

# Community Participation in Developing and Applying Criteria and Indicators of Sustainable and Equitable Forest Management

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Nicolette Burford de Oliveira



THE JOHN D. AND CATHERINE T.  
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# **Community Participation in Developing and Applying Criteria and Indicators of Sustainable and Equitable Forest Management**

## **Summary**

Between March 1997 and February 1998 three tests of Criteria and Indicators (C&I) for assessing the sustainability of community managed forests were conducted by the Center for International Forestry Research (CIFOR). The tests, each lasting approximately one month, were sited in humid forest in Central Province, Cameroon; Sanggau, West Kalimantan, Indonesia; and in the Arapiuns river basin, Pará, Brazil. Each test was carried out by an interdisciplinary team composed of a social scientist or anthropologist, an ecologist and a forest management specialist, in consultation with the local community.

This paper discusses some of the concepts and methodologies used in the tests. An overview is provided of the main results about community participation in the processes of developing and testing C&I. Two themes given prominence by the testing teams were participation in, and knowledge of, forest management and its social dimensions. We focus on these interlinked themes, discussing how participatory processes of developing and applying C&I can be expanded to identify and realise learning potential on all sides. The popular and partnership educational/learning curricula are described as suitable mechanisms for introducing participatory C&I development processes. We conclude by describing a range of research and extension activities suitable for participatory C&I development that can form part of the educational curricula discussed.

## **1. INTRODUCTION**

This paper focuses on the development of criteria and indicators (C&I) of sustainable community managed forests (CMF) as communication and learning processes. Collaborative C&I development is potentially both content and goal rich. It provides a means to integrate local traditional and scientific knowledge, and can thus expand understanding of factors that interact to determine the sustainability of forest management. Processes of participatory C&I development, and the assessment tools they generate, promise to enrich current understanding of:

- the role of traditional/indigenous forest management in forest conservation;
- the scope for devolving forest management responsibilities to local communities; and
- the prospect for certifying CMF and products (timber and NTFPs) derived from this.

Local environmental knowledge often encompasses deep awareness of the causes and effects of trends affecting sustainability. Frequently such knowledge has grown, often over the course of centuries, through regular and intimate observation of how forest species and habitats respond to human interventions. Its consideration in the design of locally acceptable and efficient procedures for assessing and monitoring sustainability is therefore important.

The C&I development phase sets out the scope for future community involvement in C&I applications. Ignoring local knowledge until the application phase risks attention being diverted from issues and options perceived as locally relevant. When widely understood and accepted

within local communities, C&I can be used to monitor their own performance as natural resource managers, to make better decisions about future courses of action and effectively communicate the local impact of forest-related policies, laws and projects. For this reason we encouraged community members to interactively participate in the processes of developing these tools.

The ideas explored here build on the results of community participation in three tests of 'Criteria and Indicators for Community Managed Forests' coordinated by the Center for International Forestry Research (CIFOR) between March 1997 and February 1998. These tests focused on forest-dependent communities in humid, lowland tropical forest in Brazil, Cameroon and Indonesia (Box 1). However, the methods used, our recommendations for their improvement and many of the C&I proposed are of wider geographical applicability.

This paper reports on some strengths and weaknesses of the collaborative processes pursued and suggest some ways to enhance interactive participation in the future. Consideration is given to how some underlying concepts related to sustainability and its assessment can be explained to communities. Methodological recommendations made mainly concern collaborative action research involving community groups and offer scope for diverse outside partners to participate.

## **2. BACKGROUND INFORMATION**

The general objectives of the CIFOR tests were to:

- develop C&I for assessing and monitoring community managed forests and their social and economic aspects, at the test sites and sites with similar characteristics, that
  - match the needs and capabilities of diverse CMF interest groups, including the forest managers at the test sites, many of them semi-literate or illiterate forest farmers;
  - are easy and cost-effective to evaluate by at least some specified user groups; and
  - are unambiguously relevant to forest sustainability or its social or economic dimensions; and
- critically appraise the methodologies used to test and develop C&I.

There are two main purposes for which C&I can be used. One is to generate baseline data to assess current circumstances, the other is to monitor change.

### **2.1 C&I for generating baseline information**

In order to encourage sustainability, management decisions must be based on relevant and sufficiently precise information about the current situation. This is baseline information which C&I can be designed to capture. Historical data will increase understanding of how current circumstances have evolved. Baseline information can be sufficient to draw some conclusions on the social and ecological acceptability of present-day circumstances. Basic comparisons between different sites can be made. From baseline information alone it is often possible to recognise how a reorientation of resources or the introduction of new technologies has affected or might affect sustainability.

