible community members. A more thorough assessment that differentiates between the degree of fire impact caused by different groups within the community would take much longer. But the main reason for not entering into this depth is the high unlikelihood of obtaining reliable information on who caused accidental or uncontrollable fires.

The Brazilian forest management specialist suggested that including an assessment of whether the incidence of forest fires varies according to the economic value of the forest and whether more care is taken to prevent the spread of agricultural fires into privately held neighbouring holdings than into communally held land would add interest and depth to the set. However, none of the Brazilian C&I are designed to directly answer these questions.

ii) C&I: Fire Impact (Damage) and Management

Comments and observations on C&I attributes

<u>Verifier</u>

No use of fire in hunting.

Generalisability:

Fire is an important component of many, but not all, traditional hunting systems. In some isolated locations where hunting pressure is low, the use of fire in hunting may be acceptable. Such cases are, however, becoming increasingly rare.

<u>Verifier</u>

Fire breaks are constructed before burning.

Relevance:

High – however, the reasons for why firebreaks are not constructed may be more important indicators of sustainability, than the fact of fire breaks not being constructed. Lack of family labour, not having the funds to employ casual labour, lack of community co-operation and, in the case of migrant forest farmers, lack of fire management traditions, are often the root cause of inadequate fire management.

Despite the tremendous ecological implications of forest fires, the Cameroonian ecology specialist did not develop any C&I concerning the management of agricultural or forest fires or measures to minimise fire hazards. In the Cameroonian forest management subset only two statements on fires appear. One of these is the verifier *'**Controlled use of fire in site preparation**'* for the indicator *'**During farm site preparation, valuable trees are protected**'*, and the other, the indicator *'**The use of fire for land clearance is kept to a minimum to prevent respiratory illnesses**'*. From these statements it is clear that the forest management specialist thought people's motivation to control the use of fire is indicative of the care they administer when burning their fields or using fire for other reasons. He identified the protection of health and that of useful trees as factors that strongly motivate people to use fire cautiously. Factors as diverse as poor education, changes in diet or forest product prices can limit or diminish these factors' motivating powers, and thus contribute to the relaxation of fire management practices, and increased fire hazard.

The only mention of fire in the Indonesian ecology subset is confined to the verifier of commercial hunting controls *'**No use of fire in hunting**'*. Various hunting techniques practised by different forest groups make use of fire. It is not clear to which technique this verifier refers or whether it is equally applicable to all hunting techniques involving fire.

The Indonesian and Brazilian forest management subsets are by comparison much more oriented towards the assessment of the efficacy and application of community fire management methods and prescriptions. Both include verifiers that inquire into whether forest farmers consider the lay of the land, make fire breaks and take account of wind direction. In the Indonesian case the relevant verifiers are: *'**Fire breaks are constructed before burning**'*; *'**Wind direction and velocity are considered in the timing of burns**'*; and *'**Burning procedures take slope into account**'*. These issues and others are incorporated into just one verifier in the Brazilian case: *'**Fire accident prevention and control techniques including consultation and agreement between neighbours on the choice of area to be slashed and burnt and intended day of burning, the appropriate choice of season and hour for burning, the cutting of fire breaks, directing the fire against the wind**'*. This is another example of a statement that is explicitly compound. To facilitate systematic recording and comparison of the results of consecutive assessments, this verifier should be disagregated into its component elements.

The Indonesian verifiers belong to the indicator *'**Fire management to open ladangs (shifting cultivation plots) is applied**'* which supports the criterion *'**Low input sustainable agriculture is applied**'*. This chain of statements acknowledges the technological appropriateness of fire as a management technique. However, the indicator *'The community possesses rules for the controlled use of fire during the agricultural land preparation, cleaning of pasture and other applications'*, associated with the Brazilian verifiers, is of broader scope than the Indonesian criterion and also appears to accept fire as a legitimate land preparation tool.

Criterion

The risk of uncontrolled fires entering areas of fallows, secondary and primary forests is minimised through the application of appropriate fire management techniques.

Relevance:

High.

Assessment:

Quantifying 'risk' is complicated and imprecise. Recent environmental changes brought about by phenomena beyond the local community's control, such as climate change, add complications. More stringent fire prevention techniques than traditionally used, may be required, depending on changes in vegetation structure and the landscape mosaic, as well as climate change. Especially, with regard to climate change, people may be unprepared to respond adequately. Such failure does not necessarily mean the community's attitude towards fire management is flawed.

Although rules can take the form of customary, unwritten norms, sometimes they will be documented and shrouded with greater formality. Several communities in the region of the Brazilian test site have created complex rules on fire management and stipulate these in their community '*estatuto*', which, if registered with the local government, gives them some authority to penalise non-conformists. In communities that have a record of poor fire management, recent elaboration of fire management rules and their incorporation into some form of Community Charter or Constitution, can indicate a certain commitment to tightening fire controls in the future. Such commitment suggests some understanding and appreciation of the serious ecological and social consequences of forest fires, even where lax behaviour of a segment of the community could be interpreted to indicate the contrary.

The Brazilian ecology specialist attached great importance to fire management as a critical component of good forest management, introducing fire at the criterion level with the statement '*The risk of uncontrolled fires entering areas of fallows, secondary and primary forests is minimised through the application of appropriate fire management techniques*' (Box 4.9). The management techniques referred to would presumably comply with community rules on fire control and, hence, correspond with the measures covered by the above Brazilian verifier. Thereupon, the lines of inquiry pursued by the Brazilian forest management and ecological I&V on fire diverge, with the ecological I&V using 'absence of fire damage' as a proxy indicator of adequate fire management practice. This approach is weak. Firstly, the absence of fire damage does not necessarily indicate fires are well managed it could instead be due to propitious weather or timing. Secondly, evidence of fire damage does not automatically imply defective fire management methods have been used by the community. Climatic factors, the spread of fire originating from outside the community, or fire hazard conditions created by intruders (e.g. external logging companies) could be the cause.

Calculation of the Brazilian ecology verifier '***Local impact of fire in terms of the mortality differential of plants (e.g. number of species surviving per size class compared with the normal size class distribution in burnt forest areas***' requires some knowledge of which species are sensitive and which are resistant to fire. Clearly, the proportion of fire resistant species that has subcombed to fire damage, helps indicate the intensity of fires.

The comparatively strong emphasis the Brazilian team placed on the assessment of fire controls and damage, reflects the fact that the forest of both the Brazilian test site communities had suffered fire damage some months before the test took place. This damage had at the larger of the two communities been catastrophic. There, the test team and community members estimated that the el Nino and the opening up of the forest by the external timber company both significantly augmented the forest's flammability/susceptibility to fire. Had the test taken place before these forest fires, then there is a likelihood that it would have generated a lesser number of C&I concerned with fire.

None of the Brazilian C&I direct attention to the deliberate burning of natural pastures on seasonally emerging river banks, a practice done in some riverine Caboclo communities located in the same region as the Brazilian test site.

The reason for the low profile of fire considerations in the Cameroonian and Indonesian sets, may be that the test teams thought the adequacy of fire controls would be reflected by readings obtained for other more general C&I in the sets, such as the indicators *'**Areas of ecological importance are recognised and protected**'* (Indonesia, ecology), '***Productivity of natural forests is maintained***' (Indonesia, forest management), and '***The abundance dominance consistency (distribution) and frequency of species is comparable to that of the original forest***' (Cameroon, ecology) or the verifier '***Villagers exploit raw materials in a sensible and frugal manner to ensure the sustainability of local cottage industries***' (Cameroon, forest management), to give but a few examples.

Although the Indonesian test was sited in a part of Kalimantan that had a few months previously been afflicted with thick smog caused by some of the biggest forest fires in Indonesian history, the actual test site communities were fortunate in that these fires did not spread into their forest areas. It may have been because the issue of forest fires did not directly affect these communities, that the Indonesian specialists did not formulate more C&I to address a fuller range of management factors affecting the risk of forest fires.

Box 4.9 C&I of Fire Management (Brazil Test)

Ecology

Criterion: The risk of uncontrolled fires entering areas of fallows, secondary and primary forests is minimised through the application of appropriate fire management techniques.

Supporting indicator:

- No incidence of accidental fires.

Supporting verifiers:

- Frequency with which accidental fires have spread into large forest areas over the last 20 years.
- Ratio of burnt to non-burnt forest area within the community common access forest.
- Local impact of fire in terms of the mortality differential of plants (e.g., number of species surviving per size class compared with the normal size class distribution) in burnt forest areas.

Forest Management

Indicator:

- The community possesses rules for the controlled use of fire during the agricultural land preparation, cleaning of pasture and other application.

Supporting verifiers:

- Fire accident prevention and control techniques including consultation and agreement between neighbours on the choice of area to be slashed and burnt and intended day of burning, the appropriate choice of season and hour for burning, the cutting of fire breaks, directing the fire against the wind.

4.8 Land Use Planning to Limit Forest Conversion and Fragmentation

This section addresses some means communities use to limit forest conversion and fragmentation through formal or informal 'zoning' processes, including the development of protected areas.

4.8.1 Planning for Restrictions on Forest Conversion ('Zoning')

Deforestation can be limited and forest protected by the application of measures and provisions that restrict forest interventions, harvesting intensity and forest clearance to different degrees in different areas according to local community characteristics and environmental carrying capacity. This is what the zoning of forest areas hopes to achieve. Whether zones are formal or informal need not affect their socio-ecological significance. Zones often exist by informal agreement within the forest community. Indeed, informal zones sometimes command much greater local respect than more formal zones imposed, and often policed, from outside.

Zoning is similar to matching the basic resource attributes of a habitat with human demands in such a way as to not impair carrying capacity. This links in closely with land suitability classification systems, such as FAO's *Framework for Land Evaluation* (FAO 1976), in which land suitability is defined as the fitness of a given type of land for a specified kind of land use.

Recognising that agricultural land requirements, even where appropriate agriculture and population controls exist, are subject to future increases, the Indonesian forest management specialist included the verifier '***Areas permissible for conversion (to agriculture) exist***'. Other C&I in the Indonesian set can establish whether the natural forest conversion rate is acceptable for conservation purposes, and the extent to which conversion of tembawang forest gardens is being limited. To assess whether the limits imposed upon tembawang conversion are acceptable, the indicator '***Conversion (of tembawang) is followed by the development of tembawang in other areas***' is useful. The most detailed C&I complex on community rules about forest resources management is found among the Indonesian social C&I (see section on Social C&I). The complex can be used to estimate community capacity and success in restricting conversion of natural forest and tembawangs.

Although no criterion or indicator equivalent to the Indonesian verifier '***Areas permissible for conversion (to agriculture) exist***' occurs in either the Cameroonian or Brazilian sets, inhabitants at the Cameroonian test site claim to have set aside a zone of forest for conversion. This claim was received with disbelief by some of the professionals attending the workshop, who could not envisage how the communities might survey or manage such a zone unaided.

4.8.2 Protected Forest Areas

i) Background

All tests generated C&I on protected forest areas. The existence of such areas does not address the *causes* of forest fragmentation, but, if well enforced, such areas can geographically limit fragmentation.[20] They are especially important if they cover areas where species with highly restricted distributions (i.e., are endemic to a relatively small area) and/or with large territorial ranges, or that are specialists, reside.

[20] C&I related to enforcement are reviewed in Chapter **6 (Social Dimensions: The Social and Economic Outcomes of Forest Management) and** 2.6 (Social Dimensions: Determinants of the Social and Economic Outcomes of Forest Management).

However, more and more forest communities are finding themselves with insufficient forest left to create or maintain protected forest areas. Where hunting is prohibited in protected forest areas, ensuring the areas' protection becomes even more difficult. Markopoulos (1998) reports that some of the communities participating in the Lomerío Forest Management Project in Bolivia do not have enough forest resources remaining to create protected forest areas of viable size. Although the protection of some areas might obviously be of lesser conservation value than that of others, Marlopoulos (1998) observed there are difficulties inherent in assessing the viability of protected areas in the absence of detailed information about their ecology. Identification of planning and management needs is constrained by these difficulties.

Managing what occurs within protected areas is one, but not the only thing needed to ensure their continuing viability. Equally important is that management strategies for protected areas incorporate the management of areas surrounding these areas. There must be compatibility between the management objectives of protected and adjacent areas. Only thus does it become possible to integrate protected areas into the larger regional scheme as required to ensure biological and social sustainability (McNeely *et al*. 1990). Creating zones can help achieve this wider objective provided the relationship between zones is adequately understood and dealt with.

ii) C&I: Protected Areas and Forest Reserves

The fact that all tests generated C&I on protected forest areas reflects the fact that these are key tools for conserving biodiversity (Reid *et al.* 1993) (see Table 4.5). An indicator commonly used towards this end by policy makers is '***Percentage of total forest area that has strictly protected area status***' (*ibid*.). This indicator helps us to ascertain the amount of effort devoted to dealing with ecological problems caused by forest decline in relation to these problems' magnitude. Ideally this indicator would be applied to different habitats and soils, making it possible to draw comparisons between the adequacy of protected areas within each. With this sort of desegregation, information can be assembled on factors that may explain the persistence of some forest species following severe forest fragmentation.

Comments and observations on C&I attributes

Indicator:

Islands of relic primary forest occurring within the successional forest mosaic are preserved.

Relevance:

High.

Assessment:

Registering the existence of relic forest patches is important. Their existence reflects unsustainable forest management in the past. Concrete evidence of these patches being now preserved will come in the form of prohibitions and sanctions seen to be actively enforced.

The Brazilian ecologist thought the protection of rare ecological sites to be a matter of priority. He therefore created the indicator statement '***Among the various types of natural habitats occurring within the region, the rarest (or least extensive) in the forest landscape are strongly protected from conversion to agriculture***' and the verifier '***Islands of relic primary forest occurring within the successional forest mosaic are preserved***'. Moreover, he also included the indicator '***Forest reserves and sanctuaries of adequate size and distribution within the CMF are maintained***' to address the critical determinants of the effectiveness of reserves and protected areas in performing ecological functions and resisting biodiversity erosion. Larger areas within a given habitat are more likely to contain viable species populations than smaller areas. It is assumed that if a given area of a particular habitat is capable of assuring the survival of the minimum viable populations of all species, then it will protect lesser known as well as more common species (Landers *et al.* in McNeely 1990). Temple (1992) maintains a rough estimate of area of habitat required to support a viable population of a particular species, is obtainable by multiplying the species' actual density in the habitat by its minimum viable population size. Larger bodied mammals and animals with large territorial ranges, for example orang-utan (*Pongo pygmaeus*) in Kalimantan need especially large areas to maintain viable populations (MacKinnon

Indicator:

Sites of special socio-cultural, historical and tourist value to the local communities are known and protected by social control mechanisms.

Relevance:

There is sometimes disagreement between what the community and outsiders believe they should be. Processes of acculturation can lead to communities losing interest in ancestral sacred sites. Regional authorities may however demand the protection of these sites continue for national heritage reasons.

Indicator

Existence of zones (areas defined for different use intensities in accordance with resource potential).

Who can best assess this:

In this case, although the indicator refers to 'zones', it is not only official or project land allocation schemes which might undertake the assessment. Frequently, communities have their landzones in place which respond to environmental capacities and their own needs. Their participation in the assessment of this indicator is therefore essential.

and MacKinnon 1991). The distribution and shape of protected areas indicates their vulnerability to encroachment (Peres and Terborgh 1995). Also, worthy of note, is that small forest patches associated with small species populations become a problem for long-term protection against changing environmental conditions (Quin and Karr 1993).

Contrary to expectations, no C&I of size of forest remnants were developed on the Indonesian test even though deforestation was more pronounced at this test site than at the others, and had resulted in forest islands within the landspace.

On the Cameroonian test, treatment of protected and reserved forest areas was narrower. References to such areas is restricted to the social C&I subset where it occurs relatively high up in the C&I hierarchy with the criterion '***Sites of special socio-cultural, historical and tourist value to the local communities are known and protected by social control mechanisms***'. However, this criterion does not address the ecological importance of protected areas as directly as the Indonesian ecology indicator '***Areas of ecological importance are recognised and protected***' does.

The Brazilian C&I cover the protection of sites of special cultural significance, referring in particular to the anthropogenic 'black earth soils' which occur in relatively small patches sparsely scattered throughout the region of the Brazilian test site. These soils, rich in indigenous pottery remains, tend to be of exceptionally high fertility. Their archaeological value led the Brazilian social and forest management specialists to conclude that their protection should be prioritised above all alternative uses. The social specialist included a prescriptive indicator on their registration with the relevant official authorities. As a verifier of existing knowledge on the distribution of sites of local cultural significance, he also included '***Stories of agroforestry resources and of the locations of special historical and cultural significance***'.

The Indonesian forest management subset contains the criterion '***The management of each land use system takes into account the characterisation and delimitation of preservation areas and areas of different use intensity***'. This criterion corresponds closely with the Brazilian forest management indicator '***Existence of zones (areas defined for different use intensities in accordance with resource potential)***' and verifier '***Verification of uses defined for different use intensities in accordance with resource potential***'. These C&I could capture the area of protected areas and, if fully assessed, provide information on their sustainability under existing management strategies. The two Brazilian statements aim to assess how effectively ecological capacity and resource use are matched.

Table 4.5 C&I on Protected Forest Areas

<table>
<tr><th>Cameroon</th><th>Indonesia</th><th>Brazil</th></tr>
<tr>
<td>Criterion (social):
• Sites of special socio-cultural, historical and tourist value to the local communities are known and protected by social control mechanisms.

Indicator:
• Mystical sites of socio-cultural significance to communities.</td>
<td>Indicator (ecology):
• Areas of ecological importance are recognised and protected.

Verifier:
• Absence of intensive activity in protected areas.

Criterion (forest management):
• The management of each land use system takes into account the characterisation and delimitation of preservation areas and areas of different use intensity.</td>
<td>Verifier (ecology):
• Islands of relic primary forest occurring within the successional forest mosaic are preserved.

Criterion (ecology):
• The preservation of a mosaic of natural habitats maintains the natural complementarity of species occurrences.

Indicator:
• Among the various types of natural habitats occurring within the region, the rarest (or least extensive) in the forest landscape are strongly protected from conversion to agriculture.

Verifiers:
• Areas of ecological importance are identified and protected.

Criterion (ecology):
• The long-term maintenance of reserve areas and reproductive individuals is considered by the community in order to guarantee the survival of exploited populations.

Indicator:
• Forest reserves and sanctuaries of adequate size and distribution within the CMF areas are maintained.

Indicator (forest management):
• Existence of zones (areas defined for different use intensities in accordance with resource potential).

Verifiers:
• Verification of uses defined for different zones are being respected.</td>
</tr>
</table>

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

Chapter 5.

Technical Aspects of Managing Flora and Fauna

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

CHAPTER 5.

TECHNICAL ASPECTS OF MANAGING FLORA AND FAUNA

Chapter 5. Technical Aspects of Managing Flora and Fauna[21]

5.1 Overview

This section concentrates on the practical and technical aspects of forest interventions, in particular forest tending and harvesting activities, including non-timber forest product collection and hunting. C&I developed on the planning and localisation of these activities are examined. The C&I developed on the timing of interventions, the techniques these interventions involve, the conditions under which they take place, and their impact on species and the environment are presented and reviewed. All three disciplinary sets address these technical issues to some extent, but the majority of C&I discussed below originate from the ecological and forest management sets.[22]

It was difficult to wholly separate technical forest management considerations from social and economic considerations. Drawing distinctions between the technical and ecological aspects of forest management, proved especially problematic because the production function of the ecosystem is often modified by forest management objectives and methods. An example coming from the Cameroonian test concerns the harvesting of cane from rattan palm clumps. If this is done without damaging the capacity of the clumps to regenerate by suckering, then not only is the continuous production of cane assured, but also some degree of ecosystem integrity of the habitat. In this example the direct objective of management (careful harvest) is the continuous production of cane, and the degree of ecosystem integrity maintained is a by-product or secondary effect.

Thus, although this section concentrates on the methods, tools and timing of human interventions within the forest, we have felt compelled to appraise these variables in terms of their ecological significance and impact. We therefore review many of the C&I of technical aspects in conjunction with ecological C&I.

5.2 Key Issues for Forest Resource Management Techniques

From the testing process and our overview of the C&I sets produced, we have identified three of the issues addressed on all the tests as umbrella concerns:

- **The management objectives.** These will predetermine planning needs.
- **The planning of forest management interventions**. This covers the selection and co-ordination of activities in space and time to achieve production objectives in a sustainable manner.
- **The recognition of different forest types and sites with special characteristics**. This is a prerequisite to matching the type and intensity of interventions with the carrying capacity of different areas. Where such recognition is lacking due to insufficient knowledge, the acquisition of knowledge needed to correct the deficiency becomes a planning objective. On the other hand, where it is found to be satisfactory, it forms part of the framework for planning processes to build upon.

---

[21] Written by N. Burford de Oliveira with H. Hartanto.

[22] No systematic comparison of how the testing teams differed in their allocation of issues between disciplinary fields, is attempted.

These issues set the overall context within which the components of management practice and their temporal and spatial interrelationships can be evaluated.

5.2.1 Management objectives

None of the test generated C&I refer to management objectives. These are automatically included in management strategies or plans which, whether formal or informal, are oriented towards the fulfilment of objectives. That is to say, plans and strategies need to be evaluated in terms of the efficiency with which they achieve their own objectives.

Management objectives will, either consciously or unconsciously, evolve as local circumstances change. They may not always evolve along appropriate lines, but if they do not evolve, then plans and strategies are likely to become outdated and lose their relevance to emerging environmental and/or social scenarios. Periodic review of management objectives is, therefore, a potentially illuminating task.

The setting of objectives must, logically, proceed planning. Management objectives indicate a recognition of opportunities and problems that require some co-ordinated response to ensure sustainable forest resource use and harmonious socio-economic development. Their primary role may be perceived by communities, as mandates, or community '*constitutions*' that express their commitment to actively assume certain responsibilities. Their framework often sets the foundations not only for management plans but for the processes by which the community develops, enforces, and monitors rules and regulations and adherence to them.

In the Brazilian Amazon region, it is becoming increasingly common for rural communities, including Caboclo communities, to develop an 'Estatuto', which is a form of Community Constitution. Each community registers its Estatuto with the relevant local government authorities, an act which gives the document legal recognition. The Estatutos of Caboclo communities along the Tapajos and Arapiuns rivers, typically outline community commitment to co-operating on the protection of fishing resources and forest commons, hunting and third party access controls, and the control of game meat and fish sales. They usually also outline restrictions on land tenure transfers and conflict resolution procedures. However, they are usually regarded as too broad and insufficiently detailed with regard to processes, to be considered as management plans.

5.2.2 Forest Management Planning

The importance to rational forest harvesting of planning procedures and their timing was stressed on all tests, but especially the Brazilian test. The general consensus amongst teams was that management plans for CMF need not always be formal or include rigorously defined sets of rules and prescriptions. This consensus is, however, not clearly conveyed by the C&I complexes in the Indonesian set, nor is it fully communicated by the Brazilian C&I on planning. No direct mention of planning is made in the Cameroonian set (see Table 5.1).

C&I: Plans and Planning

Comments and observations on C&I attributes

Verifier:

Existence of management plans and annual plans for timber and NTFPs.

It was generally agreed on all tests that informal management plans should encapsulate local knowledge on the forest's productive potential (i.e., on the forest's suitability for interventions of different intensities), and set limits to the harvesting of species and plant parts accordingly. Opinion was unanimous that management plans should include forest treatments, which, to the best of locally available knowledge, minimise the risk of impairing carrying capacity, and improve this capacity for degraded forests. The Brazilian forest management verifier ***'Existence of management plans and***

Application:

Calendars of household production activities can reveal the degree of order governing forest interventions. Extra enquiries into considerations given to the timing of events can be helpful.

Relevance:

The current wording can easily be misinterpreted to refer only to formal plans, especially given the prevalence of 'annual plans' for timber management.

annual plans for timber and NTFPs' aims to capture informal application of sequences of management activities based on local notions of 'best practice'. The Brazilian forest management specialist maintained that annual plans, i.e., those that embrace annual seasonal variation, should be flexible enough to accommodate the communities' evolving knowledge of changes in markets and market access, and of new technologies.

The only Indonesian statement of direct relevance to management plans, the verifier **'*There is a land use plan for the village area, drawn up and formalised by the community*'** from the ecology set, seeks to establish the existence of a formal, written plan. This verifier supports the indicator **'*Drastic land cover change is prevented*'**. Despite this reference to formal planning, a view widely expressed among the Indonesian test participants was that formal planning, with its western scientific connotations of precision and registration, is not necessarily a critical issue in the context of traditional systems of CMF. Overstating its importance could generate false conclusions about the considerations behind actual management practice.

The Indonesian test team understood local decisions on forest interventions to be based on a constant review of a complex of interacting factors undergoing perpetual, if at times subtle, change. Possibilities for finely tuned responses to change could be unduly restricted by more fixed procedures. The team therefore thought participatory, community-based decision making processes and their outcomes are generally more critical to sustainability than is the existence of and adherence to formal management plans. The appropriateness of the latter (formal plans) would depend on the former (decision making processes). This perception is reflected by the Indonesian set containing more C&I on decision making processes than the other sets. It is the decision making processes, the Indonesian team maintained, that ought to be regarded as the planning processes which direct CMFs.

There was awareness expressed on all tests of the informal planning processes, often embracing broader dynamic social processes, which facilitate the integration of changing management objectives of multiple forest user groups. The C&I of 'participation', 'decision making processes' and other variables related to these social processes are more closely examined in subsequent sections on social aspects and policy.

Plans and planning are not explicitly referred to in the Cameroonian set, even though the test site communities were developing a written management plan to apply for a legal 'community forest' at the time of the test. Decision making

Criterion:

Indigenous strategies aimed at reducing pressure on wildlife are worked out in conformity with the laws and regulations for hunting.

Relevance to sustainability:

There is an undeniable need to strive for mutual support between indigenous strategies and national laws and regulations. However, the relevance of the above criterion depends upon the appropriateness of hunting laws and the pressure exerted by local hunters. In remote areas where hunting pressure does not pose a threat to certain animals, prohibitions on the hunting of these animals, that are justifiable elsewhere, should perhaps to be wavered so that traditional livelihoods are not undermined.

processes, rather than planning *per se*, were highlighted in the Cameroonian test, as they were on the Indonesian test. The concept of a plan is, however, communicated with the use of the word 'strategy' in the Cameroonian ecology criterion **'*Indigenous strategies aimed at reducing pressure on wildlife are worked out in conformity with the laws and regulations for hunting*'**. Unlike any of the other statements on plans, this criterion implies the importance of local strategies being worked out in conformity with laws and regulations. Since contact with the outside world is exerting an increasing influence over community forest resources, this detail will be important. The criterion also stands apart in that it and one of its supporting indicators ***'Indigenous strategies exist aimed at protecting certain species'*** are the only statements in all of the sets to overtly link strategies or plans with hunting. All other C&I that explicitly mention plans or planning are confined to the Brazilian set. Because of their position in relation to other C&I within the hierarchy, they appear only to refer to tree and plant products.

Although apparently unintended, the Brazilian test's C&I on planning appear to primarily concern formally planned timber management. This focus is suggested by the forest management indicator **'*Application of specific silvicultural treatments (liana cutting, elimination of other competitive plants, etc.) in accordance with annual plan of operations*'**, and the separate verifiers '***Definition of the cutting cycle, the annual area exploited, harvesting intensity, minimum diameter for respective species, mapping of all the species (100% inventory) and chronological calendar of activities'*** and **'*Existence of plans for directional felling of trees to reduce gap sizes and damage to other potentially harvestable trees*'**. Application of the first of these two verifiers would require breaking it down into numerous component parts, many of which could be satisfactorily evaluated with C&I that have already been developed specifically for commercial timber management. The Brazilian forest management specialist herself recognised that, the ideal of a 100% inventory of species is unrealistic, especially for poor forest communities. Even with this concession, exactly what was meant by a '100%' inventory remains unclear.

The verifier concerning directional felling focuses on protecting 'potentially harvestable trees', accentuating thereby considerations of economic efficiency. This stress on economic efficiency is recurrent in the Brazilian forest management C&I set.

The above I&V give the impression that timber cutting cycles are a feature of CMF at the Brazilian test site, and that it is the measures of harvested volume per area and period which must be assessed. However, there was no clear evidence that such cycles are or should be characteristic features of CMF at the Brazilian test site, although their review would be relevant to commercial timber harvesting carried out in the area under the direction of outside interest groups. It was clear that the Brazilian test site communities have not undertaken any 'formal' timber management to date, if by 'formal' we understand management regimes typical of the commercial forestry sector. This raises the question as to how pertinent some of the proposed C&I are to the evaluation of current modes of community forest interventions at the test sites.

The above Brazilian C&I could be interpreted to imply sophisticated 'modern' management strategies are required, especially for timber production, to ensure sustainability, and that, therefore, communities must ultimately commit themselves to their adoption. These C&I also help us appreciate that, applying C&I sets developed specifically for timber production to CMF sites is more likely to generate results that fit in with external scientific knowledge sets, than reflect the community's awareness of the sustainability of its own forest interventions.

Table 5.1 C&I: Strategies, plans and planning

Cameroon	Indonesia	Brazil
Criterion: • Indigenous strategies aimed at reducing pressure on wildlife are worked out in conformity with the laws and regulations for hunting. ***Indicator:*** • Indigenous strategies exist aimed at protecting certain species.	***Verifier:*** • There is a land use plan for the village area, drawn up and formalised by the community.	***Indicators:*** • Existence of management plans and annual plans (for timber and NTFPs [plants]). • Application of specific silvicultural treatments (liana cutting, elimination of other competitive plants, etc.) in accordance with annual plan of operations. ***Verifiers:*** • Definition of the cutting cycle, the annual area exploited, harvesting intensity, minimum diameter for respective species, mapping of all the species (100% inventory) and chronological calendar of activities. • Existence of plans for directional felling of trees to reduce gap sizes and damage to other potentially harvestable trees.

5.2.3 The Recognition of Different Types and Sites with Special Characteristics

All three tests generated C&I on local knowledge of areas supporting different ecological habitats or land uses. Local people use such knowledge to distinguish between areas according to productive potential and service value. Without such knowledge it becomes difficult to define the allowable harvesting pressure for species of interest under given sets of biophysical conditions, or to identify areas that merit special conservation status. An observed lack of knowledge would normally be interpreted in terms of research needs, the fulfilment of which necessarily precedes the full recognition of appropriate and/or inappropriate conservation, management and use strategies.

i) C&I: Definition of Land Types, Zones and Boundaries

Comments and observations on C&I attributes

Matching vegetation types and land attributes with different forms and intensities of use is the subject of the Indonesian forest management criterion ***'The management of each land use system takes into account the characterisation and delimitation of preservation areas and areas of different use intensity'*** and the Brazilian forest management indicator ***'Existence of zones (areas defined for different use intensities in accordance with resource potential)'*** (Box 5.1). The concept of matching is suggested by mention of 'sufficient knowledge' in the Cameroonian forest management criterion ***'Villagers have sufficient knowledge of the composition and distribution of different forest types'***.

Box 5.1 C&I: Zones and Boundaries (Brazil, Forest Management)

Criterion: Natural resources must offer a vast range of economic, social, environmental and cultural goods and services.

Supporting indicator:

- Existence of zones (areas defined for different use intensities in accordance with resource potential).

  Supporting verifiers:

  - Verification of uses defined for different zones being respected.
  - Mapping of the 'principal land uses' with the use of maps and satellite images.
  - Observation of and communication about conservation of water sources.
  - Inclusion of 'Indian black soils' in the community reserve.

OBSERVATION: NO DEFINITION FOR 'COMMUNITY RESERVE' WAS PRODUCED.

ii) C&I: Land Type Boundaries and Mapping

Local awareness of natural or human created boundaries to different land types relates to forest farmers' oblique vision of the landscape in contrast to the aerial view associated with high technology and academic expertise. Locating zones and their boundaries on maps, or physically demarcating them on the ground, were seen as potential ways of communicating local knowledge or adding to it. Participatory 'map reading' was thought to be a useful activity that can increase the knowledge of all involved. All three test teams recommended the use of participatory mapping techniques. Apart from actually producing maps that can be used to verify land use patterns, these techniques have high educational potential because of the communication they stimulate between participants.

Comments and observations on C&I attributes

Indicator
Community property rights are indicated on official land use maps.

Cost and Ease of application:
Community property rights may be demarcated on official maps, but obtaining the maps to verifier the accuracy of their demarcation may be difficult. The cost of this verifier's application would depend on how readily the relevant maps can be obtained. (Furthermore, even the official maps may not be accurate or undisputed).

According to the Brazilian team, the current state of the landscape can be verified with the use of maps and mapping techniques. Periodic ground checks to verify the content of existing maps and/or the comparison of maps created at different times can help verify and monitor C&I such as: **'*The size of annual agricultural land holdings is not increasing*'** (forest management, Brazil); **'*Community property rights are indicated on official land use maps*'** (social indicator, Indonesia); **'*Distinguishable elements in the landscape resulting from the prolonged use and management of agroforestry resources (anthropogenic forests, orchards and cultivated land)*'** (social verifier, Brazil); ***'Relative surface areas of burnt and unburned forest within the forest areas used by the community'*** (ecology, Brazil)*; and* ***'The reduction in area covered by natural forest over a given interval of time'*** (forest management, Cameroon) (Table 5.2). On the Brazilian test, it was mentioned that greater quantities of information can be acquired through the combined use of participatory mapping techniques and remote sensing image interpretation. The interest expressed in this combined approach on the Brazilian test is probably attributable to its having been successfully used by various non-governmental organisations working with communities in the Brazilian Amazon area (IMAFLORA *et al.* 1996).

The Indonesian social indicator **'*Community property rights are indicated on official land use maps*'** implies participatory mapping techniques have an important role to play in the definition and subsequent affirmation of agreed boundaries. The Indonesian and Brazilian teams created C&I to examine the existence of clear, recognised boundaries to protected areas (Box 5.2).

One observation made during the Cameroonian test, was that different sets of boundaries demarcate the realms of activity of different interest groups within the community. Social relationships and hierarchies of power normally determine these differences. Social boundaries to forest areas or products are not always physically demarcated and usually vary in permeability – some groups are freer than others to transcend them. Some gregarious plant products may, for instance, be freely gathered from neighbours' fallows by all, while hunting in the same areas is only permitted to close kin or people belonging to certain privileged groups.

Also in Cameroon, intractable problems of conflicting land claims involving different tribal groups, the government and, increasingly, people with officially registered and recognised permanent land title deeds were described as 'very common'. Conflicts of this nature are antagonistic to long-term management investments as they can result in the benefits of labour being appropriated by third parties.

Box 5.2 C&I: Boundaries and their Relationship to Land Tenure

From the Indonesian Forest Management C&I Set:

Criterion: The management of each land use system takes into account the characterisation and delimitation of preservation areas and areas of different use intensity.

Supporting indicator:

- Preservation areas are communally owned and subjected to low intensity use.

Supporting verifiers:

- Communal decision making applies to the utilisation and conversion of preservation areas.
- Presence of clear and distinct boundaries to preservation areas that are recognised by the community.

From the Indonesian Social C&I Set:

Criterion: Secure community tenure system is guaranteed by the State.

Supporting indicator:

- Secure community tenure system is guaranteed by State laws and regulations.

Supporting verifiers:

- Participatory mapping.
- Community property rights are indicated on official land use maps.
- There are no overlapping (tenure) rights.

Table 5.2 Selected C&I: Zoning, Boundaries and Habitat/Land Use Areas

Cameroon	Indonesia	Brazil
Indicator: • Boundaries of community area are known and respected by community members. ***Verifier:*** • Knowledge of important features indicating boundaries among communities. ***Criterion:*** • The villagers have sufficient knowledge of the composition and distribution of different forest types. ***Indicator:*** • The forest boundaries and all those with neighbouring villages are known and respected by all concerned. ***Verifiers:*** • The ancestral names of trees, rivers and other landmarks delimiting the forests are well known. • Different types of forest such as swamp and secondary forests, indicator species, species-rich areas of forest, valuable timber species, shrubs, herbs, streams, fish species and their location in the forests are known with a high degree of precision.	***Indicator:*** • Areas of ecological importance are recognised and protected. ***Criterion:*** • The management of each land use system takes into account the characterisation and delimitation of preservation areas and areas of different use intensity. ***Verifiers:*** • Presence of clear and distinct boundaries to preservation areas, that are recognised by the community. • Knowledge on forest area potential (including on timber and NTFPs) • Areas permissible for conversion (to agriculture) exist. • Taboos restricting product extraction from certain areas exist. ***Indicator:*** • Community property rights are indicated on official land use maps. ***Verifier:*** • Participatory mapping. ***Criterion:*** • Each land use system is located on suitable soil.	***Indicator:*** • Existence of zones (areas defined for different use intensities in accordance with resource potential). ***Verifiers:*** • Verification of uses defined for different zones being respected. • Mapping of the 'principal land uses' (and vegetation cover) with the use of maps and satellite images. • Inclusion of 'Indian black soils' in the community reserve. • Definition of the area for the harvesting of each product in accordance with its economic viability. • Participatory mapping of NTFP resources. ***Indicator:*** • The size of annual agricultural land holdings is not increasing. ***Verifier:*** • Distinguishable elements in the landscape resulting from the prolonged use and management of agroforestry resources (anthropogenic forests, orchards and cultivated land). ***Indicators:*** • Respect for and the protection of sites of special cultural significance is prioritised in the allocation of all forms of natural resource use and exploitation. • Forest reserves and sanctuaries of adequate size and distribution within the CMF area are maintained. ***Verifier:*** • (Describe) the spatial distribution of Brazil nut trees in relation to open areas and secondary forests.

5.3 Forest Harvesting and Resource Utilisation

We now turn to the C&I created to assess localised forest interventions such as tending and harvesting operations. To facilitate the comparison of these for the different test sites, the most relevant C&I from the three C&I sets were pooled and re-sorted into the following categories[23]:

- plant products (including timber and non-timber products) (section 5.3.1)
- hunting (section 5.3.2)

[23] Fishing was also a very important management and livelihood activity form; it is interspersed with C&I on hunting, as well as water management C&I, in this report.

Individual C&I were allocated only to those categories that reflect their associations within the C&I complexes to which they were assigned by the test teams. For example, the indicator '***All growth phases of groups of species are represented***', taken from the Indonesian ecology set, theoretically applies equally well to fauna as it does to flora. However, we do not consider it in relation to fauna, because the context within which it occurs in the C&I set restricts its focus to flora. Certain statements that occur only in relation to fauna or to flora when they could apply equally well to both, suggest gaps in the coverage of the C&I sets.

In the Brazilian forest management and ecology sets, rather then insert bridging statements with a wide embrace into the upper levels of the hierarchy, and then under these segregate I&V into separate complexes for flora and fauna species respectively, several partially repetitive high-level statements (i.e., P&C) are incorporated. Thus, for instance, the Brazilian ecology set contains three principles, one for plants, one for terrestrial animals and one for aquatic animals (Annex 3). The C&I assigned to each of these principles are for assessing whether viable populations of renewable resources extracted by community members from the accessible forest ecosystems, can be maintained over biologically relevant time scales. Several of the C&I are species specific, so may not be appropriate for other CMF sites, unless adapted.

However, the applicability of the standard demographic approach used in the Brazilian ecology set, to estimate whether focal resource populations are likely to persist in viable numbers or be driven to local extinction, is almost universal. It simply defines sustainability as a function of the underlying renewal rate, ***R*** (e.g., cohort replacement[24]), of any given resource population, and its depletion rate, ***D*** (e.g., harvest rate) brought about by the local community. It is widely accepted that ecological sustainability is only possible if depletion rates do not exceed the baseline renewal rates of any given resource. The maximum permissible depletion rate will vary depending on the population-specific schedules of fecundity, mortality, immigration and emigration. Under conditions where $\boldsymbol{D} > \boldsymbol{R}$, populations will eventually be driven to local extinction, as has been the case at the Brazilian test site with a number of large-bodied game vertebrates (e.g., Spider monkeys [*Ateles marginatus*]; tapirs [*Tapirus terrestris*]) and commercially valuable timber species (e.g., Pau rosa [*Aniba rosaeodora-Lauraceae*]; copaíba [*Copaifera multijuga*]; itaúba [*Mezilaurus itauba-Lauraceae*]). Virtually all fish, game and plant species that have been clearly overharvested by the Brazilian test site communities share a low reproductive rate, usually because of low fecundity, late age of first reproduction, and long intervals between consecutive breeding events. The forest vertebrates overhunted were invariably large, slow-growing and late-maturing species (Peres 1990, 1996 in press).

5.3.1 Forest Plant Products

The term 'plant products' is here used to refer to products originating from all types of plants ranging from woody to herbaceous species. To facilitate their comparison, we have roughly divided the C&I on plant products into the following categories concerned with:

- harvesting – temporal considerations, selectivity, techniques and technologies, and intensity of biomass removal;
- the impact of forest interventions on population structure and natural regeneration; and
- husbandry techniques affecting forest productivity and species composition and frequency.

Inevitably, these categories overlap considerably.

[24] A Cohort is a taxonomic group ranking above a superorder.

i) Harvesting: Temporal Considerations, Selectivity, Techniques and Technologies, and Intensity of Biomass Removal

Temporal considerations, the selectivity of harvesting of plants and plant parts, the harvesting and tending methods used, and the amount of biomass removed were all variables believed to affect, and, therefore, be indicative of sustainability. There were, however, some marked differences in how the test teams prioritised among these issues for assessment purposes.

a) C&I: Temporal Considerations

Comments and observations on C&I attributes

Criterion:

The role of seasonality in the use of forest resources and farming systems is recognised.

Application by whom:

The role of seasonality must be known to be recognised. Local people are likely to be more aware than outsiders of this role with regard to indigenous species.

Verification:

Failure to adhere to seasonal indicators of appropriate timing is often indicative of some factor(s) that prevents people from acting as they would under normal circumstances. Disease may reduce labour resources; sources of child labour may have been depleted by school attendance. There may be a backlog of initiating effects resulting from a delay caused by climatic irregularities.

Several references to the seasonality, timing and periodicity (frequencies and interval lengths) of forest-resource-based activities appear in the Cameroonian and Brazilian sets **(Table 5.3)**. In the Cameroonian forest management set, seasonal considerations are ranked highly at the criterion level, with the statement ***'The role of seasonality in the use of forest resources and farming systems is recognised'***. The Cameroonian management specialist thought the harvesting of plant parts other than fruits should be restricted as far as possible to times when plant growth is at its most vigorous. This minimises plant stress and ensures a relatively speedy recovery from induced stress. To back this assertion he created the indicator ***'Plant parts including bark are collected in the appropriate seasons'***. For the majority of plant species growth tends to be most vigorous during the rainy season. A verifier proposed for this indicator is ***'Plant parts are collected, dried and stored for later use'***. Significant increases in the shelf life of products can reduce the need to harvest out of season. Hence this verifier can help assess whether harvesting is being confined to appropriate seasons. Some highly perishable products for which no local processing methods exist face a greater risk of out of season harvesting pressure. Sometimes greater ease of collection during the dry season, adds to out-of-season harvesting pressure.

For timber harvesting, the Brazilian forest management set includes the verifier ***'Timber extraction in upland forest must not take place during periods of high rainfall'***. This verifier, which emanated from concerns about soil erosion, recognises seasonal considerations to mediate harvesting's impact on the physical environment as well as on individual plants and species populations. ***'Definition of timing, seasonality and frequency of harvesting for each species'*** is the most comprehensive verifier about temporal considerations relating to harvesting in the Brazilian forest management set. In addition to choosing the correct season, an appropriate rest period must be respected for the harvested species or population to recover. The more intensive and the more out of season the harvesting activity, the longer the recovery period required. Site conditions will also partly determine rest requirements for given harvesting intensities. Species growing at the limits of their geographic range will often succumb to relatively light harvesting pressure, requiring correspondingly longer recovery periods.

Only one direct reference to timing or phasing occurs in the Indonesian set. This is the forest management verifier '***Rest periods between tapping are adequate to maintain latex yields over time***'. This verifier concerns the periodic discontinuation of rubber tapping to allow tapped rubber trees to recover from stress (Table 5.3). Slight modification of the wording could make this verifier equally applicable to assessing the tapping of resins and saps (e.g., *damar* and *benzoin* in Indonesia, and *copaiba* in Brazil).

The only references to resting species between periods of harvesting activity in the Brazilian set are the ecological verifiers: '***Latex tapping techniques used in the CMF enable the survival of tapped trees***' (for the criterion '***The extraction of latex and resins from trees is done on a sustainable basis***'); and '***Only low impact techniques which permit healing of trunk wounds are used to extract copaiba oil***' (for the criterion '***Practices involving the extraction of oils or saps from tree trunks do not have an adverse impact on the demographic viability of harvested species***'). Thorough assessment of these verifiers involves the challenging task of determining the 'correct' length of rest periods between harvesting. This also applies to the assessment of the aforementioned Brazilian forest management verifier '***Definition of timing, seasonality and frequency of harvesting for each species***'.

Table 5.3 C&I: Seasonal Considerations

Cameroon	Indonesia	Brazil
Criterion • The role of seasonality in the use of forest resources and farming systems is recognised. (This criterion could readily apply to fauna and flora resources). ***Indicator*** • Plant parts including bark are collected in appropriate seasons. ***Verifier*** • Plants are collected, dried and stored for later use (between seasons).	***Verifier:*** • Rest periods between tapping are adequate to maintain latex yields over time.	***Verifiers*** • Chronological calendar of activities. • Definition of timing, seasonality and frequency of harvesting for each species. ***Indicator*** • Calendar of the collection and extraction of agroforestry products. ***Verifier*** • Timber extraction in upland forest must not take place during periods of high rainfall.

b) C&I: Selectivity: The Maturity of Harvested Plants and Plant Parts

Comments and observations on C&I attributes

Verifier:

Harvested timber is of optimal diameter.

Relevance:

At very low timber harvesting intensities, such as are characteristic of traditional forest communities, variation in bole diameter may not significantly affect sustainability.

Poles of timber trees are often used more frequently in the construction of village houses than is timber. Their use tends to result in a greater removal of established trees, many of them of species that yield quality timbers.

Rewording the verifier to '**Diameter of trees harvested for construction purposes**' could expand its relevance to a wider range of CMF scenarios.

The Indonesian and Cameroonian forest management sets both include a prescriptive indicator for restricting harvesting to mature plants. Initially, the Cameroonian forest management specialist proposed the indicator ***'When possible, only mature plants are harvested'*** with only rattan and raffia in mind (Table 5.4). On reconsideration, he found the indicator to be applicable to most plants and thus rephrased it accordingly (i.e., by removing the words rattan and raffia). Note that this indicator refers to the maturity of the plant as a whole at the time of harvesting plant parts. It does not specify the maturity of the plant parts (leaves, flowers, bark, etc.) being harvested.

From the Indonesian test, the indicator **'*Only mature non-timber forest products are harvested*'** is of relevance here. Although it embraces all NTFP species (and its relevance can be extended to animal species), three of its accompanying verifiers (***'Green colour stem for mature rattan (whitish-yellowish colour characterises immature rattan)'***, ***'Absence of thorns on 2-3 m of stem from ground level'***, and **'*Young sprouts are kept during "pandanus" harvesting*')** aim to help establish the incidence of immature rattan plant harvesting. The first two of these verifiers describe characteristics of mature rattan (see also Noor 1992). In addition, the Indonesian set includes the verifier ***'Harvested timber is of optimal diameter'*** which is related to the age and maturity of trees at harvest time.

The question arises regarding the extent to which restrictions on the harvesting of immature organs of mature plants are species specific. To what extent is it possible to categorise species and/or varieties to fit different sets of restrictions or management prescriptions? Woody species could, for instance, be categorised into those that produce sucker shoots or coppice regrowth and those that do not. Species and varieties of monocotyledons that do not produce suckers might quite obviously require some different management strategies from those that do. This is recognised to be the case with respect to two açai palm species, *Euterpe oleracea* and *Euterpe precatoria.*[25] Of these, only the former produces suckers, yet both yield fruits rich in iron and vitamins, as well as palm hearts. Some argue that the harvesting of palm hearts, because

[25] It has been suggested that the species *Euterpe precatoria* not be harvested for palmito because of its inability to regenerate from clumps. This recommendation is difficult to apply, especially in the case of *E. precatoria*. whose natural distribution extends into areas in central and western Amazonia where *E. oleracea* does not naturally occur. In parts of Peru *E. precatoria* palm hearts are a favoured food item and the species is intensively extracted for palmito production industries. This is believed to be reducing natural stocks of the species (Kahn 1996). Theoretically, it should be possible to harvest it on a sustainable rotational basis.

it involves cutting down stems, should only be permitted with *Euterpe oleracea* since only this species can regenerate shoots. Harvesting palm hearts from other species means destroying the tree and, therefore, foregoing future harvests of its fruits. A similar distinction can be drawn between rattan species. Some of the wider diameter types of rattan only produce one stem, while individuals of the majority of rattan species produce multi-stemmed clusters that can be partially harvested on a rotational basis and will thereafter normally regenerate shoots (Panayotou and Ashton 1992).

Many believe that the decision as to whether the removal of immature plant parts from trees should be permitted depends on the relative importance of the purpose for which the parts are removed. Sometimes the purpose relates to the species' morphology. Pruning or the removal of terminal buds is sometimes done to manipulate tree architecture to improve the form of timber stems or to facilitate tending and harvesting, especially in the case of fruit trees. In other cases, trees and bushes are cut back to make them more effective for a particular function, e.g., living fences.

Indicator:

Harvesting practices for each species are compatible with the species productive potential.

Cost of evaluation:

Assessment of whether this statement applies is very information demanding. For most NTFPs with small or uncertain market prospects, insufficient information is available. Research to generate the required information will usually be uneconomic and therefore infeasible.

None of the C&I in the Brazilian set specifically refer to plant age at the time of harvest. However, the need to take age into account is implied by the very general indicator *'**Harvesting practices for each species are compatible with the species productive potential**'*. To assess this compound indicator with any precision, knowledge about many variables including the species productivity under different climatic and environmental conditions, at different ages and with different timing of harvesting and harvesting methods, would be required.

Table 5.4 C&I: Plant Maturity at Time of Harvesting

Cameroon	Indonesia	Brazil
Verifier • When possible only mature plants are harvested.	*Indicator* • Only mature non-timber forest products are harvested. *Verifiers* • Green colour stem for mature rattan (whitish yellow characterises immature rattan). • Absence of thorns along the stem for 2-3 m from the ground. • Young sprouts are kept during *Pandanus* harvesting.	—

c) Harvesting Techniques and Technologies

So far in this section we have looked at C&I which focus on the plant's suitability for harvesting. The C&I we now go on to discuss were proposed for assessing the suitability of the harvesting techniques and technologies being used. Harvesting methods range from simple, manually executed deeds to ones involving the use of sophisticated tools, processes and/or technologies. We use the words 'method' and 'technique' interchangeably to mean a process, the sequence and timing of steps it involves, and all the inputs including skill and technologies required for its execution. Thus a method embraces all aspects of practice in the execution of an event. Technologies and skills are aids for the execution of techniques. Not all techniques (methods) involve the use of technologies.

1. C&I : Low-impact versus Destructive Harvesting Techniques

All tests created C&I to assess the destructive impact of harvesting techniques in use (see Table 5.5). This variable is central to the assessment of sustainability. A harvesting practice is considered unacceptably destructive if plants and species, either those harvested or others, are unnecessarily destroyed by the harvesting act. On this basis, timber harvesting, when done with low-impact felling techniques, is less likely to be classified as destructive in a negative sense. Although low impact techniques often results in the death of harvested and some other trees or plants, it can be argued that they prevent unnecessary damage. Where the word 'destructive' occurs in C&I statements, it carries a connotation of unacceptability. Exactly what techniques should be classed as destructive appears therefore to be a matter for subjective judgement.

Several of the Brazilian C&I search for evidence of the use of 'low-impact' techniques, e.g., the forest management indicator **'*Application of low impact techniques*'** and the ecology verifier **'*Only low-impact techniques which permit healing of trunk wounds are used to extract copaiba oil*'**. These are prescriptive statements, a negative evaluation of which is unlikely to provide information on how far practice fails to satisfy the standards that are thought should apply. Techniques differ in their capacity to affect species and the environment. The full implications of their impact also depends upon species and environmental resilience. Some techniques, including some very simple ones, are unacceptably destructive under virtually any circumstances. Their application is unambiguously indicative of unsustainability. Felling host trees to harvest epiphytes and lianas is an example. This is commonly done in some Amazonian riverine communities, although no indications of it were noted at the Brazilian test site. None of the Brazilian C&I mention this practice specifically. However, in the Indonesian forest management set evidence of such practices would be brought to attention by the verifier **'*Minimal plant or tree canopy damage caused by rattan extraction*'** if the word '*rattan*' in this verifier were to be replaced with '*lianas and epiphytes*'.

Another form of unacceptably destructive harvesting, that sometimes takes place in the Amazon region is the felling of some latex-yielding tree species, such as Maçaranduba (*Manilkara huberi* Stande.), to obtain one-off extra-large quantities of latex. With the disappearance of the Macaranduba latex market, this practice has become rare. However, its incidence/re-emergence would be revealed by the Brazilian ecology verifier **'*Latex-tapping techniques used in CMF enable the survival of tapped trees*'**. The tapping of some exudates is necessarily highly invasive (i.e., damar resins); it causes wounds to the trunk that place tapped trees at a comparatively high risk of pathogen infection. The focus should then focus on assessing whether the tapping techniques used are the least damaging of survival chances.

At the Indonesian test site the presence of some species that can be host to the fungi which produce *gaharu* wood was observed in the forest. Harvesting of *gaharu*, although not identified as an important economic activity at the test site, contributes significantly to the income of forest communities and nomadic groups inhabiting other parts of Kalimantan. Inexperienced commercial *gaharu* gatherers commonly fell potential host trees without advance knowledge of whether they are infected with *gaharu* fungi. Consequently, many trees are cut down unnecessarily, reducing the future potential for *gaharu* production. Traditional forest inhabitants, on the other hand can usually tell which trees are infected before cutting them down and sometimes climb trees to make a detailed diagnosis of symptoms. Signs of infection include those of dieback, such yellowing leaves or leafless branches. Swellings are sometimes present along the branches or the trunk and the bark tends to be dry. Seedlings and saplings surrounding an infected mother tree also usually show signs of senescence. Finally, knocking on the trunk of an infected tree produces a hollow sound. Unacceptable destructive harvesting of *gaharu* could be captured with the Indonesian indicator **'*Production of non-timber forest products is sustainable*'**. But, more narrowly-focused verifiers, including ones on local knowledge of best practice, would permit more precise evaluation of *gaharu* harvesting pressure.

Destructive harvesting methods are mentioned twice at the indicator level and once at the verifier level in the Cameroonian set. One of the indicators, **'*Destructive harvesting of leaves, suckers, stems, roots, branches, etc. is avoided to ensure their availability at times of need'*** is from the forest management set. It concerns the destructiveness of harvesting methods that retard species' productive capacity through the induction of stress and not the total destruction of the plant organism harvested (although the cumulative affect of a number of successive harvests may be premature death). The other indicator ‘***Destructive forest exploitation practices and techniques are known, e.g., destructive hunting, fishing methods, etc.’*** is from the Cameroonian social set. It regards the individual’s and the community’s knowledge as a key to avoiding destructive harvesting methods. It presents an expanded notion of destructive harvesting; one that covers the direct killing of whole living organisms and various mechanisms that indirectly reduce species populations.

Table 5.5 C&I on Harvesting Techniques

Cameroon	Indonesia	Brazil
Verifier • Forest fruits are collected mostly from the forest floor where there is less pressure on the forest ecosystem. • Villagers exploit raw materials in a sensible and frugal manner to ensure the sustainability of local cottage industries. ***Indicator*** • Techniques for gathering NTFPs ensure sustainability. ***Verifiers*** • Conservation techniques. • Destructive harvesting techniques. ***Criterion*** • Harvesting techniques are sustainable. ***Principle*** • Community forest management practices and techniques fully incorporate indigenous knowledge systems. ***Indicator*** • Destructive harvesting of leaves, suckers, stems, roots, branches, etc. is avoided to ensure their availability at times of need. ***Verifier*** • Tree barks and other plant parts are removed without either damaging the xylem and phloem or girdling the trunk so that tissue regeneration is ensured. ***Indicator*** • Destructive forest exploitation practices are known, e.g., destructive hunting, fishing methods etc.	***Verifier*** • Panel damage is reduced. ***Criterion*** • Low impact harvesting is applied. ***Indicator*** • Equipment used is adapted to local technological knowledge *(also applies to tending)*. ***Verifier*** • Optimum timber diameter trees are harvested.	***Indicator*** • Application of low impact techniques. ***Verifier*** • Knowledge and application of the best harvesting practices. ***Indicator*** • Harvesting practices for each species are compatible with the respective species productive potential. ***Criterion*** • Practices involving the extraction of oils or saps from tree trunks do not have an adverse impact on the demographic viability of harvested species. ***Verifiers*** • Only low-impact techniques that permit healing of trunk wounds are used to extract *copaiba* oil. • Latex-tapping techniques used in CMF enable the survival of tapped trees. • Existence of plans for directional felling of trees to reduce gap sizes and damage to other potentially harvestable trees.

2. C&I: The Use of 'Low' versus 'High' Technologies

The effects of forest technologies on forest sustainability largely depend on how, and how much they are used, and on site conditions. Whether or not their impact is acceptable depends on whether the ecological and socio-economic trade-offs incurred or sustained by their use are considered acceptable.

Technologies differ in many ways, including their capacity for environmental destruction and their energy requirements. Simpler, more traditional tools often, but not always, have a relatively low capacity for environmental destruction. Compared to more sophisticated technologies, many traditional tools are more energy efficient. However, they also tend to be less labour efficient. Consequently, forest farmers increasingly seek powerful modern tools such as chainsaws. Chainsaws are very expensive to produce and operate, but they dramatically reduce the labour required to fell trees, convert trunks into planks and clear forest and fallow lands for agriculture. *If* the use of chainsaws and many other modern technologies adheres to good guidelines, then these technologies can improve living standards without adverse environmental impacts[26].

Comments and observations on C&I attributes

The impact of technologies depends on the technical skill and conscientiousness with which they are used. Harvesters must refrain from their over- or misapplication. Both skill and attitude are the products of knowledge. Knowledge of how technologies function, their attributes and drawbacks becomes more critical with growing access to modern technologies. Two interrelated issues are important. The first is the process of transition from traditional, in-situ evolved technologies to modern, introduced technologies. The second is the understanding people possess of newly adopted technologies. Any technological transition must be smooth enough to ensure constructive adjustment to the secondary consequences (i.e., changes in socio-economic and cultural status) of technological change. In other words, the transition must not be so fast that the development of people's understanding of consequences lags behind to the point where they are unable to respond appropriately. The Cameroonian team founded the social principle ***'Community forest management practices and techniques fully incorporate indigenous knowledge systems'*** upon this concern. The Indonesian team created a similar indicator ***'Equipment used is adapted to local technological knowledge'*** and, for it, the verifiers '***Technologies to make harvesting tools in the area***' and '***Technologies to maintain tools existing in the area***'. This I&V complex relates to the criterion '***Low-impact harvesting is applied***'. Where a community plans to manage timber stocks for commercial exploitation, the question of the complexity of harvesting technologies and the resources available for their maintenance would require special consideration. The ecological, social, and economic impacts and implications of technologies must be adequately understood by communities prior to their implementation. Their adoption thus must be accompanied by an expansion of the local

[26] Technologies do not, of their own accord, damage the environment. It is those who use the technologies who are responsible for any environmental damage.

knowledge base. Increasing contact with the outside world and greater integration into the regional economy make this an even more pressing concern. It is reflected in the Indonesian complex of verifiers ‘***The use of local knowledge***’, ‘***Mobilising scientific knowledge***’ and ‘***Training***’ (which appears under the social indicator ‘***There is policy and activity aimed at rationalising the ladang*** [***shifting cultivation***] ***system***’). These verifiers inquire into whether people have sufficient experience and qualifications to use introduced technologies. It is self-evident that as these technologies come from outside the communities the knowledge needed to use them effectively must, in most cases, also be introduced. This requires commitment on the part of external groups, e.g., policy makers (the group targeted by the above Indonesian indicator), project planners, the media, etc. The Indonesian social set includes additional related verifiers (e.g., training) under the criterion ‘***Formal and non-formal education supports the sustainability of forests***’.

The introduction of modern, energy-demanding but labour-efficient technologies into traditional communities commonly affects these communities’ local social organisation or hierarchical order. Those wealthy enough to purchase such technologies often gain in social status by doing so. Typically, they hire the technologies out for others to use, thereby accumulating more wealth and causing the income gap within the community to widen. The introduction of chainsaws in some Caboclo communities has been observed to dramatically reduce the incidence of communal agricultural work groups that traditionally formed to clear forest and fallow for agriculture.

d) C&I: Biomass Extraction/Removal (including C&I on harvesting intensity and nutrient cycling)

Comments and observations on C&I attributes

All sets include C&I to ascertain whether harvesting practices impair or enhance species’ productive potential (see Table 5.6). In the Cameroonian forest management set this question is indirectly approached by verifiers on harvesting methods and intensities, e.g., ‘***Cottage industries that use indigenous skills exist and encourage the wise harvest and use of forest raw materials***’ and ‘***Villagers exploit raw materials in a sensible and frugal manner to ensure the sustainability of local cottage industries***’. Both these verifiers support the indicator ‘***The interests of the various community forest user groups complement each other and do not adversely compete***’. Impact on productive potential can furthermore be deduced from information obtained with I&V from the same set that, located under the criterion ‘***Harvesting techniques are sustainable***’, seek evidence of destructive harvesting. Finally, a verifier in the Cameroonian forest management set which does not resemble any statement included in any of the other sets is ‘***Forest fruits are collected mostly from the forest floor where their harvesting places less pressure on the forest ecosystem***’.

Verifier:

Fruiting patterns of harvested species are not adversely affected by harvesting.

Ease of application:

Difficulties arise in trying to tell apart factors that interact to influence fruiting patterns. Depending on the biological mechanisms involved for the species, a valid assessment of this verifier may require many years of close monitoring conducted by professional biologists.

In the Indonesian ecology set, the focus turns to the forest's condition as indicative of harvesting impacts, with the verifiers '***Harvesting does not reduce the resource base***' and '***Species of non-timber forest products which are harvested or negatively affected during harvesting retain their ability to regenerate***' given for the indicator '***Production of non-timber products is sustainable***'. Also in the Indonesian ecology set and of relevance here is the indicator '***Vegetation structure is maintained***' and its verifiers '***The existence of all normal strata in the climax vegetation***' and '***Basal area distribution is normal***'. The verifier '***The approximate density of large trees (> 40 cm dbh) felled within the primary forest exploited by the community***' in the Brazilian ecology set, looks at takeoff or harvesting intensity in relation to a pre-harvesting condition, in this case density, of the residual stand.

Some of the Brazilian forest management I&V proposed for the criterion '***The exploitation of non-timber forest products is based on sustainable practice***' require some quantification of productive potential before they can be accurately assessed. Examples of this are the two verifiers '***Estimates of the quantitative potential of each product***' (for the indicator '***Existence of management plans and annual plans***'), and '***Definition of harvesting intensity (collection of fruits per tree, individual insertions per stem, number of stems cut per liana or epiphyte, number of cutting panels (paineis de corte) per rubber tree, etc.***' (for the indicator '***Harvesting practices for each species are compatible with the respective species productive potential***').

Estimates of productive potential or of permissible harvest rates can serve as a baselines against which biomass removal rates can be evaluated. Such baselines would be needed to assess the degree to which the Brazilian ecological principle '***The extraction of forest resources is compatible with the demographic and genetic viability of plant populations (and the animal populations upon which they depend) which sustain those extractive activities***' is being fulfilled. A number of the verifiers under this principle draw attention to the demographic viability and physical condition of species or species groups to assess the impact harvesting has had upon them. Some examples include: '***Fruiting patterns of harvested species are not adversely affected by harvesting***'; '***Adult Brazil nut trees that have been harvested for at least 20 years are in good physical condition and show no signs of senescence***'; and '***Copaiba trees previously subjected to oil tapping do not succumb to higher mortality rates than untapped trees in the same population***'. This last verifier could also apply to other species tapped for exudates.

C&I on Nutrient Cycling

The Indonesian forest management set shows a clear leaning towards assessing harvesting intensity in terms of biomass removed from the ecosystem. This is communicated by the two verifiers ‘***Extracted timber waste is allowed to decompose in the forest***’ and ‘***Timber is converted into planks in the forest***’. These present a different orientation to that conveyed by the Brazilian forest management verifier ‘***No evidence of high tree stumps, excessive extraction losses or splits caused during felling, or of felled trunks left in the forest***’. This Brazilian verifier, meant to help evaluate the indicator ‘***Application of low impact techniques***’, was conceived with a mind to economic efficiency.

Timber waste and the increased volume of litter and other organic debris brought about by logging activities constitute sources of soil nutrients that should be left in the forest. Nutrients released from the breakdown of these organic materials by soil organisms will be absorbed by the surrounding trees relatively quickly when the gap size is fairly small (Bruijnzeel 1990). When soil cover is destroyed and soil is compacted by machinery, there is a greater risk of leaching, and consequently, of soil fertility decline.

Table 5.6 C&I on Harvesting Intensity and the Disposal of Harvest Residues

Cameroon	Indonesia	Brazil
———	*Verifiers:* • Basal area distribution is normal. • Extracted timber waste is allowed to decompose in the forest. • Optimum timber diameter trees are harvested. • Timber converted into planks in the forest.	*Verifiers:* • The approximate density of large trees (>40 cm dbh) felled within the primary forest exploited by the community. • No evidence of high tree stumps, excessive extraction losses or splits, caused during felling or felled trunks left in the forest. • Estimate of the quantitative potential of each product. • Definition of harvesting intensity (collection of fruits per tree, individual insertions per stem, number of stems cut per liana or epiphyte, number of ‘paineis de corte’ (cutting panels) per rubber tree, etc.) *Principle:* • The extraction of forest resources is compatible with the demographic and genetic viability of plant populations (and of the animal populations upon which they depend) which sustain those extractive activities. *Indicator:* • Cofaidera trees previously subjected to oil tapping do not succumb to higher mortality rates than untapped trees in the same population.

There must be a balance between the harvesting techniques used and the yield obtained. More stress-inducing techniques must be associated with lower long-term yield potentials if their use is to be sustainable.

Several of the Indonesian and two of the Brazilian statements presented above concern timber exploitation. These may be used to assess traditional as well as modern methods of timber harvesting employed either for domestic or commercial purposes. C&I specifically on timber harvesting were not included by the Cameroonian team. This team, concentrating on actual forest management practice at the test site, saw timber exploitation as a relatively low-profile issue since logs are only very occasionally extracted by community members and then only for domestic use (Box 5.3). This situation is however likely to change in the not too distant future.

Box 5.3 Community Timber Extraction

At none of the test sites was the local community managing timber stocks for commercial exploitation at the time of the test. However, at all the sites, local residents cut some forest trees for domestic use. In most cases, felling and conversion into planks is still done with axes or cross-saws and planks are cut at the felling site. At least at the two Brazilian test site communities, there has been a notable increase in the use of chainsaws by community members over the last few years.

Most of the C&I on timber management in the Brazilian set, despite their applicability to traditional exploitation methods, were developed with the assumption that the community would exploit the commercial potential of timber management in the future. The Indonesian test site communities were closer to engaging in commercial timber management due to their involvement with the Social Forestry Development Project. They had not started doing so at the time of the test and, therefore, most of the C&I on timber management generated were developed specifically to assess the sustainability of traditional exploitation methods. None of the C&I generated by the Cameroonian test explicitly address timber exploitation.

A likely explanation of why more C&I on timber management occur in the Indonesian set than in the Cameroonian set, may lie in the fact that the local demand for house construction timber is much higher in the Indonesian than in the Cameroonian test site villages. At the Indonesian test site, houses are built with wooden planks on wooden stilts and roofed with shingles that are also wooden. At the Cameroonian test site, the houses are constructed with rattan scaffolds filled with mud. They are roofed with thatch or corrugated iron sheets.

The Brazilian and Indonesian teams, differing in their priorities, believed different types of information is needed to assess the harvesting of timber. The *'Conversion of logs into planks within the forest'* and *'Leaving conversion waste to decompose within the forest'* appear as verifiers in the Indonesian set. One verifier related to waste is also found in the Brazilian set '*No evidence of high tree stumps, excessive extraction losses or splits caused during felling, or of felled trunks left in the forest'*. The Indonesian verifiers were devised to verify the amount of nutrients removed from the forest ecosystem by logging. They were also meant to inform about the incidence and severity of soil disturbance and compaction resulting from skidding and transporting timber, for which another separate verifier was also created. The Brazilian verifier on the other hand, stems from considerations of economic efficiency. Professional foresters at the Brazilian workshop held the view that converting timber into planks within the forest is not a commercially viable community forestry practice. Planks produced using simple modern technologies (e.g., chainsaws and portable sawmills), they claimed, are of inferior quality. Their calculations indicate communities such as those of the Brazilian test site, could get higher returns by selling round logs than locally sawn planks. As these examples show, background considerations of this sort are often not clearly communicated by the wording of criteria, indicators or verifiers.

A consideration raised on all tests but not specified in any of the proposed C&I, relates to the setting of cautionary procedures and rates of forest product removal. Some clarity on safety margins for annual takeoff rates was thought important to compensate for knowledge deficits on species' regenerative capacities. However, this issue does not limit the formulation of C&I. It concerns the development of standards that facilitate the interpretation of C&I assessment results.

ii) Impacts on Population Structure and Natural Regeneration

a) C&I: Residual Forest Damage

Comments and observations on C&I attributes

Verifier:

Honey bee trees (sompun, keladan, tappang [*Lithocarpus sundaicus*), etc.] are not extracted or damaged.

Generaliseability:
This verifier is obviously only relevant for sites at which bee keeping is amongst the income generating activities. Even if not relevant to all sites for that reason, it does offer a good example of a measurable locally-relevant indicator. Other communities may have different specific NTFPs involved, but the basic premise of 'don't bite the hand that feeds you' that underlies this verifier would be transferable to many of these. This would be even more useful if it specified, for example, what 'damage' referred to (and what an 'unacceptable level of damage' would be).

Damage caused to neighbouring plants and vegetation by harvesting activities was an issue addressed on all three tests (see Table 5.7). The Indonesian forest management set includes the most detailed complex of I&V on the issue, developed around the criterion '***Low-impact harvesting is applied***'. One of the indicators included, '***Harvesting causes minimum disturbances***' can be partially assessed with the verifier '***Minimal soil disturbance/compaction caused by skidding or other ways of transporting timber***'. Another more narrowly focused version of this indicator (also given for the above criterion), is '***Minimal disturbance to animal habitats***'. The only verifier for this indicator is '***Honey bee trees (sompun, keladan, tappang [Lithocarpus sundaicus] etc.) are not extracted or damaged***'.

The two Indonesian forest management verifiers '***Minimal plant or tree canopy damage caused by rattan extraction***' and '***Limited number of trees are cut during non-timber forest product harvesting***' restrict themselves to damage caused by NTFP harvesting and, the first one, to that caused by the harvesting of just one NTFP species; rattan. The Cameroonian and the Brazilian sets each have only one statement at the verifier level on residual damage; '***Damage caused to neighbouring plants and vegetation by harvesting practices***' (Cameroon) and '***No observation of residual trees that have died or been damaged as a result of harvesting activities***' (forest management, Brazil). Both refer to harvesting activities in general. Note that the Brazilian verifier is associated with the criterion '***The exploitation of non-timber forest products is based on sustainable practice***'. It would be unrealistic to use the verifier for assessing damage caused by timber harvesting.

Included in the Brazilian ecology set is the indicator ***'The density and size of clearings caused by the felling of trees in primary forest must not exceed the dimensions of natural treefall gaps'***. The size of natural treefall gaps is highly variable, making it difficult to define natural tree fall gap size. On average, approximately 1% of total area is taken up by gaps in tropical rainforest that has not been disturbed by people. This is much less than the gaps one would expect to result from reduced-impact techniques at low harvesting intensities, i.e., removing no more than 5 trees per hectare at one time[27]. Not only are the gaps created by cut trees falling incremental to those caused by natural tree fall, but there is the additional canopy opening caused by tree extraction to be considered. The above indicator is invalidated by the fact that its strict fulfilment is only possible with zero felling of trees. Of relevance to the assessment of gap size is how gap size affects water flow. Many studies have shown that, changes in forest cover of less than 20% do not usually cause changes in the catchment streamflow (Brouwer 1996; Jetten 1994; Bruijnzeel 1990).

The Brazilian indicator on gap density and size is *clearly irreconcilable* with the Brazilian C&I on timber management and the sustainability of an economically viable community-run timber management enterprise. The disparity illustrates how the interests and values of different groups can conflict. These conflicts are based on different underlying concepts of sustainability. The Brazilian ecologist's indicator reflects his prioritisation of keeping the forest close to its original pristine state. In the strictest sense, this is irreconcilable with the fulfilment of the Brazilian forest management C&I of the long-term economic viability of community commercial timber management (something not yet attempted by the Brazilian test site communities). Such disparities between C&I, have their counterparts in real disputes. Resolution of incompatibilities between prescriptive C&I must be decided around the negotiating table where agreements on objectives and trade-offs are decided.

Arguably, where human forest communities are recognised as an integral element of the forest ecological system, natural tree fall would include the felling of trees to provide for basic human subsistence needs. For community logging to qualify as 'natural' on these grounds, most people would probably agree that felling would have to be minimal (e.g., < 1 tree per hectare per year) and that planks should be cut inside the forest and carried out on the shoulder. Traditional timber harvesting practices employed at some of the test site communities still largely comply with these standards, but they are being steadily replaced with more aggressive methods.

[27] In Asia conventional logging that removes an average of 8 trees per hectare damages about 50% of the original tree population. With 500 trees per hectare before logging, this would mean damage is caused to 250 trees, approximately half of which (125) would be killed by felling and skidding and the other half injured. Natural mortality in primary forest averages 1% of the tree population, i.e., about 5 trees per ha per year. After logging, the forest will regenerate but the annual mortality rate compared to unlogged primary forest, will remain high at about 3-5% of the residual tree population because the injured trees are much more fragile. With reduced-impact logging and medium logging intensity (< 8 trees/ha) it is possible to reduce the damage to only 25% . Even with the use of reduced-impact logging techniques the removal at one time of 5 trees per hectare would result in much higher mortality rates. Perhaps greater reductions are possible in South America where only 5 trees per hectare on average are extracted, reducing damage to about 15% of the original population. It is important to remember that logging does not only consist of felling trees but also in extracting them with tractors and that this is another major cause of damage. In summary, limiting the damage to a threshold of 20-25% seems reasonable given an adequately long felling cycle of about 50 years (Plinio Sist, pers. comm.).

Table 5.7 C&I: Damage to Residual Vegetation and other Resources

Cameroon	Indonesia	Brazil
Verifier: • Damage caused to neighbouring plants and vegetation by harvesting practices.	***Verifiers:*** • Minimal plants or tree canopies damaged during rattan extraction. • Limited number of trees of trees are cut during non-timber forest product harvesting. • Minimal soil disturbance/compaction caused by skidding and transporting timber. ***Indicator***: • Minimal disturbance to animal habitats. ***Verifier:*** • Honey bee trees (sompun, keladan, tappang [*Lithocarpus sundaicus*] etc.) are not extracted or damaged.	***Verifier:*** • No observation of residual trees that have died or have been damaged as a result of harvesting activities. ***Indicator:*** • The density and size of clearings caused by the felling of trees in primary forest must not exceed the dimensions of natural treefall gaps.

Despite the Indonesian and Brazilian ecologists' and forest managers' interest in assessing damage caused by logging activity, no C&I were created to assess how the percentage of logging damage caused by CMF compares with the average amount of damage caused by standard logging techniques.

b) C&I: Age Structure of Plant Populations

All tests produced C&I on either the age structure, size classes or representation of development phases of plant populations (Table 5.8). The Indonesian and Cameroonian ecology sets each include one indicator of the population structure of species occurring within the natural forest: '*The abundance dominance consistency (distribution) and frequency of species is comparable to that of the original forest*' (Cameroon); and '*All growth phases of groups of species are represented*' (Indonesia). The Cameroonian indicator requires such intimate knowledge of the original forest, that probably only exceptionally experienced elderly community foresters can use it. However, its wording is highly technical, requiring that it first be explained to local people.

The Indonesian test created five verifiers on population structure. Between them they refer to knowledge on species' growth rates and normal diameter class distributions, and to the age class distributions of sufficient numbers of 'key' species. No definition of the controversial term 'key species' was provided (see Scott Mills *et al*. 1993 for a critique of the use of 'keystone' species).

Table 5.8 C&I on Population Structure and Growth Stages of Plant Species

Cameroon	Indonesia	Brazil
Indicator: • The abundance dominance consistency (distribution) and frequency of species is comparable to that of the original forest.	***Verifiers:*** • Knowledge on the growth rates of local commercial species. • Diameter distributions of commercial species follow normal distributions. ***Indicator:*** • All growth phases of groups of species are represented. ***Verifiers:*** • Sufficient numbers of trees in their seedling, sapling, pole and mature phases. • Sufficient numbers of other key species in various growth stages. • Age and diameter class distributions (in tembawang)	***Verifiers:*** • Quantification of the age structure of the Brazil nut tree population in the CMF area. • The number of adult Brazil nut trees in the community's area has not suffered a substantial decline over the last few decades. ***Indicator:*** • Local populations of latex-yielding trees (e.g., *Hevea, Brosimum, Couma* and *Manilkara* spp.) are demographically viable. ***Verifier:*** • Observation of plant species of interest in various stages of development. ***Indicator:*** • There has been no noticeable marked decline in the population density of local timber species.

Comments and observations on C&I attributes

Verifier:

The number of adult Brazil nut trees in the community's area has not suffered a substantial decline over the last few decades.

Cost and ease of application:

A cheap and reasonably reliable measure of this verifier is obtainable by asking elderly community members whether they recall any decline in the adult population of the species having occurred during their lifetime. Some cross-checking is advised to gauge whether people's recollections correspond with each other. Local inhabitants are likely to know the answer to this verifier. This makes it possible to avoid expensive and time-consuming inventories of age classes.

The Brazilian contribution on age class distribution is restricted to I&V of less general scope. Only the verifier **'*Observation of plants or species of interest in various stages of development'*** refers to species in general. The other statements specifically address the age structure or population trends of particular species or groups of species of economic importance at the test site. They include: the indicator **'*Local populations of latex yielding trees (e.g., Hevea, Brosimum, Couma and Manilkara* spp.*) are demographically viable*';** and (the unconnected verifiers) ***'The number of adult Brazil nut trees in the community's area has not suffered a substantial decline over the last few decades'***; **'*There has been no noticeable marked decline in the population density of local timber species*'**; and **'*Quantification of the age structure of the Brazil nut tree population in the CMF area*'.**

A species size class distribution in a given area can indicate past overharvesting by the incidence of under-represented or absent age classes. Similarly, age class distributions can reveal the ability of species to recover from disturbance or overharvesting. Care is needed to eliminate the influence of factors other than human interference, such as mast years, climatic irregularities and population senescence. There is, for instance, some evidence to suggest that Brazil nut tree clusters tend to be even-aged and that this is not due to human influence. Empirical evidence suggests that the productivity of the majority of individuals belonging to a Brazil nut tree cluster drops simultaneously supposedly because they are all senescing at the same time. The Brazilian verifier ***'The number of adult Brazil nut trees in the community's area has not suffered a substantial decline over the last few decades'*** refers to the declining physical presence of adult trees but will not shed light on the cause of decline. This could be forest conversion or logging, or to the lack of recruitment of adult trees due to a gap in the age class structure. If the cause of the decline can be identified, then this verifier can provide information on the magnitude of the cause's impact.

c) C&I: Natural Regeneration

It should be possible to assess natural regeneration using C&I related to population structure, such as those presented above. However, all tests generated additional C&I with a narrower focus to specifically cater for the evaluation of natural regeneration (Table 5.9). The difficulties of assessment are reduced if only natural regeneration, and not age class distribution, is to be quantified. However, the significance of the volume of natural regeneration observed depends upon the size of the mature, reproductive population. Restricting the focus to only natural regeneration would therefore limit the value of the assessment.

Comments and observations on C&I attributes

Except for two indicators in the Brazilian ecology set, reference to natural regeneration in the three test sets is confined to the verifier level. The two Brazilian indicators are specific to Brazil nut trees: **'*The natural regeneration of harvested Brazil nut trees is maintained to ensure a demographically viable population*'** and **'*Mutualistic interactions between Brazil nut trees and their pollinators and seed dispersers are maintained*'**. Two of the four Brazilian verifiers related to natural regeneration support the latter of these indicators. They are therefore also species specific within the context of the C&I hierarchy. One is the prescriptive verifier **'*Hunting of agoutis in traditional Brazil nut-gathering areas is highly restricted (to perhaps a few individuals)*'**. The other is the descriptive verifier **'*The frequency with which the occurrence of pollinator bees (*Euglossine *spp.) is observed in the crowns of flowering Brazil nut trees*'**. Evaluation of this last verifier is impractical due to the inaccessibility of most Brazil nut tree crowns, especially those of trees within the forest. We raise these last two verifiers in connection with natural regeneration as they concern essential prerequisites to natural regeneration.

All the tests generated a verifier for the regeneration of harvested species. These were '***Natural regeneration of harvested species is observed as sufficient to ensure no decline in future product availability***' (Cameroon, forest management), '***Species of non-timber products which are harvested or negatively affected by harvesting activities retain their ability to regenerate***' (Indonesia, ecology) and '***Observation of the natural regeneration of harvested species***' (Brazil, ecology). The Cameroonian ecology verifier '***The undergrowth looks scattered thickly with seedlings***', although being a rough measure, provides a rapid means of assessment that can be adequate where a 'thick' coverage of seedlings can be defined for different species in relation to their fecundity under prevailing site conditions.

As the I&V related to Brazil nut trees suggest, key considerations are often species specific. The absence of more detailed I&V about the ecology of other useful species' natural regeneration probably reflects the limited knowledge of the teams. A more thorough survey of local and scientific knowledge is needed to assess how adequately existing knowledge (local and scientific) can explain the impact forest interventions have on species productivity and reproduction.

Table 5.9 C&I on Natural Regeneration

Cameroon	Indonesia	Brazil
Verifiers: • Capacity for regeneration for each species. • Natural regeneration of harvested species is observed as sufficient to ensure no decline in future product availability. • The undergrowth looks scattered thickly with seedlings.	***Verifiers:*** • Species of non-timber products that are harvested or negatively affected during harvesting retain their ability to regenerate. • Existence of seedlings, saplings and poles of extracted species in neighbourhood of cutting area.	***Verifiers:*** • Observation of a natural regeneration regime of harvested species. • Fruiting patterns of harvested species are not adversely affected by harvesting. ***Indicators:*** • The natural regeneration of harvested Brazil nut trees is maintained to ensure a demographically viable population. • Mutualistic interactions between Brazil nut trees and their pollinators and seed dispersers are maintained. ***Verifiers:*** • Hunting of agoutis in traditional Brazil nut-gathering areas is highly restricted (to perhaps a few individuals). • The frequency with which the occurrence of pollinator bees (*Euglossine* spp.) is observed in the crowns of flowering Brazil nut trees.

iii) Forest Species Husbandry Techniques Affecting Productivity and Species Composition

a) Overview

Like harvesting selectivity and intensity, measures to protect or promote the species productivity can affect species richness and frequency. Shifts in species dominance and composition can be stimulated by either destructive or nurturing interventions. Differentiating between and quantifying the influences of factors contributing to such shifts can be difficult. However, over harvesting, by weakening the competitiveness of the harvested species, theoretically opens the way for other species to proliferate or invade. Some silvicultural treatments involve direct elimination of less desirable competing species (Table 5.10). Less drastic change generally results from treatments such as pruning that are administered directly on favoured species i.e. involve no direct manipulation of their competitors. However, even a response to such treatments, e.g., an increase in vigour or precocious fruiting, can lead to the suppression of other species.

In the CMF context, a relatively large number of species normally receive some protection or active tending because of their usefulness. Many will have multiple uses. Interventions, therefore, need to follow a careful appraisal of alternative uses, including the ecological utility of the species in sustaining relationships of interdependency between trees, animals and aspects of the physical environment. The characteristics of CMF at the test sites suggest the need for a balance between harvesting and husbandry methods and protective/conservation measures that complements those ecological trade-offs and trade-offs between social and ecological priorities identified as reconcilable with sustainability. The long-term implications of such compromises are often significant.

Depending on the circumstances, the selective harvesting of any one species can conflict unduly with the interests of some social groups within the community. Participatory decision making on which species to harvest and at what intensities can help prevent such conflicts occurring. Awareness of this is portrayed by the Brazilian forest management verifier '***Participation of the community in decisions on which trees to extract, that take into consideration the species and diameter of trees***' for the criterion for timber management '***Timber exploitation is undertaken on a sustainable basis***'.

Table 5.10 C&I on Silvicultural Treatments and the Manipulation of Species and Species Composition

Cameroon	Indonesia	Brazil
Verifiers: • Growth of trees increases following the elimination of competing species in land clearance (for agriculture). • Changes in availability of useful plants and animal species.	***Verifiers:*** • Regular spacing applied to support better tending and tapping. • Actions to intensify tembawang exist (planting, cleaning , tending, liberation cutting, gap stimulation, etc.). ***Criterion:*** • Optimisation of the local agroforestry system. ***Indicator:*** • Optimisation of tembawang (forest garden).	***Indicator:*** • Application of silvicultural treatments. ***Verifiers:*** • Knowledge and application of practices that **favour** production (line and path weeding, liberation cutting of lianas, elimination of sprouts, etc.). • Lianas are cut from trees tallied for harvesting one year before harvesting is to take place. • Cutting of lianas to liberate the development of trees destined for timber production. ***Indicator:*** • Application of low-impact treatments and husbandry methods (in the control of pests and diseases, pruning, etc.).

b) C&I: Forest Husbandry Interventions – General

Comments and observations on C&I attributes

The C&I on silvicultural treatments such as weeding (including liana cutting) and liberation thinning in the Indonesian and Brazilian sets suggest promoting the productivity of economic species, even if at the expense of other species, is a positive action. The Brazilian C&I on these issues relate to the management of natural forest and stress the importance of weeding to improve timber production. This is made obvious in the three forest management verifiers '***Knowledge and application of practices that favour production (line and path weeding, liberation cutting of lianas, elimination of sprouts etc.)***'; '***Lianas are cut from trees tallied for harvesting one year before harvesting is to take place***'; and '***Cutting of lianas to liberate the development of trees destined for timber production***'. In contrast, the Indonesian C&I on treatments mostly directly address humanly established forest gardens (jungle rubber and tembawang), as shown by the forest management verifiers '***Regular spacing applied to support better tending and tapping.***' and '***Actions to intensify tembawang exist (planting, cleaning, tending, liberation cutting, gap stimulation, etc.)***'.

Criterion:
Optimisation of the local agroforestry system.

Relevance:
Achieving the 'optimal' is unlikely to ever occur. however, it is a worthy goal that seeks to integrate ecological, social and technical considerations to maximise long-term viability under existing resource endowments. Addressing it at the criterion level is therefore appropriate.

In Table 5.10 we have included the Indonesian social criterion '***Optimisation of the local agroforestry system***' and its indicator '***Optimisation of tembawang (forest garden)***' on the understanding that species composition, especially in a humanly created agroforestry system, must be manipulated to become 'optimal', as defined by other C&I and the standards or thresholds accepted for their evaluation. The definition of what is 'optimal' is constantly changing with economic and cultural change.

In addition to those created, some extra C&I relating to constraints to achieving a better balance between husbandry and harvesting methods and competing demands could deliver information of social and ecological importance. Also useful could be additional C&I for assessing how prescriptive C&I (such as the Brazilian ones on liana cutting) should be modified to reflect site-specific characteristics of the broader context. Many foresters specialising in timber management widely recommend liana cutting. However several liana species, still or previously common in forest around the Brazilian test site, have high local utility as well as commercial value. Conversations with forest farmers at the Cameroonian and Brazilian test sites suggested the actual value exceeds the potential value of timber. Lianas, for example, can be used for many things: ropes; weaving and basketry; furniture making; house construction; and traditional medicines. Numerous liana species yield traditional medicines. If their stems are harvested prematurely, then most of these uses are foregone. Because of their multiple uses, it is logical to evaluate the standards applied to liana cutting. As a silvicultural treatment to encourage the growth of timber trees, usually there is no discrimination between young and older lianas.

c) Husbandry Interventions Relating to Forest and Species Protection and Maintenance of Species Associations

1. Overview

The maintenance of species associations is a fundamental concern encompassed in the C&I generated on the protection or conservation of biodiversity and species (Table 5.11). Many of these C&I imply measures must be taken to mitigate damage caused by harvesting and husbandry interventions. Within this category we have included C&I that contain verbs such as 'to protect' and 'to maintain' interpreting these in the positive sense as referring to humanly determined actions rather than coincidental outcomes.

Table 5.11 C&I: Protection of Species, Species Associations and Biodiversity

Cameroon	Indonesia	Brazil
Criterion: • Biodiversity is conserved. ***Indicator:*** • Useful trees that are becoming rare are known and protected. ***Verifiers:*** • Conservation techniques. • Exotic species do not pose a threat in natural forest. ***Indicator:*** • During farm site preparation valuable trees are protected (including fertilising trees). ***Verifiers:*** • Many timber, non-timber and plant species are present on farm, fallow and secondary forest land. • Harvesting pressure for forest foods is alleviated by its spread over different forest types. ***Indicators:*** • Steps are taken by local communities to actively protect their timber species from exploitation by outsiders who may or may not be backed by the forest service. • Indigenous strategies exist aimed at protecting certain species.	***Criteria:*** • Impacts on the biodiversity of forest ecosystems are minimised. • Diversity of agroforestry products in tembawang is maintained. ***Indicators:*** • Species and genetic diversity is maintained. • Species richness is maintained. • Endangered plant and animal species are protected. ***Verifiers:*** • The existence of an agreement among community members not to hunt certain animal species or collect certain plants. • Associations of symbiotic commercial timber species are maintained. • Honey bee trees are kept (sompun, keladan, tappang, etc.). • Limited trees are cut during NTFP harvesting.	***Indicator:*** • The natural regeneration of harvested Brazil nut trees is maintained to ensure a demographically viable population. ***Verifier:*** • Hunting of agoutis in traditional Brazil nut gathering areas is highly restricted (to perhaps a few individuals).

2. C&I: Species Frequency and Composition

Stimuli that alter the competitiveness of species within a community are usually composites of many factors, a comprehensive review of which is beyond the scope of this paper. We have already noted that the combination of harvesting pressures and husbandry measures presents an important balance equation, especially where forest products are scarce compared to demand. The speed of development of trends altering species composition and relative frequencies, is checked by the resilience or tolerance of the species and ecosystem concerned. Resilience is closely related to the biophysical environment, and will have been lowered by any previous forest degradation.

Comments and Observations on C&I attributes

Indicator:

Useful trees that are becoming rare are known and protected.

Ease of assessment:

Older community members usually know whether this is true. Younger ones may be unaware of which trees were once common. Asking people with different specialisations (e.g., hunters, weavers, etc.) may produce a more complete picture as they are likely to have recognised the disappearance of different species.

Verifier:

Associations of symbiotic species, including timber species, are maintained.

Ease of application:

Assessment of this will be limited by available local and scientific knowledge. Often it will be local people who, due to their intimacy with the forest's species, will be best informed to apply the verifier.

Verifier:

Growth of trees increases following the elimination of competing species in land clearance (for agriculture).

Relevance:

Conceptually this verifier is interesting and points to a possible way in which shifting cultivation systems can promote useful species in secondary forest.

Ease of application:

Positive measures would be difficult to authenticate. Where circumstances fail to conform with the statement, the reasons may be obvious (e.g., fire damage to trees, lack of fire control measures etc.).

Some human influence over the biological composition of CMFs is introduced during the preparation and cultivation of shifting agricultural plots. For example, at the Cameroonian test site useful forest trees are sometimes protected during forest conversion to agriculture. The incidence of this can be captured with the ecological indicators 'Useful trees that are becoming rare are known and protected' and 'During farm site preparation valuable trees are protected (including fertilising trees)', and the forest management verifier 'Many timber, non-timber and plant species are present on farm, fallow and secondary forest land' (all from the Cameroonian C&I set).

C&I that indirectly address trade-offs between ecological and socio-economic objectives include the Indonesian C&I on optimisation (Table 5.10). Also related to defining and then evaluating these trade-offs is the Brazilian verifier 'Quantification of actual product utilisation and the identification of alternative future uses of products from diverse ecosystems (agape, forest, fallows, lakes, etc).' The Indonesian forest management verifier 'Associations of symbiotic species, including timber species, are maintained' concerns ecological trade-offs driven by the competitive edge of different species and the extent to which their equilibrium relationship is maintained or disrupted as a result of human interference. This verifier is for the indicator 'Productivity of natural forests is maintained' that supports the criterion 'Natural forests are maintained for their production and environmental values'. This complex makes clear that the sustainable production of forest products for human consumption depends on sustaining an ecological equilibrium within the plant community. In the Cameroonian ecology set this need is acknowledged by the indicator 'The abundance dominance consistency (distribution) and frequency of species is comparable to that of the original forest' which states the need's fulfilment.

Only two statements (both of them verifiers) relating to species composition appear in the Cameroonian set. One, 'Growth of trees increases following the elimination of competing species in land clearance (for agriculture).', approaches an issue not addressed by any other of the C&I generated, namely the role that forest conversion to agriculture plays in promoting populations of the useful tree species protected during the conversion process. Several farmers at the Cameroonian test site claimed they protect certain naturally regenerated forest trees when clearing forest. Even though no C&I on this were formulated on the Brazilian test, inhabitants of the Brazilian test site also said they sometimes protect useful trees on land being cleared of forest. Seed trees may thus survive. However, the impact of fire and altered light levels on seeds, seedlings and saplings can still have a deleterious impact on the populations of the protected tree species. It is interesting to note that, at the Brazilian test site, farmers said they endeavour to select forest for clearance that is poor in useful species, so that the surviving forest areas are those that were originally the richest in useful species. This selective behaviour carries implications for the species composition of forest fragments and corridors.

Verifier:

The extraction of animal products used in the local economy does not have a negative impact on the population dynamics of the animals associated with those products.

Evaluation:

Other C&I about the age class distributions and population structure will generate information needed to assess this verifier.

The other Cameroonian verifier concerned with species composition is ***'Changes in availability of useful plants and animal species'*** which provides a straightforward measure of shifts in species composition and frequency. It was formulated for the social indicator ***'Community members effectively contribute to forest resource assessment'***. This suggests the verifier was thought to be one that local people can readily use. Shifts in the availability of useful species are usually of significant socio-economic consequence and therefore unlikely to go unnoticed by local people.

The Brazilian test generated several C&I to quantify or describe the present extent or state of resources, one example being the ecological verifier ***'The extraction of animal products used in the local economy does not have a negative impact on the population dynamics of the animals associated with those products'***. This concerns useful species but leads towards the assessment of changes in the population dynamics of species that, while themselves of little use to humans, somehow depend upon the population dynamics of species subjected to harvesting pressure. No additional verifiers were developed to determine whether a positive reading for this verifier reflects human design or mere coincidence.

It is important to distinguish between the actual state of conditions (in quantitative and qualitative terms), and the factors influencing it. How well the distinction is made depends upon the composition of C&I clusters. Do they contain C&I that ensure information on a resource state can be matched with information on factors affecting it? Basic resources may appear damaged or exhausted, yet they may be improving either spontaneously or under the influence of human efforts to reverse the effects of abusive interventions. Sometimes these improvements and the processes responsible for them take place so slowly they are hard to detect, especially over relatively short time spans. Appropriate clusters of C&I are needed for them to be monitored at relatively long as well as short intervals to ensure change is adequately quantified and registered.

d) Management Relating to Distortion of Species Associations

1. Background

Distortion of species dependency relationships can culminate in significant social as well as ecological costs. Dependency relationships may be severed as a result of competition between people and animal species for forest food sources. People and animals sometimes compete for the same forest fruits, or for tree species that both yield important animal foods as well as produce high-quality timber.[28] Cutting trees that fall into these categories diminishes animal food sources, thereby contributing towards the local extinction of the animals which depend upon

[28] Timber companies, sedentary agricultural tribes, nomadic pygmy groups and animals, notably gorillas, compete to benefit from the Cameroonian rainforest tree species Moabi (*Baillonella toxisperma*). The fruits of this species are amongst the most prized by forest inhabitants. They also contribute significantly to the sustenance of several bushmeat species. Their importance to gorillas is not insignificant, as gorillas are close to extinction in Cameroon. Moabi is also one of the most important of Cameroonian timber species. Attempts to develop C&I for sustainable timber management in natural forest have thus far failed to be explicit about the multiple-use status of this species and the rights of access of other groups, including animals.

them. Villagers, however, look upon wild animals as a source of protein for their families – ones they wish to continue benefiting from. They therefore wish to ensure populations of these animals don't enter irreversible decline. This requires them to weigh the size of wild animal protein harvests against that of fruit and timber harvests. Not only must they take into account their own preferences, but also they must consider how the harvest of one desired product affects the long-term availability of others. Other variables, for instance, crop damage caused by forest animals, and the role of wild animals as the dispersers of the seed of other valued species will also require attention. These considerations amount to a balancing or optimising exercise.

The gravity of these considerations must not be underestimated. The consequences of severed dependency relationships may take years or even decades to manifest. At present the consequences of different community forest interventions continue to be poorly understood. This means we have to contend ourselves with a high level of uncertainty surrounding the outcomes of different types of interventions. If the intention is to keep forest options open for future generations, then constraint must be exercised in the face of uncertainty. Many changes in ecosystem dynamics can not be easily reversed, if at all**.**

2. C&I: Species-Specific Dependency Relationships

Comments and observations on C&I attributes

Indicator:

Mutualistic interactions between Brazil nut trees and their pollinators and seed dispersers are maintained.

Ease of assessment and monitoring:

Assessment within the forest is problematic because of the difficulty in observing the bee pollinators. Hunters and Brazil nut gatherers are normally aware of significant declines in Agoutis, the main seed dispersers. Monitoring the size of hunters' Agouti catch can give some indication of whether trends are satisfying this indicator.

A species-specific form of the Indonesian verifier ***'Associations of symbiotic commercial timber species are maintained'*** is the Brazilian ecological indicator ***'Mutualistic interactions between Brazil nut trees and their pollinators and seed dispersers are maintained'.*** This is supported by the Brazilian verifier ***'Hunting of agoutis in traditional Brazil nut-gathering areas is highly restricted (to perhaps a few individuals)'***. These two statements focus on this dilemma of competing interests. In the case of the Brazil nut tree, both the nuts (seeds) and the principal seed dispersers, agoutis, are much sought after by people for food. People have to limit their consumption of both as the survival of each depends on the other. In the Indonesian set the verifier ***'The existence of an agreement among community members not to hunt certain animal species or collect certain plants'*** examines commitment at the community level to regulate trade-offs. The Cameroonian indicator ***'Indigenous strategies exist aimed at protecting certain species'*** covers similar ground.

Honey-making bees are associated with particular forest tree species in Kalimantan. These 'honey bee trees' are traditionally protected. Reference to these trees occurs in the Indonesian forest management set with the verifier ***'Honey bee trees (sompun, keladan, tappang, etc.) are kept'***.

e) Enrichment Planting and Domestication

1. Overview

Enrichment planting and the domestication of wild plant species were identified as significant for sustainability on both the Indonesian and Cameroonian tests for similar reasons. These practices, it was said, can compensate for harvesting pressure on forest species. On both these tests the stress was on enrichment being carried out with indigenous species (Table 5.12). The issue was most elaborated upon during the Indonesian test, where 10 verifiers of direct relevance to it were developed. Six of the 10 appear in the social subset. The Indonesian test attributed much greater importance to the economic significance of enrichment planting than did the Cameroonian test This is probably a reflection of the high socio-economic importance of tembawang and rubber gardens at the Indonesian test site. No mention of enrichment planting or domestication of forest species is made in the Brazilian C&I set.

Table 5.12 C&I: Enrichment Planting and Plant Domestication

Cameroon	Indonesia	Brazil
Indicator: • Useful and rare indigenous species are planted. ***Verifiers:*** • Planted trees are regularly inspected. • Number of trees per species planted per family. • Attempts to domesticate certain species. • Exotic species do not pose a threat in natural forests.	***Verifiers***: • Enrichment planting is carried out with indigenous species. • Occurrence of jungle rubber (a secondary forest enriched with rubber trees) • Actions to intensify tembawang exist (planting, cleaning, tending, liberation cutting etc.) • Use of high-yielding local planting material. • There is systematic replanting of trees. • Rattan planting in specific land use systems. • Enrichment with economically valuable trees. • New tembawang are planted with economically valuable trees. • Decision making on tembawang enrichment is a social not an individual occasion. • Appropriate technology for tree improvement.	

2. C&I: Enrichment Planting

The C&I generated on enrichment planting include the Cameroonian ecological indicator '***Useful and rare indigenous species are planted***' and the Indonesian ecological verifier '***Enrichment planting is carried out with indigenous species***'. These cover virtually the same ground, as do the statements to which they are linked: the criterion '***Biodiversity is conserved***' (Cameroon) and the indicator '***Species richness is maintained***' (Indonesia) respectively. The only real difference between these pairs of statements consists of the hierarchical levels on which they occur. The word 'domestication' is not used in the Indonesian set. However, planting indigenous species is a step towards species domestication, and the tembawang forest gardens are rich in indigenous species that have been fully or semi-domesticated.

Verifier:

There is systematic replanting of trees.

Relevance:

The fulfilment of this verifier is relevant to sustainability as it refers to an activity that sustains a population of trees however small. A negative rating would not necessarily indicate unsustainability as there may be adequate natural regeneration.

The Cameroonian ecology verifier **'*Number of trees per species planted per family*'** sets out to measure the scale at which enrichment planting is undertaken. Resembling this verifier is the Indonesian verifier **'*There is systematic replanting of trees*'**, which occurs in the forest management subset and incorporates the notion of tree planting on a habitual rather than a one-off basis. Verifiers on tending planted trees were formulated by both tests. **'*Planted trees are regularly inspected*'** (ecology, Cameroon) examines whether planted trees are receiving the attention they need to become established. This verifier is most closely matched by the Indonesian verifier of somewhat broader scope **'*Actions to intensify tembawang exist (planting, cleaning, tending, liberation cutting, etc.*)'**. The broad nature of this verifier possibly mirrors the apparently greater dependence upon and hence familiarity with more complex, manipulated agroforestry systems at the Indonesian test site than at the other sites.

Verifier:

Appropriate technology for tree improvement.

Utility:

This verifier is very ambiguous because of its reference to 'appropriate technology'. What is appropriate varies by context and site, as well as by perspective. The parameters of 'appropriate' would have to be defined for this to become useful.

The Indonesian team was the most sensitive to the socio-economic consequences of enrichment planting. Tree products produced in tembawang and rubber gardens at the Indonesian test site communities are major sources of monitory income. The adaptation of forest gardens to enhance their economic value to the family unit was seen as important for social sustainability. Hence, two verifiers of technical measures to facilitate adaptation were formulated on the Indonesian test; **'*Use of high yielding local planting material*'** (forest management) and **'*Appropriate technology for tree improvement*'** (social). Assessment of the first of these would require verification of local knowledge on within-species genetic variation in the natural forest and tembawang gardens, which is a prerequisite to selecting superior trees and seeds for propagation. No specific verifiers of this were however included in the Indonesian C&I set.

Enrichment of agricultural fallows destined to revert to secondary forest, is common practice at the Indonesian test site. A verifier from the Indonesian forest management set **'*Rattan planting in specific land use systems'*** will direct attention to fallow enrichment with rattan, should this system be used at the assessment site. Enriching fallow with rattan is commonly done in parts of East Kalimantan and can generate significant returns from what would otherwise be land left idle. Rattan is ready for cutting after approximately 10-15 years, a period equal to that required for the fallow soils to recuperate their fertility (Panayotou and Ashton 1992). In other words, the time for harvesting the rattan and re-cultivating the fallow are the same.

The combination of the Indonesian ecological verifier '***Enrichment planting is carried out with indigenous species***' with the indicator '***Species richness is maintained***' suggests enrichment planting can compensate for a reduced rate of natural regeneration of species richness. This could be misinterpreted to mean that sacrifice of natural species richness is permissible because of the ability of enrichment planting to compensate; no supplementary C&I were formulated to suggest that enrichment planting should necessarily be undertaken in those areas where species richness is being impaired.

The planted tembawang forest gardens are famed for their diversity of useful plants that are indigenous to the local forest (Box 5.3). Access to a tembawang garden makes travelling far into the forest in search of many NTFPs unnecessary. By lowering dependence on the natural forest for forest products, tembawangs inadvertently lower the opportunity cost of forest conversion to agriculture. This cost has been further reduced by a probable depletion in game animals due to overhunting. Such developments were recognised on the Indonesian test to reflect the powerful influence of enrichment planting on landuse and related socio-economic and ecological trade-offs.

Neither enrichment planting nor plant domestication are mentioned in the Brazilian set. The Brazilian forest management specialist did not comment on the significance for forest sustainability of planting herbaceous and woody forest species on homesteads. The use of the term 'agroforestry' by the Brazilian social to encompass natural forest interventions and integrated forms of land use by the Brazilian social scientist, however, acknowledges the importance of cropping systems that include perennial components to the overall sustainability of human communities.

5.3.2 Criteria and Indicators for Assessing the Impact of Hunting on Sustainability

i) Background

As with most forest communities in the moist forest tropics, hunting is an important form of forest use at all the test sites. Many forest inhabitants are known, in fact, to distinguish between ordinary hunger and the hunger for meat. Furthermore, hunting is also richly laced with cultural meaning in most forest societies. Good hunters are admired and gain high social status on account of their ability to provide food, their agility and skilful use of technologies, and their stamina to endure what often amount to uncomfortable, and sometimes, dangerous conditions within the forest. As a group, they hold a vast store of knowledge on hunting as well as on forest plants and ecological processes. The latter is so because hunters usually combine their hunting activities with other plant tending and gathering activities.

All else being equal, we can expect the productivity of hunting to be highest in the most isolated forest areas. The sparse human habitation of isolated areas is associated with low hunting pressure and, therefore, a relative abundance of animals. However, even under these circumstances, animal stocks tend to be insufficient to satisfy people's protein requirements, which therefore have to be supplemented with vegetable sources of protein. The hunting knowledge and skills of inhabitants of these areas are often sophisticated to minimise the capture cost of animals (the capture cost is the labour and capital required to catch the animal). Application of this knowledge can require high levels of individual and/or group organisation. To prevent efficiency leading to the over-exploitation of the animal resource, superstitions often exist that restrict hunting activity. These play a part in guaranteeing the fulfilment of future subsistence and ritual needs.

There are other reasons for the profound socio-economic significance of hunting and its environmental impacts. When trade possibilities emerge, game meat, animal products and fish

Box 5.4 Tembawang Forest Gardens and Natural Forest Conservation

Tembawang forest gardens, typical of the Indonesian test site, clearly distinguish this site from the other test sites. These gardens provide a striking example of forest species domestication. Developed from local forest gene stocks, they yield a much larger quantity of certain forest products per unit area than does the natural forest (de Jong 1997). They have thus brought forest products to within easier reach of people, significantly reducing collection costs. The system's dominant *tengkawang* trees (*Shorea stenoptera*) yield valuable illipe nuts from which edible oil is extracted. Despite the species salient tendency to masting, the nuts are a major local cash crop. The tall *tengkawang* trees, that in the natural forest occupy the canopy strata, are intercropped with a wide diversity of other forest species including some introduced from elsewhere. The establishment of these gardens contradicts persuasive theories that high social rates of time preference and an abundance of forest cover act as a strong disincentive for forest farmers to plant trees. The disincentive is believed to increase in correspondence to an increase in the gap between the time of planting and that of the first harvest. . People's dependence on the natural forest for a wide range of products has been reduced by tembawangs as many useful forest species have been transplanted into them. Local perceptions of the socio-economic worth of the natural forest appear to have been reduced by this circumstance. Nonetheless, the natural forest still contains useful species such as durian and other fruit trees and tree species hosting honey bees. Some fruit trees within the natural forest are believed to have been planted. They are still owned by the individuals who either planted or inherited them. The naturally regenerated honey trees are also owned by individuals or families. It appears that in some places honey gatherers have, over the course of many years, enriched forest areas in the immediate surrounds of honey trees with useful species, especially fruit tree species, either by consciously planting them or by inadvertently shedding their seed while collecting honey (de Jong 1997). Many other naturally regenerated species of economic value that yield timber or shingles for roofing remain in the forest awaiting exploitation. Stocks of the more valuable tree species such as ironwood (*Eusideroxylon* spp.) have, however, already suffered heavy depletion, especially in the forests surrounding the test site Darok where they were once particularly common.

We may presume that the reduced dependence on natural forest has reduced the opportunity cost of conservation, rendering the forest thus more vulnerable to encroachment by agriculture. Even in Bedigong where less tembawang exist than in the older settlement of Darok, several inhabitants attested to primarily regarding the natural forest as a reserve of fertile land for agricultural expansion.

are among the first forest products to become commercialised (Wilkie and Godoy 1996)[29]. Traders favour them over other forest goods because of their high 'price to transport cost' and 'value to weight' ratios. Game meat, being an animal protein, usually fetches a higher price than other food stuffs. The fact that part of the costs of extracting game and other forest products is from open-access forest commons, and is thus borne by the community (i.e., externalised), makes their commercialisation all the more lucrative. By contrast, households have to meet all the costs agricultural production incurs (Wilkie and Godoy 1997). Regarding the assessment of CMFs, we expect there will be many places where a focus on hunting will be more revealing of sustainability than a focus on timber management, or even plant NTFPs.

In more accessible areas, like São Pedro and Darok, hunting is usually more difficult than in remote areas, but, nonetheless, often continues to be an important source of protein for

[29] Wilkie and Godoy (1996) calculate on the basis of the protein content and weight to value ratio, traders will rank indigenous raw products as follows: animal products (including skins) > nuts and seeds (including most spices) > fruits and tubers > leaves and stems.

many families. To compensate, markets are closer. Alternative imported foods are, therefore often cheaper and agricultural profit margins higher.

The importance of hunting, game meat for local consumption and for trade, can decline in response to:

- **a reduction in forest cover.** Deforestation usually radiates outwards from around human settlements or abodes, forcing hunters to spend more time travelling deeper into the forest to hunt, until the distances involved turn hunting economically unviable.
- **the degradation of forest habitats.** Factors that degrade forests include, for example, fire and the removal of important species for animals by logging or extractive activities. Some animal stocks decline as their food sources diminish, others are killed (e.g., by fire) or frightened away (e.g., by fire or logging).

  The degradation of forest habitats affects different species differently, and may even boost the populations of some. Grazing and browsing animals recover quickly from forest fires provided it rains, as fire stimulates the sprouting of new shoots. In the aftermath of forest fires thickets of vegetation regrowth sometimes form. These offer animals some amount of protection since they can only be penetrated by hunters with great difficulty.

An important consideration regarding assessment of hunting related issues (as well as some others) is that discussions between local people and outsiders on hunting can not always be relied upon to provide truthful information. Most local people know which animal species it is illegal to hunt even for subsistence purposes, and which hunting techniques are outlawed. They are usually aware that enormous penalties await those caught even distantly engaged in the illegal trade of CITES protected animal species. Whosoever has cooperated, even if only in a very indirect way, with traders of rare, protected animals, is bound to provide misleading information to divert inquiries away from the fact.

ii) Differences in C&I Coverage of Hunting-related Issues

The C&I generated on hunting cover ecological, social, economic, cultural and technical issues. The broad interdisciplinary treatment of hunting is suggestive of how a topic can be turned into a central point around which an interdisciplinary complex of C&I could be created. Despite agreement on the integrative nature of hunting C&I, there were also some significant differences between how the Brazilian test team and the other test teams dealt with the topic. We find that the Brazilian C&I which explicitly refer to hunting, are confined to the ecology subset. In the Cameroonian and Indonesian sets they are more evenly distributed among the ecology, social and forest management subsets. The Cameroonian and Indonesian tests generated C&I that can reveal the behaviour of community members with respect to hunting - their team members were interested in assessing hunting *motives* and *processes* rather than the *outcome* of these. They felt that from motives and processes it is possible in many instances to deduce outcomes with sufficient accuracy. The main hunting-related issues addressed in the Cameroonian and Indonesian sets were:

- community protection of resources upon which animal populations depends (not explicitly mentioned in the Cameroonian set);
- seasonal considerations in hunting;
- hunting skills, techniques and knowledge;
- commercial hunting; and
- community strategies and regulations to limit hunting.

These parameters, because they allow insights into human behaviour, are very useful if we want to obtain an explanation of the relative abundance or lack of fauna species in a CMF area. Furthermore, they can divulge information from which predictions may be calculated.

Apart from commercial hunting, an issue picked up in some detail by the Brazilian ecology C&I, none of the above issues is addressed with a stated reference to hunting by the Brazilian set. By contrast, the Brazilian set places a greater emphasis on C&I that can be used to measure animal populations and changes therein.

We begin exploring the test-generated C&I with the above issue of viability of populations, continue on the significance of diet, and then on to the five key issues listed above.

iii) Establishing the Viability of Populations of Animal Species

a) Overview

The Brazilian C&I about hunting focus much more on assessing changes in the size of fauna species populations then on factors that might explain the changes or lack thereof (Box 5.5). These C&I will generate baseline information against which future demographic trends in animal populations can be measured. They can be used to monitor the development of these trends. Because they make no connection with community practice, they can not, if used on their own, be regarded as reliable indicators of the sustainability of community hunting practices.

Box 5.5 C&I: Abundance of Game Species (Brazil, Ecology)

Criterion: The abundance of medium and large-bodied game species within the community's hunting range is satisfactory from the ecological as well as the socio-economic point of view.

Supporting indicator:

- The abundance of game species is satisfactory from the ecological as well as the socio-economic point of view.

  Supporting verifiers:

  - Checklist of the most intensively hunted game species.
  - Game species that were once common but no longer occur within the community's hunting range.
  - Actual population status and detection radius of the species most susceptible (or sensitive) to hunting activity; including: tortoises, piping guanas, currasows, great tinamous, white-lipped peccaries, tapir, brown capuchins, and spider monkeys (or woolly monkeys).
  - Ratio of successful to unsuccessful hunting forays by unit of hunting effort (km covered; hours or days spent hunting)

Supporting indicator:

- The rate at which the abundance of game animals increases beyond a critical distance from the source of hunting pressure (e.g., village).

  Supporting verifiers:

  - The residual stock of game increases rapidly from a certain distance from the source of hunting pressure.

Compared to this, the Indonesian set contains only one statement, the ecology verifier '***Frequency of animal occurrences***', that could be used to directly assess population size and its viability. No closely corresponding statements that explicitly refer to hunting, occur in the Cameroonian set.

The comparative lack of Cameroonian and Indonesian C&I for assessing fauna populations' viability may have been, in some cases, due to an oversight rather than to a conscious decision that there is no need for such C&I. Both the Cameroonian and Indonesian teams formulated C&I for assessing the population structure. They may not have noticed the limited scope imposed upon some C&I by their subordination to upper order statements that refer explicitly to plants but not animals. The Brazilian ecologist may have skipped including C&I on hunting techniques and temporal considerations, believing that they were covered address was covered by some of the more general C&I included in the Brazilian forest management subset.

The degree to which hunting is covered by other C&I that do not specifically mention hunting is not altogether clear. The meaning of the term agroforestry in the Brazilian social C&I is ambiguous - some might think it applies only to on-farm practices (i.e., silvi-pastoralism, intercropping of annual and perennial crops), and not realise the much broader meaning of agroforestry as a natural forest ecosystem managed for tree and NTFPs including animals. Many people are unlikely to associate the term 'harvesting' with hunting.

b) Species Susceptibility to Hunting Pressure

In subsistence economies animals species that come under hunting pressure are those with a high '*dietary value to capture cost*' ratio. When opportunities for trade emerge the pressure expands to those animals that have a high '*monetary value to capture cost*' ratio. The species in the latter category will change in concert with changes in technologies and market opportunities. Species subjected to comparable levels of hunting pressure vary in their susceptibility to over-exploitation.

Therefore, to assess the impact of hunting, we first need to know how hunted species respond to different levels of hunting pressure. This will allow identification of the most susceptible species. The Indonesian and Cameroonian ecology subsets each make a reference to protected species: '***Endangered plant and animal species are protected***' (Indonesia, indicator) '***Publication of the list of partially or totally protected species***' (Cameroon, verifier). These statements imply knowledge on which species are the most susceptible must be tapped to assess hunting impact.

The assessment scope will vary depending on whether inquiries focus on species that are endangered on a regional or national scale (i.e. the species most likely to be listed in publications) or on species that are locally endangered. The population of locally endangered species may be viable on a regional or national scale. Some locally abundant species may, on the other hand, be extinct over large parts of their former range and, therefore, listed as endangered species. These distinctions are important. To subject indigenous forest communities to laws that make the hunting of endangered animals illegal, even when these animals are not endangered on indigenous territory or as a result of indigenous natural resource interventions, could be regarded as an infringement of indigenous rights.

Furthermore, it is unclear from the C&I generated whether the use of the word 'endangered' was meant to refer only to those species whose populations are in danger of becoming *demographically unviable*, or if it also refers to species in danger of becoming functionally *extinct* (i.e., species whose demographic viability is not threatened, but whose population size is too small for them to interact with other species on a scale that the maintenance of ecosystem integrity requires).

Some of the species mentioned in the Brazilian ecology verifier '***Actual population status and detection radius of the species most susceptible (or sensitive) to hunting activity; including: tortoises, piping guanas, currasows, great tinamous, white-lipped peccaries, tapir, brown***

Table 5.13 Selected 'General' C&I that can Assess Hunting Impact

Cameroon	Indonesia	Brazil
Ecology: ***Criterion:*** • NTFPs must be sustainably managed. ***Indicator:*** • NTFPs are known. ***Verifiers:*** • Classification by importance linked to volume taken or to annual income. • Capacity for regeneration for each species. ***Indicator:*** • Techniques for gathering NTFPs assure them sustainability. ***Verifiers:*** • Conservation techniques. • Destructive techniques.	**Social:** ***Indicator:*** • Sustainable extraction of NTFPs under community management. ***Verifiers:*** • There is organisation under local management that co-ordinate extraction of NTFPs. • Rules on harvest techniques of NTFP. • Rules on NTFP tenure.	**Forest Management:** ***Indicator:*** • Clarity of the qualitative and quantitative potential of managed natural resources in economic and productivity terms. ***Verifier:*** • Survey of resident population's knowledge of harvested and/or managed species and of those species of potential economic value (including species formerly exploited that could regain economic importance in response to future increases in market demand). ***Criterion:*** • The exploitation of non-timber forest products is based in sustainable practice. ***Indicator:*** • Existence of management plans and annual plans. ***Verifiers:*** • Estimate of the quantitative potential of each product. • Definition of the area for the harvesting of each product in accordance with its economic viability. • Participatory mapping of NTFP resources. • Chronological calendar of activities. • Matrix (table) including the principle uses of products, the tools and equipment used in harvesting/extraction, harvesting techniques, time spent and financial return by product. ***Indicator:*** • Application of low impact techniques. ***Verifier:*** • Knowledge and application of the best harvesting practices.

***capuchins, and spider monkeys (or woolly monkeys)*'**, occur only in neo-tropical rain forests. However, species especially vulnerable to local extinction can be identified the world over by their possession of pre-disposing characteristics. Animals that exhibit K-traits - slow growth, long periods to maturation, long gestation period separated by long periods that result in relatively small numbers of highly dependent progeny, tend to easily succumb to hunting pressure. Many of them are large bodied mammals. If a herd of migratory K species such as peccaries is wiped out, the species almost certainly becomes locally extinct as each herd occupies a territory of several kilometres. Species that either have very restricted ranges, are relatively immobile and/ or have very specialised feeding habits, i.e. that are very well adapted to their environments, are also highly susceptible to hunting pressure. The likelihood of their being driven into extinction increases when they are hunted in fragmented forests (Tilman *et al.* 1994).

An observed fall in the population of a hunted species may reflect changes in predator-prey interactions. If the hunted species is, for the sake of argument, a predator, a decline in its population may be due to its chief prey having been overhunted. Or, alternatively, its decline in numbers may be a passive response to a reduction in the food supplies of its chief prey species. The causes of population decline can sometimes be so difficult to trace and attribute to driving factors, as to make fluctuations in populations appear random (Leaky and Lewin 1995). Difficulties of this genre present challenges to the assessment of hunting pressure in areas where little systematic research on hunting has been done. Local people, because of their close interaction with their environment, may be best informed on the cause and effect relationships responsible for swings in the population sizes of hunted species. But even their knowledge on these matters can be limited when animal behaviour and its outcomes are obscure or difficult to observe.

iv) The Relationship between Diet and Hunting

Several C&I on the inclusion of game meat in the local diet occur in the Brazilian and Cameroonian sets (Table 5.14). Dietary intake of game meat is a poor proxy indicator for hunting pressure, as things other than the over-exploitation of game stocks can be the cause of reduced local game meat consumption.

Knowing whether and how the protein composition of the diet is changing, can lead to a better understanding of many things. In other sections we discuss how C&I on dietary composition can inform on cultural change and the changing content of local knowledge. From information on local diet, benefit distribution patterns and how these change can be deduced. And, in some cases, dietary composition may be indicative of hunting impact. Changes in dietary composition can be detected and monitored using the Brazilian ecology indicator '***Game meat is still important in the local diet***' and its verifier ***'Describe the relative contributions of animal protein made to the local diet by: 1) terrestrial vertebrates; 2) fish and other aquatic animals; 3) small sized domestic animal, and 4) salted meat coming from urban abattoirs or frozen fish from fishing boats***'. If more desirable game species begin to form a smaller proportion of the diet, and species previously avoided because of their low palatability (e.g., carnivore species) are eaten with greater frequency, then it would appear to suggest changes in the population status of the preferred species.

Several explanations for a decline in local game meat consumption, other than community over-exploitation of the forest fauna may, however, apply. Habitat destruction or fragmentation may shoulder a greater share of the responsibility than hunting. Sometimes fauna species are driven into local extinction by the activities of outsiders, including outsiders hunting or extracting timber, either within the community's forests or in adjacent areas. Forest conversion outside the community forest area, sometimes causes the disappearance of certain species within the community forest area. The local extinction of animal whose territorial range extends across community forest and adjacent areas could be caused in this way. Also, hunters may choose to sell their high value catch rather than supply it to their families. Rises in returns from agriculture may have made it affordable to stop hunting and purchase instead animal protein in urban centres.

Table 5.14 C&I: Game Meat in Local Diet

Cameroon	Indonesia	Brazil
***Verifier** (ecology)* • Eating habits, taboos. ***Indicator** (forest management)* • The variety of forest products of nutritional value that supplement local dishes and meals. ***Verifiers** (forest management)* • Harvesting pressure for forest foods is alleviated by its spread over different forest types. • Contributions made by forest foods to local diet.	—	***Indicator** (ecology)* • Game meat is still important in the local diet. ***Verifier** (ecology)* • Describe the relative contribution of animal protein made to local diet by 1) terrestrial vertebrates; 2) fish and other aquatic animals; 3) small sized domestic animals, and 4) salted meat coming from urban abattoirs or frozen fish from fishing boats. • Identify the 5 game species most important (most consumed) to the local population.

The growth of human settlements need not always cause an increase in hunting pressure. This may remain the same but, because there are more people among which to share the catch, the average game content of the individual's diet falls. Information obtained by monitoring with the above verifier will be of vital importance to piecing together a better understanding of the socio-economic importance of hunting and its ecological sustainability. Additional supporting information on related issues will, however, be needed to assess to what extent community hunting methods are sustainable.

v) Hunting and Protected Areas

The Brazilian ecology subset includes the indicator '***The existence of areas scarcely hunted or unhunted within the area accessible to hunters belonging to the community***'. What this indicator aims to reveal can also be shown through the joint application of the Indonesian indicators '***Animal habitats are maintained and restored***', '***Endangered plant and animal species are protected***', and (the independent ecology verifier) '***Maintenance of water holes, nests and salt sources in the area***'. All of these link with the criterion '***Impacts on biodiversity of the forest ecosystem are minimised***'. If animal habitats are maintained and endangered species protected, then this implies that some scarcely or unhunted areas exist.

The two approaches to assessing the existence of scarcely hunted or unhunted areas differ considerably. The Brazilian statement seeks merely to establish whether such areas occur within the community area. The Indonesian statement looks for evidence of human action intentionally directed to maintaining, protecting and restoring resources. The only slight exception to this is the Brazilian ecology verifier '***The existence of animal sanctuaries (or areas that are functionally equivalent to that) within a radius of 15 km walking distance from the community centre***', if it is agreed that animal sanctuaries are human creations. Prior to the acceptance of this verifier, an indicator was proposed that was very similar except that it was *prescriptive* in nature. This indicator prescribed that forest areas distanced more than a certain number of kilometres from the community should be designated out of bounds to all forest harvesters including hunters. Villagers from the Brazilian test felt it should not be included as it would be impossible for the community to control hunting in distant forest commons, particularly hunting carried out by outsiders.

vi) Seasonal Considerations

Inhabitants of Maro thought it would be more feasible and, indeed desirable, to bar hunters from certain forest areas (including some subjected to relatively high hunting pressure), during particular times of the year, such as during the rainy season when the majority of medium to large sized mammals give birth. However, no C&I for this assessment created.

That the impact of hunting is affected by seasonal considerations is a well-recognised fact, which is enshrined in hunting legislation of many countries through their specifying different hunting seasons for different animals. Recognition of the need to limit hunting to certain periods is conveyed by the Cameroonian ecology verifier '***Knowledge by all of the start and finish of the hunting season***' and the Indonesian forest management indicator '***The hunting season is regulated***' (Table 5.15). The verifier supporting the latter indicator (i.e., '***Hunting for specific animals at specific times/periods***') communicates that not just one, but several hunting seasons are required. Each of these would be designed to protect a particular hunted species or group of species. Much knowledge about the consequences of hunting different animals at different times of the year is held by the community at large. However, as noted above, local people often lack knowledge on animal behaviour that is difficult to observe in nature.

The reasons for the Cameroonian forest management indicator '***Hunting by trapping and fishing are noticeably reduced during the dry season***' and its verifier '***Species the hunting of which is reduced during the dry season***', remain unclear. These statements, supposedly based on the knowledge and opinions of inhabitants of the Cameroonian test site, contradict the opinion expressed by inhabitants at the Brazilian test site that, hunting should be limited during the rainy season.

Table 5.15 C&I: Seasonal Considerations

Cameroon	Indonesia	Brazil
Verifier *(ecology):* • Knowledge by all of the start and finish of the hunting season. ***Indicator*** *(forest management)* • Hunting by trapping and fishing are noticeably reduced during the dry season. ***Verifier*** *(forest management)* • Species the hunting of which is reduced during the dry season.	***Indicator*** *(forest management):* • The hunting season is regulated. ***Verifier*** *(forest management):* • Hunting for specific animals at specific times/periods.	***Verifiers*** • Chronological calendar of activities. • Definition of timing, seasonality and frequency of harvesting for each species. ***Indicator*** • Calendar of the collection and extraction of agroforestry products.

vii) Hunting Skills, Techniques and Knowledge

Initially traditional communities sought to develop hunting strategies that would minimise capture costs. They endeavoured to learn about the behaviour and movements of wild animal species to use this knowledge to reduce the time and effort spent in trekking animals down. Hunting skills, however, gradually disappear when a reduction in forest quality, access and/or area causes returns to hunting inputs to fall. Alternative livelihood pursuits can also replace hunting, and bring about the loss of hunting knowledge.

No C&I specifically on hunting knowledge were developed on the tests. But, the C&I that were developed about hunting techniques, seasons and rules and regulations, were understood to implicitly refer to local knowledge and its changing content.

Reductions in area and quality of forest commonly occur in tandem with shifts in hunting techniques. Adoption of relatively new hunting technologies tends to lead to the erosion of forest knowledge upon which many traditional hunting skills are based. More reliance on shoot guns and ammunition has made it easier to hunt down, at least in the short-run, some increasingly scarce animals. However, when the sought after animal species become too scarce or the technologies too expensive, the species can be said to have become economically extinct. The higher the cost of ammunition, the higher the cost of learning to use a shoot gun becomes. Hunting then becomes an activity that many youth can not afford to consider (and thus knowledge, or at least opportunities for the perpetuation of knowledge are lost).

Related to this, greater attempts could be made to develop C&I that could help find answers to the questions: At what point do animal species enter economic extinction? What is the cause of their economic extinction? Have they become too scarce? Has the cost of hunting methods become too high? Or, is there some other explanation? C&I informative on these things would assist with the development of policies to manage the economic extinction of wild animals so that their populations do not become too small to be ecologically functional.

On a note of interest here, a few weeks before the Brazil test took place, the Brazilian government had sharply raised the price of all ammunition including all its major derivatives, bringing the cost of an average shoot gun shoot to the equivalent of one US dollar. At the test site community of São Pedro, the early impact was a virtual paralysis of ammunition and gun power sales at the local store. The store owner said that people would no longer be able to afford to hunt. This met with cynicism on the part of some of the test team members who thought hunters will rapidly find a way of short-circuiting the ammunition supply chain to once again obtain cheap supplies. This particular price reform is believed to have been introduced to help stamp out violence, so its influence on hunting is coincidental. However, through the effective enforcement of price reform policies such as this, governments could play a major role in ensuring the widespread control of hunting pressure.

viii) Commercial Hunting

All three tests developed C&I designed to reveal the level of commercial hunting and poaching (Table 5.16). On all three tests commercial hunting was identified as a major threat to the survival of animal species, and the species with which they interact. Commercial hunting was perceived to fall roughly into two categories:

- the hunting of game meat (of endangered and currently non-endangered species) for sale as food; and
- the hunting of mainly endangered animals to supply illegal traders in animal-derived medicines and potions (bear gall bladders, dolphin eyes etc.), artefacts (skins, ivory, elephant feet for stools and, according to some Cameroonian forest inhabitants, gorilla hands as ashtrays), and rare species pets (parrots, snakes etc.).

There was agreement among the C&I generated by the three tests that, for hunting to be sustainable, it must only be undertaken for domestic consumption. This message is articulated at the Criterion level in the Indonesian set with the forest management criterion '***Hunting is practised only for local consumable animals considered pests to the ladangs (cultivated fields)***'. The criterion constrains the permissibility of hunting even further to that of animals which are pests. In the Cameroonian and Brazilian ecology subsets, the message is delivered with the verifier '***Taken animals are intended solely for local consumption***' and the indicator '***No commercial hunting takes place within the community***' respectively.

Perceiving perhaps that few communities will these days hunt for subsistence only, the Brazilian ecology specialist accepted the verifier '***The occurrence of game meat sales (salted or fresh) to community members and outsiders (e.g., delivered to urban markets)***'. This verifier permits assessment of the extent to which the trade of game meat is contained within the community the trade in game meat is. The confinement of game meat sales to within the community, would indicate that the total hunting pressure exerted by the community continues to hover around the subsistence level mark.

Table 5.16 C&I: Subsistence versus Commercial Hunting and Poaching

Cameroon	Indonesia	Brazil
Indicator *(ecology)* • Anti-poaching methods are valued and applied. ***Verifier*** *(ecology)* • Taken animals are intended solely for local consumption.	***Indicator*** *(ecology):* • Commercial hunting is controlled. ***Verifier*** *(ecology):* • Protected plants and animals are not sold in market. ***Criterion*** *(forest management)* • Hunting is practised only for local consumable animals considered pests to the ladangs.	***Indicator*** *(ecology):* • No commercial hunting takes place within the community. ***Verifiers*** *(ecology):* • The occurrence of game meat sales (salted or fresh) to community members and outsiders (e.g., delivered to urban markets). • The socio-economic importance of the sale of surplus game meat not consumed by community households. • Informal and institutional mechanisms (e.g., IBAMA patrols and inspections) exist effectively controlling commercial hunting in the CMF area. ***Indicator*** *(forest management)* • The community has mechanisms to control the collection and sale of animals and plants. ***Verifier*** *(forest management)* • Observation of techniques used in the collection and sale of animals and ornamental plants.

All three sets also include C&I that seek evidence of the active control of commercial hunting. These include: the verifier '***Anti-poaching methods are valued and applied***' (ecology, Cameroon); the indicator '***Commercial hunting is controlled***' (ecology, Indonesia); the verifier '***Informal and institutional mechanisms (e.g., IBAMA patrols and inspections) exist effectively controlling commercial hunting in the CMF area***' (ecology, Brazil); and the indicator '***The community has mechanisms to control the collection and sale of animals and plants***' (forest management, Brazil). These C&I presumably refer to community enacted controls, as well as other external controls (except for the Brazilian forest management indicator which clearly refers to community controls only). This Brazilian indicator's verifier '***Observation of techniques used in the collection and sale of animals and ornamental plants***' brings the assessor to consider how the impact of techniques used affects the overall impact of commercial hunting. The negative ecological impact of a high incidence of commercial hunting would be much amplified by the use of inherently destructive technologies and methods and deceitful business transactions.