### Box 1. The CIFOR test sites

#### **São Pedro (Arapuins 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 Arapuins 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 Arapuins river system, including São Pedro and Cachoeira de Maró, develop a proposal for the creation of a legally gazetted extractive reserve.

#### **Bedigong and Darok, Sanggau district, West Kalimantan, Indonesia.**

Land-Dayaks of these villages are Christians, but retain some of their traditional beliefs. Most speak only their native Dayak language. In first few decades following independence Indonesian government actively discouraged residence in traditional Dayak longhouses. Consequently they, like most Dayaks, now live in wooden houses of standard size for Indonesia. Shifting cultivators, their 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 generally much richer in useful forest species than the natural forest (de Jong, 1997). Their dominant species, tengkawang (*Shorea macrophylla*), a tall forest tree, produces commercially valuable oil-yielding nuts, whose local economic importance is second to that of rubber. Other locally important forest products are honey, rattan, shingles and ironwood. 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 previously logged-over forest-rich zone. 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. 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 développement 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 11x35 km. 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.

## 2.2 C&I for 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 certification of CMF products.

From a practical angle, C&I can aid monitoring by:

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

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

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

## 3. METHODOLOGIES USED IN THE CIFOR TESTS

Members of the interdisciplinary testing teams were in-country professionals. Each team consisted of an ecologist, a forest management specialist and a social scientist (or anthropologist) with experience in community development. Each individual was asked to produce a set of C&I for his or her discipline, in consultation with the inhabitants of the test site community and covering all factors thought to significantly affect sustainability at the test site. Field checking verified the relevance of selected C&I and the validity of their underlying assumptions. Each test concluded with a workshop for review of the proposed C&I by an audience of government policy makers, academics, members of other forest communities, and representatives of non-governmental organisations (NGOs).

Each member of the test teams chose his/her own methods for achieving interactive participation. Structured information gathering, Participatory Rural Appraisal (PRA) and focused interviewing techniques were used during field testing of the C&I. Considerable spontaneous, open-ended exchange of information also took place.

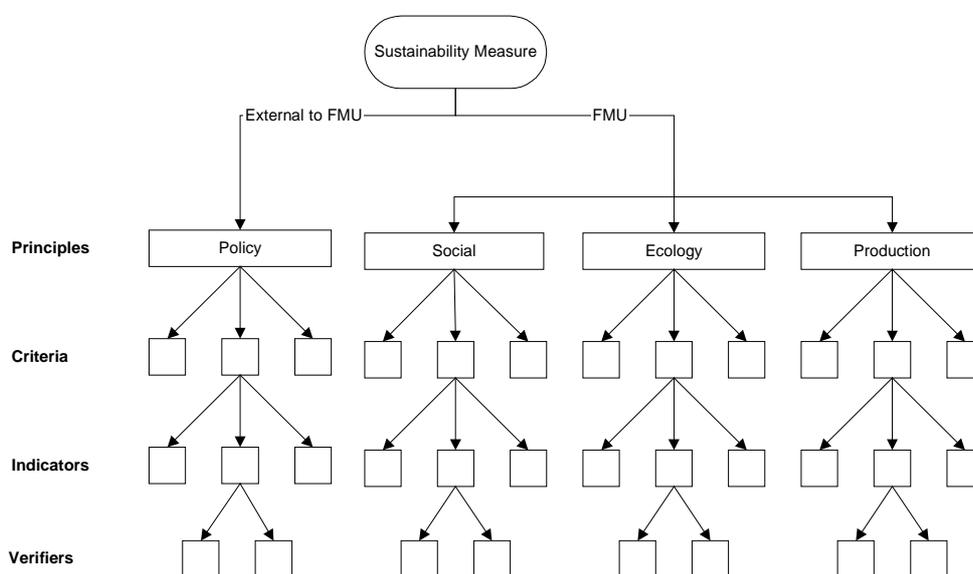
The form of participation by community members in the workshops was considered on a case by case basis for each test, along with ways to facilitate participation. Several community members gave presentations at the workshops about their views of important factors affecting sustainability. They were also active in review groups set up during the workshops to critically assess the proposed C&I. Skilled facilitators offered guidance and support.

The specialist team members completed a 'justification' form for each P, C, I & V proposed. These recorded the relevant input and observations made by community members, and who in the community understood and agreed with the criterion or indicator. The relevancy of each C&I to test site conditions was also detailed.