Patterns of change triggered by the commercialisation of wild animal products affect sustainability in a variety of ways. The purchasing power created by the sale of forest products generally reduces the pressure on forest products for which superior substitutes exist, as people opt to purchase them (Wilkie and Godoy 1996). Forest inhabitants typically seek to substitute for goods which are costly to produce (e.g., stone axes), short-lived (e.g., thatched roofs, wicker baskets etc.), and/or relatively inefficient (e.g., spears and bows and arrows compared to shotguns). The pressure on these goods will thus tend ease off, whilst that on goods of high monetary value will increase. The change in the range of goods harvested, may but, need not affect the total number of goods harvested. By providing the means for acquiring technologies that reduce the capture cost of animals, the game meat and animal trade contributes to its own intensification.

The advent of commercial harvesting changes the traditional subsistence hunter's objective from maximising the 'dietary value to capture cost' ratio to maximising 'the monetary value to capture cost' ratio (Wilkie and Godoy 1996). This switch changes some of the species in the 'hunting set' as well as their ranking in order of desirability. The composition of the hunting set is determined by *'optimal foraging theory'*. As stocks of species, their market value, markets, infrastructure and hunting technologies change, so the set's composition too changes. The gradual exhaustion of populations of the highest '*value to capture cost'* species will reduce the set's average rate of return, so that hitherto lower rated species will begin to enter the set. A change in the hunting set's composition may therefore be indicative of hunting pressure. But, such changes complicate the overall assessment of the human impact on animal populations. So many factors contribute towards determining the composition of the hunting set (i.e. predator-prey interactions, forest fragmentation, changing taboos and legislation etc.), that it can be difficult to isolate their respective contributions.

ix) Community Strategies and Restrictions to Limit Hunting

a) C&I to Limit Hunting

Strategies, rules and other mechanisms to limit hunting were the theme binding a complex of C&I around the Cameroonian ecology criterion '***Indigenous strategies aimed at reducing pressure on wildlife are worked out in conformity with laws and regulations on hunting matters***' (Box 5.6). This statement, like several others in the Cameroonian set, focuses on the harmonisation of community strategies with national interests (Table 5.17). The I&V allocated to it, therefore, branch out to investigate the significance to sustainable hunting practice of indigenous strategies (e.g., taboos and the condemnation of the use of certain hunting methods) on the one hand, and more formal mechanisms imposed from outside (e.g., laws), on the other. Many of the I&V do not draw a distinction between community created rules and regulations and those imposed upon the community by the state. Being able to distinguish what controls on hunting originate from within the community is important in that it creates opportunities for internal and external recognition of the community's sense of responsibility and achievements. Moreover, it can raise awareness of obstacles faced by communities in their attempts to administer greater control over hunting activities.

In the Indonesian set, organised hunting control is covered by the social indicator '***There are rules that ensure the sustainable use of the forest***' and its verifier '***Community respects rules on hunting***' (Table 5.17). It is also addressed by the ecology verifiers '***The existence of an agreement among community members not to hunt certain animal species or collect certain plants***', and '***Protected plants and animals are not sold in the markets***', which accompany the indicator '***Endangered plant and animal species are protected.***' However, the absence of protected animal species in markets does not always mean that these animals aren't being hunted. Capture and trade of highly endangered animals is normally so shrouded in secrecy, that rarely can it be evidenced in market places.

Many examples of self-imposed community hunting restrictions exist. Caboclos often speak disparagingly about the use of the 'ramal' method, and some communities forbid it. The method involves waiting at night to shoot animals that cross a line cut and cleared through the forest the previous day. It is critiqued on the grounds that too many animals are caught in a short space of time with its use. Hunting with dogs is also a method heavily criticised, but nonetheless frequently used by Caboclos. They say it frightens animals away. In the Brazilian Amazon as a whole, the collection of turtles and certain forms of fishing are being increasingly regulated by riverine communities. In Cameroon the use of highly effective traps made with modern materials, is often banned by local communities because of the danger they pose to

Box 5.6 C&I: Strategies to Control Hunting (Cameroon, Ecology)

Criterion: Indigenous strategies aimed at reducing pressure on wildlife are worked out in conformity with the laws and regulations for hunting matters.

Supporting indicator:

- Laws and regulations on hunting matters are known to all the participants.

  Supporting verifiers:

  - Publication of the list of partially or totally protected species.
  - Knowledge by all of the start and finish of the hunting season.

Supporting indicator:

- Indigenous strategies exist aimed at protecting certain species.

  Supporting verifiers:

  - Eating habits, taboos.
  - An effective surveillance system is in effect.

Supporting indicator:

- Destructive hunting tools and methods are outlawed.

  Supporting verifiers:

  - Hunting with traps is banned.

people. The scope of community hunting regulations commonly extends to activities of outsiders - they do not permit outsiders to hunt in their forest or engage in activities that disturb animals or frighten them away.

One topic that has been heavily debated within many of the communities along the Arapiuns river together with the STR (the Rural Workers' Union) is which rules to adopt to regulate the sale of game meat. As communities get larger, so peoples' occupations become more specialised and more people end up living further away from the forest. These developments result in a decline in the proportion of the community's members that hunt regularly. Consequently, more people will seek to buy game meat from hunters. In several of the communities these developments are already well underway whilst in others they are anticipated. In the light of them, several communities have opted to attempt to limit the sale of game meat to within the community. This does not match the requirements inferred as necessary for sustainability by the Brazilian ecology indicator '***No commercial hunting takes place within the community***'. It would, however, go some way towards satisfying the Indonesian ecology indicator '***Commercial hunting is controlled***'.

The possibility of taboos being effective at limiting the number of animals caught by community hunters was taken seriously during the Brazilian test. There its discussion by the test team members and community inhabitants resulted in the creation of the Brazilian social indicator '***Evidence of symbolic codes and myths that have a regulatory effect that contributes to the conservation of agroforestry resources***' and the verifier linked to it '***Narratives of myths that have an observable regulatory effect***'.

It was understood that some agreements not to hunt certain animals may be unspoken (for example, when members of a community agree to not eat a taboo species). Fear and superstitions often fortify people's resolve to stick to these agreements. Traditional Brazilian Caboclos adhere to the *panema* belief system. Hunters who overhunt are heavily penalised, sometimes for many months or even years, by curses that render their hunting exploits fruitless. To protect themselves, people will not hunt more animals than they need for subsistence. The system sees to it that the costs of over-hunting are borne directly by the perpetrator, although

Table 5.17 C&I: Hunting Methods, and Strategies and Rules to Control Hunting

Cameroon	Indonesia	Brazil
Criterion** (ecology):* • Indigenous strategies aimed at reducing pressure on wildlife are worked out in conformity with laws and regulations for hunting matters. ***Indicators** (ecology):* • Laws and regulations on hunting matters are known to all the participants. • Indigenous strategies exist aimed at protecting certain animal species. ***Verifier** (ecology):* • An effective surveillance system is in effect. ***Indicator: • Destructive hunting tools and methods are outlawed. ***Verifier:*** • Hunting with traps is banned ***Indicator*** • Destructive forest exploitation practices and techniques are known, e.g., hunting, fishing etc. ***Verifier**:* • Number of community members possessing firearms.	***Indicator** (social):* • There are rules that ensure the sustainable use of the forest. ***Verifier** (forest management):* • Community respect rules on hunting. ***Verifier** (ecology):* • The existence on an agreement among community members not to hunt certain animal species or to collect certain plants. ***Verifier:*** • No use of fire in hunting.	

his or her dependants usually end up sharing the burden of the penalty. In so far as the *panema* belief system is effective, it internalises the costs of over-exploiting the commons, thereby restricting access to it.

At the Cameroonian workshop it was clear not everyone was prepared to accept that food taboos and taboos on hunting certain species sometimes effectively limit hunting pressure. On what bases the regulatory powers of taboos were questioned, was not effectively captured. The Cameroonian ecologist, however, supported the view that they often do have a regulatory effect. She conceded that this effect is often obliterated by negative counter-effects incurred by the hunting activities of community members who have broken with taboos or are anti-social individuals acting only in self-interest. She thus accepted '***Eating habits and taboos***' as a verifier for the ecology indicator '***Indigenous strategies aimed at protecting certain species***'. The environmental impacts of activities of outsiders, e.g., logging, can similarly neutralise or overturn the regulatory effects of taboos, especially if they take place on a large scale. On this understanding the indicator '***Anti-poaching methods are valued and applied***' and its supporting verifier '***An effective surveillance system is in effect***' were incorporated into the C&I complex to address factors undermining the effectiveness of indigenous regulatory strategies.

Rule and law enforcement efforts have to be assessed in relation to the scale of the incidence of rule or law violation. The continuing use of prohibited hunting methods could indicate exceptionally extreme or organised violation of regulations. Under average circumstances, the regulations in question could be described as adequate in their scope and degree of enforcement. Having to combat extraordinarily heavy violations, makes excessive demands upon local resources, or may indeed be completely beyond a community's ability. Poverty causes desperation and can accentuate people's felt need to be 'out to save their own skins'. With this attitude, people will seek to justify their failure to cooperate with the rest of the community in implementing resource use regulations. One suggestion put forth on the Brazilian test, was that the intention of C&I should be to estimate the average impact of hunting pressure, to level out the influence of individuals who over-exploit game stocks. Whilst this offers a comparable measure of hunting pressure, it is in no way clear that the measure could be used as a policy or decision making tool in all circumstances without unduly prejudicing some communities.

Interestingly, only one C&I statement was formulated that specifically draws attention to the assistance communities receive from official government departments in enforcing laws restricting hunting activities. This statement is the Brazilian verifier '***Informal and institutional mechanisms*** *(*e.*g., IBAMA patrols and inspections) exist effectively controlling commercial hunting in the CMF area*'.

b) Alleviating Hunting Pressure by Raising Domestic Livestock

Participants on the Cameroonian and Indonesian tests believed that improved know-how on raising domestic animals of well-adapted species and breeds can reduce reliance on hunting for animal protein acquisition. Thus, in the Indonesian social subset we find the indicator '***There is appropriate animal husbandry***' and the verifier '***Animal husbandry is practices by most households***'. Closely resembling these statements are the Cameroonian ecology indicator '***Extensive breeding of domestic animals allows reduction of pressure on wildlife***' and verifier '***Number of domestic animals/species/family***'. The specialists who accepted these I&V were clearly aware that livestock rearing can exert its own pressures on forest resources e.g., browse damage to trees or forest conversion to pasture. The level of these pressures would need evaluating to ascertain that the shift from hunting to livestock rearing, does not result in a more negative impact on forest sustainability. Despite wide recognition of this need, none of the sets offer any C&I for evaluating the matter.

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

Chapter 6.

Social Dimensions:

The Social and Economic Outcomes of Forest Management

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

Chapter 6.
Social Dimensions:
The Social and Economic Outcomes of Forest Management

Chapter 6.
Social Dimensions: The Social and Economic Outcomes of Forest Management[30]

6.1 Overview

The socio-economic dimensions of CMF express themselves in the *welfare* derived from the forest by individuals and the community as a whole. Welfare is here defined to include health, material well-being, cultural fulfilment and possibilities for the realisation of aspirations. How people participate in determining their community's socio-cultural organisation affects their welfare in so far as it represents the limits to their power and authority over forest resources.

A major question concerning the social dimensions of forest management is whether the social costs it incurs are acceptable. Do the changes in forest interventions that affect sustainability lead to higher or lower social costs? How do they affect the distribution of these costs? The goal of sustainable CMF can be achieved in various ways, and the social consequences often depend upon the means by which more sustainable forest management methods are pursued. The main concern in this section is to identify those C&I that can best detect changes and trends in cost-benefit distribution patterns and reveal their causes and wider effects.

Relatedly, the social and economic aspects of forest interventions need to be understood in terms of the ecological tradeoffs they incur. This is a prerequisite to determining which are the most acceptable tradeoffs, from the points of view of both the community and society at large. Most of the test team members were of the disturbing opinion that rural economic development and ecological sustainability will ultimately conflict in many CMF settings, unless there is an injection of resources or wealth into the community from outside. Population growth and growing livelihood expectations would make sustainability possible at best only at reduced levels of ecological quality and biodiversity.

How *forest* costs and benefits are distributed among community members and outside parties is key to understanding the make-up of the above 'social' trade-offs. Cost-benefit distribution patterns are especially revealing of the social dimensions of forest management, when they are compared with:

- the distribution of power and authority to manage forest resources; and
- the relative forest dependence of different groups originating from within and outside the community.

The need to distinguish between the power the community has over its resources and the extent to which their resources are controlled by powers from outside, was recognised on all the C&I for CMFs tests. The distribution of power over forest resources is often linked to the distribution of forest benefits. How the distribution of forest-derived benefits is linked to that of power is, therefore, an important question – one that partially determines how much communities can be legitimately held accountable for:

- the state of the forests they use and regard as their own; and
- any social conditions and trends associated with these forests and their use.

[30] This section was written by N. Burford de Oliveira with Bill Ritchie and Cynthia McDougall.

Some of the social C&I generated by the tests were developed on the understanding that CMF systems are increasingly exposed to influences of external origin and are thus acquiring additional layers of complexity.

This report divides its review of the socio-economic C&I into two chapters:

Chapter 6 C&I Addressing the Social and Economic Outcomes (i.e., consequences & impacts) of CMFs

This section mainly considers the test-generated C&I that are most directly concerned with the social 'outputs' and 'outcomes' of forest management. It covers the C&I that concern elements of 'social states' attributable to forest interventions. These include:

- The distribution of the costs and benefits of forest resource management
- Forest dependency
- Economic development

Chapter 7 C&I Addressing How the Social and Economic Objectives of CMF are Achieved and Determined

This section addresses 'inputs' or determinants of achieving socio-economic objectives. These include:

- Participation
- Land tenure
- Social organisation
- Rules and regulations
- Conflict resolution
- Monitoring
- Adaptation to change

The report, however, is not overly rigid in segregating descriptive indicators of states, outcomes or outputs (Chapter 6) from process or input indicators of the means for determining or achieving states or outcomes (Chapter 7). First, this is because some processes are outcomes of other processes. Secondy, some significant relationships between these two groups of indictors are obscured if they are treated in isolation of each other. This is especially so since the test teams created complexes of C&I to capture causal relationships between variables distributed among these two indicator categories.

The social issues and relationships between variables that were highlighted varied between teams. Many of the issues for which 'social' C&I were developed have multiple implications that have also been partly addressed in the ecological and/or managerial C&I subsets. Thus, some topics explored in this section are also discussed in other sections dealing with C&I of knowledge, communication and education and the policy and legal environments.

6.2 Cost-Benefit Distribution Patterns

6.2.1 Overview

The distribution of costs and benefits among community members (and sometimes outsiders or third parties) over time identifies those who make net gains from forest interventions, and conversely, those who forego benefits (and/or pay costs) in order for others to realise those gains. The test teams understood costs and benefits to mean welfare losses and gains in the broadest sense, including those related to financial transactions and intangibles.

We recognise two positive goals against which distribution patterns could be appraised. These can facilitate understanding of the rationale behind some on the C&I formulated for social and economic issues. The two goals are:

1. **Optimal distribution for community welfare.** 'Optimal' is defined as the solution that best satisfies the interests of all community members. Determination of the optimum is inevitably subjective. The optimum will change as constraints and opportunities change, and therefore its fulfilment can never be described as permanent. Nonetheless, optimisation will always be a worthy goal, whose level of achievement is reflected in the social '**equity impact'** of CMF. (See below for definition of 'equity impact'.) Some awareness of the variability in forest dependence and of supplementary sources of livelihood sustenance that different community forest user groups draw on helps make the equity impact apparent.
2. **Distributional justice.** This refers to a means whereby organisations or institutions may seek to specifically promote sustainable forest management. It requires that the value of rewards matches that of contributions; in other words, those who contribute most to achieving the goal, i.e., sustainable forest management, are rewarded more than others. However, in resource-poor communities not everyone will be able to contribute equally. For distributional justice to be fair**,** rewards would have to be balanced against people's abilities to actively contribute to sustainable forest management. Practised at a localised scale, distributional justice can contribute towards optimising larger-scale scenarios. As a mechanism for regulating forest access and cost and benefit distribution, distributional justice is further discussed in the subsequent section on social processes and mechanisms.

The C&I included in this section explore the 'equity impact' of distribution. '**Equity impact**' is the outcome of the systems through which costs and benefits are allocated. Of those C&I presented in this section that directly concern the equity impact of forest management, most apply to the assessment of both:

- traditional forest management systems that support the social system of the community as a whole; and
- more discretely bounded, self-serving forest management institutes or enterprises within a larger social system.

6.2.2 C&I: Cost and Benefit Distribution

The issue of distribution was most thoroughly addressed by the Indonesian team, followed by the Cameroonian team. The majority of the C&I that specifically mention distribution is explicitly or implicitly based on some concept of 'fairness' or 'equity'.[31] All test team members agreed that the meaning of the words 'fairness' and 'equity' is equivocal. The use of these terms is liable to be problematic when CMF assessment is participatory, drawing out contrasting cultural perspectives. Each test explored the questions of how to decide what is fair and, once this is agreed, how to identify mechanisms to promote fairness. How fairness is promoted often depends on existing patterns of forest access, wealth and power distribution. This makes it difficult to separately address distribution patterns and the mechanisms responsible for them. Consequently, we touch upon both aspects in this and other sections of the report.

[31] According to the Oxford Dictionary, these two words mean the same thing.

Comments and observations on C&I attributes

Criterion:

Access to and the use of common land and agroforestry resources is secured for all community members regardless of their sex, colour, religion or social class.

Relevance to assessment goal:

For a criterion it is permissible to set standards that correspond with ideals whose full achievement can rarely be expected. Direct or indirect access to the productivity of land is a right of all people.

Inequality of access ultimately creates tensions that lead to conflict and the breakdown of cooperation, a circumstance that is not conducive to social sustainability.

Many C&I clusters that incorporate consideration of distribution patterns link the distribution of benefits (products and uses) with that of forest access. The Brazilian social criterion '***Access to and the use of common land and agroforestry resources is secured for all community members regardless of their sex, colour, religion or social class***', suggests all community groups have rights of access to common resources and that these rights must be actively acknowledged. In reality, traditional societies often fail to secure access to common land for all their member groups. In the few cases where all groups do have access, rarely is this equal access (Christodoulou 1990). Therefore, fulfilment of this criterion is likely to be exceptional. Sometimes there may be strong arguments favouring unequal access to forest benefits or categories of forest benefits, especially if it can be shown that such unequal access could counterbalance other inequalities existing within the community. There are cases where more powerful community groups impose extortionist conditions for access on their less privileged counterparts, and maintain these either through manipulation (e.g., false promises or the constant postponement of agreed actions) or with abusive force.

Box 6.1 Selected C&I on Cost and Benefit Distribution
(Indonesian social subset)

Criterion: Customary law and other regulations ensure fair access to community natural resources and fair distribution of their products among community members.

Supporting indicator:

- Rules that ensure fair access of all stakeholders to forest.

  Supporting verifiers:

  - Clear understanding of the composition of stakeholders.
  - Every category of stakeholder has access to forest according to customary law and other regulations.
  - Stakeholders respect the customary law and regulations on forest resources.

Supporting indicator:

- Rules that ensure fair distribution of tembawang products to all stakeholders.

  Supporting verifiers:

  - Clear understanding of the composition of all stakeholders.
  - Secure communal and private property rights on tembawang.
  - Clear rules on inheritance.
  - Clear rules on rights to harvest tembawang products.

Supporting indicator:

- Rules that ensure fair distribution of irrigation water where sawahs (irrigated rice fields) exist. Supporting verifiers:
- Participatory planning and building of irrigation works.

Comments and observations on C&I attributes

Criterion:

Forest products contribute significantly to the socio-economic well-being of the different age and sex groups of the community.

Relevance:

Assessment of this criterion will reveal marginalised, weak groups and will provide some insight into the flow of benefits between generations.

Verifier:

Secure communal and private property rights on tembawang.

Ease of assessment:

The impact of policies and laws on the traditional land tenure systems can reveal this. These impacts can be estimated through interviews with local farmers and government officials. The economic value of tembawang products and incentives to convert or sell tembawang can also be indicative, as can expectations of tembawang inheritance.

Verifier:

Clear rules on inheritance.

Relevance to assessment goal:

Normally, inheritance is understood to mean the transfer of wealth and assets upon death. A good measure of inter-generational access to resources, it will also ensure capture of wealth and asset distribution across the sexes. In many societies, dowry payments are as powerfully indicative of inter-generational access to resources by gender as are inheritance rules. Significant shifts in resource distribution patterns usually follow a breakdown of traditional inheritance and dowry rules.

The complex of I&V accompanying the Indonesian criterion '***Customary law and other regulations ensure fair access to community natural resources and fair distribution of their products among community members'*** (Box 6.1) has a wider application than the previously discussed Brazilian criterion, since '*community natural resources*' are meant here to include communal as well as privately held property. That this is the intended meaning is conveyed by the verifier '***Secure communal and private property rights on tembawang'***, which is linked to one of the indicators in the criterion. Similarly, the Cameroonian social criterion '***Forest products contribute significantly to the socio-economic well-being of the different age and sex groups of the community'*** reflects the distribution of communal and private forest resource access and usufruct rights among groups within the community. However, it gives no insight into how distribution patterns relate to groups defined by variables other than sex or age.

The above Indonesian criterion gives a more comprehensive cover of distribution issues than criteria produced by the other tests, by calling for assessment of the 'fairness' of rules and regulations governing not only the distribution of access but also that of benefits. For the assessment of this criterion, the Indonesian team included the verifier ***'Clear understanding of the composition of stakeholders'*** to substantiate existing knowledge about the identity of stakeholders. The implication is that stakeholder groups must be perceived in terms of their relative forest dependency for the 'fairness' of rules to be ascertained. Who pays for the externalities of communal and private resource management and how that group/individual is determined, would seem another relevant consideration. Conversely, it is just as important to consider whether beneficiaries of positive externalities compensate those parties whose management of communal or privately held resources generates these externalities. However, no C&I with a specific focus on externalities were developed.

It is at the time of death in many traditional and modern societies, that the mainstay of family wealth and assets is transferred to younger generations. Therefore, capturing the nature of transfers at this time seems particularly important for assessing inter-generational distribution of access to resources. While there are several statements on the distribution of resource access and use rights between age classes within the community, only two concern the transfer of these rights upon death. One is the Indonesian social verifier '***Clear rules on inheritance'*** for the indicator '***Rules that ensure the fair distribution of tembawang products to all stakeholders'(Box 6.1)***. The other is the Cameroonian social verifier; '***Property inheritance patterns'***, for the indicator '***Land appropriation procedures are accepted and respected***'.

Box 6.2 Selected C&I on Forest Benefit Distribution
(Cameroonian social subset)

Criterion: Community institutions have the capacity to determine and distribute benefits from the forest.

Supporting indicator:

- Community norms and values on the distribution of the meat of relatively large hunted animal species.

Supporting verifiers:

- Distribution practices for the meat of wild animals.

Supporting indicator:

- Community food taboos.

Comments and observations on C&I attributes

Criterion:

Community institutions have the capacity to determine and distribute benefits from the forest.

Ambiguity:

This is a valid criterion. However, required capacity will depend on the extent and complexity of tasks. This will in turn depend on many factors, including the quality and productivity of the resource base, the social heterogeneity of the community and its size. Factors undermining traditional organisations often reduce local capacity to control distribution.

Dependence upon human value judgement:

Fairly high.

Overall, the Indonesian and Cameroonian social C&I on distribution cover similar issues. The Indonesian set refers to customary rules, whereas the Cameroonian set emphasises the role of community institutions and norms. Unless otherwise indicated, customary rules can pass as community institutions or norms. The Cameroonian social specialist used the term 'institutions' to include conventions and shared belief systems. The I&V for the Cameroonian social criterion '***Community institutions have the capacity to determine and distribute benefits from the forest***' inquire into how access and harvesting pressure are curbed by socio-cultural mechanisms such as food taboos (Box 6.2). Other C&I developed for access restrictions (as opposed to access rights) are presented and discussed in the following section on C&I on social regulatory mechanisms. The Indonesian social subset includes '***Participatory planning and building of irrigation works***' as a verifier of whether rules ensure the fair distribution of irrigation waters. Darok's inhabitants, as pointed out earlier, regard irrigation water as a forest product. This verifier is the only direct reference made to physical participation in the development of community infrastructure in any of the C&I sets. The I&V supporting the already mentioned Cameroonian social criterion '***Forest products contribute significantly to the socio-economic well-being of the different age and sex groups of the community***' allow differences between household members and households to be detected in terms of forest benefits enjoyed. One of the verifiers proposed for this indicator is people's knowledge of forest products' market value. Their knowledgeability of this value obviously influences their ability to realise potential benefits. Another verifier is the contribution made by forest products to household cash and non-cash income. Assessment of this entails a review of household food consumption patterns. Jointly, the I&V clustered around this criterion point to links between distribution patterns and intra-community variation in forest dependency.

6.3 Forest Dependency

6.3.1 Overview

Forest dependency is an outcome of historical, as well as present day factors, influencing distribution patterns. It is manifested in the fulfilment of needs from a limited supply of forest resources whose substitution is impossible, too expensive or not desired for some other reason. Sometimes forest dependency is interpreted as being analogous to economic reliance on the forest. However, with such an interpretation, dependence upon intangible forest values such as aesthetics and spiritual value and the forest's role in cultural reproduction, tends to be overlooked. Infrastructure, market access, rural economic development in general, and knowledge and communication all influence forest dependency. The nature of their influences is often largely determined by the ideologies dominating the national political and economic systems.

The equity impact of forest interventions shows up in the relationship between forest cost-benefit distribution patterns and relative forest dependency. From this relationship the social optimisation, or lack thereof, of multiple forest management objectives can be deduced. Distribution and dependency patterns must therefore be considered in relation to each other. Several of the C&I developed relate to forest dependency and cost-benefit distribution. They can generate baseline information on the forest dependency and wealth of different groups. With reference to this baseline information, many of these C&I can then also be used to monitor the equity impact of changes to assess whether changes are leading towards a socially more optimal allocation of forest resources. The sort of information they generate can expand understanding of how altering forest interventions in kind or intensity can affect people's livelihoods.

Some knowledge about the forest dependence and wealth of different groups within the community is needed. It becomes essential where positive discrimination in forest benefit distribution is being considered to protect certain critically forest-dependent groups.

6.3.2 C&I: Forest Dependency[32]

Changes in relative forest dependency are potentially indicative of, among other things: motivation to protect and sustainably manage forest resources; relative poverty; alteration of the knowledge base; and inter-generational access to forest use options. Analysis of such changes may clarify the likelihood of future trends and scenarios. Patterns of forest dependency change in concert with environmental, as well as social and economic changes. Therefore, several C&I concerned with aspects of dependency relate to C&I clusters developed around ecological or technical issues in the ecological or forest management C&I subsets.

Below we review some of the C&I developed around variables and phenomena that reveal forest dependency and how it is shaped by existing circumstances and change (Box 6.3).

For reasons including the propensity of NTFP profit margins to fluctuate wildly under free market conditions, the Brazilian social specialist thought it necessary to consider the role of subsidies and other incentives in guaranteeing stable returns from certain forest uses. Some communities do receive external subsidies or other forms of external support for forest management, or for small-scale forest industries. In some places, this support has led forest farmers to extend their forest management time horizons.

The less economically and politically self-reliant the forest community is, the lower its capacity to control its forest resources is likely to be. Should the community become dependent on external subsidies or incentives to engage in a particular resource-based activity, then these

[32] In Indonesia it was decided to shift the policy approach from large-scale multi-beneficiary approach to a focus on targeting assistance to less advantaged groups (Otsuka 1998, p. 7)

Box 6.3 C&I Relevant to the Assessment of Forest Dependency
(Brazilian Social Subset)

Criterion: Management activities applied to agroforestry resources have significantly contributed to the biological, socio-economic and cultural well-being of the local population.

Supporting indicator:
- The level of dependency on raw materials produced and obtained within and by the community.

Supporting verifiers:
a) Inventory of agroforestry items (products) used in local infrastructure and technology.
b) Individual and collective histories of the use of natural resources and its change over recent decades.

Supporting indicator:
- The management activities applied to agroforestry resources release sufficient funds for the maintenance of small-scale businesses and cottage industries.

Supporting verifier:
a) Individual and collective initiatives to develop centres for the processing of raw materials and production of handicrafts.

Supporting indicator:
- Community dependence on external subsidies provided by NGOs, religious organisations and/or the government.

Box 6.3 Continued

Supporting verifiers:
a) Community efforts to give continuity to management systems introduced or being implemented by external actors.
b) Contribution made by external subsidies to the development of community infrastructure.

Supporting indicator:
- Agroforestry resource management activities economically contribute to the community's access to education, health and other social services.

Supporting verifiers:
a) Anthropometry of children aged 0 - 10 years.
b) Map of infrastructure and its evolution over recent decades.
c) Percentage of school-aged children with regular school attendance.

Supporting indicator:
- Existence of effective benefits for the subsistence and reproduction of domestic units derived from the management of agroforestry resources.

Supporting verifiers:
a) Quantification of the agroforestry production of the domestic unit.
b) Food consumption by the domestic (household) unit with special attention to agroforestry products.
c) Inventory of domestic household assets and utensils.
d) Domestic unit (household) income fluctuations from agroforestry resource management activities.
e) Stable or slow population growth.
f) Female access to and use of family planning and contraceptives.

incentives are likely to exert greater control over resource pressures than the individuals or the community. Whether subsidies can be justified depends more specifically on whether and how the market's distribution of wealth fails to meet societal welfare and environmental objectives. In the context of CMF, external support is often targeted at removing obstacles to rural development and sustainable forest management that the community is ill equipped to deal with itself.

The merits of subsidies as a means of protecting forest communities from competition on the open market have to be balanced against those of capital transfers. Unlike subsidies, the latter constitutes an unambiguous transfer of power. By improving financial capacity, capital transfers such as donated assets can increase a community's self-reliance and its economic autonomy in the long term, especially if appropriate training is provided. Compared to many forms of subsidisation, capital transfers are often more effective at adjusting wealth distribution. How subsidies and capital transfers are likely to affect the balance of wealth among sectors within the community, and between the community and society at large, would have to be considered.

The C&I on dependency in Box 6.4 can clarify the economic, allocative and distributional efficiency of forest inputs (including subsidies) and outputs within the community. Despite their current rough, embryonic form, they present a set of nested issues around which the assessment and monitoring of forest dependence can be structured. They can lead inquiries towards the causes and effects of adjustments in a community's dependency status – clarifying whether these adjustments are caused by some groups out-competing others, a shift in dependency from forest to non-forest based economic activities, or by some other phenomenon such as erosion of the forest's dependability. Their scope encompasses questions such as whether and why forest-based activities are expanding or contracting, making the cumulative effects of ongoing trends easier to forecast.

i) C&I Relating to Dependency, Agroforestry and NTFPs

Comments and observations on C&I attributes

Indicator:

The level of dependency on raw materials produced and obtained within and by the community.

Ease and cost of application:

Referral to existing survey data or carry out survey. The ease of the latter depends on survey design and trained field workers – local people's willingness to honestly respond will affect the quality of results.

Under the Brazilian social criterion '***Management activities applied to agroforestry resources have significantly contributed to the biological, socio-economic and cultural well-being of the local population***', we find a complex of I&V for the integrative assessment of various facets of forest dependency. The first indicator of this criterion, '***The level of dependency on raw materials produced and obtained within and by the community***', unambiguously aims to ascertain the degree of overall dependency on the primary sector. It is followed by the indicator '***The management activities applied to agroforestry resources release sufficient funds for the maintenance of small-scale businesses and cottage industries***'. The rationale behind this is that profit margins give an idea of the room for manoeuvre or flexibility conferred by natural resource management. Theoretically, forest profits can be invested in the maintenance and development of forest-based enterprises, enabling thus greater economic dependence/reliance upon forest resources. Increases in dependency can be accompanied by a decrease in forest harvesting pressure, if greater profits are obtained from a given quantity of forest product as a result of value-added processing. An increase in some forms of dependency can relieve reliance on forests for basic needs fulfilment. This is so as the forest-generated income can be used to purchase substitutes for forest products (e.g.

forest foods, medicines and construction materials) and imported foods, reducing thereby the demand for agricultural forest land.

We need to remain aware of how easily forest profits, especially from NTFPs, can fluctuate with changes in market demand or the cost of inputs. The efficiency of forest product harvesting, processing and marketing also affects profits. The cumulative effect of efficiency in all stages from production through to marketing is to increase returns to forest management inputs. Higher profits present additional capital for reinvestment in forest management or in forward linkages such as local industries and enterprises (dealt with by the above indicator) or social services (covered by an indicator discussed further below). Although efficiency affects forest dependency, its direct address is confined to within C&I complexes that do not mention dependency.

ii) C&I Relating to Dependency and Subsidisation

Comments and observations on C&I attributes

Verifier:

Contribution made by external subsidies to the development of community infrastructure.

Ambiguity:

How subsidies are defined is not clear. For instance, it is unclear whether economic transfers are being treated as subsidies.

Subsidising direct or indirect forest-based economic activities will invariably reinforce or increase the forest dependence of some people. However, disadvantaged groups, which are highly dependent on forests for the fulfilment of basic needs, are unlikely to benefit from subsidies unless they are specifically designed for that purpose. Investigation of these issues is stimulated by the Brazilian social indicator ***'Community dependence on external subsidies provided by NGOs, religious organisations and/or the government'*** for which the Brazilian social specialist chose ***'Community efforts to give continuity to management systems introduced or being implemented by external actors'*** as a verifier. However, not all introduced forest management systems that are adopted have been or are subsidised. The role of subsidies in their creation or execution would have to be established before any conclusions are reached.

Forest dependence created by subsidies is commonly viewed as insecure. Some believe it is more aptly described as dependence on the subsidies themselves rather than on the forest. The withdrawal of subsidies can cause problems by undermining resource dependence artificially made possible by their application. The second verifier ***'Contribution made by external subsidies to the development of community infrastructure',*** proposed for the above indicator, could help assess the long-term impact of subsidies. This will vary according to the nature of the project or activity. Basic infrastructure is needed to provide sound foundations for rural development including the development of forest-based commercial enterprises. However, roads require maintenance work without which forest-based economic activities dependent on reliable market access will collapse.

iii) C&I Relating to Dependency, Social Services and Benefits

Comments and observations on C&I attributes

Verifier:

Map of infrastructure and its evolution over recent decades.

This verifier can show how many resources have been allocated to infrastructure development. Its wording is very general; by using the word 'evolution', all aspects of infrastructure can be under review, including where the resources came from to develop them.

One can partially deduce dependence on forest interventions from the contributions the interventions make to local education, health and other social services. This focus is reflected in the indicator '***Agroforestry resource management activities economically contribute to the community's access to education, health and other social services***'. As well as sometimes generating substantial profits, these activities often yield medicinal plants for domestic use and contribute to social knowledge frameworks. Although the latter make no direct financial contributions, their economic significance to rural communities can be great. Medicinal plants, by improving health for example, increase the community's active labour pool, thus enhancing its potential economic productivity.

The wording of the above indicator is, however, somewhat ambiguous. We assume it refers, among other things, to community-administered levies, taxes and voluntary contributions obtained from agroforestry profits for investment in community welfare services, and to the health and educational benefits households derive from agroforestry-generated income. Proposed as verifiers for these items were the output or response indicators of standard child health care and school attendance '***Anthropometry of children aged 0-10***', ***'Percentage of school-aged children with regular school attendance'***, and '***Map of infrastructure and its evolution over recent decades***'. Measures of the first two of these verifiers tend to be compound values, aggregating and thereby obscuring the variable effects of contributory factors. This makes it difficult to know exactly how they relate to the indicator they are attributed to, thereby limiting their usefulness. Overall, we feel the indicator '***Agroforestry resource management activities economically contribute to the community's access to education, health and other social services***', and its verifiers, are too broad for practical application. These I&V would benefit from a further breakdown into their components.

Verifier:

Domestic unit (household) income fluctuations from agroforestry resource management activities.

Relevance to assessment goal:

How to improve livelihood means during lean periods is a key question in the search to improve social sustainability. When food stores have been depleted, and before the new

The last indicator in Box 6.1, '***Existence of effective benefits for the subsistence and reproduction of domestic units derived from the management of agroforestry resources*'**, concerns household dependence on forest resources for subsistence, reproduction and wealth accumulation. In '*no-alternative*' situations, this indicator can help reveal how far forest dependence satisfies subsistence requirements, given the forest resource's carrying capacity, the overall pressure the community imposes upon it and the individual household's forest access. The indicator's supporting verifiers include '***Quantification of the agroforestry production of the domestic unit***', '***Food consumption by the domestic unit (household) with special attention to agroforestry products***', '***Inventory of domestic household assets and utensils***' and crop is ready for harvest, health tends to deteriorate and there is no money left to pay for medication. The timing of lean periods therefore has to be identified.

'***Domestic unit (household) income fluctuations from agroforestry resource management activities***'. A single questionnaire can be used to assess these verifiers. Studying these variables together facilitates cross-analysis of their results, so that variations in productivity can be related to differences in nutrition, asset possession and wealth. Income fluctuations can be compared with food consumption patterns. Gaps in need fulfilment can thus be identified and compared for different forest user groups. The Brazilian test team felt population growth rates and women's access to family planning methods should be included as verifiers to grasp the influence family size and changes in population size on the above indicator's reading. Population size will allow some inferences to be drawn on inter-generational access to resources.

6.4 Economics in the C&I Tests

Because of concerns that including economists in the test teams may introduce a highly westernized perspective on costs and benefits of CMFs, as well as budgetary constraints, there were no economists in the test teams. Also, it was assumed that the expertise of highly professional social specialists would include adequate understanding of the economic dimensions of CMFs. In addition, the economists perspective was sought by inviting distinguished economists, with a specialised interest in CMF or rural development, to the tests' concluding workshops. Over the course of the tests, however, the lack of an economic perspective was increasingly felt as a drawback. Local people tended to regard economic considerations as very important, often urgent in fact. All the test site communities claimed economic issues gave direction to their management objectives and plans. As a result, although only one principle was created that referred specifically to economics, all the tests generated a significant number of C&I that can be described as being more closely related to economics than to any other discipline.

At the Indonesian test site, people's visions of economic opportunities appeared to encompass long time horizons. The tembawang forest gardens, planted with tall tree species such as Tenkawang (*Shorea stenoptera),* which are relatively slow to produce a first crop of illipe nuts from the time of planting, are indicative of long term vision. However, even here forest farmers candidly explained they perceive areas of natural forest, that they consider to be of relatively low cultural or economic value, as supplies of land for future agricultural expansion to meet demands imposed by population growth. Several tembawangs alongside rivers have already been cut down in Darok and replaced by irrigated rice fields. Traditionally, a new tembawang garden must be planted for each one cut down. Whether Darok inhabitants strictly follow this rule was not determined during the test. Nor did it become clear whether compensatory replanting of tembawangs is being increasingly restricted to areas of poor soil.

6.4.1 C&I: Economic Sustainability

At all the test sites, the test teams perceived a strong correlation between local concern over forest conservation and local knowledge of the forest's real or full value. The Cameroonian and Brazilian forest management team members, in particular, saw the community's perception of the forest's economic potential as critical to its willingness to provide for its conservation. This is reflected in the criterion '***The benefits derived from productive activities have served as an incentive to perpetuate those activities in a sustainable manner***'. From this criterion's indicators (Box 6.8) it is clear that financial 'benefits' are primarily the concern. The Cameroonian forest management specialist believed that, in traditional subsistence forest-based economies, villagers normally regard the protection of forest resources to sustain forest benefits as a matter of common sense. In the Cameroonian forest management subset, mention of diversification and value-added processing is confined to I&V allocated to the criterion, '***Different forest user and interest groups of forest products coexist harmoniously***'.

Usually, the forest's value is perceived as an amalgamation of cultural, utilitarian and monetary values. Ultimately the value is limited by geographical variables that determine ecological carrying capacity and resilience. Knowledge about the forest's value therefore also includes ethno-biological information as well as knowledge about market prices of inputs and products. Moreover, it includes awareness of the value of forest benefits realised outside the forest's boundaries, e.g. reliable and adequate water supplies to replenish rivers and lakes and for use for irrigation and domestic purposes.

The higher the returns from forest management, the more resources become available for investing in the development of forward forest linkages, e.g., employment-generating forest industries and enterprises. Should these linkages be continuously dependent on forest, then their development will increase at least some people's reliance upon the forest. The Brazilian forest management specialist proposed that this would increase people's motivation to protect the forest's productive capacity**.** With this in mind she developed the criterion '***The benefits derived from productive activities have served as an incentive to perpetuate those activities in a sustainable manner***' and placed under it the indicator '***Existence of continual effort to diversify and increase value-adding processing capacity with the aim of increasing the gross aggregate value of the products***' and the verifier '***Existence of value-adding processing structures and equipment***'. Other indicators found under the criterion focus on knowledge, e.g., '***Knowledge of markets for forest (and agricultural) products***' and '***Knowledgeability on the costs of production (depreciation cost of equipment, reinvestments, maintenance)***'. The bargaining power of local people in commercial forest product transactions depends upon their knowledge of product values and markets. These C&I can, therefore, help with the assessment of people's bargaining power, in so far as this can be deduced from the extent of their relevant knowledge. People's bargaining power is assumed to affect their interest in preserving the forest's productive capacity.

C&I of knowledge content and skill possession were also linked to economic issues on the Cameroonian and Indonesian tests (Boxes 6.6 and 6.7). On both tests, knowledge content was understood in a broad sense to embrace cultural and scientific knowledge as well as technical skills. This is communicated by the indicator '***Cottage industries that use indigenous skills exist and encourage the wise harvest and use of forest raw materials***' (forest management, Cameroon), and the verifiers '***The use of local knowledge***', '***Mobilising scientific knowledge***' and '***Training***' (social, Indonesia).

Both at the Indonesian and the Brazilian test sites, local inhabitants were found to regard commercially valuable timber trees as banks of capital that can be liquidated when a sudden need for cash arises, i.e., for the purchase of school books or medication.

6.4.2 The Impact of Changes in Forest Value on Forest Conservation

The proposition that increases in the market value of forest products promote conservation remains controversial. The CMF case study literature abounds with diverging, but equally compelling arguments to show that high returns to NTFP commercialisation can have devastating or ameliorating ecological effects, depending on many other variables. Clearly the forest's economic value will affect its ecological sustainability and future social significance. The key questions are how and what factors determine this.

The history of the Brazilian test sites since the turn of the century, with all the pilferage of forest mammals for the skin trade and destructive harvesting of latex-yielding trees, is a good example of how price increases can lead to over-harvesting for windfall profits. The boom-and-bust economies revolving around ephemeral markets for NTFPs in Amazonia have been described elsewhere (Homma 1996).

6.4.3 The impact of Changes in Forest Value on Community Welfare

No clear, generic correlation between forest product prices and overall community welfare has been discovered. While a rise in forest product prices under some circumstances provides extra incentives to protect the forest, it is almost certainly bound to increase competition for forest access. Left uncontrolled, competition is going to have a profound affect on distribution. Growing contact between traditional communities and the outside world, and the integration of these communities into the monetary system, thus often transforms internal community relationships based on reciprocity into competitive ones. Under conditions of marked resource scarcity, competition can be remarkably fierce, incurring heavy casualties. The more successful competitors are likely to become increasingly powerful and the less successful ones, correspondingly less so.

The displacement of some forest user groups is a common consequence of monetary integration. Within the forest groups there may be differentiated impacts as well – in many cultures for example the roles of men expand as NTFP market opportunites arise, even when it has been women who have previously tended or worked with the products in the past.

6.4.4 Socio-economic and Ecological Optimisation of Resource Allocation

The Indonesian social principle '***Economic gains do not compromise ecological integrity***' is the only principle generated by the tests that explicitly refers to economics. Linked to it is the criterion '***Optimisation of the local agroforestry system***' which addresses the balance between dependency and distribution patterns and ecological issues. The majority of the Indonesian I&V about economic issues is clustered around this criterion. Tradeoffs between ecological and social considerations are a concern underlying the Indonesian C&I on enrichment planting. Compared to the C&I sets of the other tests, the Indonesian social subset places far greater emphasis on the economic importance of manipulated and artificially regenerated forest systems. It is not clear why a similar emphasis did not appear on the other tests as such systems also featured at the other test sites.

i) C&I: Enrichment Planting and Domestication

The Indonesian team saw enrichment planting and the domestication of wild plant species as traditional ways of enhancing the forest's economic value, as suggested by the tembawang gardens and their high socio-economic importance. Domestication was seen as a viable means to reduce forest product collection costs in the long run and/or simply to increase stocks of useful species(Box 6.4).

What the Indonesian C&I perhaps fail to adequately address is whether the relatively high interest in intensively manipulated forest and agroforestry systems has resulted in diminished interest in conserving the remaining natural forest.

Box 6.4 C&I: Economic Forest Management Issues
(Indonesian Social Subset)

Principle: Economic gains do not compromise ecological integrity.

Criterion: Optimisation of the local agroforestry system.

Supporting indicator:
- Optimisation of tembawang (forest gardens).

Supporting verifiers:
- Enrichment with economically valuable trees.
- New tembawangs are planted with economically valuable trees.

Supporting indicator:
- Tembawang retains its social function.

Supporting verifier:
- Decision making on tembawang enrichment is a social, not an individual occasion.
- Decision making on tembawang conversion is a social, not an individual occasion.

Supporting indicator:
- The productivity and quality of the rubber gardens are being increased.

Supporting verifiers:
- Appropriate technology for tree improvement.
- Appropriate technology for post-harvest activities and processing.
- Market for rubber exists.

Supporting indicator:
- There is policy and activity to rationalise the ladang system.

Supporting verifier:
- The use of local knowledge.
- Mobilising scientific knowledge.
- Training.
- Field trial.

No C&I on enrichment planting occur in the Brazilian set. This can be partially ascribed to the overriding interest in timber management expressed by the participants of the Brazilian workshop's forest management C&I review group. Their majority opinion was that enrichment planting is not a cost-effective proposition for timber management in natural tropical forest. Agroforestry, fallow enrichment and a variety of planted tree-based systems do, however, form a mainstay of traditional Caboclo land use patterns in many parts of the Amazon region. Community organised cooperatives and NGO-assisted projects often focus on either disseminating such systems or upgrading their management. Several families at the Brazilian test site have planted indigenous forest palm and tree species such as *cupuaçu* and *açai* on their land, and a significant number possess small rubber stands, most of which had fallen into a state of neglect because of the low price of rubber. On a related point of interest, the Brazilian government recently committed itself to subsidising rubber production again. It is therefore, we hope, fortuitous that many families did not eliminate their rubber stands over the years of depressed rubber prices. It is unclear why the Brazilian team did not develop extra C&I to prompt assessors to examine these artificially established tree-based systems more closely.

Comments and observations on C&I attributes

Verifier:

'**Enrichment with economically valuable trees**' and '**New tembawangs are planted with economically valuable trees**

Context Specific:

All the C&I that refer to economically valuable species rely on their being both knowelge of commercial value, and most importantly, access to that economic market. (They also rely on market stability through the period of maturity of harvest).

Judgement call:

The degree to which 'econonic gains do not compromise ecological integrity' is a subjective judgement, which will reflect the 'assessors' perception of what comprises 'ecological integrity', or in other words, what are the reasonable trade-offs.

The Indonesian verifiers '***Enrichment with economically valuable trees***' and '***New tembawangs are planted with economically valuable trees***' suggest planting valuable economic species is desirable. These verifiers for the indicator '***Optimisation of tembawang***' occur under the principle '***Economic gains do not compromise ecological integrity***' as does the indicator '***Tembawang retains its social function***'. One of the latter indicator's proposed verifiers '***Decision making on tembawang enrichment is a social not an individual occasion***', conveys a need to safeguard equitable distribution by involving many people in decisions about which species to plant. It was proposed that participatory decision making on this issue would help ensure that the undue compromise of non-monetary and monetary (often marginal) benefits enjoyed by some groups does not result from adapting tembawang gardens in response to changes in market demand. The I&V clustered around the criterion '***Optimisation of the local agroforestry system***' thus complement each other so that the integration of social and economic issues can be assessed.

Some of the Indonesian I&V for assessing potential economic benefits deal with plant improvement (through the tending and selection of planting stock), enrichment planting and market demand, as all these things can influence economic value. '***Market for rubber exists***', is therefore, for example, included as a verifier for the forest management indicator '***The productivity and quality of the rubber gardens are being increased***'. Another verifier for the same indicator is '***Appropriate technology for tree improvement***'. Its application may require an appraisal of the pros and cons attached to the introduction of improved clonal stock and people's understanding of how to apply techniques. As in the Cameroonian forest management set, mention of processing is confined to the verifier level, but included in the social rather than the forest management subset. The verifier '***Appropriate technology for post-harvest and processing activities***' theoretically includes the storage of produce, as well as processing. The Indonesian forest management set also contains the verifier '***Markets for tembawang products exist***' for the assessment of the criterion '***Tembawangs are capable of supporting people's livelihoods***'. Markets for rattan, tengkawang nuts and damar resin, especially, deserve consideration in the planning of enrichment plantings. Markets, their links and distribution channels are likely to change over time, mirroring changes in supply and demand, infrastructure and knowledge.

ii) C&I: Economic Diversification and Value-adding Processing

Comments and observations on C&I attributes

Verifier:

Appropriate technology for post-harvest activities and processing.

Verifier:

Villagers exploit raw materials in a sensible and frugal manner to ensure the sustainability of local cottage industries.

Degree of Subjectivity:

Both of the above verfiers rely on a great deal of subjective juedgement on the part of the assessors ('appropriate', 'sensible', 'frugal'). This degree of subjectivity does not necessarily take away from their necessity or utility, but it should be recognized and their should be trusted and acceptable mechanisms in place to assess according to such criteria if they are used.

In all three countries the test teams created C&I on value-adding processing of forest products and on the diversification of forest enterprises. In the Indonesian case two verifiers '***Enrichment with economically valuable trees***' and '***Appropriate technology for post-harvest activities and processing***' were considered necessary to assess the social criterion '***Optimisation of the local agroforestry system***'. Processing capacity was viewed as indicative of the community's current ability to capture potential gains from planting superior, more productive trees.

All teams urge assessors to explore the links between sustainable harvesting, processing efficiency and economic diversification by the way they group C&I (see C&I clusters in Boxes 6.5, 6.6, 6.8). In the Cameroonian case, for example, such links are forged by the forest management indicator '***Forest benefits supplement diverse sectors of the rural economy***' and its supporting verifiers; '***Cottage industries that use indigenous skills exist and encourage the wise harvest and use of forest raw materials***' and '***Villagers exploit raw materials in a sensible and frugal manner to ensure the sustainability of local cottage industries***'. Another verifier for this indicator is designed to tell whether the product quality ensures the longest possible replacement gap '***Selection of plant species and standards of craftsmanship result in value-added products (e.g., mortars, canoes, etc.) with a long useful life-span***' (Box 6.5).

In the Cameroonian forest management set, the diversification of the village forest economy is a high ranking issue, addressed at the criterion and indicator levels. The criterion '***Different forest user and interest groups of forest products coexist harmoniously***', suggests a scenario which supports and caters for diversification. Evidence of this is sought by the indicators '***The interests of the various community forest user groups complement each other and do not adversely compete***' and '***Forest benefits supplement diverse sectors of the rural***

economy'. Related verifiers '***Local skill endowment enhances division of labour within the village setting***' and '***Employment provided to villagers by local cottage industries***' reveal a concern that goes beyond the profitability of forest enterprises to their capacity to generate employment. This C&I complex links profitability, diversification and benefit distribution in a way that the other sets do not. The distribution aspect is further targeted by the verifiers '***Locally produced value-added products for local use and sale***' and '***Interdependence between different direct and indirect forest user groups***.' With these two verifiers the economic implications of market links, bargaining power of local forest user groups and the proportion of profits appropriated by outsider forest interest groups can be determined.

With the I&V complex for the criterion '***Different forest user and interest groups of forest products coexist harmoniously***' the CMF scenario can be assessed for diversification, and its converse, the increasing incidence of monoculturation. Information this complex generates on the spillover effects that changing levels of diversification have on distribution channels and patterns will lead to questions relating to economies of scale. These economies are often a justification for large-scale deforestation, the homogenisation of production systems and capitalist processes of wealth accumulation. The social and environmental costs and benefits of improving economies of scale will need evaluating.

Box 6.5 C&I: Economic Issues related to Forest Management
(Cameroon – FM set)

Criterion: Different forest user and interest groups of forest products coexist harmoniously.

Supporting indicator:

- The interests of the various community forest user groups complement each other and do not adversely compete.

Supporting verifiers:

a) Local skill endowment enhances division of labour within the village setting.

b) Interdependence between different direct and indirect forest user groups.

Supporting indicator:

- Forest benefits supplement diverse sectors of the rural economy.

Supporting verifier:

a) Cottage industries that use indigenous skills exist and encourage the wise harvest and use of forest raw materials.

b) Employment provided to villagers by local cottage industries.

c) Locally produced value-added products for local use and sale.

d) Villagers exploit raw materials in a sensible and frugal manner to ensure the sustainability of local cottage industries.

e) Selection of plant species and standards of craftsmanship result in value-added products (e.g., mortars, canoes, etc.) with a long useful life-span.

f) Post-harvesting processing and storage techniques are adequate.

6.4.5 Subsistence versus Monetary Economies

Among the C&I created for assessing the economic viability of local forest enterprises, some appear more concerned with the attributes of traditional, more closed economic systems (Cameroon), while others focus more explicitly on processes of monetary integration within the regional economy (Brazil) (see box 6.6). Field observations were inconclusive about which of the three test sites contained the most economically isolated villages. Both features of economic isolation and of economic integration were noted at the more geographically isolated of the test site villages in Cameroon and Brazil. The differences in emphasis between the Brazilian and Cameroonian C&I complexes concerning economic issues probably partially reflects the respective team members' interests being biased in different directions. The Cameroonian forest management specialist stressed factors affecting sustainability during economic isolation (i.e. under current constraints). The Brazilian team saw economic integration (or rather developing its potentials) as a pressing concern on which the future of sustainability depends. The Indonesian contributions perhaps come closest to combining the two approaches, thus facilitating understanding of the interface between cultural and monetary integration.

Contrary to expectations, the forest management specialists in Brazil and Cameroon developed more C&I on forest enterprises and value-added processing than did the social scientists on their teams. In Indonesia, both the forest management and the social science members developed C&I on these issues.

Box 6.6 Monetary Integration and Forest Conversion to Agriculture

The characteristics of the test sites suggest monetary integration tends to be more advanced in forest communities with relatively easy access to urban areas, whether because of greater proximity or better infrastructure. The more accessible communities tend to enjoy higher prices for agricultural and forest products, and this often encourages them to increase their production of marketable surpluses of these products. Large increases in agricultural production sometimes result. The trend has been singled out as one of the strongest accelerators of deforestation in some forest communities.

With increasing forest conversion to agriculture, forest harvesting pressure is likely to mount as harvesting becomes concentrated within a progressively smaller area. Sought-after forest products consequently become scarcer. All else remaining equal, the price of these products is likely to rise, maybe even above the average community member's means. Farmers can sometimes choose to invest some of the extra income earned from agricultural surpluses (or from other types of enterprise) in forest technologies to extract remaining forest resources more efficiently. Should these resources be finally made economically extinct, farmers can spend the income obtained from their over-exploitation and agricultural surpluses on forest product substitutes (where these exist) and agricultural inputs. Debatably, this transition can sustain social welfare at levels equal to or even higher than those achieved during periods of greater forest richness.

However, the drive to increase surplus production of forest and/or agricultural products typically culminates in the introduction of wage labour, the consolidation of land holdings and individualism. Wage labour has been linked to the breakdown of traditional forms of mutual work groups that, commonly based on kinship and neighbourhood ties, served to cement cooperative and often, more equitable relationships (Chibnik 1994; Otsuka 1998). At the Cameroonian test site, SOLIDAM recognises the important, traditional role of mutual work groups. One of its aims is to strengthen these groups and encourage their expansion.

i) C&I: Isolated Subsistence Economies

Comments and observations on C&I attributes

Most of the Cameroonian I&V on the community's forest-based economy are grouped under the criterion '***Different forest user and interest groups of forest products coexist harmoniously***'. Their scope closely fits that of traditional, relatively isolated economic systems aimed at satisfying internal demand. Nonetheless, some of the I&V for this criterion could be successfully used to assess the socio-economic efficiency of forest production destined for external markets. The complex as a whole can reveal economic interdependencies, whether and how activities are synchronised, and how these factors promote the community's common good and cohesiveness. To fully estimate the local value of forest resources, the Cameroonian forest management team member stressed the need to take into account all the contributions made by forest products and services to diverse rural production modes and enterprises, including those not primarily forest-product based. Hence, the indicator '***Forest benefits supplement diverse sectors of the rural economy***' for the criterion '***Different forest user and interest groups of forest products coexist harmoniously***' (Box 6.5). This indicator calls for recognition of how the livelihoods of collectors of raw materials are linked to those of fishers, hunters, farmers, artisans, traders, etc. and vice versa, by way of providing for each other's needs. Some of the verifiers for this indicator seek to establish the incidence of deliberate moves taken by individuals and local small-scale industries to limit their exploitation of forest resources in order to protect the community's forest dependent economy. These verifiers imply that the potential for forest-based economic growth is maximised when all community members assume partial responsibility for the survival of local businesses that benefit the community's overall socio-economic system, by not defiling the forest's regenerative capacity. Another Cameroonian verifier of how successfully the forest supplements a diverse rural economy is '***Selection of plant species and standards of craftsmanship result in value-added products (e.g., mortars, canoes, etc.) with a long useful life-span***'. In a closed village economy, this affects replacement rates and demand. It can reveal the pressure local industries and craftsmen exert on the forest. Perishable forest products are addressed in the verifier '***Post-harvesting processing and storage techniques are adequate***'. Measures for minimising waste and to thus reduce excessive extraction of forest products to compensate for wastage, can be assessed with this verifier. The types of techniques referred to can also be assessed in terms of whether they fulfil the needs of a diversified village forest economy.

ii) C&I: Subsistence Economies in Transition

Comments and observations on C&I attributes

The more outward-looking Brazilian C&I on the local forest economy stand apart by directing inquiries towards the role of the community (i.e., collective), instead of the individual, in managing forest-based enterprises and taking advantage of opportunities for greater integration into regional markets (Box 6.7). They include I&V on community production and trade mechanisms and cooperatives. As in the Cameroonian and Indonesian sets, diversification is stressed as important for maximising total returns to forest management inputs. This is conveyed by the forest management indicator '***Existence of continual effort to diversify and increase value-adding processing capacity with the aim of increasing the gross aggregate value of the products***'.

Verifier:

The community is knowledgeable on market alternatives, fluctuations and demands.

Stakeholder differences:

This verifier uses the community as a single unit. In fact, in most cases, knowledge relating to markets may not be equally shared amongst community members, and this may greatly affect opportunities of the different stakeholders to benefit.

The C&I on cooperation generated by the Brazilian test, whilst revolving very much around the economic value of forest products, do not directly address employment as a form of distribution. The Brazilian set seems significantly weighted towards evaluating the profitability of forest production, processing and marketing modes. Transmitting this perspective are the indicator '***Knowledge of markets for forest (and agricultural) products***' and its verifiers '***The value of products is perceived as an incentive for their sale***' and '***The community is knowledgeable on market alternatives, fluctuations and demands***'. In addition, the indicator '***Knowledgeability on the costs of production (depreciation cost of equipment, reinvestments, maintenance)***' and its verifier '***Relationship between the costs of production (existing equipment, useful life of existing equipment, time of acquisition, forms of maintenance, etc.)***' also reflect this focus.

The success of community-run forest enterprises and cooperatives often rests on adequate knowledge of markets and production costs, and accountancy skills. The Brazilian forest management specialist thought it important to assess people's understanding of the relationships between the various costs of production when verifying their overall knowledge of production costs, and added a verifier for this; '***Relationship between the costs of production (existing equipment, useful life of existing equipment, time of acquisition, forms of maintenance, etc.)***'. These relationships reflect coordination of different types and quantities of inputs over time. People's understanding of these relationships influences their perceptions of alternative options (see also Byron and Arnold 1997).

The matter of cooperation is addressed with the Brazilian forest management indicator '***Existence of community mechanisms for the commercialisation of products***'; and, more specifically, by the related verifier '***Existence of community-run 'cantinas' (or 'revendas' which are cooperatively run trading posts) that sell forest farmers' products and purchase inputs***'. These statements focus more on establishing the financial viability of cooperatives than their organisational or distributional structure. Community-run cooperatives for forest product processing and marketing and the purchase of inputs were widely recognised on all tests for their potential to optimise returns from forest management. Many inhabitants of the Cameroonian and the Indonesian sites were members of cooperatives at the time of the tests. Cooperatives can unite people, pool resources and share risk, thereby giving resource-poor households the chance to reap benefits of scale and to gain a more equitable share of profits/benefits. Sometimes they give people access to group credit schemes to obtain natural resource investment capital (Burford de Oliveira and Oliveira 1994). Credit can effectively offset the delay in returns to inputs associated with the long period to maturation of tree crops.

Verifier:

Infrastructure and transport accessible to the community (boats, paths, roads, etc.).

Potential users:

Community members can assess this themselves in so far as they are aware of the infrastructural constraints that face them. They may however have a less realistic idea of the options for removing these constraints and their respective costs.

Rural cooperatives generally operate on voluntary contributions. Profits are usually shared out according to the principle of distributional justice, where those who contribute most are correspondingly rewarded more. Sometimes, however, the profits are siphoned off by local leaders, village elites or outsiders seeking to further their own interests. In such cases the benefits of collective action accrue to a select few and the poorer members are essentially subsidising the livelihoods of the wealthier or more powerful. The study of cooperatives and similar organisations can provide a comprehensive overview of the equity impact of forest management, product processing and marketing strategies. On the Brazilian test it was noted that infrastructure and transport (because they indicate market access) should be evaluated in conjunction with community-run cooperatives whose developmental capacity/scope they largely determine. The relevant verifier designed for this is '***Infrastructure and transport accessible to the community (boats, paths, roads, etc.)***'.

Box 6.7 C&I: Economic Forest Management Issues
(Brazil Management Subset)

Criterion: The benefits derived from productive activities have served as an incentive to perpetuate those activities in a sustainable manner.

Supporting indicator:

- Existence of continual effort to diversify and increase value-adding processing capacity with the aim of increasing the gross aggregate value of the products.

  Supporting verifiers:

  - Existence of value-adding processing structures and equipment.

Supporting indicator:

- Knowledge of markets for forest (and agricultural) products.

  Supporting verifier:

  - The value of products is perceived as an incentive for their sale.
  - The community is knowledgeable on market alternatives, fluctuations and demands.

Supporting indicator:

- Existence of community mechanisms for the commercialisation of products.

  Supporting verifiers:

  - Infrastructure and transport accessible to the community (boats, paths, roads, etc.).
  - Existence of community-run 'cantinas' (or 'revendas' which are cooperatively run trading posts) that sell forest farmers' products and purchase inputs.

Supporting indicator:

- Knowledgeability on the costs of production (depreciation cost of equipment, reinvestments, maintenance).

  Supporting verifier:

  - Relationship between the costs of production (existing equipment, useful life of existing equipment, time of acquisition, forms of maintenance, etc.).

Supporting indicator:

- Existence of community mechanisms to generate production.

  Supporting verifier:

  - Observation of community methods and forms of managing production.

The proposed C&I fall short of directing the assessor's attention to all the factors that might significantly affect the economic sustainability of forest product harvesting at the test sites. For instance, few C&I have been created on biological features that endow species with economic prospects. Factors such as speed of regeneration and propensity to mast significantly influence long-term commercial viability, but the C&I do not directly refer to them. The question of rural credit designated to support sustainable forest product-based enterprises is not directly raised. However, C&I of cooperative organisations may lead assessors towards evaluating the receipt and application of credit funds, either with self-developed C&I or other assessment tools.

Many CMF products have low market value or cannot be cost-effectively transported to markets because of inadequate infrastructure or transport facilities. In some countries there has been collaboration between communities, NGOs and government to improve infrastructure for isolated communities to penetrate markets. However, cases exist where government, sometimes in collaboration with forest conservation groups, takes active steps to prevent infrastructure development in remote forest areas, viewing it as a prelude to spontaneous migration into such areas. More sensitive C&I, including ones to capture obstacles to cost-effectiveness in the marketing chain of CMF products, and ones to detect the Achilles' heel of infrastructure development which transforms it into a precursor of forest conversion, would be of value to policy makers.

The Influence of economic outmigration is outlined in Box 6.8.

Box 6.8 Impacts of Economic Out-migration

The impacts that economic out-migration can have on sustainable CMFs were discussed on all three tests. At various times in the past, external income sources had contributed significantly to the village economies of most of the six test site communities.

Economic out-migration can restrict market surplus production and related incursion into forest areas. Comparison of the test sites suggests it is more characteristic of communities with easy access to urban areas. Its impact on forests is difficult to isolate. Local demand for agricultural land can be temporarily reduced. A seasonal exodus of male agricultural labour often adds to women's burdens, increasing their childcare and agricultural tasks. This affects who in the family harvest forest products, the scale and the purpose. Periods of out-migration are commonly timed to coincide with slack periods in the forest/agricultural calendar. Reductions in marketable surpluses are thus minimised. Depending on priorities, income earned externally is spent on labour-saving technologies such as chainsaws. These can potentially compensate for seasonal reductions in the agricultural labour force. The impact of out-migration on the forest can therefore vary greatly as can its influence on the distribution of forest management costs and benefits. Otsuka (1998) describes how, in southwest Sumatra, the dispersion of lineage members in Minangkabau communities caused by their seeking outside employment, reduced community control over in-migration. This disrupted customary authority causing organisational readjustments that altered distribution patterns.

For the majority of forest inhabitants, few viable, internal or external non-forest based livelihood strategies exist. Disturbing developments such as the fall in net per capita income throughout much of sub-Saharan Africa and the recent economic catastrophe in South East Asia, support this assertion. Although out-migration sometimes curbs deforestation at the migrant workers' place of origin, it can cause deforestation or environmental degradation at their destination sites. Activities destructive of forests, such as gold mining, large-scale charcoal production, unsustainable timber harvesting and ranching, absorb a large proportion of the rural migrant labour force in Amazonia. Some of the Brazilian test site inhabitants had been temporarily employed in these activities. However, the last decade has seen a fall in gold mining opportunities in the Brazilian Amazon and employment in the urban sectors has plummeted in Cameroon and Indonesia, jeopardising sources of income much relished by some forest communities.

Until recently, many men and some women from the Indonesian test site migrated annually to Malaysia to undertake unregistered wage employment. Some stayed in Malaysia for several years. The recent economic recession has squeezed immigrant labourers out of Malaysia's job market. Consequently, many Dayaks from forest communities in Kalimantan must adjust to doing without a supplementary income source they had come to rely upon. In order to uphold living standards made possible by external earnings, villagers may decide to increase their pressure on forest resources.

Since 1986, Cameroon has been facing severe economic hardships. In recent years, many young rural people, who had migrated to urban areas in more prosperous times, have been forced by financial circumstance to return to their birth villages. Many villages, unprepared for this influx, have broken into conflicts about how to redistribute resource access to meet the needs of returnees.

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

CHAPTER 7.

SOCIAL DIMENSIONS: DETERMINANTS OF THE SOCIAL AND ECONOMIC OUTCOMES OF FOREST MANAGEMENT

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

CHAPTER 7.

SOCIAL DIMENSIONS: DETERMINANTS OF THE SOCIAL AND ECONOMIC OUTCOMES OF FOREST MANAGEMENT

Chapter 7.
Social Dimensions: Determinants of the Social and Economic Outcomes of Forest Management[33]

In the previous section we looked at C&I that can help describe the social impacts or outcomes of CMFs. We now turn to examine the tested C&I that more directly concern the factors and phenomena which determine and regulate these impacts and outcomes. This category encompasses the mechanisms and processes that, deliberately or through default, structure decision-making, channel access, and shape relative forest dependency. Organisational structures and procedures, institutions, norms, taboos and rules are all included in this category. Often complex and subtle, they commonly have their roots in the local cultural and ecological environment (Ostrom 1990). Collectively they may be referred to as the 'instruments' used by community or community-based organisations to orchestrate social impact. If skilfully developed and used, they should nurture a sustained flow of forest benefits to maximise collective welfare without compromising ecological carrying capacity.

The C&I presented and discussed below can be used to evaluate the factors, means and processes that determine the mix of forest production objectives and how closely this approximates the socially optimal mix. They can shed light on the capacity of the community or part of it to 1) exert control over forest resources, and 2) adapt to changing circumstances in order to maintain or increase this capacity. Some of the information they aim to capture can be used to forecast the equity impact of unfolding or incipient trends arising from or affecting CMFs. The C&I we now go on to examine, therefore, cover issues that play a central role in shaping the future.

We have grouped the C&I reviewed in this section under the main subject headings:

7.1 Participation and social organizations

7.2 Rules and regulatory instruments

7.3 Monitoring

7.4 Conflict and inter-community relations

7.5 Adapting to change

7.6 Land and tree tenure

Our review of these groups follows the above sequence. The reason for this sequence is explained as the review proceeds. Some of the C&I discussed in this section are also discussed in one or more other sections, because of their broad significance.

7.1 Participation and Social Organisation

Participation and social organisation are two inseparable parts of a whole, where neither can be fully defined without reference to the other. This integrated fit is perhaps most clearly conveyed by the Cameroonian I&V under the criterion '***Different forest users and interest groups of***

[33] Written by N.Burford de Oliveira with Bill Ritchie and Cynthia McDougall

Box 7.1 C&I Reflecting how Participation creates Social Organisation
(Cameroonian Forest Management C&I)

Criterion: Different forest users and interest groups of forest products coexist harmoniously.

Indicator:

- The interest of the various community forest user groups compliment each other and do not adversely compete.

  Verifiers:

  - Local skill endowment enhances division of labour within the village setting.
  - Interdependency between different and indirect forest user groups.

Indicator:

- Forest benefits supplement diverse sectors of the rural community.

  Verifiers:

  - Cottage industries that use indigenous skills exist and encourage the wise harvest and use of forest raw material.
  - Employment provided to villagers by local cottage industries.

forest products coexist harmoniously', presented in Box 7.1. The coordination of activities and sharing in the community's production through gainful employment, both imply participation.

Belief systems and values organise and structure complex networks of human relationships spatially and in time. Many small traditional forest communities do not have complex social stratification. Daily life, including forest interventions, revolves around reciprocal relationships between individuals and groups typical of gift economies (Smith 1996). All individuals belonging to a community obey environmental constraints understood within the context of a shared worldview. Usually, participation in resource decision-making is, in such cases, predominantly informal and spontaneous. People spontaneously participate in natural resource management through adherence to cultural norms. By simply following their religious or animistic belief systems, they may actively, although not necessarily, perpetuate conservation ethics.

7.1.1 Participation

On all the tests, social organisations (formal and informal) were considered important because of their potential capacity to represent the diverse forest interest groups within the community. Accurate representation depends in part on knowledge of the interest groups' needs and aspirations. How much knowledge is acquired depends on the depth of contact and communication between groups and/or individuals. Different groups within the community must keep each other informed of their conditions, needs, interests, etc., before they can hope to fully understand how their diverse and sometimes diverging interests can best be integrated. In smaller communities, frequent informal contact and communication between groups of kin and neighbourhood ties are usually sufficient for satisfactory agreements on forest resource allocation to be reached. In larger communities, more integrated into the market economy, resource allocation decisions are more likely to involve communication between kinship and social groups and more highly developed, internal community organisations that exercise authority over the whole community.

With many forest products and services in demand, the regulation of competition within the community to maximise social benefits over social costs presents a challenging task. It underscores the need to mobilise information to keep decision-making processes for setting tradeoffs adequately informed and transparent. Multi-directional communication and communication channels are therefore vital prerequisites to positive participation in determining cost-benefit distribution patterns. Positive participation is here meant to refer to cases where the participant's contribution to the reproduction, adaptation or creation of some aspect of reality is consciously self-determined. Communication removes obstacles to the perception of the socially optimal mix of production objectives and pathways leading to their fulfilment. Discussion between forest interest groups is, therefore, a basic tenet of participation.

The level of participation in decision-making and conflict management processes often reflects the level of participation realised in their development. To truly foster understanding and deal constructively with rising tensions and conflicts, participatory processes must be transparent, i.e. they must be communicative. Participation, in the form of creative involvement in community-focused assessment and decision-making processes, is gaining recognition as a basic human need (Reddy 1994).

7.1.2 C&I: Participation

Multi-directional communication channels were identified by the three test teams as indicative of how effectively information on the needs of different groups is gathered and disseminated. Communication networks can indicate social alliances and exclusions that reflect patterns of social organisation. Participation in information exchange and in the critical review of information during decision-making processes were identified as variables that can influence cost-benefit distribution patterns and, consequently, the forest dependency status of different groups.

The criterion '***Institutions or organisations exist to cater for the diverse interests of different forest user and interest groups'***, from the Cameroonian social subset addresses the consideration given to the needs of different group in the allocation of resources. The Indonesian and Brazilian test teams, especially, saw participation (and levels thereof) in objective setting and in the assessment, monitoring and planning of forest interventions, as good indicators of the representation of stakeholders' interests. Degree of participation in these activities was thought to influence the tradeoffs, access restrictions and penalties for deviant behaviour, etc., that model CMFs.

The Indonesian and Brazilian C&I sets place the most emphasis on 'participation' of diverse community sectors in decision-making institutions (Table 7.1). Both include I&V on the involvement of women in decision-making. Further C&I may be needed that pose the same question about other potentially under-represented minorities or oppressed groups (which in some cases constitute the majority). This makes it important to establish how these groups can be distinguished from special interest groups that are not disadvantaged within the community context. Here, the Indonesian social verifier '***Clear understanding of the composition of stakeholders***', although it appears in connection with C&I on laws and regulations, seems relevant. It remains unclear whether the references to participation and gender equality (that in certain cases imply democratisation of indigenous systems, a significant cultural shift for many communities[34]) were recognised as important within the communities or whether they were solely generated by the test teams. No C&I were developed that directly inquire into which groups are being effectively excluded from participating in different ways. Additional, more detailed C&I that more directly identify social problems and inequalities, may be useful.

[34] The cross-cultural comparison of values and ideologies merits more thorough investigation. We would like just to point out that Dayak culture, a variant of which characterises the Indonesian test site, is noted for its relatively high equality in gender status. The women folk of caboclo communities in the Arapiuns valley where the Brazilian test site was located typically enjoy much higher rates of literacy than their male counterparts. Consequently, they also tend to possess significantly greater earning power. The incidence of economic out-migration of women from caboclo villages to urban areas tends to be much higher then that of men.

Table 7.1 Participation in Decision-making

Indonesia	Cameroon	Brazil
5.3.1 Meetings are organised on environment and land use problems. 5.3.3 Participatory decision-making. 4.2.1.1 There is full participation of local community in planning (and implementation). v. There is participation in decision-making on benefit sharing. 4.2.1.3 Gender equality in all processes. 5.3.2 Women represented equally in meetings and decision-making. v. Decision-making on tembawang enrichment (and conversion) is a social, not individual occasion.	___	6.4 The community participates in and monitors (patrols) all the planning process of any management system to be executed within the agroforestry it impacts on. 6.4.1 Active community participation in the conception and monitoring (patrolling) of agroforestry resource management systems. (5.2.1.1 Participation of the community in decisions on which trees to extract…….) v. Effective female participation in discussions and decisions concerned with community welfare.

The test teams agreed all community groups affected by forest management decisions should participate in decision-making processes. More detailed C&I on participation than those proposed may be required to examine how the community deals with groups such as 'free-riders', whose full participation in decision-making maybe inappropriate on account of their apparently antisocial behaviour. These groups are not easily defined. Free-riders may sometimes be sub-categorised into further groups. For instance, there may be some who are forced to free-ride by poverty and others who are selfishly opportunistic for reasons other than survival. In resource-poor communities, destructive forest harvesting will often be caused by people not being able to afford to abide by sustainable management practice rather than their lack of a conservation ethic. The poor are most likely to suffer sanctions as a consequence of not conforming with regulations and laws. The participation of certain categories of 'outsiders' in community decision-making processes may also merit extra consideration to establish the grounds upon which their participation is encouraged, tolerated, limited or denied by the community.

No C&I were proposed on the breadth of the participatory base for collective actions geared towards increasing access to development resources such as training and investment capital. C&I-based assessments may be improved if this deficiency is redressed.

7.1.3 Social Organisations

The test teams did not explain how they distinguished between the meaning of the words 'organisation' and 'institution'. This makes it difficult to be consistent in our own interpretation of the word 'institution' and reduces the confidence with which some of the C&I can be interpreted. We have, however, after consideration, taken the word 'institution' in many cases to be used as a synonym for 'organisation'.

Social organisations provide structural frameworks for making and implementing decisions. Frequently they play a major role in determining participation in resource access, utilisation, transformation and marketing. Their capacity and strength are often thought of as critical determinants of control over forest resources. Overwhelming evidence suggests that successful community management of common forest resources is positively correlated to strong social organisational capacity (Alcorn 1996, p. 242; Agrawal and Yadama 1997, p. 456) and indicated by the community's ability to guard the resource against illegitimate exploitation and monitor rule adherence.

Community-based organisations and institutions operate on various planes and vary in their degree of formality. Some are inherited, others arise either spontaneously or as a calculated reaction to novel circumstances. They may function to favour a minority local elite with wealth, status or moral authority, or they may serve the interests of all community members. They may be instigated with or without external support. Potentially, C&I can facilitate assessment of whether organisations empower poor forest farmers and enhance their productivity in a manner commensurate with forest sustainability.

The community as a whole can be regarded as an organisation with its cultural or religious identity providing institutional frameworks upon which social relationships and patterns of forest resource use are organised and regulated. Within the community, groups operate as sub-organisations. These vary in nature, ranging from kinship and neighbourhood groups, age classes and traditional village councils to groups more recently formed to fulfil newly defined socio-political or developmental mandates.

In some cases, patron-client relationships of interdependency prevail that comprise a form of social organisation illustrative of unequal participation. Deciding which forms of social organisation are relevant to the assessment of CMFs is complicated. Few would think patron-client relationships in forest resource exploitation can classify as part of community forest management. However, they may occur concurrently with other forms of forest use more fully under community control. In addition, the scope of these other forms of forest use may be defined by the limits of patrons' controls. Frontiers of interests and powers of different forest interest groups also exist when government and/or NGOs exert their powers of influence over communities' forest interventions. The Brazilian social specialist maintained that some communities that had come to depend upon the patronage of traditional patrons such as rubber barons, whose power and presence has been diminished by regional power shifts, have come to view development agencies as substitute patrons. These considerations he sought to target with the indicator ***'Community dependence on external subsidies provided by NGOs, religious organisations and/or the government'***.

Numerous factors, including settlement patterns, resource endowment, infrastructure, income distribution and social stratification, affect the performance and cohesion of community organisations (Otsuka 1998). Some organisations or sub-organisations may have the goal of managing forests sustainably through collective action. The motivation for collective action can derive from many sources. Profound differences in social organisation between traditional subsistence, gift economies and market economies have been noted. Failure to recognise their importance has been blamed for the disintegration of cooperative forest management initiatives (Smith 1996).[35]

The success record of community organisations in achieving objectives through collective action is indicative of their capacity to represent the community's interests. Good success records tend to reinforce commitment and motivation. Repeated failures by comparison are more likely to culminate in despondency and lack of confidence. Following the failure of collective efforts, it becomes more difficult to engender commitment to new collective undertakings (Otsuka 1998) and the chances of individualism becoming more entrenched are increased. Hence, some organisations whither in spite of their experience and new organisations that have

[35] Otsuka (1998) identifies three types of social sub-organisations – local development associations, cooperatives and interest associations – whose respective distinguishing attributes, in terms of objectives and the means most commonly adopted for their achievement, can be indicative of distribution patterns and social cohesion in the pursuit of sustainable community forest management.

not had the opportunity to become disenchanted may be in a better position to meet a challenge. However, their very inexperience places them at a greater risk of failure.

C&I on participation can lead to the evaluation of the membership composition and size of organisations. It can reflect concordance with the organisation's ideological persuasion, power balances within the community and direct or indirect representation of forest stakeholder groups. In the broadest sense, sustainability will be affected by the relationship between the myriad existing sub-organisations, i.e. by how well they complement each other and how effectively their respective evolutionary paths are coordinated (Wolstenholme 1990). Research on the role of community organisations in Minangkabau communities in Sumatra, led Otsuka (1998) to conclude that 'no matter how strong the traditional top-down social and administrative hierarchies were, the norms associated with customary authority and followed by the community, mitigated against the corruption or malpractice of leaders'. This is because their gradual development, often over centuries, has allowed people to understand their complexity and perceive even minor indications of irregularities.

The strength and 'fairness' of local social organisations depends on their structural and functional attributes, including:

- procedures to ensure participatory decision-making and/or other forms of representation;
- strategies for distributing the costs and benefits of CMFs;
- ability to communicate and negotiate with external parties (neighbouring communities, timber companies, government officials, NGOs, etc.);
- ability to instigate and mediate intra-community negotiation and conflict management processes;
- active involvement in monitoring forest health and social aspects of forestry, setting up of feedback loops and the dissemination of new knowledge; and
- developing, renewing and enforcing rules and regulations on forest access and the distribution of costs and benefits, to cope with problems arising from new developments.

C&I for the assessment of all these attributes were developed. The three test teams approached these issues in different ways. For instance, in the Cameroonian set of C&I the word 'participation' is not used, but the need for some participation is implied by references to representation and dialogue structures.

7.1.4 C&I: Social Organisations and Institutions

There was broad agreement on all tests that the authority community-based organisations have over decision-making and CMF distribution patterns strongly indicates their control over forest resources. Community organisations were thought to be so important to the sustainability of CMFs that they were made the subject of a principle in the Indonesian and Cameroonian social C&I subsets and of a criterion in the Brazilian social C&I subset (Table 7.2). The Cameroonian criterion '***Different forest users and interest groups of forest products coexist harmoniously'*** and its supporting indicator '***The interest of the various community forest user groups complement each other and do not adversely compete'***, also reflect social organisation; 'harmony' is a product of effective organisational skills.

The Brazilian social specialist pointed out that in Amazonia political parties commonly patronise or manipulate rural communities into supporting them and that this trend is usually more pronounced in larger communities with a bigger electorate. The proposed Brazilian social criterion '***The community exercises the right to social and political organisation***' is, however, not sufficient to judge the contribution to sustainability. Political organisation must reflect a certain level of political awareness in order to support sustainability. It is this level that is difficult to define, especially because of the potential conflicts between indigenous and alternative or dominant ideologies that are liable to be brought to light as awareness develops.

Table 7.2 Selected principles, criteria and indicators on social organisations and institutions

Indonesia	Cameroon	Brazil
5. Local social institutions support a sustainable land use system. 5.3 Local social organisation has the capacity to enforce customary law and other regulations. 6.1.1.3 There is organisation under local management that coordinates the extraction of timber. 6.1.2.1 There is organisation under local management that coordinates the extraction of NTFPs. 6.2.2 Tembawang retains its social function (organisation of C&B distribution). 6.3.2 Local organisation manages the irrigation system.	7. Responsibility for long-term forest management is assumed by community-level institutions or organisations. 7.1 Institutions or organisations exist to cater for the diverse interests of different forest users and interest groups. 3.4.1.3 Collectively organised patrols. 7.1.1.1 Village council of Wisemen or Elders 7.1.3.1 Representative community-based development associations and groups. 7.2 Community institutions have the capacity of determining and distributing benefits from forest resources.	Verifier: Existence of cooperatively run community ‘cantinas’ or ‘revendas’ (trading-posts)…. 6.2 Effective measures and institutions for conflict management must exist. 6.6. The community exercises the right to social and political organisation. 6.6.1 The community possesses forms of inter- and intra-community organisation.

7.2 Rules and Regulatory Instruments

Most CMF systems have evolved a suite of instruments to regulate how decisions are made, by whom and when, and to enforce agreed forest access and use regulations. The instruments may be either informal or formal. Informal instruments like norms, taboos and customs are usually unwritten. Normally they derive from cultural inheritance and spiritual and religious belief systems, and evolve or degenerate with wider processes of cultural transformation and environmental change.

By contrast, formal regulatory instruments are more likely to be expressed in written form. They are usually derived from decisions taken through more or less formally structured organisational processes, especially through processes developed by organisations with a ‘statutory’ role in rule making.

Whether existing rules are formal or informal has little to do with how they affect people’s behaviour. This will depend much more on whether the people under their influence think they make sense and are fair, and the extent to which they are enforced and the consistency of reprimand for those who break them. Rules governing traditional societies often internalise the wisdom of ethical and spiritual beliefs, giving these practical applications. Traditional practices, whose value has been verified over time, are perpetuated by community support. Eventually, this support may be formalised by members of the community or their representatives into binding agreements that function like rules.

7.2.1 C&I: Acceptability of Rules and Regulations

One of the first aims of monitoring should be to assess from whose point of view existing social structures and processes regulating resource access and distribution patterns are acceptable.

A measure of fairness or justice articulated by all test teams is people's agreement with or respect for a circumstance or decisions taken. This may be indicated by willingness to conform or to adapt behaviour to comply with the exigencies of existing norms, rules and regulations. C&I on the issue are included in all country sets (Table 7.3) Some scholars propose distinguishing between 'working rules' and other rules (Thompson and Freudenberger 1997)**.** A working rule is one that is accepted as fair by the majority affected, and that is adequately enforced. A rule fitting this definition is not necessarily an adequate rule because it may still discriminate unfairly against minority groups. Acceptance may result from coercion, resignation or lack of information on the full implications of the rule. There is a need therefore to distinguish between types of acceptance. In some cases acceptance will be no more than tolerance. In others it may demonstrate compliance resulting from intimidation. For acceptance to be founded on agreement in principle, it must be based on shared knowledge and understanding.

All the test teams agreed with this proposition. This is most clearly reflected in the Brazilian social criterion ***'Local awareness and knowledge of agroforestry resource use and management demonstrates an ethic of sustainable land use and conservation'*** and the Indonesian social verifier ***'All adult members of the community have adequate knowledge about the customary laws attached to land use systems'***. Ostrom (1990) also recognises this, as she imbues the definition of 'working rules' with greater precision, maintaining that such rules "…are common knowledge and are monitored and enforced. Common knowledge implies that every participant knows the rules, and knows that others know the rules, and knows that they also know that the participant knows the rules". She thus suggests the importance of communication channels, broad-based participatory rule-making and transparency in the creation of effective rules.

Table 7.3 Knowledge about and Respect for Regulatory Instruments

Indonesia	Cameroon	Brazil
5.2.1.3 All adult members of the community have **adequate knowledge** about the customary laws attached to land use systems. 5.1.2 All sections of the community **respect** customary law and other regulations on the sustainable land use. v. There is **consensus** on **how** land-use conflicts are resolved. 6.1.1.1 People **know** the regulations. 5.1.4.1 The community **respects** rules on hunting.	7.1.1 Decisions of conflict resolution institutions are **respected.** 1.3.1 Laws and regulations on hunting matters are **known** to all the participants. I. Land appropriation **procedures** are accepted and **respected**. C. Access to community forest commons is **regulated** through **collective action and suppor**t.	4.4.1.b The majority of the adult population has **knowledge** of and **agrees** with the management system. C. Local **awareness and knowledge** of agroforestry resource use and management demonstrates an **ethic** of sustainable land use and conservation.

Knowledge and understanding are not always perceived to be the same thing. Therefore more C&I may be needed to assess whether the significance of information and knowledge is thoroughly understood. Knowing what a rule is and even understanding its purpose and broader implications may not be enough to ensure respect and compliance. People are angered by rules they feel forced to break and their understanding of these rules often reinforces their anger.

The Brazilian social specialist observed that individuals' attitudes towards a rule can change depending on whether they are relating it to domestic or community affairs. At the community level, someone may fully support, in principle, the regulations in force. However, on the basis of his or her household's particular circumstances, this same person may feel equally justified to break the very same regulations and see no inconsistency in their attitude or behaviour. Self-justification of behaviour exhibiting contradictory values, and aimed at taking advantage of diverse, incompatible but equally appealing opportunities is known in psychology as cognitive dissidence. It reinforces the importance of effective mechanisms for the enforcement of community regulations. Moreover, it reflects the need to optimise cost-benefit distribution patterns so that fewer people feel compulsion to break the rules.

7.2.2 Rules Adherence and Enforcement

Wide acceptability of regulations, and the processes whereby these are defined, is indicated by rules adherence and a consensus on mechanisms for their enforcement against violation by community members and outsiders. Rule enforcement within the community can be carried out by external, centralised government agencies, by local, more decentralised authorities or by individuals policing their own behaviour (Baland and Platteau 1996). The risk of community-based organisations failing to achieve their objectives is amplified where rules on resource access, rule enforcement and sanctions for rule breakers are lacking (Otsuka 1998). Too few rules to protect investments, increases the risk of collaborative undertakings being undermined by free-riding behaviour. Regulatory mechanisms thus serve as a strong incentive to collaboration as they increase security. All the test teams' social specialists acknowledged the need for local organisations to possess effective regulatory instruments to encourage, moderate or constrain the behaviour of individuals, families, groups and the whole community.

Despite the unanimous recognition of the importance of rules and sanctions, only the Indonesian set includes C&I that explicitly refer to community capacity to enforce customary law and other regulations and to apply sanctions for those who break the rules (Table 7.4).

Table 7.4 Enforcement and Sanctions

Indonesia	Cameroon	Brazil
5.3 Local social organisation has the capacity to **enforce** customary law and other regulations. 5.1.1 There are **sanctions** for breaking the rules. 5.1.1.1. Specific sanctions are attached to specific land use systems.	–	–

7.3 Monitoring Rules Adherence and Sustainability

Sustainability is achieved over time. The sustainability of community forest resource management therefore depends on its adaptability to changing circumstances. To recognise change a system of monitoring is needed. The magnitude of threats to sustainability depends on the nature and pace of change (Colfer 1996) and on the community's capacity to respond constructively and quickly enough (see Box 7.2). It depends on the characteristics of both the community's natural and social capital. Three types of monitoring can be seen as critical to ensuring the adaptability necessary for sustainable CMFs:

- monitoring rule adherence;
- monitoring the condition of the resource; and
- monitoring methods and intensity of exploitation.

Box 7.2 Rule Enforcement Capacity of Social Organisations
(Indonesian Social Set)

Criterion: Local social organisation has the capacity to enforce customary law and other regulations.

Indicator:

- Meetings are organised on environmental and land use problems.

  Verifiers:

  - Recent case of community meeting on environmental and land use problems.
  - Relevant parties in the conflict are present.
  - Other members of the community than the conflicting parties are present.
  - There are decisions made.

Indicator:

- Women are represented equally in meetings and decision-making.

  Verifiers:

  - Women are present in meetings.
  - Women are involved in discussion.

Indicator:

- Participatory decision-making.

  Verifier:

  - Decisions are made in meetings of adult members of the community.
  - Participants understand the subject of discussion.
  - No monopoly of discussion by authority.
  - People agree on the discussion inside and outside the meeting.

Ways of monitoring the resource's condition can range from being highly formal to quite informal. Information generated on the resource's condition is useful for adapting resource management interventions such as harvesting methods and rates. Occasionally it may be possible to deduce the success of rule enforcement indirectly using C&I of correlated variables such as aspects of resource condition, but the tests developed no clear proposals on which variables would be suitable. However, it is not usually reliable to deduce the success of rule enforcement from information obtained through monitoring the resource's condition. Direct monitoring of rule enforcement is therefore desirable.

7.3.1 Monitoring Rules Adherence

Monitoring of rule adherence can provide valuable insights into the social significance of rules. It is believed to be particularly critical to the success of common pool resource management. Some rules that support existing management strategies meet with strong social resistance, while others are enforced with the support of the community as a whole. Rule compliance can therefore be indicative of different things. Other factors must be taken into account to understand why rules are obeyed. Widespread compliance may reflect broad support for rules and help prevent conflicts from arising. Very strictly enforced rules are also likely to work in many situations. However, they may work more because people are deterred from violation by a fear of drastic punishment than because they support them. Regulations associated with dictatorial rule are more likely to repress potential conflicts than to prevent their development. Interest must extend from whether the rules and sanctions enforced are sufficient to protect forest resources from over-exploitation, to whether they support a socially just system. Other questions include that of whose interests the rules are designed to protect, and how they affect the lives of less advantaged groups.

In small communities, where forest resources face no significant threat, informal rules of normative behaviour may be sufficient. In such situations, adherence is often reinforced by mutually interdependent relationships between community members. In situations characterised by greater conflicts of interest over the allocation of degraded forest resources, the need to ensure cooperation and to constrain individual activity in the interests of the environment or society at large, is likely to be more urgent. More numerous and formal rules usually become necessary along with more severe sanctions for non-compliance. Rules and sanctions will have to be monitored to assess their continuing appropriateness under changing circumstances, and to release information needed to update rules to meet the specific requirements of new problems.

Empirical research in India on forest-dependent communities that have had formal authority to manage their forests since the 1930s, showed local policing and guarding of community forests to be the strongest indicators of successful management. This led the researchers to conclude that "the capacity of a forest council to monitor and impose sanctions on rule breakers is paramount to maintain the forest in good condition"(Agrawal and Yadama 1997). The research indicates that, of all the various forms of participation, the most important was the level of participation in investment in monitoring and protection.

7.3.2 C&I: Monitoring

Comments and observations on C&I attributes

The only mention of monitoring in the Indonesian set is the verifier '***Timber extraction is monitored by the (management) authority***' for the social indicator '***Sustainable extraction of timber under community management***'. Another verifier for this indicator, '***People know the regulations***', implies a need to establish whether community members' knowledge is adequate to define expected levels of cooperation as realistic. People must be aware of rules and regulations before they can be expected to comply with them.

The complex of I&V under the Cameroonian social criterion '***Local systems exist for the monitoring and evaluation of different forest resources***' (Box 7.3)can yield information on all three forms of monitoring listed above. Similar to the Indonesian examples, the first indicator of this complex '***Destructive exploitation practices of forest and techniques are known***', suggests that being knowledgeable about what is being measured and why is a basic prerequisite to effective monitoring. Some developments take a long time to show visible symptoms and therefore escape recognition until they enter advanced stages. Ignorance of the significance of developments can obscure the need for close monitoring. Although not proposed on any of the tests, regularly assessing people's knowledge of destructive practices would be one way of monitoring their capacity to oversee forest resource exploitation and the efficacy of access and use regulations.

Criterion:

'Local systems exist for the monitoring and evaluation of different forest resources'

The indicator's verifier '***Number of community members possessing firearms'***, suggests that local awareness of the destructive potential of firearms in over-harvesting game is a factor that serves to limit their possession. However, this verifier can be unreliable given the large range of other possible explanations for the frequency of firearm ownership, including purchasing power, and people's resolve to not misuse firearms that they possess. The second verifier '***Reported cases of partial or massive destructive actions on forest resources, e.g. fish poisoning'*** shows the level of active community participation in monitoring human forest resource interventions. The verifier is useful for monitoring rule adherence but also applies to activities that take place outside the scope of rule address.

Indicator:

Community members effectively contribute to forest resource assessment'.

Verifier:

'Changes in availability of useful plants and animal species'

Relevance/logic:

The above verifier would better serve its Indicator, and the Criteria (regarding existence of a monitoring system) if it referred spefically to 'knowledge of' the above changes. This would make for a more explicit and easily verifiable point of information

The second indicator for the above Cameroonian criterion is ***'Community members effectively contribute to forest resource assessment'***. For the evaluation of this indicator some idea is needed of how the individual's contributions correspond to the nature and scale of changes. For this the verifier ***'Changes in availability of useful plants and animal species'*** is provided. However, a reliable value of this verifier is usually only available where effective community contributions to evaluation have been achieved. It is also necessary to establish whether people are able to effectively contribute to monitoring. This can be assessed with the verifier ***'Individual/collective reporting of encroachment by non-community members'***. Here the incidence of reporting would be taken as an indicator of monitoring capacity. The problem remains of establishing whether the rate of reported incidents reflects the actual incident rate. This has to be known to assess monitoring efficiency. The latter verifier is virtually identical to the verifier '***Reported cases of partial or massive destructive actions on forest resources, e.g. fish poisoning'***. However, unlike the former verifier, this covers the actions of community members as well as outsiders.

Box 7.3 Cameroonian C&I on Monitoring
(Social Set)

Criterion: Local systems exist for the monitoring and evaluation of different forest resources.

Indicator:

- Destructive exploitation practices of forest and techniques are known.

Verifiers:

- Number of community members possessing firearms.
- Reported cases of partial or massive destructive actions on forest resources, e.g. fish poisoning.

Indicator:

- Community members effectively contribute to forest resource assessment.

Verifiers:

- Changes in availability of useful plants and animal species.
- Individual/collective reporting of encroachment by non-community members.
- Changes in fallow periods.

Comments and observations on C&I attributes

Verifier:

'The majority of the community's adult population has knowledge of and agrees with the management system'

Representativeness:

While this is a useful verifier in many ways, it leaves out an important element of the population – that is the youth. Their views may have strong implications for sustainability. Also, a 'majority' could involve all the male members of the community, and yet a very small percentage of the female members of the community – still an overall majority, yet not representative nor equitable.

The closest direct references to monitoring rule adherence in the Brazilian set occur in the complex of forest management I&V allocated under the criterion '***The community has developed mechanisms for monitoring and controlling productive activities'*** (Box 7.4). Here it is proposed that monitoring be assessed at the same time as patrol controls over forest timber and NTFP management. The verifiers '***Observation of internal rules and agreements on the patrol and control of methods/practices used to extract NTFPs'*** and '***Observation of techniques used in the collection and sale of animals and ornamental plants'*** both directly concern monitoring of rule adherence, if we interpret the word observation as an ongoing action. Other verifiers included in this complex relate to the factors being or to be monitored. One example here is the verifier '***Community intervention mechanisms to prevent or curtail over-fishing and the use of predatory fishing techniques by outsiders up and down stream from the community***'. The Brazilian social subset includes the criterion '***The community participates in and monitors all the planning processes of any management system to be executed within the agroforestry area'***. This is supported by the indicator '***Active community participation in the conception and monitoring of agroforestry resource management systems'***. One verifier provided for this, '***Leadership(s) within the community are representative of all groups and factions within the community',*** leads to the evaluation of how groups that do not participate directly, do so indirectly. Another of the verifiers '***The majority of the community's adult population has knowledge of and agrees with the management system'***, signals the importance of knowledge to monitoring. This is a concern expressed in the C&I results of all three tests. This last Brazilian verifier further implies that agreement is necessary for there to be a willingness to monitor.

In view of the importance ascribed to monitoring by empirical research (Ostrom 1990) more attention seems warranted to developing C&I of monitoring processes, as well as of variables in need of monitoring to assess the long-term sustainability of CMFs.

Box 7.4. C&I on Monitoring, Patrolling and Controlling Forest Management
(Brazil Forest Management Set)

Criterion: The community has developed mechanisms for monitoring and controlling productive activities.

Indicator:

- Existence of community mechanisms for patrolling and controlling the various stages of timber extraction undertaken either by community members or outsiders.

  Verifiers:

  - Verification of the registration of 'sales contracts' in a cartorio that permits interruption in the case of the violation of the terms contained in its clauses (legal land tenure, inventory requirements, infrastructural planning, definition of species to be exploited, harvesting methods, shedding of toxic materials into water courses/reservoirs, reduction of waste production during harvesting, observation of workers legal rights, etc.)

Indicator:

- Existence of community mechanisms for patrolling and controlling the extraction of NTFPs by the community members and/or outsiders.

  Verifier:

  - Observation of internal rules and agreements on the patrol and control of methods/ practices used to extract NTFPs

Indicator:

- Monitoring and control of fishing undertaken by community members and/or outsiders.

  Verifiers:

  - Community intervention mechanisms to prevent or curtail over-fishing and the use of predatory fishing techniques by outsiders up and down stream from the community.
  - Existence of fishing agreements between communities.

Indicator:

- The community has mechanisms to control the collection and sale of animals and ornamental plants.

  Verifier:

  - Observation of techniques used in the collection and sale of animals and ornamental plants.

7.4 Conflict and Inter-community Relations

If existing rules and norms are not followed, because they are perceived as inherently unfair, unworkable or outdated in the face of new developments, then they become a potential source of conflict. The introduction of new rules and regulations can also lead to friction should they clash with the interests of some groups. On all three tests the importance of conflict management mechanisms was highlighted. We have suggested that there is sometimes a causal relationship between rule enforcement and the prevention, creation or suppression of conflicts. However, the ramifications of many conflicts extend beyond the reach of rules and regulations.

Conflicts indicate distance from the attainment of a collective vision of how multiple interests of different user groups can be integrated. For forest management to fully qualify as a community initiative, it must be subordinate to a collective vision – a goal to which all individual subsidiary interests relate and aspire. Opposing interests and decisions manifest in conflicts. The Brazilian social specialist noted that in small communities conflicts tend to be disruptive of relationships of especially high interdependence. Consequently, they readily translate into very heavy social costs. These costs divide into those inherently incurred by the nature of the conflict and those in the form of resources spent on trying to resolve the conflict.

Highly stratified or heterogeneous communities face special challenges to organising themselves around a common interest. The more heterogeneous the community, the more difficult it is to treat all its segments equally, and the more likely conflicts of interests will develop. There are inherent difficulties to uniting under a common cause landholders and the landless, the rich and the poor, patrons and their clients, i.e. groups that, in terms of their forest dependency status, differ markedly from each other.

During periods of cultural transition, dual forms of leadership and organisation often emerge. While the vestiges of an increasingly weak traditional leadership may continue to exist, new leaderships typically emerge in response to exogenous constraints and opportunities. Sometimes developments along these lines divide the community and, in so doing, generate conflict.

7.4.1 C&I: Conflict Management

Conflict management mechanisms cover a wide spectrum spanning formal and informal instruments and including ones designed to either contain, resolve or suppress dormant or active conflicts. There is a need for conflict prevention mechanisms to promote conditions conducive to maintaining peace, just as there is for mechanisms to mediate between rival groups and enhance problem solving capacity.

All three tests generated several general C&I concerning discord between villagers and some C&I that make specific reference to conflicts between villagers and outsiders (Table 7.5).

All three tests, for example, generated statements seeking to establish the existence and nature of measures, procedures and institutions for conflict resolution. In the Brazilian set it is the social criterion '***Effective measures and institutions for conflict resolution must exist***'; in the Cameroonian set it is the indicator ***'Procedures for the resolution of conflict between outside exploiters and villagers'*** and in the Indonesian set, the indicator '***There are conflict resolution mechanisms***'.

In all cases, one statement concerning conflict management between communities, or communities and outside parties, has been included. These are the indicators ***'There are conflict resolution mechanisms beyond community boundaries'*** (Indonesia, social set); '***The application of legal proceedings in the resolution of conflicts about agroforestry resources involving internal and/or external actors (neighbours, timber companies, other communities, patrons, etc.)'*** (Brazil, social set) and the Cameroonian forest management verifier ***'Procedures for the resolution of conflict between outside exploiters and villagers'***.

Table 7.5 Managing Conflict

Indonesia	Cameroon	Brazil
Criterion: •Local social organisation has the capacity to enforce customary law and other regulations. ***Indicators:*** • There are conflict resolution mechanisms. • There are conflict resolution mechanisms beyond community boundaries. ***Verifiers:*** • There is consensus on how conflict on land use is resolved. • Relevant parties in the conflict are present (at conflict resolution meetings). • Other members of the community other than the conflicting parties are present (at conflict resolution meetings). • Adult members of the community can tell how conflicts on land use are resolved.	***Indicators:*** • Decisions of conflict resolution institutions within the community. • Decisions of conflict resolution are respected. • Individual community members have the possibility of appeal. ***Verifier:*** • Procedures for the resolution of conflict between outside exploiters and villagers.	***Criterion:*** • Effective measures and institutions for conflict resolution must exist. ***Indicators:*** • Informal mechanisms exist for the resolution and negotiation of community conflicts, family disputes, and complaints about the use, possession and ownership of agroforestry resources. • The application of legal proceedings in the resolution of conflicts about agroforestry resources involving internal and/or external actors (neighbours, timber companies, other communities, patrons, etc.). ***Verifiers:*** • Solutions to conflicts and agreements are reached in a legitimate manner that represents the common interest. • Individuals' perceptions of the nature of conflict resolutions, the negotiation arena and the concrete outcome of conflicts over resources.

7.4.2 C&I: Conflict Management and Transparency

Comments and observations on C&I attributes

Indicator:
Decisions of conflict resolution institutions within the community.

User group consideration:

The indicator defines a topic for subjective review. Evaluation of the adequacy of decisions will be affected by the evaluators' interests. An interesting issue would be what, if any, are the discrepancies in how the conflicting parties evaluate the decisions.

Conflicts can only be truly considered resolved when the solution has either a positive or neutral effect on the common good. Whether this assertion applies can be assessed with the Indonesian social verifier ***'There is consensus on how conflict on land use is resolved'*** or with the Brazilian social verifier '***Solutions to conflicts and agreements are reached in a legitimate manner that represents the common interest'***. Confirmation of these verifiers is only possible if conflict resolution processes are transparent. No specific C&I on transparency were proposed in connection with the issue of conflict on the Brazilian test.

Only the Indonesian set includes statements that directly examine the transparency of conflict resolution mechanisms (see Box 7.5). The verifiers provided for the Indonesian social indicator ***'Meetings are organised on environmental and land use problems'*** address transparency in decision-making. They include ***'Relevant parties in the conflict are present'*** and ***'Other members of the community other than the conflicting parties***

Verifier:

Individual perceptions of the nature of conflict resolutions, the negotiation arena and the concrete outcome of conflicts over resources.

Type of verifier:

This is a compound verifier as it covers several factors, each of which requires separate assessment. Where possible, compound C&I should be broken down into several C&I, so that there is one for each component part. This will facilitate cross-comparisons of their values with values obtained for other C&I.

are present'. Elsewhere, the Indonesian social specialist proposes the verifier ***'Adult members of the community can tell how conflict on land use is resolved'*** for the criterion '***Customary law and other regulations ensure land use systems are sustainable land use'***.

Some statements on the outcomes of conflict resolution processes, i.e. the resulting decisions, were developed. Two social indicators generated by the Cameroonian test apply. They are ***'Decisions of conflict resolution institutions within the community***' and '***Decisions of conflict resolution are respected'***. In the Brazilian set the verifier '***Individual perceptions of the nature of conflict resolutions, the negotiation arena and the concrete outcome of conflicts over resources'*** deal with outcomes as well as other conflict-related factors. The Indonesian set does not specifically refer to the outcome of conflict management procedures.

Unlike the other sets, the Cameroonian set includes an indicator to assess the reversibility of the decisions of conflict management institutions; ***'Individual community members have the possibility of appeal'***. This important variable gives some indication of flexibility and the ability of the community to respond to new ideas and information.

The absence of conflict gives no reliable indication of a community's capacity to deal constructively with conflict. It may indicate only that, up until now, there have been no major clashes between forest interest groups. The suppression of oppressed groups within the community may explain the lack of open conflict, for instance, if client-patron relationships of interdependency exist. These often survive because the clients have no alternatives or are unaware of potential alternatives. Inequalities, such as those characteristic of client-patron relationships, often indicate dormant conflicts liable to erupt at some time in the future. At the Cameroonian test's Concluding Workshop, it was pointed out that sometimes conflicts present a positive move towards more equitable distribution patterns, and hence greater social sustainability. Conflict can therefore act as a positive force for change.

Furthermore, because CMFs are often part of a rapidly changing socio-economic environment, a current absence of conflicts may tell little about the long-term social resilience of a CMF system. Forecasting future demand for conflict management is difficult as friction is not usually planned and erupts unexpectedly. Although the outcomes of conflict management processes might suggest the appropriateness of conflict management mechanisms, neither the processes nor their outcomes are necessarily of lasting relevance. However, by focusing on the assessment of conflict management processes, the C&I evaluation procedure can examine the preparedness of communities for dealing with conflict even if there has been little need to date.

Peace and harmony are achieved when people agree on each others' roles and responsibilities in achieving CMF's multiple use objectives. Participatory processes facilitate communication between different groups about their respective roles and responsibilities. Such processes are therefore important in the prevention and resolution of conflicts. Facilitating the conciliation of interests, they help prevent conflicts arising. Many of the C&I generated on the

Box 7.5 The Role of Social Organisations in Conflict Management
(Indonesian Social Set)

Principle: Local social institutions support a sustainable land use system.

Criterion: Customary law and other regulations ensure a sustainable land use system.

Indicator:

- There are sanctions for those who are breaking the rules.

  Verifier:

  - Specific sanctions attached to specific land use system.

Indicator:

- All sections of the community respect the customary law and other regulations on the sustainable land use system.

  Verifiers:

  - Adult members of the community know fairly about the customary laws attached to land use systems.
  - People agree that customary laws is still effective.
  - There are recent cases where sanctions were felt.

Indicator:

- There are effective conflict resolution mechanisms.

  Verifier:

  - Adult members of the community can tell how conflict on land use is resolved.
  - There is consensus on how to resolve land use conflict.
  - Recent cases of traditional conflict resolution on land use.

Indicator:

- There are rules that ensure the sustainable use of the forest.

  Verifier:

  - Community respects rules on hunting.

Indicators:

- Rules that ensure the sustainability of forest service functions.
- Rules that ensure the sustainability of tembawang.
- Rules on ladang/shifting-cultivation practices that ensure an appropriate fallow period.

participation or representation of community-based forest stakeholder groups, although not directly addressing conflict management, can provide insights into the community's capacity to avoid and resolve conflicts. There is a close relationship between the variables of participation and transparency as the Indonesian statements on transparency show.

Organisational systems that lack transparency, by confining decision-making processes to obscurity, tend to be ill equipped for conflict management. The prospects for effective conflict management are commonly impaired in communities where forms of customary authority have broken down and been replaced by a closed leadership that fails to adequately consult its constituents.

Additional factors affecting the success of negotiations include the application of skill and knowledge, the participants' commitment to trying to understand various interpretations of a problem, and a tolerance of differences and a willingness to forgive. All these considerations converge to suggest multilateral adaptation is the result of successful conflict management.

7.4.3 C&I: Relationships with Third Parties and Managing Conflicts involving Outsiders

Comments and observations on C&I attributes

Indicator:

Community dialogue structures exist for the negotiation/discussion of forest management issues with State services and NGOs.

Qualitative aspects:

In this case, the more qualitative aspects of such an indicator may be very important (although difficult to measure). There may be mechanisms for negotiation/discussion, but these may not necessarily provide an equitable, accessible or effective platform for communities (and especially more marginalized parts of communities) to communicate with other stakeholders.

Compared to internal relationships, the relationships between the community and outsiders are more conflict prone because of the greater possibility of these parties possessing conflicting interests and seeing problems from different historical and other perspectives. They are therefore more likely to differ in how they define problems. As community contacts with external groups and exogenous influences increase, so does the demand for new negotiation structures on which to develop relationships and set boundaries for wants and expectations. Negotiation between internal and external groups is addressed by the social indicator ‘***Community dialogue structures exist for the negotiation/discussion of forest management issues with State services and NGOs’*** in the Cameroonian social subset. The Cameroonian forest management specialist regarded negotiation as a form of participation since it entails the active engagement of more than one party. He thus refers to negotiation in the forest management criterion ‘***Villagers participate with other stakeholders in the protection of timber resources in their communities’*** (Box 7.6).

Box 7.6 C&I on Negotiation and Conflict Resolution
(Cameroon Forest Management Set)

Criterion: Villagers participate with other stakeholders in the protection of timber resources in their communities.

Supporting indicator:

- Steps are taken by local communities to actively protect their timber species from exploitation by outsiders who may or may not be backed by the forestry service.

Supporting verifiers:

- Procedures for the resolution of conflict between outside exploiters and villagers.
- Villagers expel forest exploitation companies from their forest if they try to extract timber without first consulting with the village council.
- Collectively organised patrols.
- Compensation deals accepted by the community in exchange for allowing timber exploiters to extract timber from their forests.

An issue that featured prominently in the Cameroonian and Brazilian tests was that of compensation deals struck between commercial timber concession holders and villages that are located within concession areas. It is the focus of the Cameroonian forest management verifier '***Compensation deals accepted by the community in exchange for allowing timber exploiters to extract timber from their forests***'. In the Brazilian social subset it appears as the verifier '***The local population is compensated for damages caused to their agroforestry resources by third parties***' for the indicator '***The application of legal proceedings in the resolution of conflicts about agroforestry resources involving internal and/or external actors (neighbours, timber companies, other communities, patrons etc.)***'. In the calculation of compensation, knowledge of the value of forest resources becomes a critical determinant. Often the negotiating party with the most political influence (frequently the outside party), will use unfair practices to compensate the weaker party (frequently the community) with a package that does not amount to the full value of resources appropriated or damaged. Evaluation of the equity impact of compensation deals requires evaluating C&I of knowledge about the value of forest resources as well.

Related to the above discussions on conflict management, 'inter-community relations' in general are also significant in their relation to maximising community welfare and to security (Table 7.6). Communities can: benefit from exchange and trade with neighbouring communities; gain political strength to negotiate with external parties through numbers and unity (Box 7.7); and better protect the productivity of natural resources by preventing each other from exploiting resources beyond the remits of jointly reached agreement. (e.g., public/shared resources, such as: fish, lakes lying between communities, rivers, irrigation water, the populations of hunted animals with large territorial ranges that span communities). As populations increase, community exploitation of forest resources also tends to increase. This increases the risk of confrontation between communities.

In some cases inter-community relations are implied if not explicitly mentioned. For instance, the management of irrigation waters for paddy production is usually a responsibility assumed by a number of communities located at various points along the river being used for irrigation water. The C&I on irrigation management in the Indonesian set refer just to stakeholder agreement on distribution. In fact, all C&I that refer to stakeholder groups in general may be relevant to stakeholders that are not community members as well as those that are.

Again many of the C&I proposed that make no direct mention of outside parties will nonetheless generate information on a community's external relations. References to training and education support in the Indonesian social set are exemplary. All C&I pertaining to policy and legal matters in fact imply a relationship with third parties.

Table 7.6 C&I on Inter-community Relations

Indonesia	Cameroon	Brazil
2.2.1.2 Presence of clear and distinct boundaries recognised by the community. 4.3. Consensus on property rights exists between communities. 4.3.1 Conflict resolution mechanisms extend beyond community boundaries. 4.3.1.1 Cases of land conflicts between communities, and their resolution.	3.1.1 The forest boundaries and all those with neighbouring villages are known and respected by all concerned. 5.1.4. Boundaries of community area are known and respected by community members. 5.1.4.1 Knowledge of important features indicating boundaries among communities.	6.6.1 The community possesses forms of inter- and intra-community organisation. 5.6.3.2 Existence of fishing agreements between communities. 6.5.5.a The history and structure of intra- and inter-community organisation. 6.6.2.b. The representation of women in intra- and inter-community associations.

Box 7.7 Inter-community Knowledge Exchange and the Unification of Resource Allocation Objectives in the Arapiuns River Basin

Non-governmental organisations often play a major role in channelling information to communities. However, the more isolated communities tend to have less contact with NGOs. This was the case at the two Brazilian test site communities, where the larger, more accessible São Pedro had had more contact with the Rural Workers' Union (STR). This contact had increased the community's awareness of its regional context. Over the last few years, it has received logistical support from the STR to prepare a case against the timber company it accuses of having degraded its forests. In the process the community became more knowledgeable about the company's plans to extend its logging activities into other parts of the region.

This new knowledge, together with the community's first-hand experience of logging damage, increased local awareness of the regional effects the company's future plans. Leaders from São Pedro undertook a two-week river excursion to visit all the communities located along the Arapiuns, Arua and Maro rivers (all belonging to the Arapiuns river watershed), to discuss the timber company's plans. Because of the communities' greater isolation, their inhabitants had been unable to substantiate rumours they heard of a timber company's intentions to move into their forest. The outcome of this mission was that all the communities' leaders agreed the company should not be allowed to remain in the region. Approximately two years later, at the time of the C&I test, these communities were close to reaching an agreement with government departments on the demarcation of an extractive reserve to cover their area. Towards the end of 1998, they were granted official permission to create the reserve.

7.5 Adapting to Change

The relevance of standards and rules governing forest resources varies over time, requiring that these be updated. Amendment will be necessary as changes occur in the supply and demand of resources, the community's size and composition and its degree of integration in the national economy. Social innovation then becomes important to maintain control over forces determining change and its side effects. Mechanisms that would benefit from innovation (e.g., decision-making, rule enforcement, management methods) need to be identified, as well as the existing capacity to adapt to new conditions.

Innovative or adaptive capacity can be severely restricted by a lack of means. However, where room for manoeuvre exists, the ability to adapt still depends on a flexible attitude, sufficient knowledge and skills, and on a vision that makes the application of these turn intentions into reality. Monitoring the changes in cause and effect relationships is an important element in guiding development.

Local organisations play a critical role in coordinating and supervising the monitoring activities that precede adaptation. An important element of this role is the activation of communication channels to disseminate information about monitoring and its results or outcomes. The role of social organisations in forest resource decision-making and regulation tends to be all the more critical in larger communities whose socio-economic complexity overtakes the capabilities of informal mechanisms to control change. The extent to which this role is successfully assumed reflects the community's ability to adapt its organisational capacity in accordance with the demands generated by its growth.

Table 7.7 Selected C&I on Community Relations with Third Parties

Indonesia	Cameroon	Brazil
7.1.3.6 Information exchange with information sources outside the community.	3.4. Villagers participate with other stakeholders in the protection of timber resources in their communities. 3.4.1. Steps are taken by the local community to actively protect their timber species from exploitation by outsiders who may or may not be backed by the forest service. 3.4.1.1 Procedures for the resolution of conflict between outside exploiters and villagers. 3.4.1.2 Villagers expel forest exploitation companies from their forest if they try to extract timber without first consulting the villagers. 3.4.1.4. Compensation deals accepted by the community in exchange for allowing timber exploiters to extract timber form their forests. 5.4.1 Response to calls by village heads and opinion leaders for collective action against intruders, e.g. forest exploiters and non-community members. 5.4.1.1 Cases of incidents with intruders.	7.1.3 Community dialogue structures exist for the negotiation/discussion of forest management issues with state services and NGOs. 5.6.3.1 Community intervention mechanisms to prevent or curtail over-fishing and the use of predatory fishing techniques by outsiders up and down stream from the community. 6.2.2.c. The local population is compensated for damages caused to their agroforestry resources by third parties. 6.7.3. Community dependence upon external subsidies provided by NGOs, religious organisations and/or the government. 6.7.3.a Community efforts to give continuity to management systems introduced or being implemented by external actors. 2.1.6.3 Informal and institutional mechanisms (e.g. IBAMA patrols and inspections) exist, effectively controlling commercial hunting in the CMF area.

7.5.1 C&I: Adapting Rules and Regulations

Only the Indonesian and Cameroonian C&I sets include statements (I&V) that refer to community capacity to respond to change by adapting and/or creating new rules and regulations. The Cameroonian set includes the social indicator ***‘Communities have the capacity to develop new rules and practices of exploitation in response to perceptible changes in the resource base’*** *(Table 7.8)*. In the Indonesian social subset we find the indicator ***‘New regulations and sanctions that can cope with new development problems on land use and natural resources are still being developed’***.

Both these indicators require assessment of whether new rules and regulations are developed in response to perceived changes and whether they address problems arising as a result of environmental or socio-economic change. If such developments are evident, the implication is that the community monitors changes in one way or another. Whether people have participated in monitoring, or are informed of the findings of monitoring, can be established by the Indonesian social verifier ‘***People can differentiate between traditional and new regulations/rules that the community has agreed upon***’.

The capacity of the community to create its own rules is addressed with the Indonesian social verifier ‘New regulations/rules are initiated locally’. *This verifier also helps evaluate how closely rules and regulations address locally perceived problems.*

Table 7.8 Creating new regulatory instruments

Indonesia	Cameroon	Brazil
5.34 **New regulations** and sanctions that can cope with new development problems on land use and natural resources are still being developed. 5.3.4.1 People can differentiate between traditional and new regulations/rules that the community has agreed upon. 5.3.4.2. New regulations/rules are initiated locally.	5.4.2 Communities have the capacity to develop **new rules** and practices of exploitation in response to perceptible changes in the resource base. 5.4.2.1 Recent changes in traditional forest use regulations and/or exploitation practices and techniques.	—

7.6 Land and Tree Tenure

In many traditional forest communities the social organisation of space has evolved according to the proximity of kin. As the community becomes larger and more complex, establishes more links with the outside world and pressures on forest resources mount, so new and more complex institutions are required to ensure a coherent and binding approach to the distribution, protection and defence of resource access.

All test teams agreed that, depending on a number of other variables, land tenure situations invoke strong negative or positive trends towards forest sustainability. The opinion prevailed that forest community inhabitants should enjoy security of land tenure at all costs. Security of tenure was considered by the test specialists to be a fundamental right of traditional and indigenous forest inhabitants. It was seen as an essential prerequisite to sustainable CFM even though this it is not a guarantee by itself.

Although none of the team members made the distinction, we believe it is important to distinguish between two aspects of tenure:

1. The land and resource tenure of the community as an entity which gives its members the authority to collectively manage land and resources, and to negotiate the terms for contracting this authority out to third parties.
2. Traditional tenure systems operating within the community.

The first aspect presents the policy and legal question of how far the national government should go towards guaranteeing tenure rights of local communities and associated management responsibilities. Many people believe the State should allocate land tenure and use rights to communities as entities, rather than directly to their individual inhabitants, for distribution amongst members according to customary regulations. Empirical research shows forms of individual land ownership introduced by newly adopted economic orders frequently undermine cooperation in common resource management**.** These issues are discussed in more length in the chapter reviewing C&I related to policy issues.

Internal tenure systems vary greatly in different parts of the world, in terms of the types of tenure arrangements existing between individuals and the community as a whole. In most cases, the State has only the most superficial understanding of the relevant customary laws.Many believe that interference in customary laws should, therefore, be minimal to avoid friction, and that conflicts arising from the internal distribution of access to land should be the communities' responsibility to resolve.

To what extent internal systems of tenure and use regulation should be accountable to external systems is debatable. Various degrees of external regulation of traditional tenure systems exist. It is important to increase knowledge about traditional systems in order to fully understand the implications of their subordination to external controls.

Collectively, the myriad tenure arrangements existing in a community constitute a social institution that accommodates the political aims of the ruling group, class or caste. Important inferences about equity, capacity and opportunity can be made from the existence, security and conditions tied to land or tree tenure arrangements and agreements. Access to land and land use rights are clearly indicative of relative social welfare and power. They equate with access to natural capital from which wealth can be generated. They therefore tend to be good indicators of political and economic status.

It is surprising that none of the C&I proposed on the tests specifically addresses the conversion of common land into a marketable commodity. This is especially so in the Brazilian case. In the Brazilian Amazon region the commoditisation of land is a common phenomenon associated with an array of disturbing social consequences, such as a growing landless rural population and the pushing back of the forest frontier by dislocated forest farmers. We presume little or no evidence of this trend was found at the Brazilian test site.

7.6.1 C&I: Land Tenure and Conditions attached to Security of Tenure

Land tenure arrangements are essentially contracts that stipulate how land may be used under certain conditions. In the Cameroonian and Indonesian tests the social specialists stressed the importance of rights of access to common resources and security of tenure being tied to the fulfilment of conditions and responsibilities designed to ensure forest resources are not plundered. Responsibilities and conditions may be traditionally defined and imposed. Alternatively, they may imposed by policy prescriptions or by law.[36]

Some conditions attached to land tenure security are more effective than others in protecting forest resources from unsustainable use or conversion. The Indonesian social principle ***'Secure community tenure systems support sustainability'*** suggests the conditions tied to land tenure must be examined, as it is these that determine whether tenure systems support sustainability (Table 7.9). The existence and scope of such conditions may be revealed by C&I of customary law and of national laws and policies. The question remains as to which conditions should be attached to tenure rights and which forms of land use should be subject to regulation regardless of tenure arrangements. The Indonesian social verifier ***'Specific sanctions attached to specific land use systems'*** is the only statement in the three country sets that refers to sanctions attached to specific land use forms, whether land ownership is private or communal. It is part of the conflict management complex associated with the Indonesian criterion '***Customary law and other regulations ensure sustainable land use systems'***.

[36] In some Brazilian Amazon states, squatter farmers are now given concessionary land titles in situations where they would previously have qualified for definitive, fully transferable land title deeds. The concessionary titles bestow permanent land use rights but prohibit the sale of any part of the land and require that at least 50% of it remains under forest cover. This helps to curtail forest conversion to pasture, which previously was closely linked to land speculation.

Table 7.9 Selected P, C, I&V on Land Tenure

Cameroon	Indonesia	Brazil
Principle: Long-term community access rights to land and forest resources are clearly defined, known and accepted. ***Criteria:*** • Evidence of access/use rights demonstrated by community members. • Forest products contribute significantly to the socio-economic well-being of the different age and sex groups in the community. • Sites of special socio-cultural, historical and touristic values to local communities are known and protected by social control mechanisms. • Access rights to community forest commons is regulated through collective action and support. • Community management and use of forest resources and State priority goals on forest management and development are compatible.	***Principle:*** Secure community tenure systems support sustainability. ***Criterion:*** • Secure community tenure systems are guaranteed by the State. ***Indicator:*** • State laws and regulations guarantee secure community tenure. ***Criteria:*** • Government plans and development programmes are based on considerations of local tenure and land utilisation systems. • There is consensus on property rights between communities.	***Principle:*** The activities for the management of agroforestry resources maintain the biological, socio-economic and cultural well-being of the local population in the long term. ***Criterion:*** • The local population's land usufruct possession and occupation rights are secured in the long term. ***Indicators:*** • The local population's land usufruct possession and occupation rights are secured in the long term. ***Verifiers:*** • Survey of land use rights, possession and ownership rights. • Survey of legal and customary rights of concession of land use, possession and ownership rights. • Existence of customary agreements within the community concerning land use and agroforestry resources.

Many of the Indonesian C&I formulated on tembawang, directly or indirectly concern conditions attached to tembawang access. The customary regulations governing tembawangs amount to an institutionalised form of land ownership that integrates individual and communal ownership patterns in space and over time (Box 7.8).

An important consideration is that both private and communal property rights can generate externalities unless special regulatory mechanisms exist. It makes no difference what form of ownership land is under; local soil erosion can cause the sedimentation of rivers, the use of local wells can lower the water table elsewhere, local deforestation can result in forest fragmentation that hampers the reproduction of certain animal species, etc.

With regard to private property, agreement is needed on the ownership status of fauna species whose migratory routes pass through such property and whose capture on such property could affect the species' populations elsewhere. Hunting rights in forests and fallows on individually owned holdings, are commonly contested in forest communities. This controversial issue is one of several bridging common and private property. These issues should perhaps be subject to a set of restrictive conditions which, for the sake of ecological integrity, should apply to all land tenure arrangements across the board. In this case some more specific C&I on the scope of conditions attached to land tenure might be appropriate.

Box 7.8 Tembawang Forest Gardens: Tenure Regulations for Intra- and Inter-generational Access to Forest Resources

In the Dayak tradition of the Darok and Bedigong villages, inheritance laws ensure that tembawang forest gardens, and in particular the trees standing within them, will be delivered into the stewardship of future generations. The tembawangs are planted and established on shifting agricultural plots during crop cultivation or shortly before the plots are fallowed. Initially, the trees are the private property of the individual or family who planted them. When these people die, the nuclear families of the next of kin inherit the user rights and responsibilities attached to the planted trees and the area they occupy. With each generation, these rights and responsibilities are inherited by a larger descent group. Thus, the benefits derivable from tembawangs gradually spread across an ever-larger descent group, including, with each successive generation, more family units more distantly related. Eventually, the trees that were originally individual, private property, pass to virtual communal ownership through the expansion of the descent group over the decades.

Tembawangs can be converted to other forms of land use. However, the conditions for conversion are rigorous and include the establishment of new tembawang elsewhere. The older the tembawang, the more people hold access shares to it, and the more difficult and unlikely it becomes to reach the agreement needed for conversion.

We can conclude therefore that tembawangs fulfil multiple social roles by:

- meeting the needs of current generations;
- ensuring future generations reap the benefits of investments made by current generations;
- ensuring future generations equitable access to tembawang resources; and
- laying the foundations for social collaboration between those who share rights to tembawangs, as rules require cooperation between the shareholders to guarantee the survival of tembawang.

The inheritance regulations, designed to guarantee its survival and perpetuate its social role, are an integral part of the tembawang system. The deterministic magnitude of tembawangs makes them an important pillar upon which the social integrity of the community as a whole rests.

Tembawangs illustrate how social 'forest benefit' pathways can flow through kinship and social relationship networks to distribute forest benefits among present and future generations. These networks are normally a product of the cultural history of traditional communities. Their complete or partial disruption can translate into heavy social costs and greater inequity. The more effective the traditional networks are at fairly distributing access rights between community members and generations, the higher the social costs likely to result from their disruption. The tembawang inheritance system delivers the fruits of individual labour into the community of future generations, for their benefit. It serves as a social welfare protection mechanism. It serves to ensure future sharing of resources. The rules governing the day-to-day exploitation of tembawangs protect their productive capacity. They also exist to ensure that, the long-term social welfare conferred by tembawang inheritance, is not compromised.

Criteria, indicators and verifiers created for assessing the sustainability of tembawang gardens included the following:

C&I:

'***Customary law and other regulations ensure fair access to community natural resources and fair distribution of their products among community members***'; '***Tembawang forest gardens' social functions are retained***'; '***Rules that ensure fair distribution of tembawang products to all stakeholders***'; '***The vegetation structure of tembawangs resembles that of natural forest***'.

V:

'***The extraction of NTFPs is coordinated by local management organisations***'; '***Decision-making on tembawang enrichment or conversion is a social and not an individual occasion***'.

7.6.2 Other C&I Relating to Security of Tenure

In the Cameroonian set, the C&I complex under the social principle '***Long-term community access rights to land and forest resources are clearly defined, known and accepted***' guides assessment of the compatibility between land tenure and forest sustainability. It calls into question the relationship between access/use rights, the distribution of forest benefits and the protection of special sites. Additionally, it aims to reveal how effectively common resource access is collectively regulated. All these issues reflect, to varying degrees, the responsibilities assumed by the community for natural resources. How external factors affect the capacity of the community to assume responsibilities must also be considered.

i) Acknowledgement of Traditional Tenure Rights versus the Development of New Ones

The social specialists concentrated on developing C&I for the assessment of traditional, locally initiated and 'owned' systems of distributing and securing land tenure and resource access rights. This is in agreement with one of the test's foremost objectives: identifying the community's own managerial capabilities. Additionally, many of the social C&I on land tenure were formulated on the underlying assumption that State authorities should focus on legalising existing traditional rights rather than on altering these or creating new ones. On all tests, C&I were thus developed to ascertain the extent to which already-established 'community tenure systems' (Indonesia), 'customary tenure' (Cameroon) and 'customary land possession rights' (Brazil) are officially recognised (Table 7.10). Such recognition was considered necessary to prevent national policy and legislation from posing obstacles to the smooth, appropriate implementation and evolution of traditional systems.

Table 7.10 Selected C&I on Official Recognition of Customary Land Tenure

Indonesia	Cameroon	Brazil
4.1.1 Secure community tenure system is guaranteed in state laws and regulations. 4.1.2 Community property rights are indicated on official land use maps. 4.2 Government plans and development programs are based on consideration of local tenure and land utilisation systems.	5.1.3 Formal legal frameworks accommodate customary tenure. 5.1.3.1 Acceptance of customary use rights by State Law Courts	6.1.1 Customary land possession rights and concessionary agreements concerning the management of agroforestry are recognised.

When developing C&I we need to be aware that the use of the term 'Security of Tenure' could suggest that existing rights should somehow be converted to new legal rights in order to grant security. Under some circumstances new legal rights may offer the best solution.[37] However, both theoretical arguments and empirical evidence exist to show such developments can easily damage or destroy indigenous concepts of occupation and usufruct, and turn land and some rights into commodities (Baland and Platteau 1996 p. 43). Both social and environmental problems are likely to escalate as a result.

[37] See Smith 1996, p. 203.

ii) Tree Tenure

None of the tests generated any C&I specifically related to tree tenure. This issue was, however, discussed on the Indonesian and Cameroonian tests. At the Cameroonian workshop the importance of tree tenure and its recognition by national law was stressed in connection with the inter-generational transfer of resources. It was generally agreed that those who plant trees should be legally recognised as the rightful owners of the trees they plant. Where this is not the case, incentives for people to plant or protect trees is reduced. The point was made on the Cameroonian test that many people will die before the trees they plant reach harvestable age. Some form of reliable registration of who plants which trees is required so that when the planters of trees die, their offspring, or another party indicated by themselves, can inherit the trees. Many traditional societies have time-honoured norms on tree ownership, transfer and inheritance. Often, however, they do not conform with national legislation on tree tenure.

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

Chapter 8.

Policy and Legal Dimensions of Sustainable Community Managed Forests

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

CHAPTER 8.
POLICY AND LEGAL DIMENSIONS OF SUSTAINABLE COMMUNITY MANAGED FORESTS

Chapter 8. The Policy and Legal Dimensions of Sustainable Community Managed Forests[38]

8.1 Overview

Our interest in legislative and policy issues centres on their capacity to promote ecologically sustainable and socially equitable CMF. Around the world an increasing number of CMF systems and initiatives need, more than ever, the supportive backing of a strong policy and legal framework to deter free-riding behaviour (especially of outsiders), the creation of negative externalities, and to mitigate the adverse consequences of free competition.

Legislation and policies can pursue this objective simultaneously from two, potentially mutually supportive, angles. On the one hand, they can support or create conditions conducive to sustainability and equity; on the other hand, they can also transform or eradicate conditions antagonistic to this goal's achievement. A cross-sectoral approach helps to ensure laws and policies governing diverse sectors complement each other to promote the sustainability of CMFs. This consideration is paramount where sustainable, integrated development is the stated overriding goal. Furthermore, there must be compatibility between local and national interests – policy and law proposals to ameliorate local conditions must be assessed within a regional context to bring into focus any geographical side effects. The promotion of CMF locally should not place societal welfare in jeopardy by generating negative externalities.

On each of the three tests, a clear consensus emerged that policies and laws must:

- recognise forest peoples' <u>rights</u> to forest resources and to live under the conditions upon which their cultural identity depends.

For this to be satisfactorily achieved, it was further agreed that policies and laws must:

- enable forest communities to maintain or regain <u>authority</u> over the sustainable management of their natural resource base.

Fulfilment of the above objectives could generate positive externalities for the benefit of society at large. There is reason to believe that, for example, rural-urban migration and its associated social costs in terms of urban poverty would be diminished by the above. Persuasive arguments exist that government spending can be more efficiently targeted to forest conservation and associated watershed protection through legalising indigenous territorial claims. Empirical evidence suggests that the creation of indigenous reserves can reduce the need for policing adherence to environmental law within these areas, as substantial responsibility for this will be assumed by the reserves' inhabitants (von Hildebrant 1990).[39]

Government as an institution is responsible for ensuring that none of its constituents suffers the violation of basic human rights. This can present a dilemma where different ethnic groups within a nation wish to remain or again become politically autonomous. The human

---

[38] This chapter is written by Nicolette Burford de Oliveira with Bill Ritchie.

[39] Frequently, intrusive external forces overwhelm indigenous resource control in reserves (e.g., Yanomani in Brazil). There are also cases where the indigenous community has itself overexploited natural resources within its reserve areas, showing a failure to adequately plan and/or police its own activities (e.g., some Caiapo reserves in Brazil).

rights records of some indigenous systems of governance do not conform to national or international standards. Elsewhere the reverse applies. Some national governments fail to respect indigenous concepts of governance that are different to their own and arguably, in some cases, more socially 'just' than their own. The legal and political relationships between quasi-autonomous ethnic states and the larger nation states within which they are located are often very complex. This complexity can be especially pronounced where cultural integration is advanced or where the national government seeks to appropriate resources located on indigenous land. The sustainability of cultural diversity and social welfare depends on how policy and law reform processes deal with such dichotomies.

In our review of the C&I generated on the significance of policies and laws to CMFs, we identify six dominant interlinked concerns:

- Legal and policy provisions to accommodate customary land tenure and legal systems (8.2);
- Compatibility between community and State management and development objectives (8.3);
- The role of communication and community participation in policy and law development (8.4);
- The roles of state and community mechanisms in managing conflict. (8.5);
- The need for laws and regulations to directly restrict forest resource exploitation (8.6); and
- Social welfare policy domains with an impact on forest resource sustainability (8.7).

Below we present the C&I proposed for assessing these areas of concern, along with some commentary on the rationale behind them. We also point to issues we feel are important but which were inadequately addressed by the proposed C&I.

8.2 Legal and Policy Provisions to Accommodate Customary Land Tenure and Legal Systems

Throughout the world, nation states have assumed the responsibility for distributing private and shared access to land and forest resources through the creation and enforcement of laws and policies. In most cases, the laws and policies make security of tenure conditional, i.e., some forms of land use and/or transactions are not permitted.

The State's recognition of community tenure rights was identified as an essential, underlying precondition for sustainable CMF on all tests. The idea that the State must commit itself to ensuring the community's tenure rights was not contested. This was thought to be a prerequisite for collaboration between the State and the community on the implementation of other measures promoting sustainability. Without secure tenure rights recognised in law, communities are never entirely free from the threat to their resource access posed by timber companies and other external entrepreneurs or land grabbers.

The Indonesian team developed the most detailed complex of C&I for the assessment of land tenure security. The Indonesian social criterion ***'Secure community tenure systems are guaranteed by the state'*** overtly suggests that the nation state committed to sustainability has the obligation to secure natural resource tenure for forest communities (Table 8.1). Fulfilment of this criterion is indicated by whether ***'State laws and regulations guarantee secure community tenure systems'***. The additional indicators proposed for the criterion are intended to elicit evidence of official recognition of community tenure, such as community lands being accurately portrayed on official maps and honoured by State forest development programmes. The related verifiers are ***'Participatory mapping'*** and ***'Absence of overlapping tenure rights'***. Community participation in the mapping of lands will help ensure the reliable representation of land claims.

In the Cameroonian social C&I subset the issue is addressed by the principle '***Long-term community access rights to land and forest resources are clearly defined, known and accepted***' together with its supporting indicator '***Formal legal frameworks accommodate customary tenure***' and the verifier '***Acceptance of customary use rights by State Law Courts***'.

Table 8.1 Selected P, C, I & V on State Provisions for Land Tenure Security

Cameroon	Indonesia	Brazil
Principle: • Long-term community access rights to land and forest resources are clearly defined, known and accepted. ***Criterion:*** • Evidence of access/use rights demonstrated by community members. ***Indicator:*** • Formal legal frameworks accommodate customary tenure. ***Verifier:*** • Acceptance of customary use rights by State Law Courts. ***Criterion:*** • Community management and use of forest resources and State priority goals on forest management and development are compatible.	***Principle:*** • Secure community tenure systems support sustainability. ***Criterion:*** • Secure community tenure systems are guaranteed by the State. ***Indicator:*** • State laws and regulations guarantee secure community tenure. ***Criterion:*** • Government plans and development programmes are based on considerations of local tenure and land utilisation systems.	***Principle:*** • The activities for the management of agroforestry resources maintain the biological, socioeconomic and cultural well-being of the local population in the long term. ***Criterion:*** • The local population's land usufruct possession and occupation rights are secured in the long term. ***Indicators:*** • Customary land possession rights and concessionary agreements concerning the management of agroforestry resources are recognised. ***Verifiers:*** • Survey of legal and customary rights of concession of land use, possession and ownership rights.

The three test teams each reached agreement that the State and the community need to unite under a common definition of the community's tenure rights, and that this definition may vary from one case to the next. All teams similarly accepted the importance of the State recognising and honouring existing traditional forms of 'internal' land tenure. The general opinion was that only very rarely will the ideal definition of a community's land tenure rights (which itself will vary from place to place and from person to person) correspond with the national land law prototype. The transformation and division of land traditionally under communal ownership into individually owned landholdings, often contributes to the destabilisation of cooperative ties between community members rooted in common resource management. This can lead to conflict.

All test teams maintained that, whenever possible, the law should provide for community land tenure to evolve from traditional tenure models. On the Brazilian test, the prevailing opinion was that the State should guarantee collective tenure rights that the communities can then divide in compliance with traditional guidelines. There would be, however, certain conditions set down by the State that protect societal interests that communities would be legally required to accept. In many countries, it is under debate as to what extent internal systems of land access distribution and regulations should be made accountable to external legal systems.

With the possible exception of the Brazilian social verifier '***Survey of legal and customary rights of concession of land use, possession and ownership rights***', none of the tests produced C&I that address the nature of conditions, legal or otherwise, attached to land tenure security.

Attention to this detail could be extremely useful, since such conditions can be powerful determinants of patterns of social change. The idea that rights of access to land should be tied to its use has been widely upheld in policy forums and by academics (Christodoulou 1990). In fact, in traditional societies throughout much of Africa and Amazonia this is the norm for privately held (but not owned) or communal land. Enshrining these conditions within the law could guard against rural capitalism culminating in more skewed land ownership distribution patterns. Even so, policies and laws that tie access to land with restrictive land use must normally include a package of conditions (or set of decrees) designed to ensure the tie does not lead to adverse environmental consequences. In Brazil, for instance, until recently linking tenure security with productive land use caused deforestation as farmers cleared forest to prove land was being brought into agricultural production. New legislation has since considerably offset this undesirable outcome.

State policies and laws often create conditions under which communal land can be converted into privately owned holdings and thus a marketable commodity. The broader implications are numerous and they extend over social, economic and environmental spheres. At the larger of the two Brazilian test site communities, the question of how land sales would affect the community's social structure was topical among some of its leadership, although such sales to date have been rare. Despite the far-reaching implications of capitalisation and land sales, no C&I that specifically address these issues were created on any of the tests.

8.3 Compatibility between Community and State Management and Development Objectives

If the national law is to embrace the interests of all citizens then careful analysis is required of the rights and responsibilities of different groups and which compromises are to be upheld by the law. To address these issues, it is necessary to distinguish between stakeholder groups, who may have an interest in community forest resources, and shareholder groups, that exclusively hold the right to control community forest resources and the distribution of costs and benefits arising from them.

8.3.1 C&I: Compatibility between Local Objectives/Capabilities and State Policies and Laws

Comments and observations on C&I attributes

Indicator:

State and NGOs assist communities in sustainable forest management.

Value judgement:

The phrasing of the indicator (i.e., "assist") leaves this indicator open to considerable value judgement/ interpretation. To make this a useful indicator it would need to be specified directly or through its verifiers.

The Cameroonian social C&I, we have already mentioned, emphasises compatibility between the forest management and development goals of the community and those of the State. Among these are several indicators and verifiers concerning compatibility that are dispersed under several criteria. The issue is also the subject of a full C&I complex (Box 8.1), headed by the criterion '***Community management of forest resources and State priority goals on forest management and development are compatible***'. The legal recognition of community land and resource tenure rights is indirectly addressed by the criterion's supporting indicator '***Capacity of the legal system to include the aspirations of local communities in forest management***'. The content of and changes in forest policies and regulations, and the outcome of law reforms, are the subjects of the indicator's related verifiers. Together, the indicator and its verifiers imply that some communication between the State and the community is needed to unify the activities of different interest groups under a common end-goal of sustainability and for monitoring to lead to mutual cooperation in implementing management adjustments. Without communication, compatibility when it does appear will be coincidental and, as such, may be only transitory.

The second indicator ***'State and NGOs assist communities in sustainable forest management'*** for the Cameroonian criterion on compatibility implies appreciation of this need. The indicator aims to identify initiatives taken by the State and NGOs to actively promote sustainability. One verifier to evaluate the quality of assistance provided is ***'Initiation of procedures for obtaining legal 'Community Forests'***. This reflects the delivery (or failure thereof) of practical, readily understood and implemented extension advice. Another verifier is whether education programmes are appropriately developed to further integration of community and State goals. We return to further discuss this complex of C&I in relation to education policy.

Box 8.1 Integration of CMF Systems and State Priority Goals
(Cameroonian Social C&I Set)

Criterion: Community management of forest resources and State priority goals on forest management and development are compatible.

Supporting indicator:

- Capacity of the legal system to include the aspirations of local communities in forest management.

  Supporting verifiers:

  - Content of forestry policy and regulation.
  - Changes in jurisdiction.

Supporting indicator:

- State and NGOs assist communities in sustainable forest management.

  Supporting verifiers

  - Initiation of procedures for obtaining legal (formal) community forests.
  - Appropriate development of education programmes.

8.3.2 Communities, Capitalism, and Development Objectives

As outlined in Box 8.2 below, the integration of a community into a capitalist economy – whether as an intentional development strategy or unsolicited – incites significant enough impacts that one of the teams developed a subset of C&I specifically relating to them. São Pedro, the larger of the two Brazilian test site communities, was significantly more integrated into the mainstream capitalist economy, than was the smaller community, Cachoeira de Maró.[40] The test team did

[40] We do not intend to overlook the influence capitalism exerts over more isolated forest communities in the region of the Brazilian test site or elsewhere. The smaller of the two Brazilian test site villages is heavily dependent on river tradesmen (*regatões*) who purchase their agricultural and forest produce at very low prices and sell essential commodities at highly inflated prices. Access to capital has helped communities with better access to markets to purchase their own ships and thus break away from dependence on *regatões*.

not attempt to quantify wage labour or landlessness in São Pedro, but the majority of families appeared to cultivate their own land in the traditional way. However, the timber company which operated in the area until recently has profoundly affected the community's economic order. Several villagers complained bitterly about the company's exploitation of labourers as well as about its mismanagement of timber resources. Local conditions suggest the community's economic order could undergo more drastic transformations as a result of future participation in the market economy. Aware that this possibility could transpire and cause wealth inequalities to wider within their community, villagers have started to organise themselves to control changes of this type. The Brazilian social specialist saw the present time as a critical juncture in the community's economic history. This, and the international importance of capitalism in reshaping subsistence economies, led him to formulate a series of C&I for assessing the impact of rural capitalism on labour, and on politico-legal instruments designed to mediate this impact (Box 8.2).

Box 8.2 Legal and Policy Measures Necessitated by Processes of Capitalisation
(Brazilian Social C&I Set)

Criterion: Workers' rights and conditions are appropriate and at least considered just in employment relations between community members and external actors, concerning the use of agroforestry resources.

Supporting indicator:

- Salaries and benefits are appropriate in relation to the tasks performed.

Supporting verifiers:

- Community members have basic workers' documentation and access to legal benefits.

Supporting indicator:

- Absence of underpayment and the exploitation of child and female work.

Supporting verifiers

- Pertinent labour legislation is enforced.
- The history, structure and allocation of labour within the community over recent decades. Supporting indicator:
- The right to class organisation is guaranteed.

Supporting verifiers:

- The history and structure of intra- and inter-community organisation.
- The history of the community's participation in the definition of public policies of local and regional impact.

Supporting indicator:

- The right of collective negotiation between the community, its representatives and external actors is guaranteed.

Supporting verifiers:

- Contemporary histories of relations with external actors and the negotiation mechanisms used by external actors.

The above box highlights one of the difficulties in assessing change in forest communities and the policy or legal response to this: definition of terms. What criteria should be employed to differentiate, for instance, between those children whose *work* on their own family farms is often justified on the grounds of being a learning and socialisation process, and those who are engaged in similar activities elsewhere but are being exploited as cheap labour? This is a reminder of the importance of clarifying words (e.g., *work*) and terms (e.g., *child labour*) used in C&I that can readily generate ethnocentric assumptions. This consideration is critical if C&I are to guide policy and law reform towards more accurately targeting and protecting certain groups, such as children, within forest communities undergoing rapid cultural and economic transformation.

8.4 The Role of Communication and Community Participation in Policy and Law Development

The Cameroonian team did not create any indicators that specifically examine how the forest community proactively assists the State apply local knowledge to tailor assistance to its needs. However, the Cameroonian social indicator '***Community dialogue structures exist for the negotiation/discussion of forest management issues with state services and NGOs***' reflects recognition of the need for dialogue between the community and the State to inform policy making.

The question of communication between policy makers and the community is more explicitly raised in the Indonesian social subset. Verifiers accompanying several of the C&I in this subset aim to assess whether policy-guided government plans and development programmes are based on information exchange and participation. However, even here no stress is placed on establishing how proactive community participation is (Box 8.3).

Box 8.3 Knowledge Mobilisation to Administer Policies in Support of Agroforestry
(Indonesian Social C&I Set)

Criterion: **Optimisation of the local agroforestry system**.

Indicator:

- There are policies and activities to rationalise the ladang (shifting cultivation) system.

Verifiers:

- The use of local knowledge.
- Mobilising scientific knowledge.
- Training.
- Field trials.

The inclusion of '***Field trials***' as a verifier, allows some assessment of whether policy makers are taking steps to encourage community participation in the monitoring of potential solutions to local constraints. Should monitoring show these solutions to be viable, then stronger policies in support of their dissemination and implementation can be created.

Participation in policy and law making and government planning was seen by all the test teams as central to building consensus and, therefore, also to the coordination of government and community activities to support the dual goal of ecological sustainability and socio-economic equity.

8.4.1 Participatory Processes as a means to Prevent and/or Manage Conflicts

Although no C&I were created that directly address the role of participatory policy and law formulation as a means of conflict prevention and management, this can be inferred from the other complexes of C&I on these processes. Several Cameroonian C&I refer, as we have seen, to dialogue structures between the community and the State. Such dialogue structures promote informed policy making, thereby increasing the chances of policies responding constructively to problems affecting CMF. Indonesian C&I on tenure security raise the importance of community participation in the official, geographical definition of tenure rights. Although these C&I make no direct mention of conflict, their relevance to conflict management is indisputable.

The Indonesian social subset contains a complex of C&I for examining a community's participation in planning and implementing government plans and development programmes that will affect local tenure or land utilisation systems (Box 8.4). This set of statements leads to consideration of how participatory processes help ensure that government's plans/programmes adequately provide for different local land use systems. By virtue of its focus on participation, the complex can also reveal how well conflict between the community and the government is being prevented or managed.

Box 8.4 Community Participation in Government Development Programmes
(Indonesian Social C&I Set)

Criterion: Government plans and development programmes are based on local tenure and land utilisation systems.

Supporting indicator:

- Local land use systems form part of any development programme.

  Supporting verifiers:

  - The local community fully participates in planning.
  - The local community fully participates in implementation.
  - Gender equality in all processes.
  - There is participation in decision making on benefit sharing.
  - All categories of community members fairly participate in benefit sharing.

8.4.2 Government and Legal Apparatus Accountability to the Rural Constituency – Community Controls on the Power of Government and the Law

Many historical and contemporary examples exist to teach us that government policies and legislation cannot be relied upon to uphold the principles of sustainable resource use, social equity and liberty. Several of the C&I reviewed above suggest that policies and laws need to be scrutinised for their complementarity or compatibility with local interests and rights. Even laws that are theoretically sound in principle, can yield scope for corruption and the abuse of local confidence. Laws and policies need to be subjected to controls. Participation in policy decision making and law reforms can introduce some controls, depending on the degree to which it takes place. Hence, some of the C&I on participation are informative of the State's accountability to its citizens.

Comments and observations on C&I attributes

Under the Cameroonian social criterion ***'Institutions or organisations exist to cater for the diverse interests of different forest user and interest groups'*** can be found the indicators ***'Decisions of conflict resolution institutions are respected'*** and ***'Individual community members have the right to appeal'***. The role of the state is introduced into the C&I complex with the verifier ***'Official law courts recognise decisions of traditional legal systems'*** given for the latter of the two indicators. Other I&V that form part of the complex, such as the indicator ***'Community dialogue structures exist for the negotiation/discussion of forest management issues with state services and NGOs'*** imply that the appeal should be evaluated taking into account the opinions of diverse interest groups.

In the Brazilian social subset, the matter of objection is addressed through the assessment of community-exercised rights to articulate and express a political opposition or alternative. The concern was elevated to the criterion level with the statement '***The community exercises the right to social and political organisation'***. For the assessment of this criterion, the indicator '***The community possesses forms of inter-and intra-community organisations***' is provided and the verifier, ***'Existence of organisations recognised 'de facto' and legally'.*** The Indonesia complex, wherein 'the right to appeal' is mentioned, leads the assessor toward considering the case from a variety of viewpoints. The Brazilian set of statements on the other hand points towards assessing the community's independence from other interest groups. The Indonesian set does not contain any C&I on the right to appeal, challenge or oppose decisions, legislation or policies. However, numerous C&I contained in this set that refer to dialogue, participation, representation, fairness and agreement, would reveal pockets of opposition to decisions taken. How such opposition is expressed and considered would also be revealed by the C&I.

8.5 The Roles of State and Community Mechanisms in Managing Conflict

The integration of diverse interests and maintenance of complementarity between the activities and roles of different interest groups rests on successful conflict management. Conflicts occur at different scales, around different issues and can involve any number of parties. They can take place among community members, as well as between community members/communities and external parties. Different conflict resolution mechanisms are needed depending on the characteristics of the conflict in question. Likewise, the roles of different actors must be defined in relation to the nature of the conflict. As well as being the antithesis of harmony, conflict undermines power and control.

8.5.1 C&I: The Role of State Laws and Policies in Conflict Management

Many government policies, and particularly government laws, have an undeniable bearing on conflict (Warner and Jones 1998). In theory, both policies and laws are meant to prevent or resolve conflicts, while ensuring that natural resources are adequately protected. The law exists to prevent, manage or resolve conflicts so as to allow policies to achieve their objectives unobstructed. The law has the charge of regulating the policy domain to guarantee it remains answerable to society. In this capacity it helps to ensure that policies themselves contribute to conflict management. Often, however, laws in fact, may merely repress conflicts, impose unsatisfactory solutions, or even trigger new conflicts, and thus provoke mistrust and defiance in forest inhabitants.

Laws and policies often play a more important role in conflict management when forest communities penetrate the market economy. The outcome of community commercial endeavours will depend on the policies and laws regulating the market. As traditional subsistence economies are transformed into market economies, they need to become increasingly subject to policies and laws designed to regulate profit maximising behaviour, the pursuit of economies of scale and the negative impacts these are liable to have on forest quality and area. External controls become increasingly essential to prevent internal competition from unduly displacing 'weaker' competitors (e.g., subsistence farmers) from land or denying them access to forest benefits, or from leading to the overexploitation of sharecroppers or wage labourers. Without such outside regulation new types of conflict will build up and erupt.

Box 8.5 C&I on the Role of Policies and Laws in Community Conflict Management
(Brazilian Social C&I)

Criterion: Effective measures and institutions for conflict resolution must exist.

Supporting indicator:

- Informal mechanisms exist for the resolution and negotiation of community conflicts, family disputes and complaints about the use, possession and ownership of agroforestry resources.

  Supporting verifiers:

  - Solutions to conflicts and agreements are reached in a legitimate manner that represents the common interest.

Supporting indicator:

- The application of legal proceedings in the resolution of conflicts about agroforestry resources involving internal and/or external actors (neighbours, timber companies, other communities, patrons, etc.).

  Supporting verifiers

  - Survey of legal registers of conflicts concerning land use and possession and agroforestry resources, and their resolution.
  - Individual and collective stories of legally arbitrated conflicts about agroforestry resources, and their resolution.
  - Individuals perception of the nature of conflict resolutions, the negotiation arena and the concrete results of conflicts on resources.

Comments and observations on C&I attributes	The complex of I&V under the Brazilian social criterion '***Effective measures and institutions for conflict resolution must exist***' is designed to assess how effectively legal channels are used to manage forest resource conflicts among community members or between them and outsiders (Box 8.5). The criterion has two supporting indicators; one concerning informal conflict resolution mechanisms and the other relating to formal mechanisms. This implies there is a role for both types of mechanisms. The second of the two indicators '***The application of legal proceedings in the resolution of conflicts about agroforestry resources involving internal and/or external actors (neighbours, timber companies, other communities, patrons, etc.)***' and its verifiers relate to the national legal context which, in theory, exists to ensure that conflicts at the community level are resolved to the satisfaction of society at large. This indicator is easily assessed with information assembled using open-ended interview techniques for the proposed verifiers: '***Individual and collective stories of legally arbitrated conflicts about agroforestry resources, and their resolution***' and '***Individual perceptions of the nature of conflict resolutions, the negotiation arena and the concrete results of conflicts on resources***'. These verifiers provide scope for subjective judgement. Another verifier for the indicator, '***Survey of legal registers of conflicts concerning land use and possession and agroforestry resources, and their resolution***', seeks more objective evidence on the nature of conflict resolution involving legal mechanisms.

To encourage acceptance, laws and policies must at least appear incorruptible, impartial and non-negotiable outside the officially condoned frameworks for their reform. This often makes them too inflexible to prevent or deal effectively with new forms of social injustice emerging during periods of rapid socio-economic change. Well-designed reform processes are essential to ensure laws and policies keep abreast with social and environmental change and provide constructive and timely direction to the development of CMF. Depending on community involvement, the actual reform processes that aim to produce outputs capable of preventing, managing or resolving conflicts, can themselves function as conflict management processes.

8.5.2 The Relationship between State Legislative and Community Conflict Resolution Mechanisms

The respective roles of state and community regulatory mechanisms for resolving conflicts in which the community is considered from two perspectives in this report. The issue of community rights to settle their affairs on their own terms without the interference of the nation state is addressed in chapters 6 and 7 of this report (Socio-economic aspects of CMF C&I). The role of the state in conflict management in general terms is discussed above; this discussion is continued here with an exploration of its limitations. This avenue of discussion leads then to an assessment of potential compatibilities or linkages between community and state mechanisms.

The national legal apparatus is beset with certain inherent shortcomings with respect to its capacity to resolve natural resource conflicts both between private persons or groups, as well as between these and the public interest (Glazewshi *et al.* 1991). The ideological foundations of the legal system, for example, may not validate the basic rights of forest inhabitants. It may be insufficiently flexible to address the special needs of minority groups. Law reforms may lag behind the development of new conflicts of interest borne out of rapid socio-economic change. Most of these potential drawbacks are addressed either explicitly or implicitly by C&I reviewed above or in the following sections

Effective law enforcement, if at all feasible, requires public spending on a scale often beyond the means of developing countries. Resolution processes involving the legal system tend to be protracted and expensive. During their course, the role of the law is often marginalised, and its effectiveness limited. Furthermore, the distance of the law from the dispute complicates the gathering of information and proof related to the case. Multi-faceted disputes of interest, for example, are poorly suited to resolution by the legal system, as they tend to compound these complications. In some cases, communities simply do not have access to financial means for the legal resolution of a dispute.

For these and other reasons, dispute settlement outside state law mechanisms is often advantageous. Fewer administrative bottle necks have to be negotiated, and thus consensus may be achieved more quickly than in a state managed case. The conflict resolution process takes place closer to the site of the conflict, making it easier to compile information and proof. Face-to-face negotiations can proceed without the delays involved in long, drawn out legal proceedings.

8.5.3 C&I: Community Control over Forest Resources Conflict Management

Comments and observations on C&I attributes

The above Brazilian criterion's first indicator ***'Informal mechanisms exist for the resolution and negotiation of community conflicts, family disputes and complaints about the use, possession and ownership of agroforestry resources'*** is supported by the verifier ***'Solutions to conflicts and agreements are reached in a legitimate manner that represents the common interest'***. These statements unambiguously seek to establish the community's ability to successfully regulate its internal affairs and social relations. The cost incurred to the community as a whole by the resolution of conflicts between individuals or groups is a point of interest here.

The Cameroonian social C&I subset includes the verifier ***'The number of land conflicts resolved informally within the community compared to the number of conflicts presented to State courts'.*** This too can help determine how well communities deal with conflict situations without assistance. It can indicate a community's reliance on external support for resolving land conflicts (which may have emerged, in some cases, as a result of their rights to control land access distribution having been taken away by the state).

In the Cameroonian social set, one verifier appears to be particularly revealing of forest communities' uncontested self-determination: ***'Official law courts recognise decisions of traditional legal systems'***. Its evaluation entails the comparison of regulatory systems to establish how well the community's system of governance is validated or ratified by the State's legal system. This verifier can provide insight into the compatibility between the communities' systems for self-governance and the State's priorities with respect to multiple dimensions of forest management, including inputs (factors of production), processes (objective setting and decision making) and outputs (distribution patterns). Its assessment, however, is very information demanding.

The most appropriate and effective mix of legal and community regulations is bound to vary from context to context, and over time. The ability of some communities to regulate resource access and resolve disputes is fast declining; adjustments in the balance of community and state controls are required to bring such trends under control The extension of capitalism into traditional forest communities can, as implied above, make unprepared communities vulnerable and highly dependent on the power of national laws and policies to protect them. The nature of problems characteristic of rural capitalism (free-riding, landlessness, exploitation of cheap labour, etc.) suggests conflict management through spontaneous consensus decision-making processes that include all stakeholder groups will yield inadequate results, at least in the short-term. This is because of the persistent difficulties of reaching true agreement between groups with many conflicting interests and power differentials. Enforcement of compromises/decisions reached on the basis of social welfare theory and democratic voting processes may need to be rigorous in order to keep conflict below socially disruptive levels. (This leaves open the possibility of self/collaborative enforcement). This is especially likely to be the case where a sizeable proportion of the population is already impoverished in relative terms or is on the brink of absolute poverty, and would therefore suffer exceptionally severe consequences from continuing or greater exclusion from forest benefits.

8.6 Policy and Legal Restrictions on Forest Exploitation

As traditional forest communities grow in size and their pressure on forest resources increases, they tend to be drawn increasingly into the domain of national law. Many countries have made substantial advances in the past few decades towards outlawing unsustainable harvesting methods and rates. However, many worthy, existing laws fail to address the nature or scale of local problems because of lack of adequate supporting legal decrees and policies or inadequate resources for enforcement. Problems of mismatch between regional policies and laws and local problems persist. Some policies and laws inadvertently create criminality out of poverty through their inadequate preparation and inflexibility. During the Brazil test, community members explained to the ecologist that some of his suggestions regarding the designation of areas for wildlife sanctuaries would be unworkable as people would not be able to afford to forego harvesting produce within them. They explained that if laws were introduced to criminalise harvesting in certain areas, then people would have no other option than to break the law.

Table 8.2 presents the C&I referring to laws that restrict or prohibit specific forest resource exploitation methods. Only the Indonesian C&I subsets are devoid of such references. It is not always clear whether the C&I relating to rules, norms, prohibitions, etc., refer to community or State regulations. In most cases, where no explicit mention is made of the law, we have assumed they were intended first and foremost for the assessment of the community's own regulatory capacity. For some instances, however, related criteria or indicators specifically identify the context.

The overall appropriateness of individual laws for forest communities of different sizes and degrees of isolation must be evaluated by a consortium of actors, including community representatives and national policy and law decision makers. The impact of forest harvesting depends on human population density and settlement patterns as well as the population dynamics of the exploited species under given environmental conditions. In some small and remote indigenous forest communities, hunting some species may have an insignificant impact on those populations. In such cases, if hunting is part of the cultural heritage then imposing a ban on it would appear to be contradictory to a commitment to securing conditions for cultural survival.

Hunting and harvesting pressures are also strongly influenced by the technologies used. Interestingly, no C&I were included specifically on laws restricting the use of chainsaws and firearms. These technologies are having an increasing impact on both forest quality and on intra- and inter-community social relations. The incidence of their ownership may give some indication of market integration. The Brazil test occurred just after the Brazilian government had raised the price of ammunition. Such pricing policies can have of far-reaching effects. Local shopkeepers at the Brazilian test site said they expected this price rise to dramatically reduce the incidence of hunting. It was not clear whether the rise would cause an increase in other, more traditional hunting methods such as trapping.

Table 8.2 C&I on National Laws Regulating Community Forest Management

Cameroon	Indonesia	Brazil
Criterion: • Indigenous strategies aimed at reducing pressure on wildlife are worked out in conformity with laws and regulations on hunting. ***Indicator:*** • Laws and regulations on hunting are known to all participants. ***Verifiers:*** • Publication of the list of partially or totally protected species. • Knowledge held by all of the start and finish of the hunting season. ***Indicator:*** • Destructive hunting tools and methods are outlawed. ***Verifiers:*** • Hunting with traps is banned. • Forbidden tools and methods.	——	***Indicator:*** • Legal minimum of 50m belt of forest vegetation along rivers and streams is upheld. ***Verifiers:*** • Nesting beaches and other turtle egg-laying locations are protected by formal and informal mechanisms, especially during the dry season that is critical for their reproduction. • No capture of individual fish that are below the minimum size as defined by fishing laws existing for important commercial fish species.

8.7 Issues under the Control of Social Welfare Policy

Social welfare policy influences community expectations about gains to be made from integration into the mainstream culture, and about the types of gains made possible through improved forest resource access and management. Social welfare policy includes health and education policy, legal aid and policy on infrastructure development. Indirectly, all these policy areas can impact heavily on the sustainability of local forest resource management.

8.7.1 Health Policy

Based on the currently accepted view that population growth will accelerate rates of forest conversion to agriculture, family planning programmes that effectively contain population growth rates have long-term positive implications for the survival of forests. Vaccination, hygiene and nutritional programmes all help ensure human energy is channelled into administering good natural resource management practice rather than to recovery from illness or tending the ill, or supporting 'unproductive' dependants. Less wealthy rural families generally suffer from poorer health, a circumstance that propels them into a vicious circle of sickness reducing agricultural or forest production and thus causing malnutrition resulting in further sickness.[41] Rural health policy is therefore a critical determinant of the distribution of access to forest benefits. Although all teams developed C&I for the assessment of traditional medicinal knowledge, none of them developed C&I on access to State-run health services or on the quality of these.

8.7.2 C&I: Formal Education

The C&I created on formal State education are presented in Table 8.3. The issue is most thoroughly addressed by the Indonesian social subset, and thereafter, in a less direct way, by the Cameroonian social subset. Formal state education is not referred to in the Brazilian set.

Table 8.3 C&I: Formal Education

Cameroon	Indonesia	Brazil
Criterion: • Community management of forest resources and State priority goals on forest management and development are compatible. *Indicator:* • State and NGOs assist communities in sustainable forest management. *Verifier:* • Appropriate development education programmes.	*Principle:* • A right educational system will support sustainability of the environment. *Criterion:* • Formal and non-formal education supports sustainability of forests. *Indicator*: • Public access to all grades of formal education. *Verifiers:* • School-age children are going to school. • School-going children finished their schooling. • School for adults. *Indicator*: • Local curricula content is devoted to environmental consciousness raising. *Verifiers*: • Lessons on environment. • Lessons on local land use systems.	—

[41] Farmers at the Brazilian test site explained that illness often causes them not to use areas of slashed forest. Impenetrable, difficult to clear thickets form on these abandoned plots meaning that, rather than use them at the next possible opportunity, farmers will choose to clear new areas of forest or fallow. Unnecessary forest clearance thus takes place and scarce human energy resources are squandered.

Formal education is usually directly controlled by National education policy. Education policy, in most countries, adheres to a body of legislation that enshrines, to a lesser or greater degree, peoples' *'right to know'*. Literacy programmes and schooling empower people, providing access to information, theories and decision-making processes that have evolved, at least in part, outside the traditional context, yet potentially influence it. Being able to read and write and having basic numeracy skills are critical assets that can help with matters as diverse as following instructions on pesticide labels to obtaining waged employment to save up the money to buy a chainsaw. Appropriate education helps rural people access and apply modern health advice. It has also been established that education can help women emancipate themselves in cultures that traditionally deny them opinions, unrestricted movement, and/or other forms of 'power'. The provisional plan for the creation of an Extractive Reserve including the territory of the two Brazilian test site communities, contains an adult literacy programme for residents of communities within the reserve's catchment area. Some inhabitants of São Pedro saw this as an essential component if people are to understand the reserve's legal basis and to gradually assume a fully active role in its management.

Comments and observations on C&I attributes

Because of its empowering capacity, many governments develop education policies cautiously, or even hinder their development in certain directions if they feel that to do so might precipitate a challenge to their position of power. However, 'theoretical' and 'moral' education is essential for law enforcement, and this is of interest to all nation states, including the most dictatorial. (Although it is argued that, in the latter, formal education to reinforce law and order may be more a form of indoctrination than a measure designed to serve the public good). Relevant to these observations is the Cameroonian social criterion '***Community management of forest resources and state priority goals on forest management and development are compatible'.*** This criterion is supported by two indicators ***'Capacity of the legal system to include the aspirations of local communities in forest management'*** and ***'State and NGOs assist communities in sustainable forest management'.*** The second indicator's verifier ***'Appropriate development education programmes'*** implies that education programmes have to integrate people into the national system on a two-tiered basis. They have to build rural peoples' awareness of the law and associated policies and how these relate to their livelihoods. This should provide people with the necessary information to comply with laws and policies, or to articulate an opposition to them. This two-pronged approach to the legal system's inclusion of local aspirations, would need to have built into it multi-directional communication channels between the recipients of education, the educating institutions and the legal authorities. Only thus would formal education serve to strengthen the State's accountability to the rural population.

Depending on the curriculum content, education can empower and lead to authority and economic means. The Indonesian indicator ***'Public access to all grades of formal education'*** is indicative of government commitment to public participation in rural and national development. The interest in increasing participation in environmental decision-making through education is revealed by the Indonesian social indicator ***'Local curricula content is devoted to environmental consciousness raising'***. The verifiers accompanying this indicator stress both consciousness raising on general environmental issues and on the more detailed matters pertaining to the local land use system. The importance of local land use systems is often lost from sight as these systems buckles under the stresses brought about by increasing land scarcity, or are severely compromised by incentives to enlarge production for market surpluses.

The formulation of an 'appropriate' education system in support of environmental sustainability was made a principle by the Indonesian social specialist. He emphasised the crucial role of formal education in filling the vacuum created by the erosion of traditional forms of education. This erosion has occurred or is occurring within the framework of 'modernisation' and/or the disappearance of traditional cultures and mechanisms, including both subtle and dramatic changes. In Indonesia, during the first few decades following Independence, government policy actively discouraged ethnic groups from living in long houses, most of which were consequently destroyed and never replaced. As settlements increased in size, and contacts with the outside world become more frequent and diverse in nature, new social differences emerged and new perceptions began to take over from the traditional worldview. Changes such as these define the vacuum that the formal education system must fill. The question that remains is how it should fill this vacuum.

Noted on the Indonesian test were the shortcomings of the nation-wide application of a uniform national education curriculum that takes no account of patterns of social and environmental diversity. The text and illustrations in most schoolbooks are identical from one side of Indonesia to the other. Problems were also identified in connection with the transfer of a curriculum, custom-made for the urban context and compiled in a national and alien technical language, directly to rural schools whose pupils are brought up speaking their local language. These conditions are typical of many countries, not only Indonesia. They present serious challenges to the long-term prospects for bringing indigenous and traditional forest communities and policy makers together on a level playing field to integrate their interests.

Education policy and its relationship to the changing circumstances of forest communities should be monitored to gage how effectively the curriculum is being adapted in response to new needs. Monitoring is also required to assess whether the policy's role in the transmission of local, traditional knowledge is adequate for the purposes of preserving this knowledge and building on it in response to ongoing change. Essentially, the Indonesian social specialist maintained, the formal curriculum should be complementary to any continuing systems of informal traditional education; the two curricula should be mutually supportive of each other, and of sustainability in the community forestry sector. This is a theme underlying the Indonesian social criterion ***'Formal and non-formal education supports the sustainability of forests'***. Provisions could be incorporated into curricula to promote the development of local comparative advantage. Teaching would be required to include a practical focus on technologies and processes linked to sustainable and more efficient modes of forest and agricultural production. An assessment procedure sensitive enough to register the scope of existing teaching provisions can help formulate a more accurate description of future CMF scenarios. How education policies can be reformed to enhance sustainability would become clearer.

Absent, however, from the country sets are C&I that could highlight the existence of provisions for, or evidence of, interactive community participation in curriculum development. However, the inhabitants at the Indonesian test site's perception of the main problem with their children's schooling was not the same as that of the researchers'. At the site, some parents said their children could be doing more useful things than going to school. In Darok, the teacher complained of a lack of basic teaching materials and understaffing; the latter causing the school to remain closed over much of each school year. From these perspectives, refining the curriculum to make it more relevant to local environmental and related social problems may appear a luxury; from the researchers' perspective it is as much a necessity as teaching staff and materials.

8.8 Summary Conclusions

Our brief review of the C&I generated and the inferences that can be drawn from them suggests that the test team specialists found it imperative to consider the role of the legal system *in conjunction* with the community's capacity and right to manage its own conflicts. C&I that bring to light the relationship between these domains abound. The information they generate is critical to understanding how these domains could be rendered more mutually supportive or complementary. Among the key processes highlighted by the C&I are information transfer and development processes, e.g., education curricula, communication channels, and dialogue, and processes that promote accountability, such as appeal mechanisms. These imply a recognised need for the community and the state to jointly participate in the formulation and review of laws and policies. The issue of participation is also raised as an issue in itself that cross-cuts policy and legal implementation, evaluation and reform processes.

Complementarity and compatibility are terms raised in connection with policies and legislation relating to several issues, for example: between formal and informal education; between state and community conflict resolution mechanisms; between community and societal interests; between policies and legislation; and between traditional and new technologies.

The C&I also promote the analysis of provisions made by state legislation for integrating community interests with larger societal interests. As part of its obligation to serve in the public interest, the test team members appear to converge on the opinion that the legal system should provide a framework for securing community autonomy in so far as this corresponds with the rights of traditional forest communities to actively exercise their cultural heritage.

Scale is another theme reoccurring in the C&I relating to policy. Related to this is the question raised by some C&I of the local relevance and appropriateness of nation wide policies and legislation on issues as diverse as hunting and the content of the formal education curriculum.

Finally, there is the question raised by many of the C&I regarding the motives of legislation and policies, and the extent to which these reflect and protect local interests. C&I were developed to investigate not only the ideological basis of policies and legislation, but the existence and recourse to mechanisms for challenging policies and legislation on the basis of their ideological foundations. The state's obligations extend to providing mechanisms that communities can employ to appeal against interventionist legislation that threatens to compromise their autonomy.

Some of the descriptive C&I seek to compare attributes of State-controlled systems and their community equivalent. From a pragmatic perspective, we feel the country sets would be more powerful assessment tools if C&I on rules and regulations made clearer distinctions between their origins; i.e. whether the rules and regulations were formulated by the community or external actors.

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

Chapter 9.

Knowledge, Communication and Culture: Assessing their Significance to Sustainable Community Managed Forests

SECTION II

RESEARCH RESULTS: CRITERIA AND INDICATORS OF SUSTAINABILITY IN COMMUNITY MANAGED FORESTS

Chapter 9.

Knowledge, Communication and Culture: Assessing their Significance to Sustainable Community Managed Forests

Chapter 9. Knowledge, Communication and Culture: Assessing their Significance to Sustainable Community Managed Forests[42]

9.1 Overview

Over one hundred of the C&I statements refer explicitly to knowledge, most often local knowledge. A community's knowledge of its forest, it would appear, was therefore regarded as highly indicative of its capacity for sustainable forest management. From this it follows that the existence of effective processes for keeping local knowledge alive, and allowing it to evolve and grow, also indicates the sustainability of forests.

Knowledge embraces information, perceptions, and understandings, and the recognised effects of different combinations of these. It allows forest use-options and methods for developing their potential to be recognised. It includes the understanding of practices and their implications for sustainability. How relationships between factors and phenomena form, evolve and/or disintegrate is also explained by knowledge.

Knowledge, however, is not in itself a panacea for sustainability, as it can be abused. The saying *'a little knowledge is a dangerous thing'* can easily be applied to the forest management context. Knowledge deficits sometimes occur where knowledge has been eroded by the disintegration of traditional systems. Alternatively such deficits may form where the evolution of knowledge fails to keep pace with the speed of new developments. Appropriate responses to these new developments, which in some cases would amount to their rejection, then remain unknown.

Knowledge is the basis upon which people assume attitudes towards the natural environment and their fellow human beings. Insufficient knowledge of forest and human systems, and/or loss of traditional/local knowledge bases can create or shape attitudes that may not support sustainability.

In as far as knowledge reflects people's capacities to exploit and protect the natural environment which is their primary source of livelihood, knowledge is the ultimate manifestation of culture[43]. Some scholars believe all forests are turned into cultural phenomena through human perceptions (Schmithusen 1997). A culture is as much a knowledge reservoir as it is the ways in which this reservoir is used and replenished. Consequently, communication mechanisms are imperative for a culture's survival. Language, traditions of oral history and apprentices, other social structures, settlement patterns and transportation routes for the flow and exchange of information all influence the reproduction, evolution and diffusion of culture. The three country sets of C&I include some C&I that seek to assess the significance of all these matters.

Community managed forests are human interpretations of the meaning and functions of natural forest environments. As cultural manifestations, their state of health internalises the

[42] This chapter is written by Nicolette Burford de Oliveira with Mandy Haggith and Bill Ritchie.

[43] The Oxford Dictionary defines culture as 'a particular form, stage or type of intellectual development or civilisation in a society or group characterised by its distinctive customs, achievements, products, outlook etc'.

limitations of human understanding and attitudes. Seen thus, forests are shaped by human responses to factual observations of nature, superstitious explanations of natural phenomena, and religious obligations. All these responses, therefore, emanate from knowledge constructs that incorporate explanations and deductions created with the applied use of information, logic and with reference to a wider socio-environmental context.

From this it follows that local forest knowledge often includes knowledge of semi-gods and guardian spirits that protect the plant and animal kingdoms. As one farmer at the Brazilian test site community of São Pedro put it: 'we need good knowledge of the forest, of where the trees are, where the animals are or else we will meet with surprises and will be more likely to enrage the Curupira'. (The Curupira is the mother of the forest, an entity inherited from Amerindian ancestors.) Disrespect for the animal subjects under her benevolent eye incites her wrath, the prospect of which to this day continues to consume many Caboclo hunters with fear. Ignorance of her sensibilities and domain can culminate in profound human misery.

Distinctions drawn by indigenous forest societies between wilderness habitats and areas of human habitation are often nebulous. An exemple of the subtlety of distinction is the belief that the spirits of the dead, and sometimes even the living, are believed to migrate into the bodies of animals. Many forest peoples in West Africa believe humans sometimes transform into animals. Such beliefs are also held by some Caboclos in the region of our Brazilian test site. They relate an assumed form of human infiltration into the animal kingdom; one which confers upon people a notion of how forest animals experience their environment and contact with humans.

Discussed below are the tested C&I thought to be of relevance to assessing local knowledge and its broader cultural, socio-economic and ecological implications. In leading to their discussion, we first draw attention to how the C&I sets proposed are themselves knowledge constructs distinguishable from the knowledge they seek to discover.

9.2 The C&I for CMF Sets as Manifestations of Knowledge

The C&I sets are themselves manifestations of knowledge, reflecting the knowledge of those who created them by degrees varying according to the size and nature of their respective contributions. They cannot be said to represent common knowledge because it is unclear how widely their various component parts were commonly understood and agreed upon by different participants. Obviously, the sets are descriptions of what their developers believe needs to be known in order to understand forest resource use systems and their sustainability; in many cases, this points primarily to local knowledge. Almost every principle in each of the three country sets, for example, is supported by an indicator or verifier at some point that refers explicitly to the existence of local knowledge on the topic. While this phenomenon is understandable, the question remains to what extent this fully represents the necessary knowledge, or in other words, what is unintentionally left out of the set because it exists outside the realm of current understanding.

The application of any of the C&I will reveal existing knowledge or contribute to the development of new knowledge. One can assume, therefore, that they will all provide some insight into a community's culture; its health, and degree of evolution or transformation. Even the majority of C&I that make no mention of culture are revealing of cultural phenomena. While none of the country sets makes direct references to cultural adaptation or erosion, these processes will be revealed by assessments conducted with interdisciplinary C&I sets, such as those created by these tests, especially if they are applied as monitoring tools at periodic intervals. All strands of change have a modifying effect on culture, however slight, through their immediate influence on perceptions and possible generation of side effects leading to altered, if sometimes delayed, responses.

Monitoring with an integrated, interdisciplinary set of C&I will provide an overview of cultural shifts induced by different internal or external stimuli. Using C&I of participation in decision making and knowledge exchange, including the mobilisation of scientific knowledge, makes it possible to plot factors guiding the course of cultural evolution or disintegration. The factors can be isolated, and their response to interventions observed and studied.

In spite of the power of all C&I to generate information on knowledge and culture, many test participants felt it expedient to develop some C&I that directly target knowledge and, to a lesser extent, culture. They felt that the inclusion of such C&I in assessment protocols would lead to a better understanding of the social and ecological dimensions of community managed forests.

9.3 The C&I Sets' Implicit and Explicit Treatment of Knowledge-related Issues

Three aspects of knowledge appear to be given prominence by the proposed C&I sets. These are:

1. The extensiveness of the C&I sets' knowledge (i.e., the variety of topics covered and the proposed depth of their examination);
2. The documentation/registration (storage) of information and knowledge as future reference sources; and
3. The processes via which knowledge erodes, evolves and/or grows.

9.3.1 The Extensiveness of the C&I Sets' Knowledge Contents

The knowledge frames constructed by the C&I sets are extremely comprehensive. In all cases their coverage extends into the following four broad areas:

- ecological knowledge (of the forest, soils, animals, plants, etc.);
- practical knowledge (know-how and techniques and technologies for tending, harvesting, processing and using forest resources);
- socio-economic knowledge (this is divided into knowledge of economic value and factors affecting this, and knowledge of norms, regulations and legal instruments designed to control forest resource access and distribution patterns, and enforce boundaries); and
- cultural knowledge (of myths, legends, proverbs, folktales, ethics, etc.)[44].

This breadth of coverage was of course largely predetermined with the adoption of an inter/multi-disciplinary research team approach to C&I development.

9.3.2 The Documentation/Registration (Storage) of Information and Knowledge

The C&I sets make mention of many different formats for holding or storing knowledge (and information) for subsequent usage and communication. Possession of means for storing and conveying knowledge indicates the existence of facilities for cultural reproduction and, hence, for the survival of the community's cultural heritage and identity. The only forms of knowledge storage to which all three country sets refer are narratives and stories. The Indonesian and Brazilian sets also mention maps. In the Cameroonian and Brazilian sets mention is made of calendars. Other forms of knowledge documentation identified in the C&I include tables, matrices (Brazil), publications (Cameroon), legal documents (Brazil).

The documentation or registration of information and knowledge is important to the assessment of the sustainability of CMFs for several reasons. First, apart from their knowledge

[44] The first three knowledge categories above could just as correctly also be labelled 'cultural knowledge'.

storage and communication capacity, stories, maps, tables, matrices, compendia, legal documents and calendars can all be used effectively to organise knowledge. Organisation of knowledge plays a vital role in facilitating its appropriate application.

Secondly, documented information can serve as baseline information that can impart an historical perspective to current circumstances, thereby allowing us to trace some of the cause and effect relationships responsible for particular outcomes. Sometimes this information can be used to generate predictions on the basis of relationships identified as responsible for past outcomes. Alternatively, documented baseline information can be referred back to in monitoring to establish the type and rate of change occurring within specified periods. Monitoring can reveal how well the outcomes of planned interventions achieve objectives, or isolate the effect on sustainability of some uncontrolled variable or phenomenon. Documenting the results of assessments and monitoring activities makes it possible to keep track of change and observe how it complies with expectations and the achievement of sustainability. Documentation in this sense also supports the emergence of new knowledge.

Documenting and storing knowledge is also important for the preservation of traditional knowledge and values during periods of change. After certain cultural features have been abandoned or modified, knowledge storage facilities can enable the communities to remain aware of its history and roots. They allow communities to recover knowledge from their past as they wish. Documented traditional knowledge and histories can be incorporated into formal education curricula to increase the relevance of these to the local situation, and offer a means for bridging the past with the future. Equally important, is their potential to forge links between local and regional or national contexts.

9.3.3 The Processes via which Knowledge Erodes, Evolves and/or Grows

Some of the most interesting observations concerning the depiction of knowledge by the C&I sets relate to processes involving the application of knowledge. These processes involve knowledge in various ways, for instance, they can involve or lead to:

- **the storage of knowledge.** i.e., individual or community development processes that result in storage of knowledge within people and social institutions (either through the functional ongoing application of knowledge or its storage in documented formats) (9.3.3.1);
- **the use of knowledge**. i.e., processes that involve the application of knowledge in decision making, the execution of know-how and techniques, and the skilled use of technologies (9.3.3.2);
- **the transfer of knowledge.** i.e., informal or formal processes and their corresponding social structures whereby knowledge is communicated between different individuals or groups either within the community or between members or segments of the community and outside entities (9..3.3.3); and/or
- **the acquisition of knowledge,** i.e ., information gathering and learning processes (9.3.3.4).

These knowledge processes inter-relate in different and sometimes cyclical ways. Successful knowledge transfer becomes knowledge acquisition from the recipient's perspective. Regular use of knowledge can also be considered a form of knowledge storage. The processes combine into a knowledge system whose description reveals its health and potential for piloting developments towards greater sustainability. The description of a knowledge system can indicate the fit, or gaps between existing knowledge and knowledge requirements. It can also reveal how successfully existing knowledge is mobilised in decision making, and how well its potential relevance is exploited by mechanisms that ensure its inter-generational, inter-cultural and across-class/caste transfer. A community's knowledge system, moreover, outlines its informal education curriculum for it to learn and develop new knowledge - processes that also take place spontaneously, and to an unpredictable extent. Once a knowledge system has been outlined or 'mapped', it becomes easier to recognise its weak and strong connections, channels and vehicles for communication within the community, and between it and other communities and outside entities.

i) Knowledge Storage

The vast majority of the statements explicitly mentioning knowledge (and related issues) refer simply to its existence and, therefore, tacitly to its storage inside people (Table 9.1). This suggests that what is valued is not so much repositories of knowledge, documented and conserved for prosperity (something that much research on indigenous knowledge aims to do), but actively knowledgeable people who keep knowledge alive by applying it in their daily lives.

Table 9.1 Selected C&I on the Documentation and Storage of Knowledge

	Cameroon	**Indonesia**	**Brazil**
Narratives/stories	*Indicators:* • Folk-tales and proverbs about forest-people relationships.	*Verifiers:* • Story telling is still performed by elders for the youngsters.	*Verifiers:* • Narratives of local myths. • Stories of agroforestry resources and locations of special historical and cultural significance.
Maps		*Indicators:* • Community property rights are indicated on official land use maps. *Verifiers:* •Participatory mapping.	*Verifiers:* • Mapping of the 'principal land uses' with the use of maps andsatellite images. • Participatory mapping of NTFP resources. • Mapping of vegetation cover (forest) for different years using satellite images. • Map of infrastructure and its evolution over recent decades.
Calendars	*Verifiers:* • Activity calendars of different forest user groups.		*Verifiers:* • Chronological calendar of activities. •Calendar of rituals. • Calendar of the collection and extraction of agroforestry products. • Distribution of productive and reproductive activities (by type) using the annual calendar.
Other formats	*Verifiers:* • Publication of the list of partially or totally protected species.		*Verifiers:* • Matrix (table) including the principal uses of products, the tools and equipment used in harvesting/ extracting, harvesting techniques, time spent and financial returns by product. • Survey of legal registers of conflicts concerning land use and possession and agroforestry resources, and their resolution.

ii) Knowledge Use

A few C&I explicitly address the use or application of knowledge, while others provide a context for environmentally and socially sound use (Table 9.2).

Table 9.2 Selected C&I on Knowledge Use

Cameroon	Indonesia	Brazil
Principles: • Community forest management practices and techniques fully incorporate indigenous knowledge systems. ***Criteria:*** • Knowledge of the forest is used as a mechanism to ensure at least minimum livelihoods to community members. ***Verifiers:*** • Local skill endowment enhances division of labour within the village setting.	***Indicators:*** • Traditional conservation concepts exist. • Equipment used is adapted to local technological knowledge. ***Verifiers:*** • The use of local knowledge to rationalise the ladang (shifting cultivation) system.	***Criteria:*** • Local conscience and knowledge of agroforestry resource use and management demonstrate an ethic of sustainable laud use and conservation. ***Indicators:*** • Evidence of symbolic codes and myths that have a regulatory effect that contribute to the conservation of agroforestry resources. ***Verifiers:*** • Indigenous classification of agroforestry products used in the manufacture and production of artefacts. • Narratives of myths that have an observable regulatory effect.

The use of knowledge should be ethical. On all the tests, it was widely agreed that the existence (i.e. realised) of a conservation ethic indicates some commitment to sustainable forest use and management. This is reflected by C&I statements *'**Traditional conservation concepts exist**'* (forest management indicator, Indonesia), and *'**Local conscience and knowledge of agroforestry resource use and management demonstrate an ethic of sustainable land use and conservation**'* (social criterion, Brazil). No explicit reference to conservation ethics or concepts occurs in the Cameroonian set. However, the Cameroonian social criterion '***Knowledge of the forest is used as a mechanism to ensure at least minimum livelihoods to community members***' implies knowledge should be conscientiously used to enhance community welfare. The strength of community commitment to sustainable forest management will largely depend on the depth of its conservation ethic and whether this ethic is eroding or strengthening in response to change.

In the Cameroonian social subset, the active use of indigenous knowledge is a principle; '***Community forest management practices and techniques fully incorporate indigenous knowledge systems***'. However, we believe the wording '*fully incorporates indigenous knowledge systems*' makes it somewhat difficult to interpret. If it is meant to imply the incorporation of the original knowledge systems out of which the current systems emerged, with their indigenous vestiges, then there may be difficulty in recognising and describing the original systems. These may not be fully known anymore. The possibility of part or even most of the original system having lost its relevance to the contemporary situation would have to be considered.

iii) Knowledge Transfer

Overview of C&I

Many C&I were developed about the transfer, transmission, sharing or mobilisation of different sorts of knowledge (Table 9.3). The relevant statements can be further divided into those concerned with informal knowledge and means for its transfer, e.g., myths and story telling, and those concerned with formal knowledge and means for its transfer, e.g., technical extension advice, and training and formal education.

Table 9.3 Selected C&I on Knowledge Transfer

	Cameroon	Indonesia	Brazil
Extra-community transfer	*Verifiers:* • Knowledge provided by local inhabitants during the collection of medicinal plants by medical and other institutions.	*Verifiers:* • Information exchange with information sources outside the community. • Mobilising scientific knowledge.	*Indicators:* • Knowledge of markets for forest and agricultural products. *Verifiers:* • Registration with relevant official authorities of archaeological sites and artefacts encountered during socio-economic activities in the forest.
Intra-community transfer	*Criteria:* • Social structure permits the transmission of existing knowledge systems. *Indicators:* • Knowledge transmission during forest exploitation expeditions.	*Indicators:*• Non-formal education is functioning. *Verifiers:* • Story telling is still performed by elders for the youngsters. • Local history is still handed down to the younger generations. • Local knowledge on natural resource management is still handed down to the younger generations.	*Indicators:* • Transmission and perpetuation (written and oral) of traditional knowledge and mythology on the natural environment. *Verifiers:* • Young community members' level of interest in perpetuating traditional knowledge and mythology on the natural environment. • Observation/communication about conservation of water sources. (*This could also be a matter of extra-community knowledge transfer*)

Informal Knowledge Transfer

The issue of informal knowledge appears in all three country C&I sets. It includes the transfer of knowledge from the old to the young, and also the transfer of knowledge/information within and in and out of the community. The transfer of knowledge is vital for ensuring the community's collective intelligence and adaptability. Transfer of community wisdom and know-how from the old to the young ensures inter-generational continuity. It thereby ensures the survival of useful knowledge that keeps forest use options open. Other intra- and inter-community transfer involves the passing on of new ideas, informal education on new techniques or opportunities. Extra-community knowledge transfer includes formal exchange of information with authorities, access to scientific knowledge, and the sharing of local knowledge (e.g. on medicinal plants) with outsiders.

Interestingly, there is no acknowledgement or reference to the media (radio, television, etc.) in any of the country C&I sets, despite them being ubiquitous sources of large amounts of information in most parts of the world. Indeed, at all the test sites possession of radios appeared to be a common household phenomenon.

Conservation ethics are constructs of culture-bound knowledge. Their survival, therefore, depends on the transmission of traditional knowledge. Traditions of story telling and proverbs, initiation rituals, processes for familiarisation with mythological symbols, codes and concepts, are all indicative of knowledge transmission and cultural reproduction. References to younger generations (which we assume extend to children) are confined to C&I concerning the transmission of local knowledge and, hence, culture. These include the Brazilian social indicator ***'Transmission and perpetuation (written and oral) of traditional knowledge and mythology relating to the natural environment'*** and its verifier '***Young community members' level of interest in perpetuating traditional knowledge and mythology on the natural environment'.*** The verifier evaluates inter-generational transfer processes by their outcome. Two additional verifiers, '***Calendar of rituals***' and ***'Narratives of local myths'*** were accepted as useful for checking the above indicator**.** For the same topic the Indonesian social subset provides three verifiers: '***Story telling is still performed by elders for the youngsters'***; '***Local history is still handed down to the younger generations***'; and ***'Local knowledge on natural resource management is still handed down to the younger generations'*** all of which are affiliated with the indicator ***'Non-formal education is still functioning'***.

C&I that direct attention to the inter-generational transfer of knowledge, remind the assessor that our concerns centres not so much on knowledge *per se* but on its sustenance or transformation over time, and the significance of this to the sustainability of natural resource systems. This provides a more immediate temporal perspective, which can then be backed up with information gained by the reiterative '*snap-shot*' approach of assessing a variable or phenomenon at different points over a period of time. It is more proficient than the snapshot approach at revealing active and intentional transmission of knowledge and culture, the registration of which may sometimes be important.

Although the Cameroonian set does not explicitly isolate the issue of cross-generational transfer of knowledge for evaluation, it is implied by the Cameroonian social criterion '***Social structures permit the transmission of existing knowledge systems***'. This criterion supports the principle '***Community forest management practices and techniques fully incorporate indigenous knowledge systems'*** and is backed by the indicator ***'Folk tales and proverbs about forest-people relationships'***. The two other indicators provided for this criterion; '***Joint forest exploitation trips by different user groups***' and '***Knowledge transmission during forest exploitation expeditions'*** make a connection between knowledge held and social occasions which, representing the dynamic aspects of the prevailing social structure, permit knowledge transmission to take place.

In so far as the processes of cultural evolution are shared, all those belonging to a culture remain unified by a common worldview. Culture is a substrate in which firmly held beliefs are rooted; beliefs that bind people together and motivate them to act in unison. These beliefs form the scaffolding upon which traditional forms of authority are structured and condoned. The beliefs and the authority are inextricably linked together; destroy one and the other too is destroyed.

Formal Knowledge Transfer

More formal methods of transferring knowledge are addressed by the C&I formulated on training and formal education. Apart from the in the Indonesian C&I set, in which education (spanning formal and informal forms) is a fully elaborated social principle, very little mention is made of formal education. In the Brazilian C&I set there are no references to education as a means of knowledge transfer to support sustainable forest management.

Formal education can undermine traditional values, belittle local knowledge and practice and promote mainstream culture whilst portraying it to be at odds with indigenous worldviews. There is a lot of evidence that local formal education can destroy indigenous social systems. In some cases education (like religion) has been used deliberately to undermine indigenous social systems or to divert attention away from these to national economic interests that often do not support the interests of local communities.

On the other hand, formal education can be made to function as a valuable vehicle for transferring, reviving or conserving local knowledge. It has a potentially extremely important role in helping people understand how they can constructively respond to novel forms of change by, among other things, teaching them necessary new and useful skills including the national language, literacy and numeracy. These can increase communities' ability to learn and handle new information and help bring them on an equal footing in communications and negotiations with outside agencies, and to catalyse their more effective participation in the regional or national economic system. They can encourage innovation and creativity, providing access to new ways of perceiving resources and the management of their potential. The references to formal education in the Indonesian C&I set are with respect to this positive potential. If formal education is to enable sustainable forest management then it is crucial that curricula include coverage of relevant local issues and strive to build upon local wisdom rather than undermine it.

iv) Knowledge Loss and Acquisition

The Loss of Knowledge and Resistance Thereto

Loss of knowledge and culture may signify the closure of forest use options for future generations, especially if the knowledge lost can not be easily retrieved. It is indicative of inadequate means for knowledge transfer. Traditional knowledge transfer mechanisms are sometimes threatened by changes introduced from the outside, especially if these are stress inducing or restrictive of the traditional social order.

All cultures will, with varying degrees of success, develop coping strategies when faced with stressful situations. Some communities, or segments within them, will focus on resisting change as they highly value the sense of security that their traditional way of life offers. Elsewhere, some cultural traits may get phased out, others transformed and yet other new, more useful ones developed or accepted from outside cultures. So when a culture appears to be going into decline, rather than succumbing to absolute defeat or transformation into a more dominant culture, it may be seen as evolving, at least to some extent, on its own terms (Box 9.1).

The important questions that need to be asked include:

1) What is the community's (or social group's) differential or selective acceptance of traits of other cultures?
2) How does this selectivity influence its social equity status and natural resource management methods?
3) To what extent have the changes under way been determined by the community (or social group) or enforced upon it by circumstances others control?

The Brazilian social specialist pointed out that environmental changes and socio-economic pressures can cause people, and even whole communities, to switch ideologically to accommodate new aspirations and newly perceived constraints. Thus, the abandonment of prohibitive traditional norms can be rationalised by communities through the ideology of an alternative, newly adopted religion or political doctrine. Such ideological manoeuvres to justify the adoption of forest interventions not sanctioned by traditional belief systems, can be regarded as forms of collective cognitive dissidence. Conversion to Christianity, for instance, offered some Caboclo forest farmers a justification for their severance from restrictive superstitions that serve to limit hunting and fishing pressure and guarantee the distribution of forest resources within the community. They relinquished their fears of traditional superstitions and turned instead to praying.

Conditions at the test sites confirmed that motives and mechanisms to protect forest resources are dramatically changing in some places. Some forest farmers at the Brazilian test site said that the awesome curses traditionally believed to befall unscrupulous hunters are these days being increasingly dismissed as 'lies' (*mentiras*) although some forest farmers do still live in fear of them. To capture these types of shifts in belief systems, the Brazilian social subset includes the indicator '***Evidence of symbolic codes and myths that have a regulatory effect that contributes to the conservation of agroforestry resources***' and the accompanying verifier '***Narratives of myths that have an observable regulatory effect***'. These I&V also come under the criterion '***Local conscience and knowledge of agroforestry resource use and management demonstrate an ethic of sustainable land use and conservation***'.

Conservation ethics tend to apply only as and when people can afford to adhere to them. Some decades ago, Caboclos in the region of the Brazilian test site were heavily engaged in hunting for the animal skin trade – the financial rewards possible drove any signs of a conservation ethic out of the frame of their worldview. However, most of the forest farmers at the Brazilian test site who were asked, said they thought commercial hunting is incompatible with the Christian faith. Others did not know whether or not it is.

Knowledge Acquisition (and C&I)

Learning about how and why the natural resource base upon which a community depends upon is changing, involves gathering and assimilating information. 'Assessments' and 'monitoring' are information gathering activities that appear as a criterion in two of the country sets: '***Local systems exist for the monitoring and evaluation of different forest resources***' (Cameroon); and '***The community has developed mechanisms for monitoring and controlling productive activities***' (Brazil).

Learning new things often leads to new behaviours. Learning about a new vegetable may lead to new gardening practices and a change in diet, learning about the high market value of a forest product may lead to increased harvesting rates or more judicious harvesting practices. Learning about the plans of a third party to extract forest resources may lead to attempts to prevent it, or to seek employment. Just as knowledge in itself is no panacea for sustainability, so neither is knowledge transfer. New knowledge can lead to less sustainable and more socially unjust behaviours. But the capacity to transfer and gain knowledge is essential for informed decision making and for the community to continually attempt to adapt appropriately to the changing world. It is within the bounds of knowledge that visions of possibilities form, and the potential is perceived for combining information on different things to achieve desired effects or goals.

New knowledge can induce profound attitude and behavioural changes, but the precise nature of these changes will depend on the context in which the knowledge is explained and attributed with meaning. There is scope for further exploring how the elements of this context can be predicted or predetermined through the development and application of selectively composed complexes of C&I.

We need to seek clarity of understanding about how the impacts of knowledge depend on how knowledge is interpreted and applied by those who possess it. There are appropriate and inappropriate ways of interpreting and applying knowledge; an observation relevant to knowledge generated by the C&I assessments. For some knowledge, correct usage can be guided by standards and thresholds. But sometimes apparently reasonable standards because of their veneer of reputability, are wrongly assumed to be based on certain vital considerations. Elsewhere, values plotted around standards can be rationalised to support attitudinal positions that would not be approved, if they were to be appraised from other angles. Knowledge generated by C&I assessments on unsustainable practice or social malaise can fuel prejudices or lead to the rationalisation of support away from communities, when an injection of resources to upgrade local problem-solving capacity may be what would most benefit them and sustainability.

The misinterpretation and misuse of knowledge is minimised when an appropriate context is supplied for the application of knowledge or the examination of its broader significance. This can be done by assessing information generated by individual C&I in association with information generated by other C&I, all of which have been formulated with each other in mind to create a pertinent context. The power of contexts lies in their ability to answer 'why' questions by exposing networks of interacting factors. To compile a complex, C&I that correspond to its various component parts should be selected. If this is done, issues of significance to each other's roles, performances and effects will be covered.

C&I complexes should encompass contexts that are recognised by forest farmers as relevant to sustainability and local livelihoods, if their assessment is to produce information that will be regarded as useful and valuable by forest farmers. To achieve this, forest farmers have to participate in the formulation of C&I in such a way that they understand the rationale C&I and agree that application C&I will provide information to enhance their control over sustainability of forest resources and their long-term socio-economic interests.

To some extent, the criteria developed by the C&I researchers in the field tests, and clusters of I&V related to each of them, provide a context. However, their development was hampered, as has already been pointed out in previous sections, by the researchers being asked not to branch out into issues that were not directly connected with their disciplines.

The rationale behind the choice of C&I is a significant one, regardless of who is responsible for effecting the choice. The validity and acceptability of the rationale to other forest interest groups must be examined. Having each interest group separately examine a given set of explanations will isolate areas of conflicting interests and issues which are understood in different ways. These contentious domains could become the focus of participatory problem-solving exercises that aim to arrive at empirical generalisations concerning the relevance of individual C&I across cultures and ecological zones. Examination of the continuing relevance of explanations to different interest groups would have to be repeatedly undertaken as circumstances change and new information and knowledge comes to light.

Box 9.1 Cultural Evolution, Transformation and Integration and the Loss of Social Capital

There was an overall agreement among test team members that the partial or total collapse of traditional social structures endanger, more than anything, the survival of cultural knowledge. However, the Cameroonian social criterion '***Social structures permit the transmission of existing knowledge systems***', is the only C&I statement that specifically addresses the relationship between social structures and cultural reproduction and evolution.

New forms of community leadership and governance that infiltrate existing social structures are often stimulated into being by newcomers and/or external factors. Customary authority can be destroyed or heavily compromised by new types of more self-centred authority. Decision-making processes within the community typically then become more centralised and the leadership more closed. New leaderships often depend upon specialised knowledge and connections which, being beyond popular comprehension, ward off the possibilities of it being subjected to articulated criticism from within the community. Thus, ignorance of certain types of knowledge can inadvertently facilitate the shift of social power and control over forest resources away from traditional institutions. As new social orders gain a foothold, so the meaning of traditional knowledge gradually ceases to be of relevance and loses its powers to influence. The lack of transparency and the emerging 'knowledge abyss' create mistrust which weakens collective support for projects proposed by the new leadership (Otsuka 1998). What then emerges is a cultural pluralism; that is the pluralism of inequality, of differentials in wealth and access to the opportunities that wealth opens up (Manners 1956). People may then have no option but to contend with or adopt new forms of behaviour with adverse environmental consequences, some of which they may be unaware.

Problems can occur when changes that have no evolutionary connection with the community's history are instigated and forced upon a community by outside agents or forces. Changes that are slow and largely internally initiated generally allow communities a greater and more timely appreciation of their broader significance and this enables constructive adaptation to them.

A community's traditional technological capacity forms part of its culture and knowledge base. This capacity has often evolved over centuries in response to specific local circumstances and in many places it continues to evolve through the testing of adaptations, to make most efficient use of the changing local factor endowment without impairing the environmental carrying capacity (Reddy 1994). This is not to say that slow evolution that brings about only minimal change is the best thing or even a good thing under all circumstances; often radical change is needed to eliminate the root causes of forest degradation. However, we have noted in our review of the C&I that the adoption of new techniques and technologies often results in changes of unprecedented scale and speed, some of which are associated with potentially dramatic, disequalising social impacts. The devastating effects are often not stopped in their tracks because people, being unfamiliar with them, fail to recognise them before the damage is well advanced. When the time of realisation comes, the problems will have grown and multiplied to the point where a much larger body of knowledge is required to bring their solution into effect.

SECTION III

DISCUSSION AND CONCLUSIONS

Chapter 10.
Discussion

SECTION III

DISCUSSION AND CONCLUSIONS

Chapter 10.
Discussion

Chapter 10. Discussion[45]

The C&I for CMFs tests were carried out in three continents. They scanned a vast spectrum of issues either affecting or affected by CMF. They brought together the ideas of academics in different fields and with contrasting backgrounds. They drew community members into debates on how to describe, analyse and evaluate their own performance as forest resource managers. Additionally, they sought to derive the extent to which the C&I they generated are relevant to geographical locations other than the test sites, and what their application would require from different potential users in the way of funds, knowledge, skills and technology.

With this comprehensive scope, and comparatively little time for testing C&I, the results obtained will help direct attention to diverse areas that merit further research and development. In the ensuing discussion, we pull together some of our observations on the concepts, assumptions and methodologies underlying the C&I reviewed in preceding sections, and put forth some ideas for enhancing the overall utility of the processes and outputs of developing C&I for CMFs.

10.1 The Conceptual Framework and Methodological Processes

10.1.1 Use of the Hierarchical P, C, I&V Framework

Notwithstanding the challenges outlined below, overall, the hierarchical framework of Principles, Criteria, Indicators and Verifiers (P, C, I&V) used was found to be adequately simple to use and relatively easy to explain framework upon which to structure the issues, factors, variables, etc., identified as affecting sustainability. However, the segregation of issues among these disciplinary categories did not facilitate identification of causal relationships between them.[46]

There was considerable variation in how the testers interpreted the working definitions they were given of the words *Principles*, *Criteria*, *Indicators* and *Verifiers*. The content of some of the principles, criteria and indicators they created appear to closely reflect their specialisations, value systems and/or worldviews. The realisation that a single issue may be simultaneously allocated to various levels within the hierarchical framework, depending on the context in which it is being considered, caused some confusion. Our appraisal of the C&I complexes created, suggests flexibility in the allocation of issues on the framework does not unduly detract from its information-organising capacity.

The testers differed in the levels at which they pitched their P, C, I&Vs. Some proposed only one, all-embracing principle. In such cases, the supporting criteria tended to be of correspondingly larger scope compared to those proposed by the testers who distributed concerns

[45] Written by N.Burford de Oliveira.

[46] The hierarchical framework used shares a number of features with the Tropenbos Framework (Lammerts van Bueren and Blom 1997) and the Framework for the Evaluation of Sustainable Land Management (FESLM) proposed by the FAO (Smyth and Dumanski 1993). The latter proposes the superimposition on a hierarchical structure of any number of subsets of evaluation factors, diagnostic criteria and indicators/thresholds – themes can thus be broken down into more detailed sub-themes for discreet evaluation. This framework, however, like the Tropenbos one, does not possess mechanisms for linkages between issues highlighted in different subsets. For these linkages to become apparent, given issues would have to be allowed to reoccur at different levels in different subsets in accordance with the multiple facets of their relevance.

under several principles. Discrepancies of this sort percolated down to the indicator and verifier levels, and resulted in the proposed C&I sets varying in their degree of detail. In some cases broad indicators for broad criteria, aggregated several factors of indicative value. These were then disaggregated and identified as verifiers which could equally well be described as indicators. Other verifiers proposed constitute materials, equipment or methods for measuring, judging or otherwise evaluating indicators. These inconsistencies comprise one of several factors that undermine the possibilities for comparing the results of the three tests with a view to identifying common C&I. Despite this, the opinion formed that, while categorisation of issues into P, C, I&V is useful, it is unreasonable to consider these categories as mutually exclusive in the fullest sense. This particularly applies to the principle/criterion, criterion/indicator and indicator/verifier interfaces.

Furthermore, it was noted by the team members on all tests that opting for very stringent definitions of P, C, I & Vs, then trying to explain these to all involved, and failing to do so adequately, may isolate certain groups of the forest community from the testing processes.

10.1.2 The Base Sets

As examples of different types of C&I, and ways of organising C&I into sets, the Base Sets proved to be very valuable, broadening the test team members' appreciation of some of the possibilities open to them. As check lists, they reminded the team members of the range of issues that might be of relevance to the test sites. Less obvious was their value as a source of C&I. All testers borrowed from the Base Sets. By the end of all of the tests, most of the C&I that had been selected from the Base Sets, were rejected again or transformed so much as to be undeniably different from original statements.

The approach used (i.e., exposing the team members to and asking them to select from sets containing many C&I originally proposed for *industrial* timber management)[47], such as the CIFOR Phase 1 test results, or from other geographical contexts) is likely to have introduced some biases into the sets they compiled. (Although because of the nature of bias, its detection and assessment of degree of bias is problematic.) For example, had fewer (or no) commercial Base Sets been incorporated in the Brazilian tests, fewer C&I relating to commercial timber management may have been included in those management and social subsets. The order in which issues were ranked may have also been advertantly influenced by the ranking in the Base Sets. It is unclear how much the test results were affected by this sort of bias. All sources of bias diminish the confidence with which generic C&I can be identified. With regard to issues otherwise correctly identified as generic, bias will increase the proportion of these that fail to correspond with local priorities (as opposed to local conditions of negligible or only moderate significance) or target local perceptions of best practice.

The test teams reacted differently to the use of the Base Sets as a part of the methodology. Some of the Brazilian team members were irritated by what they thought was a flaw in the overall testing methodology; testing C&I developed for management objectives which do not correspond with the management objectives of the test site communities. There was some discussion as to which element had been wrongly chosen, the test site or the Base Sets. This led to critisism of the choice of test site. As the Base Sets, particularly the CIFOR Phase 1 Brazil test result, emphasised timber management considerations, it was argued that a site where the community operates its on a commercial timber management enterprise should have been chosen.

On the Indonesian and Cameroonian tests, the test teams were interested in reviewing the Base Sets but were unperturbed by the gulf between the topic matter of the C&I in the Base

[47] Most of the C&I of commercial timber management could not be trialled at the test sites since they refer to phenomena not occurring at the sites. Their relevance to CMF was therefore hypothesised rather than proven as a result of testing.

Sets and test site conditions. With few exceptions, all team members found developing new C&I that reflect site conditions preferable to adapting the Base Sets. The latter was seen as a circuitous route to arriving at C&I that effectively address test site realities.

10.1.3 The Expert Process

Community managed forests present a great variation of systems across different locations, many of which are based on different cultural, spiritual and religious worldviews (see Seeland 1997). They are also constantly undergoing modifications. The possibility of developing a single generic set of C&I that satisfies the assessment and monitoring requirements posed by this spatial and temporal diversity is remote. It is also likely that many of the assumptions professionals make about community forest management systems will differ vastly from the understanding forest farmers have of their resource base and which guides their decision making processes (Sinclair and Walker 1999).

Strictly speaking everything in one way or another affects sustainability. To arrive at a manageable C&I-based assessment tool, we have to pare down the number of factors for assessment to those that are more powerful determinants of sustainability. It is how people vary in the importance they attach to these different factors that leads to different definitions of sustainability (Smyth and Dumanski 1993). Seen from this angle, the contents of C&I sets developed, having been ultimately determined by 'expert' teams despite endeavours to enhance interactive community participation, are unlikely to fully equate with community understanding of what factors should serve as indicators of the social, ecological and technical significance of their forest resource interventions.

The relative importance of different aspects of community managed forests to sustainability at the three test sites, therefore, remains unknown to us. We have little idea as to how this relativity is perceived by different groups. We suspect that their perceptions are constantly changing due to the ripple effects of individual changes.

10.1.4 Interdisciplinary Teamwork

The interdisciplinary approach was meant to result in the integration of the three monodisciplinary subsets produced on each test. The approach can be interpreted to transform the process of developing C&I into a consensus-building exercise, which requires people of different disciplines and backgrounds to arrive at a mutual view of the dynamics of sustainability. Some consensus building is indeed desired. However, its achievement has to be understood in terms of knowledge and beliefs that have been compromised. A lot of communication may be necessary to harmonise assumptions and the interpretation of terminology across disciplines before any notable consensus on some issues can emerge. Moreover, the interdisciplinary approach was to include community participation – ideas emanating from the community were to be integrated in an interdisciplinary fashion with those of the team, on the understanding that all ideas had to first win consensual approval.

Processes for orchestrating this merger of ideas were not provided as part of the methodology but developed on the way with varying degrees of success. The methodological requirement of segregating issues in the C&I hierarchy according to discipline imposed some constraints upon their integration. These constraints must be seen in conjunction with how successfully teams worked in an interdisciplinary fashion. There were clear differences between the test team members regarding the amount of community participation they sought to elicit, and the importance attached to close team communication. More discussion between the team members on the Brazilian and Cameroonian tests could have clarified further how disciplines interrelate in the dynamic structuring of sustainability. How well the team members' personalities matched seemed to affect how well they worked together as an interdisciplinary team. The inclusion of methodologies designed to integrate contrasting personalities could therefore enhance interdisciplinarity.

On all the tests, the community participants only had a vague notion of how the interdisciplinary dimension of the tests was being conceptualised by CIFOR and the test team members. Many linkages between social, ecological and technical factors are, however, obvious to them. Thus, although other aspects of that approach may have been problematic, the generally interdisciplinary nature of the emergent C&I was not in contraction with local perceptions of reality (although, as described earlier, the categorisation of sets along discliplinary lines likely was problematic).

The cross-disciplinary coverage of the C&I proposed by the test teams provides some insight into the aspects of each others' disciplines that they consider to be particularly relevant to sustainability in connection with their own discipline. Many duplications occurring in the C&I subsets were removed over the course of the test. Those remaining underline, via their multiple associations with other C&I, the broader significance certain issues were recognised to have.

For the purposes of integrated assessment, some issues might have been better presented by interdisciplinary C&I complexes, rather than by dispersal across three discipline-specific sets. This could lead to a better all-round appreciation of their significance. For instance, in order to monitor how change in a forest's economic value affects people's behaviour and attitudes to conservation, we need to monitor socio-economic, ecological and managerial variables. But what needs to be monitored most of all, are the relationships between these types of variables and their outcomes (Kremen *et al.* 1996). This is especially so if no correlation has been established between them.

Perhaps one shortfall of the tests was the lack of conscious intention to design indicators that can reveal the correlations or interdependencies between ecological, managerial, social and economic variables. For example, including indicators that could reveal how a change in economic value alters patterns of social organisation, or what changes in attitude to conservation it causes. Indicators could be specifically targeted to monitor the results of interdisciplinary hypotheses being tested. Ramírez (1998) lists a number of cases where indicators have been designed to assess linkages that trace and reveal the nature of relationships between variables of different types and can be used to monitor the evolution of these relationships

10.1.5 The Integration of Disciplinary Subsets

Focusing on creating three discipline-specific C&I subsets hindered exposure of background factors of broad significance *across disciplines* (e.g. health or educational factors) and also of *causative factors* (e.g. cost cutting) that, originating in one field (e.g. social or economic), impact upon another (e.g. ecology). When it is important to enhance understanding of the social impacts of forest management and vice versa, splitting these domains into two discipline-specific categories creates certain barriers. These blur tradeoffs between issues assigned to the respective categories. Given the multiple management objectives and community stakeholder groups that must be considered in CMF, the disconnectedness between disciplinary categories proved to be particularly unhelpful.

Most of the specialists set loose and permeable boundaries to their individual disciplinary domains. This may have been spurred by the interdisciplinary approach, but, it may have been linked to the testers' own visions of their professional fields. Even those who opted to work mainly alone, developed some C&I that would, arguably, slot more precisely into a disciplinary category other than their own.

All the C&I sets produced, therefore, include some conceptually overlapping C&I, both within and between their subsets. The Brazilian team saw the overlap as desirable, saying it straddles conceptual boundaries between the ecological, social and managerial dimensions of forest management. This team also maintained that the inclusion of 'approximate' duplications of C&I within subsets did not amount to the incorporation of redundancies. Many are only partial conceptual duplications that can be distinguished according to the differing contexts that frame them. The Brazilian team maintained that this overlap or diffuse gradient in C&I content, makes the sets more robust tools, with a greater potential for matching the variable assessment requirements of different CMF scenarios and different user group capabilities.

The Cameroonian forester thought forest management C&I should integrate social and ecological C&I rather than be developed in parallel. Similarly, the Cameroonian ecologist maintained that ecological C&I for CMFs had to be defined within the context of management objectives, methods and impacts.

The Brazilian team felt two, instead of three, subsets should be produced; one on the social and economic aspects and the other on the ecological and managerial aspects of community forestry. A social scientist and an economist should work on the compilation of the first, and an ecologist and a forest management specialist on the second. However, this would not solve the question of how to illuminate the linkages between the social and economic and the ecological and managerial factors. In contrast to the Brazilian forest management C&I, the Indonesian and Cameroonian complexes in this field had a pronounced social bias. On all three tests the forest management team members developed C&I on economic variables, and on the Brazilian and Cameroonian tests, they concentrated more on economic issues than did the social scientists.

The Indonesian team was the most successful of the three in working as an interdisciplinary team. But, like the other teams, this team too felt they were not given enough time to adequately develop and integrate their perceptions and ideas. However, in addition to regularly cross-checking the contents of their respective C&I sets for overlap, they devoted the last day of the exercise to more thoroughly integrating their three subsets into one set.

The general consensus reached by the three test teams independently is that there is an intrinsic difficulty to the meeting of all the C&I within any one of the sets they produced. They maintained that, ultimately, many of the socio-economic C&I are inherently irreconcilable in the long term with the ecological C&I, taking into account forecasted population growth rates. The satisfaction of human welfare goals (especially if this includes economic growth) and that of nature conservation, are probably ultimately mutually exclusive in a wide range of CMF scenarios throughout the tropics. Even where integrated economic development rather than growth is the chosen goal, trade-offs between social welfare and ecological integrity are inevitable. The pessimistic nature of this perspective, however, does not diminish the value of the monitoring system; C&I of sustainability remain useful for identifying key stresses and problem components in CMF systems, which could then be made the focus of a constructive effort to improve sustainability.

10.1.6 Community Participation

Two important types of observations regarding community participation have been possible. They are observations on:

1. the participation aspects of the methodologies employed, i.e., how, and to what degree, different members of the test site communities participated in developing and critically screening C&I; and
2. the type and degree of emphasis placed on participation by the C&I devised with the methodologies employed.

The main findings are as follows:

i) Participation of Community Members

The nature of data and information recorded on community input makes it difficult to quantify or qualitatively assess this input. Weaknesses in the documentation processes used and the lack of a stronger methodological foundation in place for systematising community participation are to blame.

Although the test teams spoke the country's national language, some language barriers remained at the Cameroonian and Indonesian test sites where the local majority only spoke their tribal language.

As mentioned earlier, there were clear differences between the team members in their approach to eliciting and applying local knowledge. Despite efforts to encourage the interactive participation, villagers participated mainly as providers of information. The Cameroonian forest management specialist appears to have been the most successful in encouraging community participation in the development of specific C&I. According to him, the C&I in the forest management set he compiled correspond with the communities' own management priorities. He maintained the strong emphasis on socio-economic parameters has its origin in priorities expressed by local people and was accentuated by the lack of complex technical tending or harvesting methods observed in use at the Cameroonian test site.

The most active and vocal participants tended to be the wealthier, politically more influential community members. Generally speaking, less direct communication took place with women, children and the elderly than with working age men. The Brazilian social and forest management testers, however, made a special effort to get women to actively participate in the exchange and examination of ideas. On the Indonesian test, the whole team put together a special session to involve school children at one of the test site communities. This may have stimulated the inclusion of a principle on education in the Indonesian social C&I set.

The participation of the test site communities helps create and spread recognition of the value of local knowledge to developing C&I. Diverse knowledge, born out of different backgrounds and life histories, proved useful and in some cases essential. Everyone had something to give but also revealed gaps in their knowledge that others were able to fill. Sometimes a lack of communication skills hampered the discovery of important information or caused confusion. This was observed among both the rural and the professional communities. Both these groups could benefit from measures intended to further joint critical analysis of C&I for CMFs.

Less community participation could have given rise to results more limited by unrecognised information deficiencies and faulty academic preconceptions of forces governing local realities. The plausibility of such perception shortfalls was conveyed by the fact that the team members all found it necessary to alter their original ideas of what constituted the most relevant, applicable C&I for CMF after having consulted forest inhabitants and visited their homes, farms and forests. This reconfirms the importance of the field visits that have been the central feature of all CIFOR's C&I tests.

On all the tests, there was a tendency for the non-community members involved to evaluate the community members' contributions according to their own standards. The tendency was particularly notable in some of the professionals reviewing C&I with community members at the workshops. These people also often pursued arguments the academic complexity of which outstripped the community participants' comprehension. Communication was sometimes severely hindered by the use of technical jargon. For these reasons, given their current wording and their required evaluation methods, some of the proposed C&I are too complicated to be useful for semi-literate forest farmers. Some of the tendencies we observed in professional workshop participants that appeared to constrain community members' contributions were:

- a reluctance to relax academic rigour and refrain from the use of academic jargon, and to concentrate instead on basic theories and concepts backing proposed C&I;
- a tendency to substantially doubt the validity and utility of local knowledge; and
- a waryness of letting local people take the lead for fear that some important questions would go under-addressed and result in an unbalanced or incomplete C&I set.

The Brazilian forest management specialist proposed that the C&I resulting from the Brazilian test be translated into simpler, colloquial language, to make them more accessible to a larger range of potential user groups including forest farmers and local NGOs. There was not enough time in which to do this.

ii) C&I on the Importance of Participation

The contents of the produced C&I sets highlight the importance to sustainability of a broad participatory base to intra-community processes of social organisation and decision making. Several of the C&I point to the need for communities to participate with external actors in forest and land use policy and law development and implementation. A number of the Indonesian and Brazilian C&I on decision making, conflict management, rule enforcement, optimisation and monitoring among other things, explicitly refer to participation. Although the word 'participation' is not used in the C&I developed on the Cameroonian test, several C&I on complementarity between community customary regulations and State policies and legislation, and on negotiation processes, imply a need for participation.

Participation is portrayed, especially by the Indonesian and Brazilian C&I sets, as critical to ensuring that any tradeoffs are environmentally and socially optimal, in the light of available knowledge. The testing process identified ongoing participation in forest management monitoring and decision making as important, especially during times of rapid change, to help ensure that:

- compensatory adjustments brought about by changes, are detected and understood in terms of their origin and impact and can thus be subjected to adequate and timely regulation; and
- coordination between user groups' activities continues to uphold the common twin goals of sustainability and equity.

The C&I imply that all the test teams thought participation in decision-making, depending on its type and degree, generally confers upon participants a greater sense of ownership of decisions taken and a responsibility for ensuring they are honoured.

The C&I formulated that imply participation of a wide cross-section of a community in the development of C&I can:

- activate communication channels and mobilise multi-directional information flow leading to the pooling and expansion of different stakeholders' knowledge realms;
- help communities plan strategies for participatory decision making, objective setting, and for the implementation and monitoring of decisions taken;
- constitute a process of conflict prevention and/or management;
- identify and reinforce common or complementary interests; and
- stimulate a stronger mutual interest in examining current conditions, on the understanding that this will lead to the development of C&I that can then be used to improve the existing situation.

Participatory C&I development processes in themselves can serve many of the social functions/processes that some of the C&I proposed during the tests were designed to evaluate. The consecutive processes of developing C&I (i.e., demarkating the scope of a monitoring system) and then applying them contribute to the fulfilment of the same goals in a variety of ways. The more cyclically integrated these processes are, the more probable that the C&I will foster adaptive, integrated development. By building on past local knowledge and experience, such development, by definition, proceeds at the pace at which the local community's understanding of the causes and effects of change evolves.

10.1.7 The Iterative C&I Refinement Process

Nearly all the test team members had extensive experience in community forestry or integrated rural development in forested zones. Nonetheless, during the initial interdisciplinary team review and subsequent fieldwork phases, they all substantially altered the C&I compilations that, at the beginning of the test, they had thought would be the most applicable. Changes resulting from field testing indicate that communication with local residents played a role in refining the C&I

to increase their coverage of issues relevant to sustainability locally. The iterative testing process revealed how easily pre-conceived ideas that fail to fit field realities can be introduced into assessment protocols.

Some problems were, however, identified with the iterative method, especially with the role of the last filter (the workshop). During the field-testing iteration, community members were actively encouraged to contribute ideas. However, subsequent iterations, culminating with the final workshop, led to the increasing exclusion of community members in the testing process. The workshops were meant to serve as a forum at which different interest groups with different histories and objectives could debate what constitutes and indicates sustainable CMF. They were meant to provide an opportunity for diverse groups to move towards consensus decisions on how to disaggregate the factors affecting the sustainability of CMF into components for evaluation. People brought to these workshops different knowledge, world views, mother tongues and communication abilities. Consequently, not all participants could easily understand each other. The more assertive, vocal participants tended to monopolise debates. Many of the academic and professional participants had minimal knowledge on the test site conditions. As already mentioned, their often highly academic evaluation of C&I tended to be incomprehensible to community participants.

The workshops' consistency with the overall test objectives was jeopardised by some of the academic and professional participants' strong interest in pursuing the development of generic C&I for CMF or arguing for modifications that would result in the C&I complying more closely with their perceptions of what management objectives should apply to CMFs. This was most pronounced at the Indonesian and Brazilian workshops. Several of the Brazilian workshop participants, interested in developing the scope for communities to assume responsibility for commercial timber management in natural forests, wanted to amend the tested C&I to focus on this goal. At the Indonesian workshop, participants from the Lembaga Ecolabel Indonesia were interested in seeing the workshop produce generic C&I that could be applied to all CMF scenarios in Indonesia.

Professional foresters, development organisations and government forestry institutions have shown considerable interest in the development of generic C&I for CMF for use as broadly applicable forest management guidelines and assessment procedures. It is believed that generic C&I could clarify domains of common interest to different interest groups, upon which collaborative research and management planning should focus. Classifying issues according to their degree of generalisability can help link some issues (C&I) with policy decision-making spheres at different scales, e.g., local, regional or national. However, despite it having been stressed at the workshops that generalisability should not be a criterion for accepting or rejecting C&I, interest in generalisation led to amendments that made the field-tested C&I less context-dependent. Two consequences of this were:

- a number of C&I were generalised to the point that they become much less specific than they originally were in their address of particular site relevant sustainability issues; in other words, they were rendered less precisely targeted at specific issues, placing these issues at greater risk of being overlooked during the local assessment process; and
- additional C&I were introduced that did not concern current conditions at the test site (i.e. for community cooperative timber management).

The question of tailoring the iterative C&I review process more to the goal of developing the generic C&I needs to be reviewed in greater depth. We need to be aware of potential consequences of inverting the C&I development process from refinement through field testing to theorising hypotheses of regional significance. The latter could introduce new assumptions into C&I sets that had already been field tested with the explicit aim of removing invalid assumptions. This could have the counter-productive result of making the sets either irrelevant or cost-ineffective assessment tools for many places.

For future similar C&I tests, more systematic documentation of communications that take place at the workshops and of workshop-generated information would deepen subsequent analyses of the C&I' generalisability. Even so, in considering the rationale we have provided for the test-generated C&I, the reader acts as another filter C&I, thus participating in the C&I development process, and essentially leading it into one of many directions. The final analysis will be conducted by different groups relating to different situations and management objectives, and so branch out into different directions. To help ensure these groups include local community members, the Brazilian forest manager suggested that the final subsets be translated into local languages. The suggestion was well received but, because of resource constraints, could not be put into practice as part of this project.

10.2 The Relationship between C&I and the Definition of Sustainable CMF

The tests raised the query as to the extent to which a C&I set inevitably does or should define or imply, through its selective address of issues, an 'ideal' for sustainable CMF. Two questions arise in connection with this query:

1) Do we know enough about sustainability to be able to define it?

2) Whose 'ideal' is the correct one?

The fact that it is the developers of the C&I, their knowledge, ideas and interpretations that ultimately decide the content of C&I, makes it important to be clear about who they are (and who they represent). Equally important is being explicit about who was excluded either entirely or partially from the C&I development process. In addition, the meanings of the C&I must be made transparent, i.e., assumptions and judgements have to be fully and lucidly communicated.

Diversity and multiple use were found to characterise CMFs at the test sites, turning tradeoffs and the optimisation of multiple tradeoffs into pivotal concerns. Setting fair tradeoffs is analogous to reaching consensus decisions. There was general agreement that participatory processes of C&I development, although sometimes more laborious and time consuming, are more supportive of consensus building than alternative processes. It was also recognised that people sometimes consent because they are inadequately informed, pressured into doing so, or because they have hidden motives for maintaining alliances. The processes and content of consensus decisions leading to the selection of C&I, and thus to an inference of what the management objectives should be, should therefore be made transparent. For this, the participatory C&I development approaches which are devised should include built-in mechanisms to clarify whose interests the proposed C&I represent. Concerns such as these carry significant implications with respect to the extrapolation of the relevance of the C&I to other sites. The acceptability of selected C&I is a matter that must always remain open for debate amongst those who apply them.

10.2.1 Identifying the Relevant Issues at a Test Site

Deciding on the relevance of a factor or phenomenon, especially if it is of social or economic significance, often requires making value judgements. Most of the testers felt both theoretical knowledge (scientific and traditional) and value judgements are needed to arrive at a viable and useful concept of sustainability.

Value judgements are imperative for popular appreciation of existence value and for humanitarian objectives to guide and regulate human behaviour. Due to their variability, they are often at the root of disputes. Sometimes they are difficult to recognise. Therefore, despite their indisputable importance, the test teams were asked to minimise them in the C&I. When their exclusion proved impossible, the aim switched to making them as transparent as possible. Interactive multiple stakeholder participation involving the team and community members helped deter the internalisation of an ethnocentric definition of sustainability in the C&I.

Some assumptions and value judgements were incorporated into the C&I sets not so much by the individual test team members as by teams as a whole. Groups, like individuals, vary in their internalisation of assumptions. Assumptions of relevance and value judgements are incorporated either through the purposeful inclusion or exclusion of issues. For instance, one contentious issue that came up during the Cameroonian test, and to a lesser extent on the Brazilian test, was whether indigenous knowledge rights are of relevance to the sustainability of CMFs. On both these tests no common understanding of its significance was reached. This lack of consensus led to the issue's exclusion from the sets. The relevance of shifting agriculture to the assessment of the sustainability of CMF was initially disputed within CIFOR, but subsequently recognised as relevant by all the members of all three teams, as well as by community members. It became the focus of several C&I in each country set.

The results suggest some issues, e.g., ecological diversity, multiple use, local economic diversification, cultural reproduction and forest dependency widely influence the sustainability of CMF. The case study literature on community managed forests also suggests the significance of these issues is highly prevalent. However, their relevance at these and other sites must be seen as relative. Recommending their consideration does not mean they are essential qualities of CMF. A move away from multiple-use forestry need not diminish sustainability. It may even be desirable under certain circumstances. Given a favourable economic policy environment, communities may establish viable commercial harvesting or product processing enterprises or branch out into other non-forest based economic activities. Such developments may lead to greater comparative advantage, reduce dependency on forests for the satisfaction of some essential needs and have other desirable social and environmental consequences.

Once the relevance of an issue is established, it becomes of interest to know how and why it affects sustainability. This requires deconstructing the issue into its contributing factors and emergent properties. Explaining the mechanisms and contextual factors that define the issue's role in relation to sustainability improves the possibilities for effectively targeting interventions. Appreciation of contextual factors is especially important as these impose limits on the internal value or behaviour of factors or phenomena.

The relevance of many issues to a site will not be known in advance of assessment. For some variables, determining whether they are relevant will, therefore, be done as part of the assessment. Thus, a C&I set can legitimately include some C&I that could turn out to be irrelevant to some CMFs. The finding that a certain variable is only relevant to a few sites, contributes to the larger picture of what factors affect sustainability where. Such information is useful for designing and targeting policies. Failure to register where potentially important factors are irrelevant could preclude some comparisons over time being successfully undertaken later.

10.2.2 Moving towards the Identification of Common and Generic C&I

Identification of common C&I among the test results was one the project's aims that paralleled the aims of the Phase 1 C&I tests (for commercial forests). This aim was perceived as a step towards evaluating the possibilities for extrapolating the test results.

While the common methdology in all the sites enabled some possibilities for investigating the wider geographical applications of the proposed C&I, there are many limitations to such an assessment as well. The site selection criteria, for example, ensured the test sites have some features in common. But they nonetheless also embody some pronounced geographic, historical, cultural and socio-economic differences. They can be distinguished from one another by the forest products, management methods and technologies they possess. As a group therefore, they are not representative of a single 'typical' type of community managed forest (if such a thing exists).[48] This diversity, while somewhat inevitable, destabilises the basis for extrapolating the relevance of some of the test-generated C&I to sites located in different regions and in different socio-political contexts. Another factor undermining the generalisability of many of the tested C&I, is that the test-generated sets contents can be explained by many factors, as we attempt to show below.

i) Defining the Meaning of Words and Terms

Setting criteria that a single C&I must satisfy to qualify as 'common' to more than one test set, was not as straightforward as it would seem. Our approaches to the identification of common C&I ended up being more crude and imprecise than we would have liked. Initially we sought to identify individual C&I common to more than one of the three tested country sets by lifting them out of their context (defined by their position in relation to other C&I in the hierarchical framework), and attempting to match them up with other C&I according to their conceptual or linguistic fit. Thus, the C&I were screened for key words and conceptual resemblance.

The precision of C&I depends both on a definite common interpretation of the words and terms they contain, and on their overall wording. One outstanding query concerns the extent to which different words in similar contexts or the same words in different contexts were ascribed with the same meaning. There remains uncertainty, for example, to what extent the terms 'norms', 'regulations' 'mechanisms' and 'institutions' were intended to be used interchangeably (in analysis they were taken to be so). Most of the matched C&I may be best described as approximate commonalities.

Along the same lines, indicators containing words like 'banned', 'prohibited', 'outlawed', 'authorised', 'forbidden' are weakly indicative of the distribution of authority unless they state whose level of control or authority they mean to refer to, or this is clarified by their positioning within a complex of C&I. A lesson from this is that often it is very desirable to clarify specifically in C&I who has or shares possession of control over forest resource exploitation, be this the community, the State or some other authoritative body. Such distinctions can help if the strengths and weaknesses of traditional management systems are to be identified to aid the formation of appropriate policies for devolving management responsibilities.

ii) Rationale and Justifications to Explain the Relevance of Accepted C&I

Developers of C&I need to provide sufficient explanations for their C&I to be uniformly interpreted by different interest groups. The explanations of C&I have important consequences for their generalisability and wider applications.[49] A factor, variable or phenomenon can be generalised and responded to only to the extent to which its recognition is common to different interest groups across ecological regions and cultures. Many C&I conceptualise knowledge – this hinders their dissemination amongst people who 'know' things, but have not conceptualise them in the same way as the C&I, as well as amongst those who do not possess the underlying knowledge.

Modelling explanations to fit C&I requires some care, as an explanation can reach such a high level of abstraction that the factor or phenomenon it seeks to clarify ends up appearing much more generalisable than in fact it is. For instance, it may be possible to generalise about responsiveness to a particular stimuli, but not about the responsiveness to this stimuli in a special

[48] During the planning phase of the C&I for CMFs tests, discussions between CIFOR scientists failed to lead to a conceptualisation of a 'typical' community managed forest, and work towards creating a typology of CMFs was in its rudimentary stages.

[49] For more discussion of the generalisability of research results the reader is referred to Pertti Alasuutari (1995).

situation defined by a unique context. It is as though an indicator may be explained by the justification of the more generalisable criterion, with the consequence of it itself appearing as widely applicable. The generalisation takes place by relating the indicative factor or variable back to a broader entity or conceptual context (a criterion or principle) of which it is a part.

iii) Sources of Variation Complicating the Identification of C&I Commonalities

The three C&I sets differ in the issues they addressed and the distribution of emphasis among these. Issues encapsulated in upper level statements that are common to more than one set, in most cases deconstruct into different lower level considerations, reflecting different perceptions of the contributing factors. Several lower level statements, however, can also be found similarly expressed in more than one set. The variation in issues covered partially reflects the team members' perceptions of priorities and site conditions. Some issues dismissed by the team members as relatively insignificant, might have been considered significant by others. Differences in local knowledge and opinion may also be responsible; some of the variation may reflect as well the concerns and opinions of the workshop participants. The relevance of a criterion or indicator proposed for just one or two of the test sites may have been overlooked at the other site or sites. For these reasons it is not possible to conclude that the tested C&I are only relevant to the conditions of those test sites for which they were formulated (nor are they the only possible C&I relevant to their sites). Other plausible explanations for the variation in coverage are presented in Box 10.1.

There was not enough time to review all the rationale and descriptions of testing processes provided by the team members in the Justification Forms. This limits the possibilities to isolate the sources of variation with the most decisive influence on the composition of the final test-generated C&I sets. The explanations we give of the C&I are, therefore, based on logical deductions during the analysis (including possibly some faulty assumptions of which we are unaware). Which C&I, of the many proposed, refer to the more 'major' issues cannot be ascertained with a high degree of confidence. Some issues stand out because a comparatively large number of C&I were formulated for them on one or more of the tests. However, there is no reason to believe that the more C&I are developed for an issue the more important is the issue.

iv) Increasing the Application Range of C&I

Descriptive and Prescriptive Indicators

How far a C&I set defines what CMF should be and, on a separate but related note, how generalisable it is, partly depends on the type of C&I it contains. A useful distinction may here be drawn between **descriptive** (or 'revelational', C&I) and **prescriptive** ones. C&I that describe states and processes do not in themselves impose value judgements, but can facilitate deductions about limitations and potential. Patterns of change can be monitored and sometimes predicted with the use of descriptive C&I. The use of C&I in monitoring sometimes leads to the exposure and review of assumptions held. Value judgements only really become an issue when standards or thresholds for the evaluation of descriptive indicator readings are set.

By contrast, standards and threshold values that imply how things should be done or what ideological framework should apply, are usually internalised in prescriptive C&I. Social and economic prescriptive C&I are fairly commonly recognized to tend to internalise value judgements. Such judgements, however, also appear in an ecological context. The price at which ecological conservation or species existence is valued is, many would agree, a value judgement – some people do and some do not believe it is permissible to sacrifice a small proportion of animal species in exchange for longer-term economic growth and stability.

A common limitation of **generic C&I** is their failure to reveal variation in detail. Great care must be exercised when developing **prescriptive generic C&I** intended as assessment, rather than communication tools, as these can **generalise** value judgements to an extent

Box 10.1 Possible determinants of variation in the three test-generated country C&I sets

Team members selecting C&I from different C&I Base Sets at the beginning of the test

Initially exposing the experts to C&I Base Sets originally proposed either for industrial timber management or for CMF in different socio-economic and ecological contexts, and asking them to select C&I from these for CMF, is likely to have introduced biases. One of the Base Sets used on the Indonesian test included many detailed C&I on soil properties which may explain why that final set included more soil C&I than did the sets resulting from the other tests. Because the Base Sets varied from test to test, it is likely that the biases they introduced do as well.

The team members' specialist fields of interest

On the Brazilian test, the anthropologist was particularly interested in archaeology while the ecologist's expertise lay in the ecology of hunting. This may explain why, compared to the other country sets, a large number of C&I on hunting and archaeology appear in the Brazilian set, even though hunting is known to be very important at the Cameroonian test site, and probably not insignificant at the Indonesian test site.

Different local priority concerns

At the Brazilian and Cameroonian sites the communities had managed to expel logging companies from community forest areas and were, at the time of the tests, intent on resisting further incursions by such groups. Several C&I of negotiations with external timber interest groups were included for these sites. This issue was not directly addressed at the Indonesian test site where the role of third parties in the exploitation of community forest resources was perhaps less vehemently contested. At the Brazilian site, local concern over fire control was pronounced as the test took place just some months after forest fires had swept through the region with devastating effect. This probably explains why the Brazilian set includes more C&I on fire management than the other sets.

Accessibility of relevant information

At the Indonesian test site there was a general reluctance on the part of the local population to talk about hunting, probably because hunting there is illegal. It was therefore difficult to assemble information on hunting knowledge. This may underlie why so few C&I on hunting appear in the Indonesian C&I set.

The evolution of practice

The sophistication of management practices was found to vary between communities. A case in point is rubber tapping, which is an important income generating activity at both the Indonesian and the Brazilian test sites. Since none of the experts were specialised in rubber tapping techniques, their understanding of what indicates good rubber tapping was confined to within the precincts of local knowledge. At the Indonesian test site, this knowledge appeared very rudimentary compared to that encountered at the Brazilian test site. (It may also be that the Indonesian team was less successful than the Brazilian team in eliciting local knowledge on this subject.)

unwarranted by the variation that exists. They risk echoing pitfalls of centralised evaluation and planning systems that typically manifest in the oversight of important local factors which fail to respond positively to the norms or conditions prescribed. Homogeneous, pan-regional policies developed by centralised government often fail because they do not respond to the distinguishing characteristics of minority groups, amongst them many forest communities. When the complexities of communities' forest interactions escape the government's attention, the government can not consciously respond to them constructively. Moreover, there is a greater likelihood of it failing to foresee or of remaining blind to detrimental impacts its extra-sectoral policies have on forest communities.

The test teams were briefed on the limitations of prescriptive C&I and were asked to try to avoid them. Nonetheless, all the final country sets do include numerous prescriptive C&I whose local relevance may be disputed and/or whose generalisability needs to be called into question. Some team members felt incorporating standards into some C&I was needed for efficient evaluation purposes. This suggests a deeper examination of the pros and cons of prescriptive C&I is needed, in order to formulate more detailed recommendations for their development.

Unless a lot of information exists, the relevance of many prescriptive C&I to a site would need to be field-tested. However, some prescriptive indicators of ecological and managerial phenomena for which response curves are known appear more amenable to generalisability because they can be objectively measured. This renders them less susceptible to the ethical dilemmas of passing judgements across culture and class.

However, current knowledge gaps on optimal standards and threshold values restrict the scope for developing prescriptive ecological indicators, as standards must correspond with the environmental carrying capacity as defined by climate, edaphic factors and the history of exploitation. A general prescriptive indicator such as 'harvesting rates must not diminish reproductive vigour' when it can only be partially accounted for, stimulate awareness of the need for more knowledge. At the species level, many prescriptive management indicators should only apply to restricted environmental zones when knowledge on their performance elsewhere is lacking. Because the economic incentive to exploit species growing in sub-optimal environments is lower, their performance in these environments tends to be under-researched. The poor are most likely to exploit sub-optimal environments and this makes tapping their local knowledge on the flora and fauna all the more important. However, local knowledge on how species respond to sub-optimal conditions can be severely limited if production under such conditions is a fairly recent development. This might, for instance, apply to migrant farmers establishing settlements for the first time in natural forests on poor soils. Often there is a large time gap between the destructive forest intervention taking place and the full implications of damage being recognised. In such cases, all-round understanding could be improved by dialogue between local people and the scientific community on occasions such as the tests' workshops.

Prescriptive indicators are probably best developed through interactive participation involving communication with the local forest community and between groups within this community. This would help ensure that the limits such indicators impose are acceptable to the local population and that local capacity exists for their enforcement. In connection with the social indicators on rules and regulations, prescriptive indicators developed without community participation run the risk of misinterpreting local capabilities, or being insufficiently informative of them.

Grouping Species for Assessment Purposes

One way of increasing the generalisability of an indicator is to formulate it around one or more characteristics known to be possessed by a group of species. These characteristics can be biological responses, anatomical features, ecological functions or human uses. The larger the number of traits shared by the members of the group, the more management considerations that will be of common relevance. Distinguishing between species according to whether their reproductive mechanisms fall into the **K** or **r** categories, for example, provides one basis for grouping which was not considered by any of the test team members. Animal species could also be differentiated into groups according to their position in the food chain or size of territorial range, although none of the test team members identified these categories as useful for the assessment of sustainability. Some flora species could be categorised according to how they are harvested (destructive harvesting, removal of fruits, shoots, bark, etc), or some other trait or variable. The suggestion made by the Brazilian test site inhabitants, of grouping lianas into management categories according to their growth patterns, provides the best example of the potential of grouping species for assessment purposes provided by the tests. For each grouping certain 'appropriate' use or management methods would apply.

When it is possible to group species in this way and create C&I that are equally relevant to all species within the group, then the geographic range of these C&I is expanded to the extent to which the habitat ranges extend into independent areas. The assessment process becomes more efficient when a number of species of the group occurs within an area. The C&I that apply to the group as a whole can be regarded as an order above differentiated C&I on symptoms of health or stress that are species-specific.

Substitution Groups

Knowledge of substitution groups is useful for selecting indicator species that will give information on early-warning signs of non-sustainable use (Kremer *et al.* 1998). Trends such as out-competition or substitution of indigenous species indicative of certain phenomena, or that have traditional uses, can be monitored to provide information about social and ecological conditions. Their population status can guide the formulation of certain management components related to other species or practices linked to them.

The subject of substitution groups was raised by the Brazilian social specialist in relation to the assessment of hunting pressure. He proposed that the extent to which preferred game meat species are being replaced by lesser liked species or other foods in the local diet can, if certain other factors are accounted for (e.g. enforcement of new legal restrictions on hunting or a decrease in purchasing or bartering power), provide an indication of hunting pressure. C&I on preferred game species and the game species most consumed in relation to their biological availability, could thus help reveal some species' gradual descent towards local extinction.

The Cameroonian forest management specialist spoke about traditional house construction materials, and the extent to which these are being substituted with timber or alternative materials such as concrete and corrugated iron. Their substitution gives an indication of the changing pressure on forest resources exerted by the local population. Again, other factors need to be considered, for example, (hypothetically speaking) whether a switch from timber to concrete was financed with profits obtained from forest products destructively harvested. Answers to such questions would require other C&I.

Generalisation: Aggregation and Deconstruction

There is no hard and sharp divide between generic and site-specific C&I (these are 'degrees' not 'dichotomies'). The relevance of some C&I is more restricted than others. Various factors determine how widely relevant a C or I is, including how **general** or **precise** its focus and the cultural or environmental range over which it is to be applied.

Information on the generalisability of individual C&I can be used by certification bodies to develop standards applicable at different geographical scales, and to clarify how policies can increase their support of a economic and political climate conducive to the certification of CMFs and CMF products. Amongst the more generalisable C&I are those that are highly susceptible to the influence of regional and national policies. Conversely, issues of relatively restricted geographic relevance suggest the need for broad brush policies and more targeted policies that support local forest management authorities, or the devolution of forest management authority to local communities.

The chances of site conditions not conforming with a C or I internalised norm or prescription increases the more the conception of the site's 'boundaries' are extended and its area increased (unless the increase in regional scale is accompanied by a decrease in the norm or prescription's specificity). This is the case because the larger the boundaries of a particular area, the more cultural and biological diversity it is likely to contain.

Both the results of the CMF and the Phase 1 commercial timber management tests suggest that principles and criteria, as large, fundamental truths come closest to being of universal relevance. Arguably, with respect to CMF, C&I that are sufficiently general to be equally relevant to sites with contrasting characteristics, will be insufficiently targeted to generate information detailed enough to be useful. The team members thought that most generic C&I would be too general to capture the particular factors affecting sustainability at a site. Generic C&I tend to point to issues that are the outcome of conglomerates of contributing factors**.** The effects of factors contributing to aggregate C&I can not be isolated unless they are identified and disaggregated at lower levels of the P, C, I&V hierarchy. Such disaggregation was attempted for several of the large criteria included in the tested sets. Even where similar large criteria occur in the country sets, these mostly deconstruct at the lower hierarchical levels to reveal some differences in the contributing factors perceived as important.

The more detailed I&V, which constitute the more practical assessment tools for evaluating how well processes and methods are adapted to local constraints and possibilities, showed marked variation across sites and included the most statements of obviously restricted geographic relevance (e.g. that refer to local species, practices and technologies). All tests generated a much larger number of I&V compared to P&C. We have already noted that it is generally the I&V that direct the most attention to detail. The more detailed C&I are usually most adept at capturing the distinguishing features of individual CMF scenarios, and therefore are likely to play an especially important part in detecting the role of local traditional management in biodiversity and forest conservation.

v) The Balance between 'General' and 'Specific' C&I

The common diversity and multiple-use features of CMFs can translate into exceedingly complex management considerations. This is the case because the optimum harvesting intensity for a product of any one species needs to be assessed to adequately protect:

- the species' alternative uses; and
- the productivity of other useful species.

Planning of tending operations and other interventions similarly must take into account the potential direct and indirect impacts on what is often a large range of multi-purpose species valued by different groups. Adding to the complexity of designing assessment protocols for multi-purpose forestry is the fact that species and species associations vary from one ecozone to the next, and that this variation is mirrored by inhabitants' expectations of forest benefits and forest interventions. The chances are slim of forest communities having common tradeoffs that favour management of the same species for identical purposes at the expense of other identical species.

Within Amazonia alone, the Brazilian ecology specialist maintained that the ecological C&I produced would clearly fall short of being entirely useful at different sites characterised by different soil types, typological features and hydrological regimes and their attendant vegetation formations. The bio-physical characteristics of different locations present different use possibilities and thus stimulate different human environmental interactions, each with its own set of consequences.

This complexity calls for compromise as a C&I set that is sufficiently detailed to cover all aspects and their inter-relations would be unwieldy and difficult to apply. One based primarily on generic C&I is unlikely to be detailed enough to produce a realistic picture of the degree of local resource degradation or conservation and the associated social costs and benefits. The test-generated sets all strike some compromise between these extremes.

It may be feasible to develop more thorough, yet practical to apply, C&I sets for particular products, e.g. rattan, rubber, a species of monkey or Brazil nuts, although the problem will persist of assessing how to adjust the management of these products in order to optimise the overall output of multiple-use forestry. The total value of a large diversity of forest products and services remains an important variable in balancing the objectives of management strategies.

We currently lack sufficient knowledge about the ecology of many NTFP species to fully understand how they respond to different stresses and stimuli. Assessment protocols must, therefore, be structured on incomplete knowledge of the ecology of many useful species and their responses to management methods. Efforts must concentrate on developing C&I related to hypothetical ecological and social minimum safety margins. Gradually, as knowledge on different species and systems expands through monitoring and complementary research, imbalances incorporated into minimum safety margins can be reduced, and the relevant C&I correspondingly amended.

Some generic C&I can be powerfully indicative of general, overarching phenomena and, as such, are likely to reveal outcomes of conglomerates of contributing factors and trends. They are however unlikely to reveal which variables and trends contribute to an outcome and even less likely to inform on the cause and effect relationships that drive individual trends. We can label them *'aggregate'* indicators. It is because of their tendency to be vague on detail that they are relatively generalisable. Examples include social indicators such as infant mortality rates, number of landless farmers and the ecological indicator 'rate of river siltation'. They can tell us whether a problem exists and the scale of a problem, and thus lead towards measures to deal with the problem's manifestations. They are of limited value to problem solving as *they generate no information on the causes of the problem*. This makes their significance to policy making comparatively weak. They can however be used for monitoring to register the impact of actions taken and then, through a process of gradual elimination, their causative factors may be deduced.

The usefulness of generic C&I is largely confined to pointing out big 'end-product' effects which, understood to influence sustainability, are indicative of it. Being generic does not mean a criterion or indicator has to be evaluated pan-regionally with the use of common standards or threshold values. However, better insights into the processes and dynamics of sustainability at any one site are usually obtained with more focused C&I, especially if these are designed to reveal which factors and processes interact to produce the 'end-product' effects. More detailed C&I are needed to shed light on how the management of different forest products and services is integrated to meet diverse forest user groups' requirements and how this integration differs from one site to the next.

10.2.3 Seeing things in context

We are inclined to believe that matching up single C&I according to their linguistic or conceptual fit creates a weak foundation upon which to propose generic C&I. Although a number of the proposed C&I appear to be the same or very similar, the behaviour of many of them is subject to the effects of other interacting variables. For instance, social institutions, land tenure and infrastructure obviously play vital roles in determining forest resource access and the distribution of the costs and benefits of community forest interventions, and therefore affect CMF's sustainability. It comes as no surprise then that C&I to address the importance of these issues were developed on all three tests. However, their significance is often highly conditional (Kaimowitz and Angelsen 1998). This suggests that, for their effective evaluation, complexes of C&I of conditions associated with their significance are required. Similarly, although ecological and technical variables may be objectively measurable in isolation, C&I of best forest resource management practice are also likely to emerge in bundles, or complexes.

We remain unsure as to the relative importance of different factors to the sustainability of CMFs. This reflects our still-limited understanding of how individual components are located within composites of interdependent factors that represent their context. Examining single issues (i.e. individual indicators) in isolation is, therefore, of limited usefulness, as single issues on their own do not usually expose critical links or contextual constraints, unless these constitute the 'issue'. Ignoring links between indicators and the larger context results in the loss of some insights into the dynamics of a situation. Well-compiled complexes of C&I can encompass pertinent linkages between considerations to reveal their interconnection and context. They can pull together the various factors that contribute to a circumstance or trend and its outcome.

An understanding of context depends on knowing three things: 1) the single issues, variables or factors that exist; 2) the relationships between them; and 3) the sum of affects or emergent properties created by their relationships. These things have to be examined in the light of each other.

Single issues can, however, be selected as 'starting-point' considerations that branch sideways and outwards into other concepts which together can be transformed into C&I complexes. The 'starting point' considerations or issues can be selected on the basis of their perceived contribution to debilitating problems or favourable conditions, with a view to formulating C&I complexes that would generate information to improve understanding. Complexes of C&I that deal with closely interrelated issues could help to ensure that assessment processes and results facilitate integrated and practical approaches to problem solving. More important than identifying single, common issues, therefore, would seem to be examining how an issue's (or C or I's) context, or the factors contributing to cause and effect relationships affecting sustainability, varies between sites (Vayda 1996). Understanding this variation is a key to greater understanding of how given factors interrelate under different conditions at different sites with different effects.

On CIFOR's Phase 1 C&I tests for commercial timber management the creation of 'minimum' sets of C&I was emphasised. This led to duplications within and between the subsets of a country set frequently being treated as redundancies. We found this approach difficult to justify with respect to CMFs as it restricts the description of context. As some of these factors may exert significant influence over several other factors, the same or similar indicators for capturing this influence will appear in connection with C&I on other factors located in various parts of the P, C, I&V hierarchy.

10.2.4 Temporal Considerations

All concepts of sustainability are time-linked. Basically, there are two non-mutually exclusive options for capturing the temporal dimensions of different aspects of CMFs. One of these is to attempt to directly capture temporal relationships and patterns through an assessment of the historical processes out of which current circumstances evolved. From this basis it is often possible to go on to predict future trends and outcomes. The appropriate choice of C&I makes this achievable to some degree with information gained from a single (one-off) assessment.

The other option is to capture the present status of a CMF with a C&I-guided assessment, and to then return at appropriate intervals to monitor the change in the C&I readings, and the extent to which the C&I continue to be relevant to the situation. In such cases, 'snap shots' of reality at different points in time are compared for signs of development or change.

Patterns of forest resource use are constantly undergoing change. The change may vary in terms of:

- the direction in which it is moving;
- the speed at which it is moving, and the intensity of change; and
- its cyclical nature.

The speed and intensity of change and the cyclical nature of change are closely interlinked. Ecological and social systems have a certain ability to self-regulate, which is known as their resilience. Resilience is the product of inter-actions between internal and exogenous factors and depends strongly on a time component. C&I that can trace the history of forest interventions, ecological change or social developments are therefore potentially of great value to tracing trends, cause and effect relationships and predicting likely future events and trends on the basis of past ones.

For a forest to be maintained, any periods of severe stress endurance have to be followed by relatively long periods of recovery. To arrive at a measure of the impact of a harvest of a certain size, the harvest must be assessed in relation to the size of the stock, forest regeneration rate and the harvesting frequency. Some patterns or forms of forest exploitation may be tolerated for only short periods then must be discontinued if sustainability is to be ensured. The incorporation of special provisions for active forest restoration may make it possible to increase the exploitation pressure to above the exploited species' replacement rate for a specified period, yet still maintain the forest over the long term. For instance, if management strategies with long planning horizons include active restoration prescriptions, then 'excessive' harvesting rates might be considered sustainable, as long as the local management institution is sufficiently effective.

Some awareness of the temporal dimensions of variables being assessed is needed in C&I development and application. Broadly speaking, as forest resources become increasingly scarce, so it becomes more urgent that they be sustainably managed. However, moderate short-term excesses may be compensated in the long-term by sequential changes in resource use patterns and the pace at which these unfold. Even a poor response to an indicator on population structure, for example, may be compensated by indications that the interventions responsible occur only at very long cyclic intervals.

Assessment of indicators on seasonality and harvesting intervals (such as those created by the Cameroonian and Brazilian forest management specialists), in conjunction with indicators of the current compared to previous forest ecosystem health, can generate information from which the resiliance of species and systems can be deduced. From these deductions inferences regarding responses to future interventions can be made.

10.2.5 Developing Generic C&I for Diverse User Groups

The C&I developed by the tests urge departure from the idea of developing a **'minimum' set** of C&I for the assessment of the sustainability of CMF. In addition to the logic behind the interest in eliminating duplicate indicators to arrive at a 'minimum' set being problematic in the complex CMF context, this approach was not designed to accommodate the needs and capabilities of diverse potential C&I user groups. This difficulty is amplified with respect to CMF by the vast discrepancies in the interests and knowledge of groups as diverse as forest farmers, academics and scientists and policy makers, to mention just a few. Not all these groups will have similar needs, nor capacity to understand or apply one 'minimum' set of C&I.

An indicator's usefulness is determined not only by its potential *indicative power* and *'cost of application: information output'* ratio, but also by who can and needs to apply it and make use of its results. Some 'end-point', minimal C&I may be relatively useless to forest farmers compared to less globally informative process, input or output indicators. For all the above reasons, we believe *the minimum set approach is too limiting in the CMF context,* and that *more can be gained from viewing the development and application of C&I in diagnosis and monitoring as educational, learning processes.*

10.2.6 Applications of C&I

One of the original objectives of the C&I for CMF tests was to evaluate the indicators and verifiers developed according to the attributes **'ease of use'** and **'cost of application'**, amongst others. This objective could not be satisfactorily achieved within the time frame. These attributes would have to be evaluated separately for *each potential user group*, taking into account their respective capabilities (knowledge and understanding, literacy, numeracy, etc.) and access to resources (capital, labour, time, equipment, etc.). We feel such an exercise would produce useful results.

To accommodate differences in user's needs and capabilities, the systematic consideration of a set of attributes should be relaxed to focus on the most relevant attributes of individual C&I (even more than it did in the tests). Some C&I, whose application is highly demanding of scientific skills and costly (at least from the forest farmers point of view) technologies, may be judged acceptable for their relatively powerful capacity to reveal cause and effect relationships or the impact of trends. However, many less informative indicators can be just as useful if not more so because of the ease with which they can be used by forest farmers with locally available skills and resources.

Depending on the C&I in question, *some groups or individuals will be in a better position to apply them than others.* The assessment of some variables by community members will not only be cheaper, but more in line with the ultimate goals of C&I applications – the results will be more immediately available to those who, directly affected by them, would be most interested in acting upon them. Regular recording of timber extraction or ongoing monitoring of rule infringement, is best done by local people; using outsiders for such tasks could prove both overly expensive and not conducive to building trust.

The Brazilian forest management specialist proposed revising the final set of Brazilian C&I with the objective of translating the academic jargon into a simpler, locally used Portuguese. This would make the set more accessible not only to community members, but also to a variety of NGOs and government extension agencies that collaborate with communities on forest resource and rural development projects.

These observations suggest it is of questionable value to use only one or another of the C&I sets produced in the tests, or a single set comprised of selected parts of these, to assess other CMF sites directly. It seems probable that any C&I set or compilation chosen from the tests' results would include a number of irrelevant issues and lack several relevant ones. Consequently, it would be wise to first re-test the set to establish its relevance to the CMF being assessed, then to remove from and add to it until it can provide for a balanced address of the issues most critical to local sustainability. To this end, the interdisciplinary, participatory methodology of these tests could be used, incorporating the recommendations for improvement outlined in this report. Further methodological developments and amendments are encouraged, and should be documented.

Alternatively, a new C&I set could be developed for testing that incorporates some C&I from the already tested sets and other newly proposed locally relevant ones. One option could be to select the C&I from the already tested sets that occur, either in identical or very similar form, in all three country sets, on the assumption that these are the most likely to be generic. The newly compiled set could then be tested with community participation using the tested methodologies and following the methodological guidelines and recommendations developed by our C&I for CMF tests.

A third alternative would be to apply the whole C&I development methodology, with appropriate amendments, to test a new set of C&I compiled from miscellaneous sources (for instance, stakeholder consultations, SFM guidelines, sets of C&I designed by different initiatives including this CIFOR activity, etc.). This option could be modified by giving community participation a more decisive role in selecting the C&I to be tested with community participation. The greater emphasis on community participation would be paralleled by a reduced reliance on C&I derived from other sources more distanced from the community's reality.

SECTION III

DISCUSSION AND CONCLUSIONS

Chapter 11.
Conclusions

SECTION III

DISCUSSION AND CONCLUSIONS

Chapter 11.
Conclusions

Chapter 11. Conclusions[50]

These tests of C&I for CMFs have been pioneering in their aims to:

1) review and improve selected methodologies for generating C&I of the sustainability of CMFs; and
2) evaluate the relevance and informative powers of C&I with reference to, among other things, the discovered strengths and weaknesses of the methodologies used to generate them.

The tests' results were not intended to be conclusive. Although some compromises were inevitable between the number of topics covered and the depth to which individual topics were explored, the results drew together a range of issues that appear to commonly affect the sustainability of CMFs. They indicate scope for further participatory research and fieldwork into developing C&I for assessing and monitoring the performance of CMFs, their social ramifications, and tradeoffs between different disciplinary perspectives.

11.1 C&I Testing and Development Methodologies

The basic tenets of the methodologies tested by the CIFOR Phase 1 tests of C&I for commercial timber management in natural forests – an interdisciplinary approach, stakeholder consultation and field-testing – proved useful for testing C&I for CMFs. One methodological adaptation was introduced, i.e., a more participatory approach to C&I testing. Liberal interpretation of parts of the methodologies resulted in some variation in the working styles of the three test teams. This allowed for some comparative assessment of different approaches.

11.1.1 The P, C, I&V Hierarchical Framework

The hierarchical framework of P, C, I&Vs was in some ways easily transferred to the CMF C&I testing because of its simplicity. It was, however, thought to be *over-simplistic* for the structuring of the complex interacting issues that affect the sustainability of CMFs. Also, despite CIFOR's attempts to predefine and bound the definitions of P, C, I&V, the specialists differed in their views of the content and scope of P, C, I&V. We feel that the initial definitions of mutually exclusive categories used in the tests proved inadequate.

11.1.2 The Base Sets

The test team members raised questions regarding the relevance of the Base Sets to CMFs. Doubts were expressed about the appropriateness of spending time disproving or adapting C&I in the Base Sets that were originally conceived around commercial timber management objectives or geographical contexts which do not reflect local CMF test site conditions. It was thought that focusing on C&I developed around management objectives and environmental conditions other than those associated with the test sites, could introduce bias into the C&I for CMFs sets.

[50] Written by N.Burford de Oliveira with C. McDougall.

Although many of the C&I for commercial forest management might become increasingly relevant to the CMF sites in the future, their lack of current relevance meant they could not be field tested.

11.1.3 Interdisciplinarity

Team members differed in how much community participation they sought to elicit, and how much communication with their team they thought was necessary. We feel all efforts to maximise community participation and interdisciplinarity are warranted. One determinant of the interdisciplinarity achieved was the compatibility of the team members' personalities. Further benefits could be derived from incorporating methods specifically designed to integrate contrasting personality types within the test teams. This could help integrate diverse disciplinary perspectives.

Having each team member concentrate on a single discipline hindered interdisciplinarity, at least in some respects. It inhibited description of some interdisciplinary background factors of broad significance (e.g. health or educational factors), and causative factors (e.g. cost cutting) that, with their origin in one field/discipline (e.g. social or economic), impact upon another (e.g. water pollution, ecology).

Monitoring the outcome of changes in the relationships between different variables (Kremen *et al.* 1996), especially if no correlation has previously been established between them, is more important than monitoring variables in isolation of each other. More methodologies specifically designed to facilitate identification of significant cross-disciplinary factors would be desirable.

A better picture of the cross-disciplinary ramifications and factors contributing to specific issues could emerge from applying integrated, interdisciplinary complexes of C&I, rather than a selection of unidisciplinary C&I subsets. This would require C&I developers to explore more closely the connections between facets of variable disciplinary content of specific issues rather than attempt to separate these facets into mutually exclusive disciplinary categories.

11.1.4 The C&I Multistakeholder Workshops

Tighter definition of the workshop's role in the overall testing process could lead to a more systematically discernible contribution to the process outcome. Similar workshops could in the future focus more exclusively on examining C&I explanations, i.e., helping the C&I testers (including community members) understand alternatives to their ways of thinking about C&I. Creating a workshop space and atmosphere more conducive to community participation, and hence cross-learning, could result in C&I that are more widely understood and accepted. The workshop methodologies could be more precisely planned to reveal the relevance of the field-tested C&I to other CMF scenarios, by including methods for tapping into participants' personal knowledge and experience more systematically. Caution is, however, advised in extrapolating the broader relevance of C&I through processes of logical deduction and academic abstraction, as these contradict the aims of the field testing process. The test results show that field testing process was highly effective at eliminating C&I based on flawed assumptions and external, inadequate interpretations of local realities.

11.2 The Proposed Principles, Criteria, Indicators and Verifiers

In general, it is the principles and criteria that encompass the broadest scope issues. However, their level of generalisation (abstraction) in most cases was thought to be so great as to obscure important details of the dynamics of CMF's sustainability. The test teams, therefore, believed that the indicators and verifiers will be more instrumental in practically assessing factors that promote or hinder the sustainability of a CMF. In comparison to the principles and criteria, the indicators and verifiers generated by the tests covered more issues noted as being of relatively restricted geographic relevance.

The tests proposed C&I for a great number of issues. The exact mix of coverage, and where within the hierarchical framework the C&I were allocated, varied from one test to the next. This result combines variation arising from diverse sources. Isolating the variation from any one source is not possible, given the limited documentation of the rationale behind C&I and of how they were tested. Explanations offered for the variations are, therefore, largely hypothetical and many rest on assumptions. This means that the more 'major' issues among the many raised by the C&I, can only be identified through logical deduction taking empirical data into consideration. However, some subjects such as multiple use, the integration of diverse interest groups, landscape diversity, biodiversity and forest structure and natural regeneration, stood out because they were more detailed than others in one or more of the tests.

A number of issues, among them forest dependency, collective action and rural capitalisation are articulated not so much directly by individual C&I, as by association between C&I. This implies that ***complexes*** of C&I have an important part to play in capturing the cause and effect relationships affecting CMFs' sustainability.

11.2.1 C&I on Community Participation

Numerous detailed and explicit C&I were included in the Indonesian set for assessing the participation of community members in local affairs and politics and in government community development initiatives. This emphasis is less clear in the other sets. However, the Cameroonian social and forest management subsets include several statements relating to collective action and collaboration between community members. The Brazilian social subset includes some C&I of community participation in planning and monitoring management interventions. All the country sets include several C&I that refer to diverse groups, e.g. groups defined according to interests, age or gender. But only very few statements single out one particular interest or minority group. Nearly all those that do so focus on women's participation in debates. This created some concern regarding the ability of the C&I sets to capture the interests and special needs of minority groups, oppressed groups or poorly represented groups within the community.

11.2.2 Rationale for C&I and C&I interpretation

C&I developers need to provide sufficient explanations for their C&I so that they can be uniformly interpreted by different interest groups. Explanations are fundamentally important because the meaning of some C&I may be obvious to specialists by their wording, but not all C&I potential users will recognise this meaning or be familiar with the C&I supporting theory. By considering the rationale this report presents for the test-generated C&I, the reader acts as another filter C&I, thus participating in the C&I development process. The suggestion of the Brazilian forest manager that the final subsets should be translated into colloquial language was well received. Unfortunately, resource constraints meant it could not be put into practice as part of this project[51].

These tests did not systematically investigate thresholds and standards for all the C&I proposed, although it was understood from the outset that thresholds and standards are essential for interpreting C&I assessment results. They are also often essential for comparing assessment results from different sites and evaluating change over time. They are therefore frequently essential for making rationale decisions on matters likely to affect the balance of interests, e.g.

[51] This suggestion is being followed up on, however, through the translation of the "Criteria and Indicators for Community Managed Forest Landscapes: An Introductory Guide" (Ritchie *et al.* 2000) , which draws on these tests, into Portuguese.

tradeoffs or priority ranking. Used as yardsticks, they can help reveal gaps between the ideal and reality, and monitor whether these gaps are growing, diminishing or merely changing their dimensions. Geographical variations in carrying capacity and multiple use of CMFs are expected to limit the number of generic thresholds and standards that can be set.

11.2.3 Generalising the Relevance of C&I

The test methodologies offered only restricted possibilities for investigating the generalisability of the proposed C&I. Although all three test sites satisfied most of the site selection criteria, they embody some pronounced geographic, historical, cultural and socio-economic differences. They are also associated with diverse forest products, management methods and technologies. They can not, therefore, be regarded as representative of community managed forests as a whole. The relevance of some C&I to all three test sites cannot be extrapolated to other CMF sites with any degree of statistical confidence. Further reducing the reliability of generalisations on the wider relevance of the tested C&I, is the fact that the mix of C&I generated by the tests can be explained by many factors – it is not possible to deduce, therefore, that a criterion or indicator's inclusion in only one or two country sets, reflects its relatively restricted relevance.

Categorisation of C&I as either 'common' or 'site-specific' was found to be of limited value for other reasons as well. Many C&I can be better thought of as distributed along a continuum ranging form the fully generalisable to the site-specific. Our analysis of the results often shows that the more detailed the C&I developed around a single issue, the greater the number of comparatively restricted geographic scope, i.e., that refer to local species and practices.

Among the test team members the opinion prevailed that most types of generic C&I will be too general to capture the particular factors determining sustainability at the test sites. There is a tendency for generic C&I to aggregate contributing factors, making it impossible to identify these or to isolate the effect of any one, unless they are disaggregated at lower levels of the P, C, I&V hierarchy. Such disaggregation is likely to reveal a difference in at least some of the contributing factors identified as relevant at different sites.

One category was identified as composed of 'generic' indicators that do not aggregate factors. These indicators constitute 'baseline' gradients or continua (for instance, a river or watershed, population size, area, etc.) along which a community can be located or plotted. Such indicator readings are descriptive and inferences concerning sustainability can be drawn from where the community occurs along the continuum (e.g. close to, far or a middle distance from an urban centre). Field testing is not needed to establish the generalisability of this type of indicator, although their relevance to different sites will be relative, e.g., the significance of the location of a community along a river will depend on the length of the river, whether the river is navigable, etc. Often, however, readings obtained for this type of indicator will be indicative of other factors.

All three country sets include numerous prescriptive C&I whose local relevance may be disputed and whose generalisability can also be questioned.

More systematic documentation of workshop-generated information would enhance subsequent analyses of the C&I' generalisability. Classifying issues according to their degree of generalisability can link some issues (C&I) with policy decision making spheres at different scales, e.g., local, region or national. Among the more generalisable C&I we find those on issues that are the most directly susceptible to the influence of regional and national policies. Conversely, issues identified as being of relatively restricted geographic relevance suggest the need for broad brush policies that support local forest management authorities or the devolution of forest management authority to local communities.

Information on the generalisability of individual C&I can also be used to gage the need to fine-tune certification initiatives in order to accommodate the particular characteristics of diverse CMF scenarios, and to clarify areas in which policies can promote better prospects for CMFs and CMF product certification.

These considerations concerning distinguishing features of individual CMF scenarios are important for identifying and securing the role of traditional management in biodiversity and forest conservation.

11.2.4 Seeing Issues in Context

Individual C&I gain in meaning and, therefore, usefulness when they are seen in the context created by a complex of interrelated C&I. Conclusions regarding the usefulness of commonalities, i.e., single identical or very similar C&I that were generated on more than one test, should therefore be drawn with care. A more holistic picture of how the perceived importance of an issue to sustainability varies across sites, may be obtained from comparing complexes of C, I&Vs developed around specific issues (criteria or indicators) for the different test sites.

On CIFOR's earlier tests of C&I for commercial timber management, the creation of 'minimum' sets of C&I was emphasised. This led to duplications within and between the subsets of a country set frequently being treated as redundancies. We found this approach difficult to justify with respect to CMFs. Bundles of C&I we believe are needed to represent critical interacting factors. Some of these factors may exert significant influence over several others. Indicators for capturing the significance of highly influential elements will therefore reappear in connection with their various related factors, i.e., in several locations within the P, C, I&V hierarchy.

11.2.5 Participation and Encoding the Definition of Sustainable CMFs in C&I

A concern repeatedly raised revolved around the extent to which a C&I set's content will inevitably define what CMFs should and should not be. The knowledge, ideas and interpretations of C&I developers decide this content. Thus, knowing who participated, to what extent, and who was excluded from the C&I development process is important, as is ensuring that the meaning of the C&I is clear. Interest in extrapolating the relevance of tested C&I to other sites amplifies the implications of these concerns.

The tests were conducted with the understanding that C&I can serve as tools for diagnosing, assessing and monitoring sustainability. The tests, however, also expanded appreciation of how C&I development methods and applications can be used as communication tools for cross-learning among community groups, and between these and outside interest groups, e.g., policy makers, NGOs, educationalists, etc.. Development of this potential would enhance the educational role of C&I of CMFs and open up additional avenues for constructive dialogue between groups with related interests. By stimulating consensus building, this may help integrate interests both internal and external to the community. It would also pave the way for improving the coordination of different groups' activities to enhance social equity and create positive externalities and public goods for the benefit of all.

Diversity and multiple use were found to characterise CMFs at the test sites, turning tradeoffs and the optimisation of multiple tradeoffs into pivotal concerns. Setting fair tradeoffs is analogous to reaching consensus decisions. There was general agreement that participatory processes of C&I development, although sometimes more laborious and time consuming, are more supportive of consensus building than alternative processes. It was also recognised that people sometimes consent in group processes such as these because they are inadequately informed, pressured into doing so, or because they have hidden motives for maintaining alliances. Consensus decisions leading to the selection of C&I, and thus to an inference of the management objectives, should therefore be well-qualified and transparent. The acceptability of selected C&I should remain open for debate amongst the C&I users.

Participatory approaches to developing C&I should include built-in mechanisms to clarify towards whose interests the proposed C&I represent. The test teams all felt ethnocentricity should be avoided to the extent possible. Very carefully designed participatory C&I testing and development processes can help ensure this.

11.3 Directions for the Future

Although much progress has been made in terms of C&I for CMF, some conceptual ambiguities remain. Specifically, there are ambiguities such as those relating to language and subjective judgement, where the use of words such as ‘fair’ and ‘justice’, for example, render C&I liable to variable interpretation. One of the key concepts arising in CMF — ‘optimisation’ — has been criticised for its inclusion in the C&I (Indonesian set), because, ’optimisation’ is a forever-elusive goal. We argue, however, that the meaning of optimisation makes it a worthy goal even if, by defying exact description in a complex real world, its full attainment is unachievable.

This phase of the research also highlighted a number of other priority research areas and ideas. Further field research is needed to clarify, refine understanding, and enhance the generalisability of the C&I for CMF generated. At a very practical level, more work is needed on the C&I produced from this research in terms of adapting language and the organisation of the C&I complexes (i.e., shifting from a disciplinary perspective to more a community-based perspective on organisation), as well as identifying and filling in gaps that exist in the C&I. This work is already under way at CIFOR in the exploration and participatory action research application of frameworks of C&I for CMF. These C&I sets may be drawn from the field test sets, but they will move away from organization along disciplinary lines, and they will be intended for adaptation to local contexts by local users.

At a more conceptual level, more field research and accompanying analysis is needed to further the understanding of the conditions under which C&I are relevant and informative. This will help pave the way for simpler and more efficient application of C&I by users, by informing both C&I base sets themselves and adaptation methodologies. Another important avenue for possible future research is to further investigate the merits of different conceptual perspectives or frameworks for organising complexes of C&I in order to accurately reflect local perceptions. As has been initiated in the CIFOR C&I for CMF Introductory Guide (Ritchie *et al.* 2000), developing complexes of interdisciplinary C&I around selected local themes might be a more useful approach than separating issues into disciplinary C&I subsets, as was done in these tests. This could be explored through participatory action research initiatives in communities.

Finally, the research increased awareness of how C&I development methods and applications can create opportunities for shared learning between and within stakeholder groups (see also Burford de Oliveira 1999). Our preliminary research results indicate the powerful nature of processes that pool diverse knowledge bases such as local and traditional wisdom held by communities with ‘scientific’ and/or other stakeholder knowledge. Such knowledge-sharing processes may not only exchange knowledge, but contain scope for the creation of new knowledge through cross-fertilisation of the wisdom contributed by different groups. The potential role for C&I as a tool in creating constructive dialogue, and ultimately collaboration, among stakeholders needs further investigation.

Cited References

Baland, J.M. and Platteau, J. P. 1996. Halting Degradation of Natural Resources: Is there a role for Rural Communities? Food and Agriculture Organization of the United Nations, Rome.

Bossel, H. and Bruenig, E.F. 1992. Natural resource systems analysis. Ecological and socio-economic systems and sensitivity analysis for the Conservation and Management of Forest Ecosystems and Natural Resources in South-East Asia. Deutsche Stiftung für internationale Entwicklung (DSE), Germany. 145p.

Brouwer, L.C. 1996. Nutrient cycling in pristine and logged tropical rain forest: A study in Guyana. Tropenbos Guyana Series 1. Tropenbos Guyana Publication, Georgetown.

Browder, J.O., 1996. Reading Colonist Landscapes: Social Interpretations of Tropical Forest Patches in an Amazonian Agricultural Frontier. *In*: Schelas, J. and Greenberg, R. (eds) Forest Patches in Tropical Landscape. Island Press, Washington D.C.

Brown, G.W. 1985. Forestry and water quality. O.S.U. Book Stores, Inc., Corvallis.

Bruijnzeel, L.A. 1990. Hydrology of moist tropical forest and effects of conversion: A state of knowledge review. Humid Tropics Programme of the IHP, Paris.

Burford de Oliveira, N. 1999. Community participation in developing and applying Criteria and Indicators of sustainable and equitable forest management. CIFOR Project Report. CIFOR, Bogor, Indonesia.

Byron, N. and Arnold, M. 1997. What futures for the people of the tropical forests? CIFOR Working Paper No. 19. CIFOR, Bogor, Indonesia.

Chibnik, M. 1994. Risky rivers: The economics and politics of floodplain farming in Amazonia, University of Arizona Press, Tuscon.

Christodoulou, D. 1990. The Unpromised land: Agrarian reform and conflict worldwide. Zed Book Ltd., London & New Jersey. 236p.

Clinnick, P.F. 1985. Buffer strip management in forest operations: A review. Australian Forestry, 48:34-45.

DAI. 1998. Proceedings of the national synthesis workshop on criteria and indicators of sustainable forest management, 24-25 June 1998, 12p. Baguio City, The Philippines.

Dalsgaard, J.P.T., Lightfoot, C. and Christensen, V. 1995. Towards quantification of ecological sustainability in farming systems analysis, Elsevier, Ecological Engineering 4(199): 181-189.

de Jong, W. 1997. Dayak forest conservation; Practices and development potential of local forest management in West Kalimantan, Indonesia. Final Report of the Dayak Forest Management Research Project, Tropenbos Foundation**.**

DeGraaf, R.M and Miller, R.I. 1996. Conservation of faunal diversity in forested landscapes. Conservation Biology Series. Chapman & Hall.

Dove, M.R. 1983. Forest preference in swidden agriculture. Tropical Ecology 24(1): 122-42.

Greenberg, R. 1996. Forest patches in tropical landscape. Island Press, Washington, D.C.

Gross, D.R. 1975. Protein capture and cultural development in the Amazon basin. American Anthropologist 77(3): 526-49.

Hart, T.B. and Hart, J.A. 1986. The ecological basis of hunter-gatherer subsistence in African rainforest: the Mbuti of Central Africa. Human Ecology 14(1): 29-55.

Headland, T.N. 1987. The wild yam question: how well could independent hunter-gatherers live in a tropical rain forest ecosystem? Human Ecology 15(4): 463-91.

Hladik, C.M., Linares, O.F., Pagezy, H., Hladik, A., Semple, A. and Froment, A. 1996. Introduction: le contexte actuel des recherches sur l'utilisation des ressources des forêts tropicales. *In*: Hladik, C.M., Linares, O.F., Pagezy, H., Hladik, A., Semple, A. and Froment, A. (eds) l'Alimentation en forêt tropicale: interactions bioculturelles et perspectives de développement. L'homme et la biosphère UNESCO, Paris.

Homma, A.K.O. 1996. Modernisation and technological dualism in the extractive economy in Amazonia. *In*: Ruiz Perez, M. and Arnold, J.E.M. (eds) Current Issues in Non-Timber Forest Products Research. Proceedings of the Workshop "Research on NTFP", Hot Springs, Zimbabwe, 28 August-2 September 1995, 59-81. CIFOR, Bogor, Indonesia.

Hornbeck, J., Corbett, E., Duffy, P. and Lynch, J. 1984. Forest hydrology and watershed management. *In*: Wenger, K. (ed.) Forestry handbook. Wiley & Sons, New York.

IMAFLORA, MMA/IBAMA and World Bank. 1996. Mapeamento Comunitário da Margen Direita do Rio Tapajós - Projeto de Apoio ao Manejo Florestal na Amazônia. IMAFLORA, Piracicaba, SP, Brazil.

Jetten,V.G. 1994. Modelling the effects of logging on the water balance of a tropical rain forest: A study in Guyana. Tropenbos Series 6. The Tropenbos Foundation, Wageningen.

Johns, A.D. 1986. Effects of selective logging on the ecological organization of a Peninsular Malaysian rain forest avifauna. Forktail 1: 65-79.

Johns, A.D. 1992. Species conservation in managed tropical forest. *In*: Sayer, T.C. (ed.) Tropical deforestation and species extinction. Chapman & Hall, London, pp.15-53.

Kahn, F. 1996. Les Palmeraies Amazoniennes: Ressources alimentaires et aménagement des écosystèmes forestiers. *In*: Hladik, C.M., Linares, O.F., Pagezy, H., Hladik, A., Semple, A. and Froment, A. (eds) l'Alimentation en forêt tropicale: interactions bioculturelles et perspectives de développement. L'homme et la biosphère UNESCO, Paris.

Kaimowitz, D. and Angelsen, A. 1998. Economic models of tropical deforestation: A review. CIFOR, Bogor, Indonesia. 139p.

Karr, J.R. 1968. Habitat and avian diversity on stripmined land in East-central Illinois. Condor 70: 348-357.

Kemp, A.C. and Kemp, M.I. 1975. Report on a study of hornbill in Sarawak, with comment on their conservation. Report to World Wildlife Fund Malaysia. Kuala Lumpur.

Kemp. A.C. (ed.) 1985. ICBP hornbill specialist group communications 5. Cambridge International Council for Bird Preservation.

Kimmins, J.P. 1987. Forest Ecology. MacMillan Publisihing Company. 531p.

Kremen, C., Raymond, I and Lance, K. 1998. An interdisciplinary tool for monitoring conservation impacts in Madagascar. Conservation Biology 12(3): 549-563.

Lammerts van Bueren, E.M. and Blom, E.M. 1997. Hierarchical framework for the formulation of sustainable forest management standards. The Tropenbos Foundation, Wageningen, The Netherlands.

Leakey, R. and Lewin, R. 1995. The Sixth extinction: Biodiversity and its survival. Doubleday, New York.

Lightfoot, M.A., Bimbao, P., Dalsgaard, J.P.T. and Pullin, R.S.V. 1993. Aquaculture and sustainability through integrated resources management. Outlook Agri. 22: 143-150

MacArthur, R. and MacArthur, J. 1961. On birds species diversity. Ecology 42: 594-598.

MacArthur, R.H., MacArthur, J. and Preer, J. 1962. On bird species diversity. II. Prediction of bird census for measurements. Am. Nat. 96: 167-174.

MacKinnon, K. and MacKinnon, J. 1991. Habitat protection and reintroduction programmes. *In:* Gipps, J.H.W. (ed.) Beyond captive breeding. Re-introducing endangered mammals to the wild. Zoo. Soc. London Symposia 62: 173-198, Oxford University Press.

Markopoulos, M. 1998 The impacts of certification on community forest enterprises: A case study of the Lomerío Community Forest Management Project, Bolivia. IIED Forestry and Land Use Series No. 13. IIED, London.

McNeely, J.A., Miller, K.R., Reid, W.V., Mittermeir, R.A. and Werner, T.B. 1990. Conserving the world: Biological diversity. The World Bank. World Research Institute. IUCN. Conservation International. WWF.

Mulder, N. 1998. Mysticism in Java: Ideology in Indonesia. The Pepin Press, Amsterdam.

Noor, N.S. Md. 1992. Harvesting of rattans. *In*: Mohd, W.R.W., Dransfield, J. and Manodaran, N. (eds) *A* Guide to the Cultivation of Rattan. Malayan Forest Record No. 35, Malaysian Forest Research Institute, Kuala Lumpur.

Ooi, J.B. 1993. Tropical deforestation: The tyranny of time. Singapore University Press. 176p.

Osborne, L.L. and Kovacic, D.A. 1993. Riparian vegetated buffer strips in water-quality restoration and stream management. Freshwater Biology 29: 243-258.

Otsuka, M. 1998. Collectivism or Individualism? Role of community organisations for rural development in a changing society: A case from West Sumatra, Indonesia. Unpublished draft manuscript.

Panayotou, T. and Ashton, P.S. 1992. Non-timber forest products: A major component of total forest value. *In*: Panayotou, T. and Ashton, P.S. Not by timber alone: Economics and ecology for sustaining tropical forests, 70-170. Island Press, Washington, DC.

Peres, C.A. 1990. Effects of hunting on western Amazonian primate communities. Biological Conservation 54: 47-59.

Peres, C.A. In press. Vertebrate extinctions and the impact of subsistence hunting in Amazonian forests. Conservation Biology.

Peres, C.A. and Terborgh, J.W. 1995. Amazonian nature reserves: an analysis of the defensibility status of existing conservation units and design criteria for the future. Conservation Biology 9: 34-46.

Peters, C.M. 1996. The ecology and management of non-timber forest resources. World Bank Technical Paper Number 322. The World Bank, Washington, DC. 157p.

Prabhu, R., Colfer, C.J.P., Venkateswarlu, P., Tan, L.C., Soekmadi, R. and Wollenberg, E. 1996. Testing criteria and indicators for the sustainable management of forests: Phase I, Final Report. CIFOR Special Publication. CIFOR, Bogor, Indonesia.

Preechapanya, P. 1996. Indigenous ecological knowledge about the sustainability of tea gardens in the hill evergreen forest of nothern Thailand. PhD Thesis. University of South Wales, Bangor, UK.

Quinn, J. F. and Karr, J. R. 1993. Habitat frgamentation and global change. *In*: Karieva, P.M., Kingsolver, J.G. and Huey, R.B. (eds) Biotic Interactions and Global Change, 451-463. Sinauer Associates, Sunderland, Massachusetts.

Ramírez, R. 1999. Participatory learning and communication approaches for managing pluralism: Implications for sustainable forestry, agriculture and rural development. *In*: Pluralism and sustainable forestry and rural development. Proceedings of an international workshop, Rome. 9-12 December, 1997. FAO, IUFOR and CIRAD, Rome.

Reddy, A.K.N. 1979. Technology, development and the environment: A reappraisal. United Nations Environment Programme, Nairobi.

Reid, W.V. *et al.* 1993. Biodiversity indicators for policy makers. World Resources Institute, Washington.

Richards, P.W. 1973. The tropical rain forest. Scientific American 229(6): 58-67.

Ricklefs, R.E., and D. Schluter. 1993. Species diversity in ecological communities: Historical and geographical perspectives. The University of Chicago Press.

Ritchie, B., McDougall, C., Haggith., M. and Burford de Oliveira, N. 2000. Criteria and Indicators of sustainability in community managed forest landscapes: An introductory guide. CIFOR, Bogor, Indonesia.

Sahardjo, B.H. and Endang, A.H. 1998. East Kalimantan burns. Wildfire 7(7): 19-21

Sanchez, P.A. 1976. Properties and management of soils: the tropics. New York.

Schelhas, J. and R. Greenberg, 1996. Introduction: The value of forest patches. *In*: Schelhas, J. and Greenberg, R. (eds) Forest patches in tropical landscapes. Island Press, Washington D.C.

Scott Mills, L., Soulé, M.E. and Doak, D.F. 1993. The keystone-species concept in ecology and conservation - management and policy must explicitly consider the complexity of interactions in natural systems. Bioscience 43(4): 219-224.

Smyth, A.J. and Dumanski, J. 1993. FESLM: An International Framework for Evaluating Sustainable Land Management. Land and Water Development Division, FAO, Rome.

Stork, N.E., Boyle, T.J.B., Dale, V., Eeley, H., Finegan, B., Lawes, M., Manokaran, N., Prabhu, R. and Soberon, J. 1997 Criteria and indicators for assessing the sustainability of forest management: Conservation of biodiversity. Working Paper No. 17. CIFOR, Bogor, Indonesia.

Temple, S.A. 1992. Population viability analysis of a sharp-tailed grouse metapopulation in Wisconsin. *In*: McCollough, D.R. and Baret, R. (eds) Wildlife 2001: populations, 750-758. Elsevier Applied Science, London.

Terborgh, J.W. 1983. Five new worlds primates. Princenton University Press, Princenton, New Jersey, USA.

Thiollay, J.M. 1992. Influence of selective logging on bird species diversity in a Guianan Rain Forest. Conservation Biology 6(1): 47-63.

Thomson, J.T. and Freudenberger, K.S. 1997. The characteristics of the rules and resource management incentives. *In*: Thomson, J.T. and Freudenberger, K.S. Crafting institutional arrangements for community forestry, 59-63. Community Forestry Field Manual 7. FAO, Rome.

Tilman, D. *et al*. 1994. Habitat destruction and the extinction debt. Nature 371: 66.

Trimble, G.R. and Sartz, R.S. 1957. How far from a stream should a logging road be located? Journal of Forestry 55: 339-341.

Vayda, A.P. 1996. Methods and explanations in the study of human actions and their environmental effects. CIFOR/WWF Special Publication. CIFOR, Bogor, Indonesia. 44p.

Walker, J. 1994. Impact of forest management on plant diversity. Bulletin of the Ecological Society of America 75(3): 171-172

Warner, M. and P. Jones 1998. Assessing the need to manage conflict in community-based natural resource projects. Overseas Development Institute, London. 6p.

Wiersum, K.F. 1985. Effects of various vegetation layers of an Acacia auriculiformis forest plantation on surface erosion at Java, Indonesia. *In*: El-Swaify, S., Moldenhauer, W.C. and Lo, A. (eds) Proceedings of the Second International Conference on Soil Erosion and Conservation, 79-89. Soil Conservation Soceity of America, Ankeny.

Wilkie, D.S. and Godoy, R.A. 1996. Trade, indigenous rain forest economies and biological diversity: Model predictions and directions for research. *In*: Ruiz Perez, M. and Arnold, J.E.M. (eds) Current issues in non-timber forest products research. Proceedings of the Workshop "Research on NTFP", Hot Springs, Zimbabwe, 28 August-2 September 1995, 41-57. CIFOR, Bogor, Indonesia.

Wong, M. 1985. Understorey birds as indicators of regeneration in a patch of selectively logged West Malaysian rain forest. *In*: Diamond, A.W. and Lovejoy, T.E. (eds) Conservation of tropical forest birds, 249-263. International Council for Bird Preservation. Cambridge.

Zuidema, P.A, Sayer, J.A. and Dijkman, W. 1996. Forest fragmentation and biodiversity: The case for intermediate-sized conservation areas. Environmental Conservation 23(4): 290-297.

Additional References

Ahluwalia, M. 1997. Representing communities: The case of a community-based watershed management project in Rajasthan, India. IDS Bulletin 28: 23-34.

Alasuutari, P. 1995. Researching culture: Qualitative methods and cultural studies. Sage Publications, London.

Becker, H.A. 1997. Social impact assessment: Method and experience in Europe, North America and the developing world. University College London Press Ltd., London. 260p.

Brandon, K. 1996. Traditional peoples, nontraditional times: Social change and the implications for biodiversity conservation. *In*: Redford, K.H. and Mansour, J.A. (eds) Traditional peoples and biodiversity conservation in large tropical landscapes. The Nature Conservancy. Arlington, Virginia.

Chardonnet, P. *et al*. 1995. Chasse traditionnelle. *In*: Chardonnet, P. *et al.* Faune Sauvage Africaine, 89-125. La Ressource Oubliée Vol. 1. European Commission, Brussels.

Colfer, C.J.P. 1995. Who counts most in sustainable forest management? CIFOR Working Paper No. 19. CIFOR, Bogor, Indonesia.

Development Alternatives, Inc. 1998. Proceedings of the National Synthesis Workshop on Criteria and Indicators of Sustainable Forest Management, June 24-25, 1998, Concorde Hotel, Baguio City, Phillipines.

Dove, M. R. 1996. Résponses des Dayak de Kalimantan aux fructifications massives et comportement du Sanglier Barbu: une analyse des analogies entre nature et culture. *In*: Hladik, C.M., Linares, O.F., Pagezy, H., Hladik, A., Semple, A. and Froment, A. (eds) l'Alimentation en forêt tropicale: interactions bioculturelles et perspectives de développement. L'homme et la biosphère UNESCO, Paris.

Forstner, U. and Wittmann, G.T.W. 1981. Metal pollution in the aquatic environment. 2nd revised ed. Springer-Verlag, Berlin.

Fortmann, L. 1985. The tree tenure factor in agroforestry with particular reference to Africa. Agroforestry Systems 2: 229-251.

Glazewski, J., Dodson, A. and Smith, H. 1991. Tightening up the Law. *In*: Ramphele, M. (ed) Restoring the land; Environment and change in post-apartheid South Africa. The Panos Institute, London.

Grenand, P. and Grenand, F. 1996. Living in abundance: The forest of Wayampi (Amerindians from French Guiana). *In*: Ruiz Perez, M. and Arnold, J.E.M. (eds) Current issues in non-timber forest products research. Proceedings of the Workshop "Research on NTFP", Hot Springs, Zimbabwe, 28 August-2 September 1995, 177-196. CIFOR, Bogor, Indonesia.

Klemperer, W.D. 1996. Forest resource economics and finance. McGraw-Hill, Inc., New York. 551p.

Landers, P.B., Verner, J. and Thomas, J.W. 1988. Ecological uses of vertebrate indicator species: A critique. *In*: MacNeely *et al.* (eds) Conserving the worlds: Biological diversity, 193. IUCN, World Bank, World Research Institute, WWF.

Manners, R.A. 1956. Functionalism, realpolitic and anthropology in underdeveloped areas. America Indigena 16. Instituto Indigenista Interamericano.

Maser, C. 1994. Sustainable forestry: Philosophy, science, and economics. St. Lucie Press, Delray Beach. 373p.

Ogle, B. 1996. People's dependency on forests for food security: Some lessons learnt from a programme of case studies. *In*: Ruiz Perez, M. and Arnold, J.E.M. (eds) Current issues in non-timber forest products research. Proceedings of the Workshop "Research on NTFP", Hot Springs, Zimbabwe, 28 August-2 September 1995, 219-241. CIFOR, Bogor, Indonesia.

Ostrom, E. 1990. Governing the commons. Cambridge University Press, p. 88-216.

Pierce. A. 1996. Issues pertaining to the certification of non-timber forest products. A Forest Stewardship Council discussion paper. 14p.

Redford, K.H. 1996. Not seeing the animals for the trees: The many values of wild animals in forest ecosystems. *In*: Ruiz Perez, M. and Arnold, J.E.M. (eds) Current issues in non-timber forest products research. Proceedings of the Workshop "Research on NTFP", Hot Springs, Zimbabwe, 28 August-2 September 1995, 41-57. CIFOR, Bogor, Indonesia.

Sinclair F.L. and Walker, D.H. 1999. A Utilitarian Approach to the Incorporation of Local Knowledge in Agroforestry Research and Extension. *In Press*.

Smith, R.C., 1996. Biodiversity won't feed our children: Biodiversity conservation and economic development in indigenous Amazonia. *In*: Redford, K.H. and Mansour, J.A. (eds) Traditional peoples and biodiversity conservation in large tropical landscapes. The Nature Conservancy. Arlington, Virginia.

Stevens, P.R. 1997. Measuring the sustainability of forest village ecosystems-concepts and methodologies: A Turkish example. CSIRO Forestry and Forest Products, Technical Report No. 103. CSIRO, Canberra.

Van Haaften, E.H. and Van de Vijver, F.J.R. 1996. Psychological stress and marginalization as indicators of human carrying capacity in deforesting areas. Intl. J. Sustain. Dev. World Ecol. 3: 32-42.

von Hildebrant, 1992. Colombia: Setting a precedent for the world. *In*: Friends of the Earth (ed) The rainforest harvest: Sustainable strategies for saving the tropical forests? - Including the Proceedings of an International Conference held at the Royal Geographical Society, London 17-18th May 1990. Friends of the Earth, London.

Wily, L. 1997. Finding the right institutional and legal framework for community-based natural forest management: The Tanzanian case. CIFOR Special Publication. CIFOR, Bogor, Indonesia. 57p.

Wolstenholme, E.F. 1990. System enquiry: A systems dynamics approach. Wiley, Chichester.

Young, F.W. 1983. Social indicators and social structure. Journal of Community Psychology 11: 22-35.

Annex 1: Glossary of Terms

Sustainability of Forests	To sustain forests is to maintain their current regenerative capacity. Degraded forests can be sustainably managed if measures are used to restore their regenerative capacity to its level before human interference, or to at least ensure they attain a 'stable' (in that time frame) state. The pursuit of sustainability, however, should not compromise widely accepted concepts of social justice. Thus it was attempted to create C&I capable of also reflecting the social dimensions of forest resource allocation. Interest of the tests focused on identifying C&I that can reveal the variables and factors that contribute either to the maintenance of relatively stable states or to trends or changes that move towards or away from sustainability. The aim was to develop C&I sets whose application can yield an overall picture of the dynamic tensions governing sustainability at a community managed forest site. The general consensus expressed by test participants was that the focus should be both on change in forest area and in the forest's condition – whether this is improving or deteriorating, at what rate and for what reasons. The test team members were encouraged to more precisely define sustainability by applying their specialised knowledge to the selection of C&I.
Forest	All test sites were located in humid tropical rainforest zones. Our definition of forest included all forest resources and functions. With this broad definition of 'forest' at the landscape level, forest watersheds and river systems and clearings within forest were classified as part of the forest. Also regarded as part of the forest were resources, i.e., water and soil, whose availability and/or properties depend at least partially on forest cover and its intactness. Included therefore were areas converted from natural forest that support, or are destined to support, various stages of succession growth. Shifting agriculture on forest soils and fishing were both therefore treated as modes of forest exploitation whose management influences the regeneration of forest formations. This broad definition of 'forest' coincided closely with the test site forest communities' own definition of 'forest'. The area of forest (i.e., area covered with forest resources) considered during the tests was that which the community regards as belonging to it and any other forest resources that are affected by community activities.
Forest Management	By 'forest management' we mean all forest interventions and forms of usage of forest resources, products and services by community members. It is not always clear what constitutes 'random' versus 'organised' extraction and use of forest resources, or at what stage organised forest interventions or use can be regarded as formal management.

Natural Forest	Forest that, in living memory, has not been cleared for agriculture or settlement purposes but that may have been logged and in which non-timber forest product harvesting and hunting may take place. The only exception to this was at the Brazilian test site with respect to patches of forest occurring on 'black soils' with historical remains of former Amerindian residents. These small forest areas are believed to be well over 100 years old. Although it is known they are secondary, the Brazilian test team generally treated them as 'natural' rather than secondary forest.
Fallows	Areas where cultivation was abandoned 1-10 years or more ago.
Secondary Forest	Fallows in the advanced stages of ecological succession which have regained many attributes of the natural original forest, but whose species composition and morphological strata nonetheless continue to differ in several respects.
Community Managed Forests	We use the term community managed forests to include those forests that are managed, however informally, by family units, specialised groups within the community, the whole community collectively or by a combination of these groups. In some cases, management responsibilities will be defined and assumed by individuals belonging to the community. Such cases also are classified as part of community managed forests, especially where they are subordinate to community imposed norms and constraints.
The Community	The community was described as all the people who permanently reside within an area of forest that belongs to some or all of its inhabitants. Members of the community recognise each other as such and boundaries between forest lands claimed by neighbouring communities were recognised by all community members.

Annex 2.
List of Abbreviations and Acronyms

Acronym	Full Wording
C&I	Criteria and Indicators; also used to signify the full set or concept of Principles, Criteria, Indicators and Verifiers
CIFOR	Center for International Forestry Research
CMF(s)	Community Managed Forests
FAO	Food and Agriculture Organization of the United Nations
FORDA	Indonesia Forest Research and Development Agency
FM	Forest Management
FMU	(Commercial) Forest Management Unit
I &V	Indicators and Verifiers
IBAMA	Instituto Brasileiro do Meio Ambiente e dos Recoursos Naturais Renovaveis
IIED	International Institute of Environment and Development
NGO	Non-governmental Organization
NTFP	Non-timber Forest Product
OECD	Overseas Economic Cooperation and Development
PRA	Participatory Rural Appraisal
P,C, I & Vs	Principles, Criteria, Indicators, and Verifiers
SOLIDAM	Solidarity pour le developpement des villages d'Akak a Melan (Cameroon)
SFDP	Social Forestry Development Project (Indonesia)
WWF	World Wide Fund for Nature

Annex 3:
Final Subsets of C&I Generated by the Test

1. SOCIAL

- **Brazil**
- **Cameroon**
- **Indonesia**

2. ECOLOGY

- **Brazil**
- **Cameroon**
- **Indonesia**

3. FOREST MANAGEMENT

- **Brazil**
- **Cameroon**
- **Indonesia**

1. SOCIAL

CIFOR - Brazil Test, 1998

Teste de Critérios e Indicadores Sociais para o Uso Comunitário Sustentável de Recursos Agroflorestais - Cifor Teste Brasil/Sindicato dos Trabalhadores Rurais de Santarém – Versão Final

Versão testada em São Pedro (Rio Arapiuns) e Cachoeira do Maró (Rio Maró). Consultor: Rui Sérgio Sereni Murrieta (Antropólogo) Fontes: Brazil test CIFOR, FSC e outros

Critérios e Indicadores Sociais (Versão Final)

P	C	I	V	Descrição	observações
1				As atividades de manejo dos recursos agroflorestais mantém o bem estar biológico, sócio-econômico e cultural das populações locais a longo prazo. **The activities for the management of agroforestry resources maintain the biological, socio-economic and cultural well-being of the local population in the long-term.**	
	1.1			Os direitos de uso, posse, ocupação e propriedade da terra do população local estão assegurados a longo prazo. **The local population's land usufruct, possession and occupation rights are secured in the long-term.**	
		1.1.1		São reconhecidos os direitos costumeiros de posse, de títulos de terra e acordos de concessão no manejo dos recursos agroflorestais. **Customary land possession rights and land titles and concessionary agreements concerning the management of agroforestry resources are recognised.**	
			1.1.1.a	Levantamento de títulos de uso, posse e propriedade de terra. **Survey of landuse, possession and ownership rights.**	Levantamento de documentação cartorial e instituicoes pertinentes
			1.1.1.b	Levantamento de parâmetros legais e costumeiros de concessão de direitos de uso, posse e propriedade de terra. **Survey of legal and customary rights of concession of landuse, possession and ownership rights.**	Entrevistais desestruturadas e semi-estruturadas
			1.1.1.c	A existência de acordos costumeiros na comunidade sobre o uso da terra e dos recursos agroflorestais. **Existence of customary agreements within the community concerning landuse and agroforestry resources.**	Entrevista desestruturadas

P	C	I	V	Descrição	observações
			1.1.1.d	Elementos distinguíveis na paisagem resultantes do uso e manejo prolongado dos recursos agroflorestais pela população local (florestas antropogênicas, pomares, roçados). **Distinguishable elements in the landscape resulting from the prolonged use and management of agroforestry resources (anthropogenic forests, orchards and cultivated land) by the local population.**	Entrevista informal e observação direta
			1.1.1.e	A história de uso dos recursos agroflorestais pela população local **The history of the local population's use of agroforestry resources.**	Entrevistas desestruturadas e semi-estruturadas.
	1.2			Devem existir medidas e instituições efetivas de resolucão de conflito **Effective measures and institutions for conflict resolution exist.**	
		1.2.1		Existem mecanismos informais de negociação e resolução de conflitos comunitários, disputas familares e reivindicações sobre o uso, posse e direito de propriedade dos recursos agroflorestais. **Informal mechanisms exist for the resolution and negotiation of community conflicts, family disputes and complaints about the use, possession and ownership of agroforestry resources.**	
			1.2.1.a	Histórias individuais e coletivas sobre o uso dos recursos agroflorestais e suas mudanças nas últimas décadas. **Individual and collective histories about the use of agroforestry resources and how this has changed in recent decades.**	Entrevistas informais.
			1.2.1.b	Acompanhamento de processos de conflito e negociações sobre os recursos agroflorestais. **Accompaniment of negotiation and conflict resolution concerning agroforestry resources.**	Observação direta e documenta-cao pertinente.
			1.2.1.c	Identificação de regras internas da comunidade sobre uso, posse e direito de propriedade dos recursos agroflorestais. **Identification of internal community rules and regulations on the use, possession and ownership rights over agroforestry resources.**	Entrevistas informais e desestruturadas
			1.2.1.d	Resolucões e acordos são alcançados de uma maneira legítima e representativa em todas as negociações de interesse comum. **Solutions to conflicts and agreements are reached in a legitimate manner that represents the common interest .**	Observação direta e entrevistas desetruturadas.
		1.2.2		Aplicação de procedimentos legais na resolução de conflitos com atores internos e externos sobre os recursos agroflorestais (vizinhos, empresas madeireiras, outras comunidades, patrões, etc). **The application of legal proceedings in the resolution of conflicts about agroforestry resources involving internal and/or external actors (neighbours, timber companies, other communities, patrons, etc.)**	

P	C	I	V	Descrição	observações
			1.2.2.a	Levantamento de registros legais de conflitos e resoluções sobre o uso e posse da terra e recursos agroflorestais. **Survey of legal registers of conflicts concerning land use and possession and agroforestry resources, and their resolution.**	Levantamento de arquivos publicos e privados.
			1.2.2.b	Histórias individuais e coletivas de conflitos com arbitragem legal sobre os recursos agroflorestais. **Individual and collective stories of legally arbitrated conflicts about agroforestry resources.**	Entrevistas informais, desestruturadas e semi-estruturadas.
			1.2.2.c	A população local é compensada e indenizada pelos prejuízos causados a recursos agroflorestais por terceiros. **The local population is compensated for damages caused to their agroforestry resources by third parties.**	Entrevistas informais e desestruturadas
	1.3			O acesso e uso comum à terra e aos recursos agroagroflorestais é assegurado para todos os membros da comunidade independente de sexo, cor, religião, classe social. **Access to and the use of common land and agroforestry resources is secured for all community members regardless of their sex, color, religion or social class.**	
		1.3.1		Identificação de normas de regulação de acesso aos recursos agroflorestais. **Identification of norms for the regulation of access to agroforestry resources.**	
			1.3.1.a	Entrevistas coletivas e individuais sobre as normas de regulação do acesso aos recursos agroflorestais **Collective and individual interviews about the norms regulating access to agroforestry resources.**	Entrevistas desestruturadas
	1.4			A comunidade participa e fiscaliza todo o processo de planejamento de qualquer sistema de manejo a ser implantado na sua área agroflorestal de impacto. **The community participates and monitor all the planning process of any management system to be executed within the agroforestry area it impacts upon.**	
		1.4.1		Participação ativa da comunidade na concepção e fiscalização do sistema de manejo dos recursos agroflorestais. **Active community participation in the conception and monitoring of agroforestry resource management systems.**	
			1.4.1.a	Representatividade nas lideranças de todos os grupos e faccoes intra-comunitarias. **Leadership(s) within the community are representative of all groups and fractions within the community.**	Observação direta e entrevistas semi-estruturadas
			1.4.1.b	Conhecimento e consenso sobre o sistema de manejo pela maioria da população adulta da comunidade. **The majority of the community's adult population has knowledge of and agrees with the management system.**	Entrevistas semi-estruturadas (coletivas e individuais).

P	C	I	V	Descrição	observações
			1.4.1.c	A história da criação e introdução de planos de manejo agroflorestal nas duas últimas décadas. **The history of the creation and introduction of agroforestry management plans over the last two decades.**	Entrevistas informais e desestruturada
	1.5			Os direitos e condições de trabalho são apropriadas, ou pelo menos consideradas justas, nas relações empregatícias voltadas para o uso dos recursos agroflorestais entre os membros da comunidade e atores externos. **Workers' rights and conditions are appropriate and at least considered just, in employment relations between community members and external actors, concerning the use of agroforestry resources.**	
		1.5.1		Salários e benefícios são apropriados para as tarefas realizadas. **Salaries and benefits are appropriate in relation to the tasks performed.**	
			1.5.1.a	Existência de documentação básica trabalhista e benefícios legais dos membros das comunidades. **Community members have basic workers' documentation and access to legal benefits.**	Levantamento de documentação basica na comunidade
		1.5.2		Ausência de sub-remuneração e exploração do trabalho infantil e feminino. **Absence of under-payment and the exploitation of child and female labour**.	
			1.5.2.a	Seguimento da legislação trabalhista pertinente. **Pertinent labour legislation is enforced.**	
			1.5.2.b	A história, estrutura e alocação do trabalho na comunidade ao longo das últimas décadas. **The history, structure and allocation of labour within the community over recent decades.**	Observação direta, entrevistas informais e desestruturadas.
		1.5.3		As condições de trabalho são apropriadas e obedecem a legislação existente. **Working conditions are appropriate and in compliance with existing legislation.**	
			1.5.3.a	É garantido o uso de equipamento pessoal de segurança. **The use of personal safety equipment is guaranteed.**	Observação direta e entrevistas desestruturadas.
			1.5.3.b	Índice de ocorrência de acidentes relacionados às condições de trabalho na exploração e uso dos recursos agroflorestais. **Rate of occurrence of accidents related to working conditions and the use of agroforestry resources.**	Entrevistais desestruturadas e semi-estruturadas.

P	C	I	V	Descrição	observações
			1.5.3.c	Levantamento de litígios sobre condições trabalhistas e seus desfechos nas atividades de manejo dos recursos agroflorestais. **Survey of trials over working conditions and their outcomes in the management of agroforestry resources.**	Levantamento de documentação cartorial
		1.5.4		Ausência de "trabalho escravo". **Absence of 'slave labour'**	
			1.5.4.a	Liberdade de ir e vir. **Liberty to come and go.**	Observação direta e entrevistas desestruturadas
			1.5.4.b	Não há submissão à coerção econômica. **No economic coercion or submission.**	Observação direta e entrevistas desestruturadas
			1.5.4.c	Observação da legislação trabalhista pertinente. **Observation of the relevant labour laws.**	Entrevistas desestruturadas e semi-estruturadas
		1.5.5		É garantido o direito à organização de classe e grupos de interesse. **The right to working class organisation is guaranteed.**	
			1.5.5.a	História e estrutura da organização intra e inter comunitária. **The history and structure of intra- and inter-community organisation.**	Observação direta e entrevistas desestruturadas.
		1.5.6		É garantido o direito à negociações coletivas entre a comunidade, ou seus representates, e atores externos. **The right of collective negotiation between the community, its representatives, and external actors is guaranteed.**	
			1.5.6.a	Histórias das relações contemporâneas com atores externos e seus mecanismos de negociação. **Contemporary histories of relations with external actors and the negotiation mechanisms used by external actors.**	Entrevistas informais e desestruturadas
	1.6			O direito à organização social e politica é exercido pela comunidade. **The community exercises the right to social and political organisation.**	
		1.6.1		A comunidade possui formas de organização inter e intracomunitárias. **The community possesses forms of inter- and intra-community organisation.**	

P	C	I	V	Descrição	observações
			1.6.1.a	Existência de organizações reconhecidas de fato e de direito. **The existence of organisations are recognised de facto and legally.**	Entrevistas desestruturadas e levantamento documental de formas associativas locais
			1.6.1.b	**Acatamento** das decisões tomadas nas instâncias mais representativas da comunidade. **Regard for the decisions achieved at more representative organisational levels of the community .**	Entrevistas desestruturadas
			1.6.1.c	História individual e coletiva da participação de membros da comunidade em organizações políticas, sindicais e associativas. **Individual and collective accounts of the participation of community members in associations, unions and political organisations.**	Entrevistas informais e desestruturadas
			1.6.1.d	Identificação de instâncias de decisões que afetem a comunidade. **Identification of decisions that have affected the community.**	Entrevistas desestruturadas
			1.6.1.e	Histórico de participação da comunidade nas definições de políticas públicas de impacto local e regional. **The history of the community's participation in the definition of public policies of local and regional impact.**	Entrevistas desestruturadas e levantamento de documentação pertinente
		1.6.2		Participação feminina efetiva nas discussões e decisões voltadas ao bem estar da comunidade. **Effective female participation in discussions and decisions concerned with community welfare.**	
			1.6.2.a	Existência de formas associativas que contemplem questões pertinentes à gênero. **Existence of forms of associations that contemplate questions concerned with gender.**	Observação direta e entrevistas desestruturadas
			1.6.2.b	Representatividade feminina nas formas de associação intra e intercomunitárias. **The representation of women in intra- and inter-community associations.**	Observação direta e entrevistas desestruturadas
	1.7			As atividades de manejo dos recursos agroflorestais têm contribuições significativas para o bem-estar biológico, socio-econômico e cultural da população local. **Management activities applied to agroforestry resources have significantly contributed to the biological, socio-economic and cultural well-being of the local population.**	

P	C	I	V	Descrição	observações
		1.7.1		As atividades de manejo dos recursos agroflorestais produzem subsídios econômicos para a manutenção de pequenos emprendimentos e indústrias de pequena escala. **The management activities applied to agroforestry resources produce economic subsidies for the maintenance of small-scale businesses and cottage industries.**	
			1.7.1.a	Iniciativas individuais e coletivas de criação de centros de beneficiamento de matéria prima e artesanato. **Individual and collective initiatives to develop centres for the processing of raw materials and production of handicrafts.**	Entrevistas informais e desetruturadas coletivas e individuais
		1.7.2		O nível de dependência da matéria prima produzida e obtida na comunidade. **The level of dependency on raw materials produced and obtained within and by the community.**	
			1.7.2.a	Inventário de itens agroflorestais utilizados na infraestrutura e tecnologia locais. **Inventory of agroforestry items/products used in local infrastructure and technology.**	Observação direta (contagem visual)
			1.7.2.b	Histórias individuais e coletivas sobre o uso dos recursos naturais e suas mudanças nas últimas décadas. **Individual and collective histories of the use of natural resources and its change over recent decades.**	Entrevistas informais e desestruturadas, semi-estruturadas
		1.7.3		A dependência da comunidade de subsídios externos provenientes de ONGs, e organizações governamentais e religiosas. **Community dependence on external subsidies provided by NGOs, religious organisations and/or the government.**	
			1.7.3.a	Esforço comunitário em dar continuidade aos sistemas de manejo introduzidos e implementados por agentes externos. **Community efforts to give continuity to management systems introduced or being implemented by external actors.**	Entrevistas-desestruturadas e semi-estruturadas.
			1.7.3.b	Contribuição de subsídios externos na implementação da infraestrutura comunitária. **Contribution made by external subsidies to the development of community infrastructure.**	Entrevistas desestruturadas e levantamento de documentação pertinente
		1.7.4		As atividades de manejo dos recursos agroflorestais contribuem economicamente para o acesso da comunidade à educação, saúde e serviços. **Agroforestry resource management activities economically contribute to the community's access to education, health and other social services.**	

P	C	I	V	Descrição	observações
			1.7.4.a	Antropometria de crianças de 0 a 10 anos **Anthropometry of children aged 0-10 years.**	Entrevistas estruturadas e mensuração de peso/altura (idade)
			1.7.4.b	Mapa infraestrutural e a sua evolução nas últimas décadas **Map of infrastructure and its evolution over recent decades.**	Entrevistas desestruturadas coletias
			1.7.4.c	Crianças em idade escolar freqüentando a escola. **Percentage of school-aged children with regular school attendance.**	Censo indireto ou documentação disponível.
		1.7.5		Existência de benefícios efetivos proveniente do manejo dos recursos agroflorestais para a subsistência e reprodução de unidades domésticas. **Existence of effective benefits for the subsistence and reproduction of domestic units derived from the management of agroforestry resources.**	
			1.7.5.a	Mensuração da produção agroflorestal da unidade doméstica. **Quantification of the agroforestry production of the domestic unit**.	Entrevista semi-estruturada.
			1.7.5.b	Consumo alimentar na unidade doméstica com especial atenção para produtos agroflorestais. **Food consumption by the domestic (household) unit with special attention to agroforestry products.**	Entrevista semi-estruturada e recordatório de 24 horas
			1.7.5.c	Inventário dos bens e utensílios das unidade domésticas. **Inventory of domestic household assets and utensils.**	Observação direta e entrevista-semi-estruturada
			1.7.5.d	Fluxo de renda proveniente das atividades de manejo dos recursos agroflorestais nas unidade domésticas. **Domestic unit (household) income fluctuations from agroforestry resource management activities.**	Observação direta e entrevistas infomais e desestruturadas.
			1.7.5.f	Crescimento populacional lento ou estabilizado **Stable or slow population growth.**	Levantamento demogáfico indireto da com. (pop. total, mortalidade, natalidade e migração pelo menos na última década,pirâmide demográfica, taxa de fertilidade

P	C	I	V	Descrição	observações
			1.7.5.g	Acesso e uso feminino a planejamento reprodutivo e familiar **Female access to and use of family planning and contraceptives.**	Entrevistas semi-estruturadas
		1.7.6		Respeito e proteção de sítios e locais de significado cultural especial têm prioridade sobre qualquer forma de uso e exploração. **Respect for and the protection of sites of special cultural significance is prioritised in the allocation of all forms of natural resource use and exploitation**	
			1.7.6.a	Existência de normas de proteção de sítios de valor e significado histórico e cultural especiais para a população local são protegidos e preservados. **Existence of norms for the protection of sites of special historical and cultural value to the local population.**	Entrevistas desestruturadas e semi-estruturadas
			1.7.6.b	Registro de comunicação às autoridades competentes sobre sítios e artefatos arqueológicos localizados durante atividades econômicas e sociais na floresta. **Registration with the relevant official authorities of archeological sites and artefacts encountered during socio-economic activities in the forest.**	Entrevistas e levantamento de arquivos institucionais
		1.7.7		Transmissão e perpetuação (escrita ou oral) do saber e mitologia tradicional. **Transmission and perpetuation (written and oral) of traditional knowledge and mythology.**	Entrevistas informais e desestruturadas
			1.7.7.a	Nível de interesse dos membros mais jovens da comunidade na perpetuação do saber e da mitologia tradicional sobre o meio-ambiente. **Young community members' level of interest in perpetuating traditional knowledge and mythology on the natural environment.**	Entrevistas semi-estruturadas
			1.7.7.b	Calendário ritual **Calendar of rituals.**	Entrevistas semi-estruturadas coletivas
			1.7.7.c	Narrativas de mitos locais **Narratives of local myths.**	Entrevistas informais
		1.7.8		A identidade cultural é íntimamente ligada à paisagem agroflorestal, suas formas de uso e ritualização. **The cultural identity is intimately linked with the agroforestry landscape, its various uses and its ritualisation.**	
			1.7.8.a	Histórias de recursos agroflorestais e sítios com significado histórico e cultural especial. **Stories of agroforestry resources and locations of special historical and cultural significance.**	Entrevistas informais e desestruturadas
			1.7.8.b	História da utilização de manchas de terra preta de índio e áreas com potencial valor arqueológico. **History of the use of Indian black soils and areas of potential archeological value.**	Entrvistas informais e semi-estruturadas

P	C	I	V	Descrição	observações
			1.7.8.c	Repertório culinário tradicional ligado ao aproveitamento extensivo de produtos agroflorestais e seu uso comtemporâneo. **Traditional culinary repertoire linked to the use of a wide range of agroforestry products.**	Entrvistas desestruturadas e semi-estruturadas.
	1.8			A consciência e conhecimento local sobre o manejo e o uso dos recursos agroflorestais demostram uma ética de conservação e uso sustentável da terra. **Local awareness and knowledge of agroforestry resource use and management demonstrates an ethic of sustainable land-use and conservation.**	
		1.8.1		Conhecimento local amplo sobre o uso dos recursos agroflorestais, especialmente os não-madeireiros. **Ample local knowledge on the use of agroforestry resources, especially non-timber forest products.**	
			1.8.1.a	Calendário de coleta e extração de produtos **agro**florestais. **Calendar of the collection and extraction of agroforestry products.**	Entrevistas semi-estruturadas.
			1.8.1.b	Classificações nativas de produtos agroflorestais. **Indigenous classification of agroforestry products**.	Entrevistas semi-estruturadas
			1.8.1.c	Acompanhamento do uso dos recursos agroflorestais. **Accompaniment of the use of agroforestry resources.**	Observação direta e entrevistas desestruturadas
		1.8.2		Utilização de produtos não madeireiros para a tecnologia e infraestrutura locais. **Use of non-timber forest products in local technologies and infrastructure.**	
			1.8.2.a	Classificações nativas de produtos agroagroflorestais utilizados na manufatura e produção de artefatos. **Indigenous classification of agroforestry products used in the manufacture and production of artefacts.**	Entrevistas semi-estruturadas.
		1.8.3		Evidência de códigos simbólicos e mitológicos com efeitos reguladores na conservação de recursos agroflorestais **Evidence of symbolic codes and myths that have a regulatory effect that contributes to the conservation of agroforestry resources.**	
			1.8.3.a	Narrativas mitológicas de efeito regulador observável na conservacao da fauna e flora local. **Narratives of myths that have an observable regulatory effect on the local fauna and flora.**	Entrevista informal e desestruturadas

CIFOR - Cameroon Test, 1997

Social Principles, Criteria, Indicators and Verifiers of the Sustainability of Community Managed Forests, with reference to the SOLIDAM Zone, Central Province, Cameroon: Final Proposal of C&I for Social Aspects

by the Social Science Expert. This set fully endorses all the recommendations proposed by the Workshop's Social C&I Review Group

Community Access Rights to Resources and Responsibilities

P	C	I	V	Description	Related Sources	Comments & Observations
1				Long-term community access rights to land and forest resources are clearly defined, known and accepted.	**E1, SMARTWOOD P2; C1; I1; FSC**	Ownership rights over forest may not be necessary but the feelings long-term secure access and use rights.
	1			Evidence of access/use rights are demonstrated by community members.	**C1, I2; Brazil P2; I2.1 Canada**	Access and use rights are controlled by an identified group and not privately owned or managed by government.
		1		Land appropriation procedures are accepted and respected.		
			1	History of land-use and/or occupation.		
			2	Property inheritance patterns.		
		2		Decisions of conflict resolution institutions within community.	**P2, I2.3 Canada**	
			1	Village Council of Wisemen (*Nya-moto-nam*)		
			2	Number of reported cases of conflicts over land claims resolved within communities compared to those taken to State Law Courts.		
		3		Formal legal frameworks accommodate customary tenure.	**P2, FSC**	

P	C	I	V	Description	Related Sources	Comments & Observations
1				Long-term community access rights to land and forest resources are clearly defined, known and accepted.	**E1, SMARTWOOD P2; C1; I1; FSC**	Ownership rights over forest may not be necessary but the feelings long-term secure access and use rights.
	1			Evidence of access/use rights are demonstrated by community members.	**C1, I2; Brazil P2; I2.1 Canada**	Access and use rights are controlled by an identified group and not privately owned or managed by government.
		1		Land appropriation procedures are accepted and respected.		
			1	History of land-use and/or occupation.		
			2	Property inheritance patterns.		
		2		Decisions of conflict resolution institutions within community.	**P2, I2.3 Canada**	
			1	Village Council of Wisemen (*Nya-moto-nam*)		
			2	Number of reported cases of conflicts over land claims resolved within communities compared to those taken to State Law Courts.		
		3		Formal legal frameworks accommodate customary tenure.	**P2, FSC**	
			1	Acceptance of customary use rights by State Law Courts.		
		4		Boundaries of community area are known and respected by community members..		The issue here may be for community members to be comfortable with the definitions of what is perceived to be an appropriate boundary.
			1	Knowledge of important features indicating boundaries among communities e.g. trees, rivers, mountains, etc.		

P	C	I	V	Description	Related Sources	Comments & Observations
	2			Forests products contribute significantly to the socio-economic well-being of the different age and sex groups in the community.	**PIIB, Cote d'Ivoire**	
		1		Importance of forest products in households cash and non-cash incomes.		
			1	Household food consumption patterns.		
			2	Knowledge of market value of forest resources.		
			3	Contribution of forest products to household cash incomes.		It is recognised that it could have both positive and negative effects on forest sustainability.
	3			Sites of special socio-cultural, historic and touristic values to local communities are known and protected by social control mechanism.	**P3 FSC, I3.3 Canada, C5 Brazil E22 SMARTWOOD**	Such sites are often important areas of biological diversity.
		1		Mystical sites of socio-cultural significance to communities		
	4			Access rights to community forest commons is regulated through collective action and support		
		1		Response to calls by village heads and opinion leaders for collective action against intruders e.g. forest exploiters and non-community members.		
			1	Cases of incidents with intruders.		
		2		Communities have the capacity to develop new rules and practices of exploitation in response to perceptible changes in the resource base.		
			1	Recent changes in traditional forest use regulations and/or exploitation practices and techniques.		

P	C	I	V	Description	Related Sources	Comments & Observations
	5			Community management and use of forest resources and State priority goals on forest management and development are compatible.	**C1, I2; Brazil** **C1, I6, Brazil**	This is to specify to the two test villages within the SOLIDAM zone and the Cameroon legislation on community forestry.
		1		Capacity of the legal system to include the aspirations of local communities in forest management.		
			1	Content of forestry policy and regulation.		
			2	Changes in jurisprudence.		
		2		State and NGO assist communities in sustainable forest management.		
			1	Initiation of procedure for obtaining community forests.		
			2	Documents.		
			3	Appropriate development education programmes.		
Indigenous Knowledge Systems and Dissemination						
2				Community forest management practices and techniques fully incorporate indigenous knowledge systems.	**C6, I3 Brazil**	
	1			Social structure permits the transmission of existing knowledge systems.		
		1		Folk-tales and proverbs about forest-people relationships.		
		2		Joint forest exploitation trips by different user groups.		

P	C	I	V	Description	Related Sources	Comments & Observations
		3		Knowledge transmission during forest exploitation expeditions.		
	2			Knowledge of forest is used as a mechanism to ensure at least minimal livelihood to community members.		**"No community member ever returns from the forest without something for the family" on quote**
		1		Frequency of forest visits.		
			1	Activity calendars of different forest use groups.		
		2		Major cash and non-cash income sources.		
	3			Local systems exist for the monitoring and evaluation of the evolution of different forest resources.	**C4 Brazil** **P8 FSC**	
		1		Destructive exploitation practices of forest and techniques are known, e.g. hunting, fishing, etc.		
			1	Number of community members possessing fire-arms.		
			2	Frequency of reported cases of partial or massive destructive actions on forest resources, e.g. fish poisoning.		
		2		Community members effectively contribute to forest resource assessment.		**Different communities have different signs of recognising changes in availability of resources**
			1	Changes in availability of useful plant and animal species.		
			2	Individual/collective reporting of encroachment by non-community members.		
			3	Changes in fallow periods.		

P	C	I	V	Description	Related Sources	Comments & Observations
Indigenous Knowledge Systems and Dissemination						
2				Community forest management practices and techniques fully incorporate indigenous knowledge systems.	**C6, I3 Brazil**	
	1			Social structure permits the transmission of existing knowledge systems.		
		1		Folk-tales and proverbs about forest-people relationships.		
		2		Joint forest exploitation trips by different user groups.		
		3		Knowledge transmission during forest exploitation expeditions.		
	2			Knowledge of forest is used as a mechanism to ensure at least minimal livelihood to community members.		**“No community member ever returns from the forest without something for the family” on quote**
		1		Frequency of forest visits.		
			1	Activity calendars of different forest use groups.		
		2		Major cash and non-cash income sources.		
	3			Local systems exist for the monitoring and evaluation of the evolution of different forest resources.	**C4 Brazil** **P8 FSC**	
		1		Destructive exploitation practices of forest and techniques are known, e.g. hunting, fishing, etc.		

P	C	I	V	Description	Related Sources	Comments & Observations
			1	Number of community members possessing fire-arms.		
			2	Frequency of reported cases of partial or massive destructive actions on forest resources, e.g. fish poisoning.		
		2		Community members effectively contribute to forest resource assessment.		**Different communities have different signs of recognising changes in availability of resources**
			1	Changes in availability of useful plant and animal species.		
			2	Individual/collective reporting of encroachment by non-community members.		
			3	Changes in fallow periods.		
Community Leadership and Organisational Structure						
3				Responsibility for long-term forest management is assumed by community level institutions or organisations		
	1			Institutions or organisations exist to cater for the diverse interests of different forest user and interest groups.		Authority structures are often dominated by men and some families raising important problems of women and minority group access rights and participation.
		1		Decisions of conflict resolution institutions are respected.		
			1	Village Council of Wisemen or Elders.		
		2		Individuals community members have the possibility of appeal.		

P	C	I	V	Description	Related Sources	Comments & Observations
			1	official law courts recognise decisions of traditional legal systems.		
		3		Community dialogue structures exist for the negotiation/discussion of forest management issues with state service and NGOs.	**C2, I8 Brazil** **E3.4 SMARTWOOD**	
			1	Representative community based development groups and associations.		
			2	Respect/recognition of decisions of development association/group.		
	2			Community institutions have the capacity of determining and distributing benefits from forest resources.		This will be similar t the basic rules and regulations that govern most socio-cultural groups/associations.
		1		Community norms and values on the distribution of the meat of relatively large hunted animals.		This has evolved considerably as a result of increasing poverty and individualisation
			1	Distribution practices for the meat of wild animals.		
		2		Community food taboos.		Apparently has no direct link to sustainability, but structures community relations.

CIFOR – Indonesia Test, 1997

Social Criteria and Indicators for Community Managed Forests

P	C	I	V	DESCRIPTION	COMMENTS
1				**SECURE COMMUNITY TENURE SYSTEM SUPPORTS SUSTAINABILITY.**	
	1			**Secure community tenure system is guaranteed by the state.**	
		1		Secure community tenure system is guaranteed in state laws and regulations.	
		2		Community property rights is indicated in official landuse maps.	
		3		Translation and adaptation of the TGHK (Tata Guna Hutan Kesepakatan) into TGLDK (Tata Guna Lahan Desa Kesepakatan).	
			1	*Participatory mappin.g*	
			2	*Community property rights is indicated in official land use maps.*	
			3	*There is no overlapping rights.*	
	2			**Government plans and development programmes are based on consideration of local tenure and land utilisation systems.**	
		1		Local landuse system is part of any development programme.	
			1	*There is full participation of local community in planning.*	
			2	*There is full participation of local community in implementation.*	
			3	*Gender equality in all processes.*	
			4	*There is participation in decision making on benefit sharing.*	
			5	*All category member of the community fairly participate in the benefit.*	
	3			**There is consensus on property rights between communities.**	
		1		There is a conflict resolution mechanism beyond community boundaries.	
			1	*Cases of conflict on land between communities.*	
			2	*Cases of conflict resolutions.*	
			3	*Conflicts is resolved by conflict resolution mechanism.*	
2				**LOCAL SOCIAL INSTITUTION SUPPORT A SUSTAINABLE LANDUSE SYSTEM.**	
	1			**Customary law and other regulations ensure sustainable landuse system.**	
		1		There are sanctions for those breaking the rules.	
			1	*Specific sanctions attached to specific landuse system.*	

P	C	I	V	DESCRIPTION	COMMENTS
		2		All section of the community respected the customary law and other regulation on the sustainable landuse system.	
			1	*Adult members of the community know fairly about the customary laws attached to landuse systems.*	
			2	*People agree that customary laws is still effective.*	
			3	*There are recent cases where sanctions are felt.*	
		3		There is conflict resolution mechanism.	
			1	*Adult members of the community can tell how conflict on landuse is resolved.*	
			2	*There is a consensus on how conflict on landuse is resolved.*	
			3	*Recent cases of traditional conflict resolution on landuse.*	
		4		There are rules that ensures the sustainable use of the forest.	
			1	*Community respect rules on hunting.*	
		5		Rules that ensures the sustainability of the service functions of the forest.	
		6		Rules that ensures the sustainability of tembawang.	
		7		Rules on ladang/shifting-cultivation practices that ensures an appropriate fallow period.	
	2			**Customary law and other regulations ensure fair access to community natural resources and fair distribution of their products among community members.**	
		1		Rules that ensure fair access of all stakeholders to forest.	
			1	*Clear understanding on the composition of stakeholders.*	
			2	*Every category stakeholder has access to forest according to customary law and other regulations.*	
			3	*Stakeholders respect the customary law and regulations on forest resources.*	
		2		Rules that ensures fair distribution of tembawang products to all stakeholders.	
			1	*Clear understanding on the composition of all stakeholders.*	
			2	*Secure communal and private property rights on tembawang.*	
			3	*Clear rules on inheritance.*	
			4	*Clear rules on rights to harvest tembawang products.*	
		3		Rules that ensures fair distribution of irrigation water where there is *sawah.*	
			1	*Participatory planning and building of irrigation works*	
	3			**Local social organisation has the capacity to enforce customary law and other regulations.**	

P	C	I	V	DESCRIPTION	COMMENTS
		1		Meetings on environmental and landuse problems are organised.	
			1	*Recent case of community meeting on environmental and landuse problems.*	
			2	*Relevant parties in the conflict are present.*	
			3	*Other members of the community than the conflicting parties are present.*	
			4	*There are decisions made.*	
		2		Women represented equally in meeting and decision making.	
			1	*Women are present in meetings.*	
			2	*Women are involved in discussion.*	
		3		Participatory decision making.	
			1	*Decisions are made in meetings of adult members of the community.*	
			2	*Participants understand the subject of discussion.*	
			3	*No monopoly of discussion by authority.*	
			4	*People agree on the discussion inside and outside the meeting.*	
		4		New regulations and sanctions that cope with new development problems on landuse and natural resources still being developed.	
			1	*People can differentiate traditional and new regulation/rules that the community agreed upon.*	
			2	*New regulations/rules are initiated locally.*	
3				**ECONOMIC GAINS DO NOT COMPROMISE ECOLOGICAL INTEGRITY.**	
	1			**Systematic interaction of natural forest into the community resource management..**	
		1		Sustainable extraction of timber under community management.	
			1	*People know the regulations.*	
			2	*Timber extraction is monitored by the authority.*	
			3	*There is organisation under local management that coordinate extraction of timber.*	
			4	*A fair access to timber resources among the community members.*	
			5	*There is a systematic replanting of trees.*	
		2		Sustainable extraction of NTFPs under community management.	

P	C	I	V	DESCRIPTION	COMMENTS
			3	*Rules on harvest techniques of NTFP.*	
			4	*Rules on NTFP tenure.*	
	2			**Optimalisation of the local agroforestry system.**	
		1		Optimalisation of Tembawang (forest gardens).	
			1	*Enrichment with economically valuable trees.*	
			2	*New temabawang are planted with economically valuable trees.*	
		2		Tembawang retains its social function.	
			1	*Decision making on tembawang enrichment is a social occasion not an individual.*	
			2	*Decision making on tembawang conversion is a social occasion not an individual.*	
		3		Productivity and quality of the rubber gardens must be increased.	
			1	*Appropriate technology for tree improvement.*	
			2	*Appropriate technology for post-harvest and processing.*	
			3	*Market for rubber exist.*	
		4		There is policy and activity to rationalise the *ladangs* system	
			1	*The use of local knowledge.*	
			2	*Mobilising scientific knowledge.*	
			3	*Training.*	
			4	*Field trial.*	
	3			**Permanent agriculture is developed where the socio-economic conditions allows.**	
		1		Agreement among stakeholders on the conversion of part of the environment to irrigated agriculture.	
			1	*Agreement among all stakeholders.*	
			2	*Fair distribution of irrigated land among the stakeholders.*	
		2		Local organisation manage the irrigation system.	
			1	*Water distribution is managed.*	
			2	*Water is equally distributed among the irrigated fields.*	
		3		There is an appropriate animal husbandry.	
			1	*Animal husbandry is common for most households.*	
		4		There is training on permanent agriculture.	
			1	*Training on appropriate on-farm technology.*	

P	C	I	V	DESCRIPTION	COMMENTS
	1			**Formal and non-formal education support sustainability of forest.**	
		1		Public access to all grades of formal education.	
			1	*School-age children are going to school.*	
			2	*School going children finished their school.*	
			3	*School for adults.*	
		2		Local content curricula devoted on environment consciousness building.	
			1	*Lessons on environment.*	
			2	*Lessons on local landuse systems.*	
		3		Non-formal education is functioning.	
			1	*Story telling is still performed by elders for the youngsters.*	
			2	*Local history is still handed down to the younger generation.*	
			3	*Local knowledge on natural resource management still handed down to the younger generation.*	
			4	*Training of community members on environmental problems.*	
			5	*Training on income generating activities.*	
			6	*Information exchange with information sources outside the community.*	

2. ECOLOGY

Ecological Criteria and Indicators for Community Managed Forests

Brazil

Final Post-Workshop Version

P	C	I	V	**1) INTEGRIDADE ECOLÓGICA DA PAISAGEM FLORESTAL E DOS ECOSSISTEMAS TERRESTRES E AQUÁTICOS**
1				O Manejo Florestal Comunitário (MFC) não compromete a diversidade biológica e a integridade ecológica da paisagem florestal, e de ecossistemas terrestres e aquáticos contidos nela ou adjacentes a ela. ***CFM does not compromise the biological diversity or the ecological integrity of the forest landscape or of the terrestrial and aquatic ecosystems contained therein or adjacent to it.***
	1			Uma floresta contínua e estruturalmente pouco perturbada ainda oferece as condições ecológicas mais satisfatórias para a manutenção da biodiversidade local e uso sustentável de recursos florestais ***A continuous and structurally undisturbed forest still offers the most satisfactory ecological conditions for the maintenance of local biodiversity and the sustainable use of forest resources.***
		1		Proporção de mata primária e secundária (capoeiras) dentro da área de influência direta da comunidade ao longo do tempo. ***Proportion of primary and secondary forest within the CFM.***
			1	Novos roçados derrubados e queimados anualmente são feitos preferencialmente em áreas de capoeiras, ao invés de mata primária. ***New annual agricultural land clearings and fires are to be preferably done in areas of fallow regrowth rather than in primary forest.***
			2	O período de pousio (fallow period) de capoeiras derrubadas e queimadas não está sendo reduzido ao longo do tempo. ***Fallow periods are not being reduced over the course of time.***
	2			O processo de fragmentação de habitat não compromete a manutenção da diversidade biológica ao nível da paisagem florestal. ***The process of habitat fragmentation does not compromise the maintenance of biological diversity at the forest landscape level.***
		1		Os processos de fragmentação e conversão de habitats primários devem ser contidos para que não resultem na erosão da biodiversidade através de processos de extinção local ou regional de espécies. ***Processes of the fragmentation and conversion of primary habitats must be contained so as not to result in biodiversity erosion and the local or regional extinction of species.***
			1	Ilhas relictuais de mata primária, ocorrendo dentro do mosaico de capoeiras de diferentes idades, são preservadas. ***Islands of relic primary forest occurring in the successional forest mosaic are preserved.***

P	C	I	V	1) INTEGRIDADE ECOLÓGICA DA PAISAGEM FLORESTAL E DOS ECOSSISTEMAS TERRESTRES E AQUÁTICOS
			2	A fragmentação da paisagem florestal através da agricultura de corte e queima resulta num mosaico sucessional de capoeiras com uma conectividade relativamente alta com áreas de mata primária através de corredores de habitat ***The fragmentation of the forest landscape caused by shifting*** ***agriculture results in a successional mosaic that has a relatively high connectivity with areas of primary forest through natural habitat corridors.***
		2		A densidade e tamanho de clareiras antropogênicas resultantes da derrubada de árvores na mata primária não deve ser maior do que aquela gerada pela dinâmica de clareiras naturais. ***The density and size of clearings caused by the felling of trees in primary forest must not exceed the dimensions of natural gaps cuased by tree fall.***
			1	Quantificação da heterogeneidade do **dossel** (i.e. densidade e tamanho de clareiras). ***Quantification of the canopy heterogeneity (i.e. the density and size of clearings).***
			2	A densidade aproximada de árvores de grande porte (>40 cm DAP) derrubadas na área de mata primária explorada pela comunidade. ***The approximate density of large trees (>40 cm dbh) felled within the primary forest exploited by the community.***
	3			A preservação do mosaico de habitats naturais mantém a complementaridade natural de ocorrência de espécies. ***The preservation of a mosaic of natural habitats maintains the natural complementarity of species occurrences.***
		1		Dentre os vários tipos de habitats naturais, aqueles que são mais raros (ou menos extensos) na paisagem são poupados de altas taxas de conversão para sistemas agrícolas. ***Among the various types of natural habitats occurring within the region, the rarest (or least extensive) in the forest landscape are strongly protected from conversion to agriculture.***
			1	Áreas de importância ecológica são devidamente identificadas e protegidas. ***Areas of special ecological importance are identified and protected.***
			2	Ocorrência e extensão das chamadas "terras pretas de índio" na região. ***The occurrence and extension of the so-called 'Indian black earths' in the region.***
			3	Uma proporção mínima (e.g. 30%) de matas secundárias antigas (e.g. >30 anos) coincidindo com "terras pretas de índio" são mantidas. ***A minimum proportion (e.g. 30%) of old secondary forest (e.g. >30 years old) on 'Indian black earths' is maintained.***
		2		Uma faixa de florestas ribeirinhas (de largura segundo a lei ou no mínimo de 50 m das margens de rios e igarapés) são poupadas de corte raso pelas suas funções hidrológicas e de conservação da biodiversidade. ***Forests along river and stream banks are protected from clear felling to preserve hydrological functions and for biodiversity conservation. Legal minimum of keeping 50 m of forest along rivers and streams, is upheld.***
			1	Quantificação da continuidade e largura dos remanescentes de matas ribeirinhas. ***Quantification of the continuity and width of remaining riverine forest.***

P	C	I	V	1) INTEGRIDADE ECOLÓGICA DA PAISAGEM FLORESTAL E DOS ECOSSISTEMAS TERRESTRES E AQUÁTICOS
			2	Descrever como as áreas de mata de terra firme e igapó estão integradas ao mosaico de capoeiras resultantes da atividade agrícola de corte e queima. ***Description e how upland and igapó forest areas are integrated into the successional mosaic resulting from shifting agriculture.***
			3	Áreas de captação de chuva na bacia hidrográfica, e particularmente florestas ao longo de rios e igarapés, são mantidas relativamente intactas principalmente rio acima dos núcleos comunitários. ***Most important catchment areas within watersheds, and especially forests along rivers and streams, are maintained relatively intact especially upstream from villages.***
	4			O risco de fogo se propagar indiscriminadamente em áreas de capoeiras e matas primárias é minimizado através de técnicas apropriadas de manejo de queimadas. ***The risk of accidental fires in fallow areas and primary forest, is minimised through the use of appropriate fire management techniques.***
		1		Não ocorrência de fogos acidentais. ***No occurrance of accidental wildfires.***
			1	Frequencia de fogos descontrolados que chegaram a queimar grandes áreas de capoeiras e mata primária nos últimos 20 anos. ***The frequency with which accidental fires have in the last 20 years burnt large areas of fallow and primary forest.***
			2	Extensão de áreas de mata queimada e não queimadas na área de uso comunitário. ***Relative surface areas of burnt and unburnt forest within the forest area used by the community.***
			3	Impacto local do fogo em termos da mortalidade diferencial de plantas (e.g. perfil de espécies e classes de tamanho) em áreas de mata que já foram queimadas. ***Local impact of fire in terms of differential mortality of plants (e.g. species and size class profiles) in burnt forest areas.***
	5			Manutenção da integridade ecológica de todos os ecossistemas aquáticos (rios, igarapés e lagos) ***Maintenance of the ecological integrity of all the aquatic ecosystems (rivers, streams, lakes etc.)***
		1		Manutenção do regime de vazão, de inundação, e da produtividade da calha dos rios e outros processos naturais que sustentam ou subsidiam populações de animais e plantas aquáticos (integridade fisica) ***Maintenance of flooding regimes, the productivity of river channels and of natural processes that sustain or subsidise aquatic animal and plant populations (physical integrity).***
			1	Alteração da transparência e temperatura da água ***Alterations in water transparency and temperature.***
			2	Ausência de desmatamento de florestas inundáveis e em regiões de cabeceiras ***No deforestation of flooded forest in headwater regions.***
			3	Ocorrência de **assoreamento** de lagos e da calha dos rios e igarapés ***Occurrence of abnormal levels of sedimentation of lakes, rivers, and streams.***

P	C	I	V	1) INTEGRIDADE ECOLÓGICA DA PAISAGEM FLORESTAL E DOS ECOSSISTEMAS TERRESTRES E AQUÁTICOS
		2		Ausência de processos de contaminação no meio aquático (integridade química e biológica) ***Absence of aquatic contamination processes (water quality satisfactory from a chemical and biological standpoint).***
			1	Transparência, cheiro e gosto da água ***Transparency, odor and taste of water.***
			2	Ocorrência de “blooms” de alga e mortalidade abnormal de peixes ***Occurrence of algal blooms and abnormal fish mortality.***
			3	Presença de *coliformes fecais* ***Contamination from* E. coli *of faecal origin.***
			4	Alterações drásticas no pH da água ***Drastic alterations in water pH***.
			5	Ocorrência de problemas neurológicos nas pessoas que indicam contaminação por metais pesados e pesticidas. ***Occurrence of neurological and other health problems that indicate contamination with heavy metals or pesticides.***
				2) EXTRATIVISMO DE PRODUTOS FLORESTAIS MADEIREIROS E NÃO-MADEIREIROS ***Extraction of timber and non-timber forest products.***
				2.1) CAÇA DE SUBSISTÊNCIA E AQUISIÇÃO DE PROTEÍNA DA FAUNA TERRESTRE ***Subsistence hunting and protein capture from terrestrial fauna.***
2				A integridade ecológica do ecossistema florestal é mantida em termos de um complemento faunístico relativamente íntegro de répteis, aves, e mamíferos ***The ecological integrity of the forest is maintained in terms of a relatively complete assemblage of reptiles, birds and mammals.***
	1			A abundância de espécies de caça de médio a grande porte é satisfatória dentro da área caçada pela comunidade tanto do ponto de vista ecológico como sócio-econômico ***The abundance of medium and large-bodied game species within the community’s hunting range is satisfactory from the ecological as well as the socio-economic point of view.***
		1		A abundância de espécies de caça é satisfatória do ponto de vista ecológico e sócio-econômico ***The abundance of game species is satisfactory from the ecological as well as the socio-economic point of view***
			1	Listagem das espécies atualmente mais caçadas. ***Checklist of the most intensively hunted game species***.
			2	Espécies que já foram relativamente comuns, mas hoje não mais ocorrem no raio de caça da comunidade. ***Game species that were once common but no longer occur within the community’s hunting range.***

P	C	I	V	1) INTEGRIDADE ECOLÓGICA DA PAISAGEM FLORESTAL E DOS ECOSSISTEMAS TERRESTRES E AQUÁTICOS
			3	Status atual de população, e o raio de detecção, das espécies mais susceptíveis (ou mais sensíveis) à atividade de caça, incluindo: jabutí branco, jabutí vermelho, cujubim, mutum cavalo, nambú açú, queixada, anta, macaco prego, macaco cuxiú, guariba, e coatás (ou macaco barrigudo). ***Actual population status and detection radius of the species most susceptible (or sensitive) to hunting activity; including: tortoises, piping guans, currasows, great tinamous, white-lipped peccaries, tapir, brown capuchins, and spider monkeys (or woolly monkeys). (in Portuguese: jabutí branco, jabutí vermelho, cujubim, mutum cavalo, nambú açú, queixada, anta, macaco prego, macaco cuxiú, guariba, e coatás (ou macaco barrigudo).***
			4	Taxa de caçadas bem sucedidas ou fracassadas por unidade de esforço de caça (km percorrido) ou unidade de tempo (dias investidos em caçadas). ***Ratio of successful to unsuccessful hunting forays by unit of hunting effort (km covered; hours or days spent in hunting).***
		2		A abundância das populações de caça aumenta com a distância física da fonte de pressão de caça. ***The rate at which the abundance of game animals increases beyond a critical distance from the source of hunting pressure (e.g. village).***
			1	O estoque residual de caça aumenta rapidamente a partir de uma certa distância das fontes de pressão de caça. ***The residual stock of game increases rapidly from a certain distance from the source of hunting pressure.***
		3		A carne de caça ainda é importante na dieta das comunidades locais ***Game meat is still important in the local diet.***
			1	Descreva as proporções aproximadas da contribuição de carne de (1) vertebrados terrestres; (2) peixes e outros recursos aquáticos; (3) animais domésticos de pequeno porte; e (4) carne salgada e congelada (ou no gelo) proveniente de abatedouros urbanos ou barcos pesqueiros, para o consumo local de proteína animal. ***Describe the relative contribution of animal protein made to local diet by 1) terrestrial vertebrates; 2) fish and other aquatic animals; 3) small-sized domestic animals; and 4) salted meat coming from urban abattoirs or frozen fish from fishing boats***.
			2	Identificar as 5 espécies de caça mais importartes (mais consumidas) para a comunidade local. ***Identify the five game species most important (most consumed) to the local community.***
		4		Roçados e capoeiras jovens atraem um número considerável de animais caçados, particularmente veados (vermelho e roxo), caititús, e roedores de grande porte. ***Agricultural and fallow land attracts a considerable number of game species, especially brocket-deer (red or gray), peccaries, and large rodents (agoutis, pacas).***
			1	Um número disproporcionalmente alto de animais abatidos são provenientes de roçados ou das capoeiras de várias idades. ***A disproportionately high number of slaughtered animals are caught in agricultural fields or fallows of various ages.***

P	C	I	V	1) INTEGRIDADE ECOLÓGICA DA PAISAGEM FLORESTAL E DOS ECOSSISTEMAS TERRESTRES E AQUÁTICOS
		5		Existem áreas pouco caçadas (ou não caçadas) dentro da área acessível a caçadores da comunidade. ***The existence of areas scarcely hunted or unhunted, within the area accessible to hunters belonging to the community.***
			1	Existem santuários de caça (ou áreas funcionalmente equivalentes) num raio de até 15 km de caminhada da sede da comunidade. ***Existence of animal sanctuaries (or areas that are functionally equivalent to that) within a radius of 15 km walking distance from the community centre.***
			2	Proporção dessas áreas dentro do raio de caça da comunidade ***The number and extent of such areas within the community's hunting range.***
		6		A atividade de caça comercial não ocorre na comunidade. ***No commercial hunting takes place within the community.***
			1	Ocorrência de venda de carne de caça (salgada ou fresca) a consumidores internos ou externos a comunidade (e.g. mercados urbanos) ***The occurrence of game meat sales (salted or fresh) to community members and outsiders (e.g. delivered to urban markets)***
			2	Importância sócio-econômica da venda de excedentes de carne de caça não consumida na esfera domiciliar para outras famílias ou comunidades ***The socio-economic importance of the sale of surplus game meat not consumed by community households.***
			3	Existem mecanismos informais ou institucionais de controle efetivo da caça comercial na área de MFC (e.g. atuação do IBAMA) ***Informal and institutional mechanisms (e.g. IBAMA patrols and inspections) exist effectively controlling commercial hunting in the CMF area.***
				2.2) PESCA DE SUBSISTÊNCIA E EXTRAÇÃO DE OUTROS RECURSOS AQUÁTICOS ***Subsistence fishing and the extraction of other aquatic resources.***
3				O uso de fontes aquáticas de proteína animal, incluindo a pesca de subsistência, é praticado numa base sustentável. ***The use of aquatic sources of animal protein, including subsistaece fishing, is practised on a sustainable basis.***
	1			A exploração dos recursos pesqueiros não leva à extinção econômica ou demográfica de populações de peixes e quelônios. ***The exploitation of fishing resources does not lead to the demographic or economic extinction of fish and turtle populations.***
		1		A importância sócio-econômica de fontes aquáticas de proteína animal permanece significativa para as comunidades locais. ***The socio-economic importance of aquatic sources of animal protein to the local community remains significant.***
			1	Proporção de peixes na dieta da comunidade em relação à outras fontes de proteína animal. ***Relative proportion of fish in the local diet compared to that of other forms of animal protein.***

P	C	I	V	1) INTEGRIDADE ECOLÓGICA DA PAISAGEM FLORESTAL E DOS ECOSSISTEMAS TERRESTRES E AQUÁTICOS
		2		Reservatórios naturais ou criadouros de peixes são mantidos para servir de fontes de imigrantes para trechos com estoques já depletados dos rios e igarapés. ***Natural fish reservoirs or nurseries are maintained and serve as sources of immigrants to sections of rivers or streams where fish stocks have been over-exploited.***
			1	Áreas de difícil acesso nos lagos e ao longo da calha dos rios ("remansos" e "poços") absorvem uma pressão de pesca bem menor que outras áreas mais acessíveis ***Areas of difficult access within lakes and along river channels ('remansos' or 'poços') absorb a lower fishing pressure than more accessible areas.***
			2	Existem mecanismos comunitários ou institucionais para restringir a pesca excessiva dos lagos, que são críticos na procriação de espécies residentes de peixes de valor sócio-econômico. ***Community and institutional mechanisms exist to prevent excessive fishing in lakes which are critical for the reproduction of resident fish species of high socio-economic value.***
		3		Indivíduos capturados intencional ou colateralmente estão acima do tamanho crítico de maturidade reprodutiva típico de cada espécie. ***Individual fish captured intentionally or accidentally are over the critical reproductive maturity size for their respective species.***
			1	O perfil de espécies e a estrutura de tamanho de peixes consumidos pela comunidade são avaliados. ***Evaluation of the profile of fish species and size classes consumed within the community.***
			2	A pesca de subsistência praticada pela comunidade favorece técnicas seletivas (e.g. linha e anzol, espinhéis, arpão, zagaia e lanterna, tarrafa, e malhadeiras de tamanho adequado) ao invés de técnicas pouco seletivas (e.g. batição de timbó, cargas de dinamite, malhadeiras fina, e arrastão). ***Subsistence fishing practiced by the community makes preferential use of selective fishing techniques (e.g. line and hock, esphinheis, harpoon, zagaia and lantern, castnets and gillnets with appropriate-sized mesh) instead of techniques that are poorly selective (e.g. timbó fish poisoning, dynamite charges, fine fishing net mesh and arrastão)***
		4		A pesca de subsistência praticada pela comunidade é compatível com a perpetuação de peixes sedentários e cardumes migratórios de espécies econômicamente importantes. ***Subsistence fishing as practiced by the community is compatible with the perpetuation of economically important sedentary and migratory fish species.***
			1	Quantificação do sucesso de capturas por unidades esforço de pesca ao longo do tempo ***Quantification of the capture success per unit effort employed in a given period of time.***
			2	Quantificação das classes de tamanho de peixes capturados para cada espécie ao longo do tempo ***Quantification of the size structure of the fish catch for each species, over time (e.g. Are catches getting smaller?)***

P	C	I	V	1) INTEGRIDADE ECOLÓGICA DA PAISAGEM FLORESTAL E DOS ECOSSISTEMAS TERRESTRES E AQUÁTICOS
		5		A coleta de ovos e filhotes em covas, e fêmeas adultas de tartarugas e tracajás (*Podocnemis* spp.) nas chamadas "praias de arribação" são totalmente restritas. ***Collection of turtle (*Podocnemis *spp.) eggs, young, and adult females on beaches is totally prohibited.***
			1	Abundância desses quelônios nos lagos e ao longo dos rios e igarapés. ***Abundance of turtles within lakes and along rivers and streams.***
			2	Praias de arribação e outros sítios de desova de quelônios são protegidos por mecanismos formais ou informais, principalmente durante a época crítica de procriação na estação seca. ***Nesting beaches and other turtle egg-laying locations are protected by formal and informal mechanisms, especially during the dry season which is critical to their reproduction.***
		6		Florestas inundáveis sazonalmente (e.g. igapós) representam os principais sítios de alimentação de peixes e quelônios durante a época da cheia, e estão sujeitas a níveis mínimos de perturbação estrutural. ***Seasonally flooded forest are key feeding sites for fish and turtles and are therefore subject to only minimal levels of structural disturbance.***
			1	Conversão de igapós em outras formações vegetacionais por atividade agrícola de corte-e-queima não é observada, apesar da maior fertilidade do solo que esses ambientes possam prover. ***No evidence of conversion of flooded forests to other vegetation formations through activities associated with shifting cultivation, can be observed, despite the greater fertility associated with floodplain soils.***
				2.3) EXTRAÇÃO DE CASTANHA DO PARÁ E OUTROS PRODUTOS MADEIREIROS E NÃO-MADEIREIROS ***Extraction of Brazil nuts, timber and non-timber forest products.***
4				A extração de recursos florestais é compatível com a viabilidade demográfica e genética de populações de plantas (e animais das quais elas dependem) que sustentam essas atividades. ***The extraction of forest resources is compatible with the demographic and genetic viability of plant populations (and of the animal populations upon which they depend) which sustain those extractive activities.***
	1			O MFC considera a manutenção de äreas de reservas e a preservação de indivíduos reprodutivos ao longo do tempo para garantir a perpetuação das espécies exploradas. ***The long-term maintenance of reserve areas and reproductive individuals is considered by the community in order to guarantee the survival exploited populations.***
		1		Áreas de reservas e santuários com tamanho e distribuição adequados à área de MFC são mantidas. ***Forest reserves and sanctuaries with an adequate size and distribution within the CFM area are maintained.***
			1	A ocorrência das espécies exploradas nessas áreas de reservas. ***The occurrence of harvested populations within these reserve areas.***
			2	Espécies exploradas mantém os padrões de frutificação típicos de cada espécies ***Fruiting patterns of harvested species are not adversely affected by harvesting.***

P	C	I	V	1) INTEGRIDADE ECOLÓGICA DA PAISAGEM FLORESTAL E DOS ECOSSISTEMAS TERRESTRES E AQUÁTICOS
			3	Observação de regeneração natural das espécies exploradas. ***Observation of a natural regeneration regime of harvested species.***
		2		Canteiros naturais de castanheiras-do-Pará (*Bertholletia excelsa*) explorados pela comunidade local mantém uma população demograficamente viável. ***The natural regeneration of harvested Brazil nut trees are maintained to ensure a demographically viable population.***
			1	Quantificação da estrutura etária da população de castanheiras-do-Pará na área de MFC. ***Quantification of the age structure of the Brazil nut tree population in the CMF area.***
			2	O número de castanheiras adultas na área da comunidade não tem sofrido um declínio substancial ao longo das últimas décadas. ***The number of adult Brazil nut trees in the community's area has not suffered a substantial decline over the last few decades.***
			3	Existência de castanhais (ou castanheiras isoladas) acessíveis, mas que não são explorados sistematicamente, na área da comunidade. ***Existence of accessible Brazil nut tree groves and isolated Brazil nut trees which are not systematically harvested within the community's area.***
			4	Castanheiras adultas e exploradas por pelo menos 20 anos estão em bom estado físico, e não apresentam sinais visíveis de senescência. ***Adult Brazil nut trees, that have been harvested for at least 20 years, are in a good physical condition and show no signs of senescence.***
		3		Interações mutualísticas entre castanheiras e seus dispersores de sementes e polinizadores são mantidas. ***Mutualistic interactions between Brazil nut trees and their pollinators and seed dispersers are maintained.***
			1	Cotias são detectadas (visual ou auditivamente) regularmente em áreas tradicionais de coleta de castanha. ***Agoutis are regularly (frequently) sighted or heard in traditionally harvested Brazil nut groves.***
			2	A caça de cotias é restrita a poucos indivíduos em áreas tradicionais de coleta de castanha. ***Hunting of agoutis in traditional Brazil nut gathering areas is highly restricted (to perhaps a few individuals).***
			3	A ocorrência frequente de abelhas polinizadoras (mamangavas) pode ser observada na copa das castanheiras em floração ***The frequent occurrence of pollinator (*****Euglossine*** ***bees) can be observed in the crowns of flowering Brazil nut trees***.
		4		A grande maioria das castanheiras adultas está inserida numa matrix de mata primária, ao invés de em áreas de pastos degradados, roçados, e capoeiras novas. ***The great majority of adult Brazil nut trees occur within the primary forest matrix, rather than in areas of degraded pastures and agricultural fallows.***
			1	Descrever a distribuição espacial de castanheiras em relação a áreas abertas e ambientes secundários. ***Description of the spatial distribution of Brazil nut trees in relation to open areas and secondary forests***.

P	C	I	V	1) INTEGRIDADE ECOLÓGICA DA PAISAGEM FLORESTAL E DOS ECOSSISTEMAS TERRESTRES E AQUÁTICOS
	2			Práticas extrativistas envolvendo a retirada de óleos e seivas dos troncos de algumas espécies de árvores mantém populações demograficamente viáveis. ***Practices involving the extraction of oils or saps from tree trunks, do not have a adverse impact upon the demographic viability of harvested species.***
		1		Copaibeiras (*Copaifera* sp.) previamente sujeitas à exploração não são vítimas de uma taxa de mortalidade muito acima daquelas que nunca foram exploradas. ***Copaifera trees previously subjected to oil tapping do not succumb to higher mortality rate than untapped trees in the same population.***
			1	A extração de óleo de copaíba é feita através de técnicas de baixo impacto que permitam a cicatrização do tronco. ***Only low impact techniques which permit healing of trunk wounds are used to extract copaiba oil.***
	3			Espécies de madeira de lei são exploradas sustentavelmente. ***Timber trees are harvested sustainably.***
		1		Declínios demarcados na densidade populacional local de espécies de madeira de lei não podem ser observados. ***There has been no noticeably marked decline in the population density of local timber species.***
			1	A abundância e a regeneração natural de espécies exploradas de madeira de lei é mantida ao longo dos anos ***The abundance and natural regeneration of exploited timber species is maintained over the years.***
	4			O extrativismo de látex e resinas provenientes de algumas espécies de árvores é feito com base sustentável. ***The extraction of latex and resins from trees is done on a sustainable basis.***
		1		Populações locais de seringueiras (*Hevea* spp.), cauchos e amapás (*Brosimum* spp.), sorvas (*Couma* spp.), e maçarandubas (*Manilkara* spp.) mantém uma população demograficamente viável. ***Local populations of latex-yielding trees (e.g.* Hevea, Brosimum, Couma *and* Manilkara *spp.) are demographically viable.***
			1	As técnicas de exploração das espécies produtoras de látex permitem a sobrevivência dos indivíduos explorados ***Latex tapping techniques used in the CMF enables the survival of tapped trees.***
			2	Verificação de tendências populacionais em relação à abundância ou densidade dessas espécies ao longo do tempo (e.g. últimas décadas). ***Verification of population trends in relation to the abundance or density of tapped trees over the last few decades.***
	5			Extração de produtos animais usados na economia local não resulta em conseqüencias negativas às populações animais associadas a esses recursos. ***The extraction of animal products used in the local economy does not have a negative impact upon the population dynamics of the animals associated with those products.***

P	C	I	V	1) INTEGRIDADE ECOLÓGICA DA PAISAGEM FLORESTAL E DOS ECOSSISTEMAS TERRESTRES E AQUÁTICOS
		1		Atividades de coleta de mel (ou favos de mel) não é danosa à colméias de abelhas, ou às árvores provedoras de abrigos naturais e cavidades lenhosas para essas espécies. ***Methods of honey extraction do not damage bee hives or the trees containing woody cavities with which they are associated.***
			1	Técnicas de extração de mel de cavidades lenhosas garantem a sobrevivência das árvores-suporte, principalmente as de grande porte. ***Methods of honey extraction from tree cavities guarantee the survival of the support trees, especially large ones.***
			2	Número de cavidades lenhosas em outras árvores disponíveis para formação de novas colméias. ***Number of tree cavities available in alternative trees for the successful establishment of new bee hives.***

Ecological Principles, Criteria, Indicators and Verifiers of the Sustainability of Community Managed Forests with reference to the SOLIDAM Zone, Central Province, Cameroon:

Final Proposal of C&I for Ecological Aspects
by the Ecology Expert (This set is virtually identical to the proposed set presented by the ecologist to the Workshop Review Team.)

P	C	I	V	Ecologie et Gestion Durable des FGC	Liaison	Commentaires/Observations
1				**Les fonctions Biologiques de l'Ecosystème doivent être maintenues**	Bs 11	
	1			***La régénération naturelle est assurée***	CI 31	
		1		La repartition horizontale des différentes formations végétales montre un dynamisme dans la structure de la forêt		
			1	Une forêt dense stable (formation-climax) avec une organisation comparable à celle de la forêt originelle de la region		
			2	Des formations végétales diverses (séries) dans les zones dévolues aux activités agricoles, en fonction de la durée des jachères	FM 31	Jachères recentes à *Chromolema odoratum* puis à *Aframumum* et *Costus;* vieilles, jachères avec strate arbustive touffue forme d'espèces héliophiles, parsèmé ça et là d'arbres protégés. Forêt tertiaires avec 3 strates et forêt secondaire
		2		L'étagement vertical dans la forêt primaire n'est pas perturbé	IC 3,1,1	
			1	Les cimes des arbres sont étagées		3 étages
			2	Les diamètres des troncs sont variés		
			3	La canopée haute est continue	CI3,1,1,1	
			4	Le sous-bois, d'aspect clairsemé est riche en plantules d'arbres		
		3		L'abondance, la dominance, la constance et la fréquence des espèces sont comparables aux données de la forêt originelle		
	2			***La biodiversité est conservée***	CI3,1 Bs 12m FM1	
		1		Une organisation spatiale qui préserve la biodiversité	FM 32, FM 42	

P	C	I	V	Ecologie et Gestion Durable des FGC	Liaison	Commentaires/Observations
			1	70% de la forêt n'a jamais subi de défrichement	FM 13	Proportion donnée par les paysans eux-mêmes
			2	Les activités agricoles sont localisées autour des aires d'habitation, dans une auréole de 3 km environ		Manque de force ou de moyens financiers et matériels pour abattre les arbres
		2		Les arbres utiles devenus rares sont connus et protégés	FM 11, FM 122	Les arbres utiles sont les arbres d'ombre les fertilisants et les fruitiers
		3		Les espèces endogènes utiles et rares sont plantées	FM 444	On ne trouve que des vieux pieds senescents peu de plantules et pas d'arbres intermediaires: *Nauclea diderichii, Baillonella toxisperma, Ricinodendron heudelotii, Guibourtia tessmanii*
			1	Visite dans les plantations		Essais isolés et peu significatifs
			2	Nombre de plants/espèces/famille		*Garcinia cola, Baillonella toxisperma, Irvingia gabonensis*
		4		La quantité et la qualité de l'eau sont maintenues ou améliorées		
			1	Contrôle de l'utilisation des pesticides et des fertilisants chimiques		Les pesticides et les fertilisants sont peu utilisés à cause des contraintes financières
			2	Couvert végétal permanent en amont des cours d'eau et sur les berges		
			3	Dégagement des barrages sur les cours d'eau après la pèche		
		5		La productivité des ressources halieutique s'accroit		
		6		La faune sauvage sécurisée		
	3			***Les stratégées endogènes visant à réduire la pression sur la faune sauvage sont élaborées, en conformité avec les lois et réglements en matière de chasse***		
		1		Les lois et réglements en matière de chasse sont connus de tous les intervenants	SS 16	
			1	Publication de la liste d'espèces partiellement ou intégralement protégées		
			2	Connaissance par tous des périodes d'ouverture et de fermeture de chasse	FM 6	
		2		Il existe des stratégies endogènes visant à protéger certaines espèces		

P	C	I	V	Ecologie et Gestion Durable des FGC	Liaison	Commentaires/Observations
			1	Habitudes alimentaires; les taboos		Existe mais en perte de vitesse; par exemple l'interdiction aux jeunes et aux femmes de consommer les animaux tels que gorilles, pangolin, boa, tortue
		3		Les mesures contre le braconnage sont prises et appliquées		
			1	Les animaux prélevés sont destinés uniquement à la consommation locale		
			2	Mise en place d'un système de surveillance efficace		
		4		Les outils et les méthodes de chasse destructeurs sont proscrits	FM 611	
			1	Interdiction de la chasse au barrage		Barrage long de plusieurs kms sur lequel sont placées des ouvertures piégées
		5		L'élevage extensif des animaux domestiques permet de réduire la pression sur la faune sauvage	FM 431	
			1	Nombre/espèce/famille		
	4			***Les effets négatifs de l'agriculture sur l'Ecosystème forestièr sont minimisés***		
		1		Les activités agricoles sont localisées	FM 32	
		2		Les pratiques agricoles ont des effets bénéfiques sur les cultures, le sol et les arbres, à court terme		
			1	Maintien des arbres fertilisants lors des défrichements	FM 11, FM 112	*Triplochiton scleroxylon, Intendrophragma, Tehapleura tetraptera, Ricinodendron hedelotii, Ceiba pentandra*
			2	Maintien d'un couvert relatif du sol après défrichement		
			3	Induction de la germination des graines des arbres en dormance dans le sol par un flux lumineux		
			4	Augmentation de la quantité de matière organique du sol par défoliation		
			5	Lever de dormance des bourgeons ds arbres sous l'action du feu		
			6	Matières minérales, provement des cendres disponible		
			7	Croissance accrue des arbres suite à l'élimination par défrichement des espèces concurrentes alentours		

P	C	I	V	Ecologie et Gestion Durable des FGC	Liaison	Commentaires/Observations
		3		Les jachères sont suffisamment longues pour permettre la régénération du sol	FM 12	
			1	Durée minimale d'une jachère	FM 121	
		4		Des mesures sont prises pour augmenter le rendement agricole		
			1	Lutte biologique contre les pestes		Enfouissement du camelion utilisation des cendres, du tabac
			2	Semences selectionnées		Tentative timides et isolées
			3	Protection des arbres fertilisants		
			4	Amélioration des jachères		Projet en cours
			5	Fabrication et utilisation du compost		
	5			***Les NTFP doivent faire l'objet d'une gestion durable***		
		1		Les NTFP sont connus		
			1	Classification par importance par rapport au volume prélevé, ou aux revenus par an		
			2	Capacité de régénération de chaque espèce		
		2		Les techniques de récolte des NTFP leur assure une durabilité	FM 443, FM 811	
			1	Techniques conservatrices		
			2	Techniques destructrices		
			3	Essai de domestication de certaines espèces		
	6			***Le bien-être de la population est assuré***	FM 16	
		1		La santé est assurée par les produits pharmaceutiques prelevés dans la forêt	SS 123, FM 1641	
			1	Ecorces, graines, fruits, feuilles		
		2		La plus grande partie des produits consommés par la population sont tirés de l'Ecosystème forestier	SS 162	
			1	Les habitudes alimentaires		
			2	Les recettes diverses		
			3	Visite au marché		

P	C	I	V	Ecologie et Gestion Durable des FGC	Liaison	Commentaires/Observations
		3		Les matéraux de confections des objets à l'usage culturel ou esthétiques proviennes des forêts		
			1	Les objets d'art en bois divers, feuilles, rotin, paniers		
			2	Les poudres d'acajou		
			3	Les tissus en écorce		
			4	Des instruments acoustiques et de percussions		
		4		Les revenus pécuniers substantiels sont tirés de la vente des produits forestiers	SS 222	
	7			***Les ressources halieutiques sont convenablement gérées***		
		1		Il existe une saison de pêche bien respectée	FM 6	
		2		L'accès aux cours d'eau pour la pêche est réglementé et contrôlé	FM 611	
			1	Fréquence de pêche réglementé		
			2	Pêche commune ou individuelle		
		3		Les outils et méthodes de pêche assurent la régénération des poissons		
			1	Outils et méthodes autorisé		
			2	Outils et méthodes interdits		
		4		Des étangs piscicoles sont crées pour réduire la pression sur les poissons		

Ecological Criteria and Indicators for Community Managed Forests

Indonesia

(Proposed by Gusti Muhammad Hatta)

P	C	I	V	DESCRIPTION	COMMENTS
1				**ECOSYSTEM INTEGRITY IS MAINTAINED**	
	1			**Preservation of critical ecosystem functions.**	
		1		Areas of ecological importance are recognised and protected.	
			1	*Absence of intensive activity in the areas.*	
			2	*Spontaneous objection or response of any community member on any people who use the area.*	
		2		Water sources are protected.	
			1	*Vegetation cover on river banks is maintained.*	
			2	*Absence of activity in the vegetation along water course.*	
		3		Water and soil quality is maintained to secure ecosystem's sustainability.	
			1	*No use of poison in catching fishes.*	
			2	*Exposure of bare soils is minimised*	
			3	*There are no activities which cause water pollution*	
		4		Soil erosion is minimized	
			1	*No timber harvesting is taking place in highly erodible areas*	
			2	*There is a low sedimentation.*	
		5		Drastic land cover changed is prevented.	
			1	*There is a landuse plan for the village area, drawn up and formalized by the community.*	
			2	*Occurrence of jungle rubber (a secondary forest enriched with rubber trees).*	
	2			**Impacts on biodiversity of forest ecosystem are minimised.**	
		1		Endangered plant and animal species are protected.	
			1	*The existence of an agreement among community membernot to hunt certain animal species and collect certain plant species.*	
			2	*Absence of protected plants and animals sold in market.*	
		2		Commercial hunting is controlled.	
			1	*No use of fire in hunting.*	
			2	*Maintenance of water holes, nests, and salt source in the area.*	
		3		Production of non-timber product is sustainable.	
			1	*Harvesting does not reduce resource base.*	

P	C	I	V	DESCRIPTION	COMMENTS
			2	*Species of non-timber which are harvested or negatively impacted during harvesting retain their ability to regenerate.*	
		4		Vegetation structure is maintained.	
			1	*The existence of all normal strata in the climax vegetation.*	
			2	*Basal area distribution is normal.*	
	3			**The capacity of forest ecosystem to regenerate naturally is ensured.**	
		1		All growth phase of group of species are represented.	
			1	*Sufficient numbers of trees in their seedling, sapling, poles and mature phase.*	
			2	*Sufficient numbers of other key species in various growth stages.*	
		2		Animal habitats are maintained or restored.	
			1	*Frequency of animal occurrence.*	
		3		Species richness is maintained.	
			1	*Enrichment planting is carried out with indigenous species.*	

3. FOREST MANAGEMENT

C&I for Forest Management
The Brazilian Test of C&I for CMF

Version produced by Workshop Working Group

Marli Mattos, Almiro Rodrigues Almeida (FLONA), Ervano Soares Costa (Cachoeiro do Maró, Fransisco Jose Barros Cavalcante (IBAMA), Francisco Pinto de Souza (Sao Pedro), Ismair Brait (STR- Belterra), Johan Zweed (FFT), Jose Rosinaldo Sousa (Sao Pedro), Maria Socorro Ferreira (CPATU/EMBRAPA), Renata Freire (PSA), Silmara de Cassia Luciano (Proj. Varzea/ IPAM), Tasso Azevedo (IMAFLORA), Walter Suiter (FSC/Brazil).

P	C	I	V	Forest Management C&I (tested in the field)
1				THE USE OF NATURAL RESOURCES INCLUDING THE EXTRACTION OF TIMBER AND NON-TIMBER FOREST PRODUCTS, AGRICULTURAL ACTIVITIES AND FISHING, IS MULTIPLE, AND SUSTAINABLY INTEGRATED.
	1			**Natural resources must offer a vast range of economic, social, environmental and cultural goods and services**
		1		Existence of natural resource and ecosystem management forms that are based on multiple use.
			1	Quantification of actual product utilisation and the identification of alternative future uses of products from diverse ecosystems (*igapó*, forest, fallows, lakes etc.)
		2		Existence of zones (areas defined for different intensities use intensities in accordance with resource potential).
			1	Verification of uses defined for different zones are being respected.
			2	Mapping of the ‘principle land uses’ with the use of maps and satellite images.
			3	Observation/communication about conservation of **mananciais**
			4	Inclusion of ‘Indian black soils’ in the community reserve.
		3		Clarity of the qualitative and quantitative potential of managed natural resources (in economic and productivity terms).
			1	Survey of resident population’s knowledge on harvested and/or managed species and on those species of potential economic value (including species formerly exploited that could regain economic importance in response to future increases in market demand).
	2			**Timber exploitation is undertaken on a sustainable basis.**
		1		Existence of a management plan and annual plans.
			1	Participation of the community in decisions on which trees to extract, that take into consideration the species and diameter of trees.
			2	Definition of the cutting cycle, the annual area exploited, harvesting intensity, minimum diameter for respective species, mapping of all the species (100% inventory) and chronological calendar of events.
			3	The timber management plan must take into account species with alternative uses (for boat construction, house construction, non-timber products, and others).

P	C	I	V	Forest Management C&I (tested in the field)
		2		Application of low impact techniques.
			1	Observation of measures to control/minimise erosion, compaction and siltation (assoreamento) of watercourses during the construction and utilisation of roads.
			2	Timber extraction in upland forest must not take place during periods of high rainfall.
			3	Large openings in the forest do not exist.
			4	Existence of plans for directional felling of trees to reduce gap sizes and damage to other potentially harvestable trees (that favour arraste).
			5	No evidence in existence of high tree stumps, excessive extraction losses (*perdas excessivas no arraste*) splits (*rachaduras*) caused during felling or felled trunks left in the forest.
			6	Lianas are cut from trees tallied for harvesting one year before harvesting is to take place.
			7	Observation of plants of species of interest in various stages of development
		3		Application of specific silvicultural treatments (liana cutting, elimination of competitive and other (?) plants) in accordance to annual plan of operations.
			1	Cutting of lianas to liberate the growth and promote the development of trees destined for timber production
			2	Observation and registration of rules concerning the management of species' regeneration.
	3			**The exploitation of non-timber forest products (NTFP) is based on sustainable practice.**
		1		Existence of management plans and annual plans.
			1.	Estimate of the quantitative potential of each product.
			2	Definition of the area for the harvesting of each product in accordance with its economic viability.
			3	Participatory mapping of NTFP resources
			4	Chronological calendar of activities
			5	Matrix (table) including the principle uses of products, the tools and equipment used in harvesting/extraction, harvesting techniques, time spent and financial return by product.
		2		Application of low impact techniques.
			1	Knowledge and application of the best harvesting practices.
			2	No observation of residual trees that have died or have been damaged as a result of harvesting activities.
			3	Prevention and control of forest fires (with respect to honey gathering, hunters' camping fires, clearance around the base of Brazil nut trees etc.)
		3		Application of silvicultural treatments.
			1	Knowledge and application of practices that favour production (line and path weeding, liberation cutting of lianas, elimination of sprouts etc.)
			2	Observation and registration of rules concerning the management of species' regeneration.

P	C	I	V	Forest Management C&I (tested in the field)
		4		Harvesting practices for each species are compatible with the respective species' productive potential.
			1	Definition of timing, seasonality and frequency of harvesting for each species.
			2	Definition of harvesting intensity (collection of fruits per tree, individual insertions per stem, number of stems cut per liana or epiphyte, number of 'paineis de corte' (cutting panels) per rubber tree, etc)
	4			**Fishing activities are carried out on a sustainable basis.**
		1		Existence of rules and norms for low impact fishing.
			1	Seasonal considerations given to fishing.
			2	No evidence of the use of predatory fishing techniques (the use of **arrastao**, poison plants such as timbo, bombs, fine mesh fishing nets etc.)
			3	No capture of individual fish that are below the minimum size as defined by fishing laws existing for important commercial fish species.
			4	No fishing is done during the **piracema** (when fish migrate to spawning locations) period.
			5	The restriction of commercial fishing in spawning locations.
			6	Prohibition of the use of fishing nets and **arrastao** in lakes and the avoidance of diving for fish.
		2		Management of natural areas to increase fish production.
			1	Existence of natural fish nurseries (spawning locations).
	5			**Agricultural practices are undertaken in a manner aimed at minimising their impact on forest..**
		1		Existence of rules and norms for agricultural cultivation.
			1	Fallow periods are long enough to permit sufficient accumulation of biomass.
			2	Distribution of productive and reproductive activities (by type) using the annual calendar.
		2		Clearance of primary forest for agricultural land-use is being avoided.
			1	Areas of primary and secondary forest converted to agriculture.
			2	Mapping of vegetation cover for different years using satellite images.
		3		The size of annual agricultural land holdings is not increasing.
			1	Mapping of vegetation cover in different years using satellite images.
		4		The community possesses rules and regulations for the controlled use of fire in the preparation of agricultural areas, the cleaning of pastures and in other activities.
			1	Fire accident prevention and control techniques (including consultation and agreement between neighbours on the choice of area to be slashed and burnt and intended day of burning, the appropriate choice of season and hour for burning, the cutting of fire breaks, directing the fire against the wind) are effectively applied.
		5		Application of low-impact treatments and husbandry methods (in the control of pests and diseases, pruning, etc.)
			1	Adequate use of pesticides (correct dosage, use of protective equipment, adherence to use instructions, etc.)

P	C	I	V	Forest Management C&I (tested in the field)
			2	Knowledge and application of alternative agricultural practices.
	6			**The community has developed mechanisms for monitoring and controlling productive activities.**
		1		Existence of community mechanisms for patrolling and controlling the various stages of timber extraction undertaken either by community members or by outsiders.
			1	Verification of the registration of the 'sales contract' in a 'cartorio' that permits interruption in the case of the violation of the terms contained in its clauses (legal title of land tenure, inventory requirements, road and infrastructural planning, standards for the condition of roads and extraction tracks, definition of species to be exploited, harvesting methods, shedding of toxic materials into water courses/reservoirs, reduction of waste production during harvesting, observation of workers legal rights, etc.)
		2		Existence of community mechanisms for patrolling and controlling the extraction of NTFPs by community members and/or outsiders (third parties).
			1	Observation of internal rules and agreements on the patrol and control of methods/ practices used to extract NTFPs
		3		Monitoring and control of fishing undertaken by community members and/or outsiders (third party).
			1	Community intervention mechanisms to prevent or curtail over-fishing and the use of predatory fishing techniques by outsiders up and down stream from the community.
			2	Existence of fishing agreements between communities.
		4		The community has mechanisms to control the collection and sale of animals and ornamental plants.
			1	Observation of techniques used in the collection and sale of animals and ornamental plants.
	7			**The benefits derived from productive activities have served as an incentive to perpetuate those activities in a sustainable manner.**
		1		Existence of continual effort to diversify and increase value-adding processing capacity with the aim of increasing the gross aggregate value of the products.
			1	Existence of value-adding processing structures and equipment.
		2		Knowledge of markets for forest (and agricultural) products.
			1	The value of products is perceived as an incentive for their sale.
			2	The community is knowledgeable on market alternatives, fluctuations and demands.
		3		Existence of community mechanisms for the commercialisation of products.
			1	Infrastructure and transport accessible to the community (boat, paths, roads etc).
			2	Existence of community run 'cantinas' (or 'revendas' which are cooperatively run trading posts) that sell forest farmers' products and purchase inputs.
		4		Knowledgeability on the costs of production (depreciation cost of equipment, re-investments, maintenance).
			1	Relationship between the costs of production (existing equipment, useful life of existing equipment, time of acquisition, forms of maintenance etc.).
		5		Existence of community mechanisms to generate production **(?)**
			1	Observation of community methods and forms of managing production.

Forest Management Principles, Criteria, Indicators and Verifiers of the Sustainability of Community Managed Forests

with reference to the SOLIDAM Zone, Central Province, Cameroon. Final Proposal of C&I for Forest Management

by the Forest Management Expert after considering the recommendations of the Workshop's Forest Management C&I Review Group

P	C	I	V	CRITERIA AND INDICATORS OF SUSTAINABILITY
1				***Forest conversion to accommodate agriculture and social change does not pose undue pressure on the natural resource base.***
	1			Agricultural land clearing is largely confined to fallows and secondary forest.
		1		Fallow periods are long enough to permit recuperation of soil fertility.
			1	Species indicative of soil fertility are commonly found in fallows and secondary forest areas.
			2	No unacceptable long-term declines in crop yields.
			3	Crops and cropping rotations make efficient use of soil fertility.
			4	Mixed cropping and cropping sequences help ensure food security throughout the year and make provisions for crop failure.
	2			**The rate of natural forest conversion is low.**
		1		The reduction in area covered by natural forest over a given interval of time.
			1	Between 60-75 per cent of the total community land constitutes the natural forests and 25-40 per cent makes up farm, fallow and secondary forests.
		2		Provisions made to resettle new entrants and immigrants into the villages without causing undue pressures on the natural forests.
			1	Very little or no access is provided by the village authorities to settle new entrants and immigrants in the natural forests directly.
			2	Number of new entrants who establish farms in the natural forests is known and controlled.
			3	Migration trends.
	3			**The co-existence and/or co-evolution of farming, fallow and natural forest management systems maintains or increases biodiversity.**
		1		The land-use system is integrated, consisting of a diversity of sub-systems that ensures over-all biodiversity is relatively high compared to that of any one of the sub-systems.
			1	Exotic species do not pose a threat in natural forest areas.
		2		During farm site preparation, valuable trees are protected.
			1	Controlled use of fire in site preparation.
			2	Many timber, non-timber and plant species are present on farm, fallow and secondary forest land.
2				***Most members of the village community recognise and seek to maintain the global value of their forest as determined by its multiple uses.***

P	C	I	V	CRITERIA AND INDICATORS OF SUSTAINABILITY
	1			**The villagers have sufficient knowledge of the composition and distribution different forest types.**
		1		The forest boundaries and those with neighbouring villages are known, and respected by all concerned.
			1	The ancestral names of trees, rivers and other landmarks delimiting the forests are well known.
			2	Different forest types such as swamp and secondary forests, indicator species, species rich areas of the forest, valuable timber species, shrubs, herbs, the streams, fish species and their location in the forests are known with a high degree of precision.
	2			**The natural forest's role in community health care is being consciously preserved.**
		1		The variety of forest products of nutritional value that supplement local dishes and meals.
			1	Harvesting pressure for forest foods is alleviated by its spread over different forest types.
			2	Contribution made by forest foods to local diet.
		2		The compendium of medicinal trees, shrubs, herbs, snakes, toads, etc. used by local inhabitants to treat sicknesses and physical disorders.
			1	Knowledge provided by local inhabitants during the collection of medicinal plants by medical and other institutions.
		3		Watersheds and waterways are protected in the interests of community health.
		4		The use of fire for land clearance is kept to a minimum to prevent respiratory illness.
	3			**Different forest user and interest groups of forest products co-exist harmoniously.**
		1		The interests of the various community forest user groups complement each other and do not adversely compete.
			1	Local skill endowment enhances division of labour within the village setting.
			2	Inter-dependency between different direct and indirect forest-user groups.
		2		Forest benefits supplement diverse sectors of the rural economy.
			1	Cottage industries that use indigenous skills exist and encourage the wise harvest and use of forest raw materials.
			2	Employment provided to villagers by local cottage industries.
			3	Locally produced value-added products for local use and sale.
			4	Villagers exploit raw materials in a sensible and frugal manner to ensure the sustainability of local cottage industries.
			5	Selection of plant species and standards of craftsmanship result in value-added products with a long useful life span (e.g., mortars, canoes, etc.).
			6	Post-harvesting processing and storage techniques are adequate.
	4			**Villagers participate with other stakeholders in the protection of timber resources in their communities.**
		1		Steps are taken by local communities to actively protect their timber species from exploitation by outsiders who may or may not be backed by the forestry service.
			1	Procedures for the resolution of conflict between outside exploiters and villagers.

P	C	I	V	CRITERIA AND INDICATORS OF SUSTAINABILITY
			2	Villagers expel forest exploitation companies from their forest if they try to extract timber without first consulting with the village council.
			3	Collectively organised patrols
			4	Compensation deals accepted by the community in exchange for allowing timber exploiters to extract timber from their forests.
3				***Harvests are sustainable***
	1			**Harvesting techniques are sustainable.**
		1		Destructive harvesting of leaves, suckers, stems, roots, branches, etc. is avoided to ensure their availability at times of need.
			1	Tree barks and other plant parts are removed without either damaging the xylem and phloem or girdling the trunk so that tissue regeneration is ensured.
			2	When possible only mature plant parts are harvested
			3	Damage caused to neighbouring plants and vegetation by harvesting and post-harvesting practises.
			4	Forest fruits are collected mostly from the forest floor where there is less pressure on the forest ecosystem.
			5	Natural regeneration of harvested species is observed as sufficient to ensure no decline in future product availability.
	2			**The role of seasonality in the use of forest resources and farming activities is recognised.**
		1		Farm lands are cleared (slashed and burnt) just before the rainy season so that crops are planted at the right time.
			1	Signs of bad timing or delays in land preparation such as waste of prepared land and yield losses.
			2	Attention paid to climatic and seasonal factors in the timing of agricultural fires.
		2		Plant parts including bark are collected in appropriate seasons.
			1	Products are collected, dried and stored for later use (between seasons).
		3		Swamps and other fragile ecosystems are not unduly disturbed during the rainy season.
		4		Hunting by trapping and fishing are noticeably reduced during dry season.
			1	Species hunting of which is reduced during the dry season.
			2	Seasonal variation in fishing techniques.
	3			**The continuous existence of rare and vulnerable species as well as of economic species in the forests is assured.**
		1		The multiple uses of forest species are known and valued by the villagers.
			1	Rare species or species vulnerable to threats are being protected from outsiders and from the people within the village.
			2	Rare and/or threatened timber species are being protected during fallow or forest conversion and during agricultural site preparation.
		2		Viable populations of wild animals are maintained.
			1	Many families rear domestic animals.
			2	Reduction in bush meat consumption attributable to livestock rearing.
			3	Land allocated to grazing or fodder production.
		3		Laws and village made regulations are enforced by villagers to maintain hunting at sustainable levels.

P	C	I	V	CRITERIA AND INDICATORS OF SUSTAINABILITY
			1	Villagers prohibit hunting in the forests by outsiders.
			2	Attempts are made to control the sale of bush meat.
	4			**The regeneration of important indigenous species is assisted.**
		1		Species whose regeneration is protected or encouraged.
			1	List of forest species, including medicinal plants, growing in some villagers' home gardens and farms.
			2	List of species natural regeneration of which is assisted.
			3	Location and extent of area with assisted natural regeneration for each species
			4	Ownership rights to protected and planted trees are transferable.

Criteria and Indicators for Community Managed Forests

Forest Management Aspects - Post-Workshop Set

Indonesia

Retno Maryani

P	C	I	V	CRITERIA AND INDICATORS OF SUSTAINABILITY
1				*FOR EACH LANDUSE SYSTEM BEST PRACTICES OF NATURAL RESOURCES MANAGEMENT ARE APPLIED*
	1			**Each landuse system are located on suitable soils.**
		1		Local knowledge on soil types and fertility/fallow vegetation.
			1	Local name for different soil types.
			2	Knowledge on vegetation/species associated to soil fertility.
			3	Application of this knowledge to open new *ladangs.*
	2			**The management of each landuse system taking into account a characterisation and delimitation of preservation area and areas of different use intensity.**
		1		Preservation areas are communally owned and apply low intensity use.
			1	Communal decision making apply to utilise the area.
			2	Communal decision making apply to convert the area.
			3	Present of clear and distinct boundary recognized by community.
		2		Permanent agricultural lands are individually owned and apply high intensity use.
			1	Low input sustainable agriculture is applied.
			2	Soil conservation technology is applied.
			3	Agroforestry technology is applied.
2				*SUSTAINED YIELD OF TEMBAWANG AND NATURAL FORESTS.*
	1			**Natural forests is maintained for its production and environmental values.**
		1		Productivity of natural forests is maintained.
			1	Extracted timber waste is allowed to decompose in the forest.
			2	Knowledge on forest areas potential (incl. timber, non-timber, medicinal plants, etc.)
			3	Knowledge on distribution of potential species.
			4	Harvesting only mature forest products.
		2		Conversion into *ladangs* is restricted.
			1	Conversion request permission from community members.
			2	Areas permissible for conversion exist.
		3		Traditional concept for conservation is exist.
			1	"Hutan Tutupan" exist (forest area located on upper stream, of which only non-timber products is allowed to be extracted).
			2	"Taboo" for areas to be extracted exist.

P	C	I	V	CRITERIA AND INDICATORS OF SUSTAINABILITY
	2			**Low impact harvesting is applied.**
		1		Harvesting affects minimum disturbances.
			1	Existence of seedlings, saplings and poles of extracted species surrounding cutting areas.
			2	Diameter distribution of commercial species follows normal distribution.
			3	Crown structure resemble natural forests.
			4	Timber extracted is transported minimally in a form of half-finished products.
			5	Timber converted into planks in the forest.
			6	Minimal soil disturbance/compaction in skidding and transporting timber.
		2		Equipment used are adapted to local technological knowledge.
			1	Technology to make harvesting tools exist in the area.
			2	Technology to maintain the tools exist in the area.
		3		Minimal disturbances of animals habitat.
			1	Honey bee trees are kept ("sompun, keladan, tappang, etc.")
	3			**Hunting is practiced only for local consumable animals and or animals considered as pests to the *ladangs*.**
		1		Hunting season is regulated.
			1	Hunting for specific animals in specific time/periode.
			2	Avoid killing baby animals/chicks.
			3	Bird nests are kept in its place.
	4			**Tembawang is capable to support livelihood of people.**
		1		Tembawang produces commercial fruits and other subsistence needs.
		2		Tembawang produces cash income.
		3		Actions to intensify tembawang.
			1	Planting, cleaning, tending, liberation cutting, gap stimulation, etc. exist
	5			**Diversity of agroforestry products is maintained.**
		1		Species and genetic diversity is maintained.
			1	Number of species and varieties exist in tembawang.
			2	Number and types of products used in a daily life (e.g. firewood, medicine, fruits, seeds, etc.)
		2		Vegetation structure resemble natural forest.
			1	Age classes and diameter distribution exist.
		3		Low impact harvesting is applied.
			1	Fruits are harvested by climbing (not cutting the trees).
	6			**Conversion tembawang is limitted.**

P	C	I	V	CRITERIA AND INDICATORS OF SUSTAINABILITY
		1		Conversion is acceptable for conserving resources.
		2		Conversion is followed by development of tembawang in other areas.
	7			**Low input sustainable agriculture is applied.**
		1		Rubber garden is intensified.
			1	Apply high yielding and locally adapted planting materials.
			2	Regular spacing to support better tending and tapping.
			3	Tending/liberation cutting.
			4	Biological pest management control applied.
			5	Periodic fallows to produce more latex exist.
			6	Panel damage reduced.
		2		Age classes exist.
			1	Age distribution exist.
			2	Diameter class distribution exist.
		3		Fire management to open *ladangs* is applied.
			1	Fire break is made before burning.
			2	Burning taking into consideration wind direction and its velocity.
			3	Burning from the bottom part to the slope area.
			4	Burning is guarded.
			5	Absence of damage plants caused by uncontrolled fire.

Annex 4:
The Justification Form

Developing and Testing Criteria and Indicators for
Community Managed Forests

Cameroon Test, SOLIDAM

Attribute Assessment Form for Selected Criteria and Indicators

Consultant's initials:

Criterion No.:

Indicator No.:

Source:

Sources: Brazil Set = BS; Ivory Coast Set = IC; WWF Canada = WC; Team = TT; Community = C.

Criterion / indicator's main disciplinary field

Overlap into other disciplinary fields

Attributes

Obs.: Please use a scale of 1-5 when answering, if indicated.

1. Is the criterion / indicator easy (1) - difficult (5) to detect?	
2. Is the criterion / indicator easy (1) - difficult (5) to measure?	
3. Is the criterion / indicator likely to generate comparable results at different Community Managed Forest sites?	YES / NO
4. How dependent is its evaluation on the interpreter's judgement and values?	very / moderately / not at all
5. Are appropriate response curves to change and threshold levels for the criterion / indicator known?	YES / NO
If not, can they be easily calculated?	YES / NO
6. How sensitive to change is the criterion / indicator?	very / moderately / slightly
7. Can the criterion / indicator easily be used for monitoring?	YES / NO

Enter the selected criterion or indicator:

Annex 5
The base sets and guidelines used by the test teams

The Base Sets and Guidelines on which the CMF C&I test teams drew included the following:

Biodiversity Support Program. 1993. Guiding principles and recommendations for African integrated biodiversity conservation and sustainable development. *In*: Biodiversity Support Program, African biodiversity: Foundation for the future. Professional Printing, Beltsville, Maryland.

CIFOR. 1997. Possible source themes for Criteria and Indicators for Community Managed Forests. Unpublished.

FAO. 1995. Indicators of sustainability. *In*: Resource management for upland areas in Southeast Asia.

Forest Stewardship Council. 1996. Principles and Criteria for forest management.

Lammerts van Bueren, E. and Blom, E. 1997. Hierarchical framework for formulation of sustainable forest management standards. The Tropenbos Foundation, Wageningen, The Netherlands.

Lembaga Ekolabel Indonesia (LEI). The Criteria and Indicators for sustainable natural forest management on Forest Management Unit level. LEI webpage at http://www.iscom.com/~ekolabel.

Pierce, A. 1996. Issues pertaining to the certification of non-timber forest products. A Forest Stewardship Council Discussion Paper, 1 May. Forest Stewardship Council.

Prescott-Allen, R. 1996. Barometer of sustainability. *In*: IUCN, An approach to assessing progress towards sustainability. Tools and Training Materials Series 2-8317-0342-5.

Ravi Prabhu, R. *et al.* 1996. Sets of Principles, Criteria, Indicators and Verifiers resulting from tests conducted in Ivory Coast and Brazil. *In*: Testing Criteria and Indicators for the sustainable management of forests: Phase 1 Final Report. CIFOR.

Smart Wood. 1995. Standards for non-timber forest products certification: The case of Brazil nuts (*Bertholletia excelsa* h.b.k.) and rubber (*Hevea brasiliensis*), Version # 2.0, 16th August Richmond, Vermont.

Stevens, P. 1997. Measuring the sustainability of forest village ecosystem concepts and methodologies: A Turkish example. CSIRO, Australia.

Stortenbeker, C.W. *et al*. 1997. First draft of process of revision of DDB Principles, Criteria and some Indicators. Tropenbos, The Netherlands.

Zimmermann, R. 1992. Provisional assessment guidelines used in connection with smallholder eco-timber projects in Papua New Guinea (November-December). Smart Wood, Richmond, Vermont.

Zweede, J., Kressin, J., Mesquita, R., Silva, J.N.M., Viana, V.M. and Colfer, C. 1995. Final Report - Test Brazil October 22 - November 21, 1995. CIFOR Project on testing Criteria and Indicators for the sustainable management of forests. CIFOR, Bogor, Indonesia.

Justify your selection of this criterion or indicator:

Please name (give the ref. of) other criteria or indicators found to overlap or most closely resemble the criterion or indicator recommended above:

Brazil Set					
I. Coast Set					
WWF-Canada					
FSC					

Recommendation for the above criterion or indicator: **High:** ☐

Normal: ☐

The research results of 3 field tests of Ecological, Managerial and Socio-economic Criteria and Indicators of Sustainability and Equity of Community Managed Forests, undertaken in consultation with forest communities in Central Province, Cameroon, West Kalimantan, Indonesia and Pará, Brazil.