### 3.1 Conceptual framework for structuring C&I

Definitions of Principles, Criteria, Indicators & Verifiers (P, C, I & V) and their associated hierarchical framework were based on those proposed by Tropenbos (Lammerts van Bueren and Blom 1997) (see Box 2). The ability of the hierarchy to represent reality is limited by its inflexible two-dimensional aspect and four hierarchical levels. This limitation was partially overcome by applying the hierarchy three times to structure the discrete C&I subsets for ecological, forest management and social science disciplines. This allocation of C&I to discrete subsets makes it more difficult to establish causal relationships between factors from the respective categories. This shortcoming was recognised during the planning phase, but the benefits of the hierarchy’s ease of use and simple basis for comparing C&I proposed at different test sites were considered to outweigh any limitations.

**Box 2. Definitions used during the C&I tests for Community Managed Forests**



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

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

Examples: ‘Ecosystem integrity is maintained or enhanced ‘ or ‘Human well-being is assured’

**Criterion:** *A standard that a thing is judged by.* A criterion can therefore be seen as a ‘second order’ principle, one that adds meaning and operability 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.

*Box 2 continued*

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 fourth 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

*Explaining the meaning of Principles, Criteria, Indicators and Verifiers*

Underlying concepts and terms were clarified as far as possible to all involved. On the CIFOR tests the test teams provided local people with simple definitions and examples of the P, C, I and Vs. On the whole, the word 'principle' was easily understood to mean a universal law or ideal as perceived by the individual; something of wide 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 testers sometimes met with 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 illustrate what is an indicator e.g. a high temperature in a child is indicative of illness; falling yields may indicate declining soil fertility, drought or pest attack; mould is indicative of decay etc. Several types of signs may be identified, some of whose recognition may require special knowledge. Below we give examples of some types of signs that community members can identify and show how some of these can be classified into indicator categories, including the pressure-state-response categories proposed for monitoring by the OEDC (Bakkes *et al.* 1994).

- Signs that certain things are likely to happen.

**Ex:** 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 or is being done is appropriate.

**Ex:** 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.

**Ex:** Number of chainsaws/shotguns owned, size of agricultural clearings i.e. the things (i.e. harvesting equipment and intensity) that cause impact or stress and determine its scale.

*Corresponding indicator classifications:* **Pressure indicators.**

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

**Ex:** Yield response to intercropping, change in forest fires attributable to a new fire management strategy, the change in distribution patterns resulting from a decision taken, social response to an innovative idea (adaption, indifference, rejection).

*Corresponding indicator classifications:* **Response indicators**

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

**Ex:** Cation exchange capacity, forest structure, size of forest area, or organisational structure.

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

Local people had no difficulty in recognising these different types of signs. However, getting them to systematically classify signs as pressure, response, state etc... indicators, was thought would unnecessarily complicate the exercise for them and therefore not attempted.

#### 4. THE OBJECTIVES OF COMMUNITY PARTICIPATION IN C&I DEVELOPMENT

Different interest groups see the forest and its potential from different perspectives (see Box 3). They perceive different constraints and opportunities, which lead them to approach the evaluation of sustainability from different viewpoints. The developers of C&I, whoever they be, know best what they want to assess and the information available to carry out assessments. Their greater understanding extends to both the basic characteristics of C&I and how these relate to a broader context or assessment framework. Similarly, each potential user group is best able to judge whether it understands the proposed tools and has the knowledge, skills and resources to apply C&I to assess, monitor and communicate developments. Individual interest groups are the most appropriate users to identify issues they can control and those beyond their influence.

We interpret the term ‘participatory’ to embrace diverse processes that promote constructive, interactive communication between different CMF user and interest groups. Interactive community participation was encouraged throughout the CIFOR tests to better ensure:

- the capture and communication of information about factors influencing conditions and trends that support or are antagonistic to the sustainability of CMF systems. This

information can clarify options for promoting sustainability and/or more equitable cost-benefit distribution patterns as well as disclose obstacles to sustainability.

- local people's participation in a critical appraisal to identify C&I that would result in a fair and thorough assessment of the sustainability of their forest interactions. Adding transparency to screening processes can result in more widely accepted and, hence, more useful C&I.
- the creation of a commonly understood vocabulary of C&I and reference points to enhance the likelihood of assessment results provide appropriate, coordinated responses from different forest actors to changing patterns of forest resource use.
- inclusion of C&I used or created by members of the community.

The people that develop C&I may introduce some bias to protect or advance their own interests. It is also possible that incomplete or faulty knowledge is used. Participation of diverse interest groups (knowledge holders) often helps to reveal these biases. Sometimes pooling of knowledge can fill participants' information gaps.

Where the importance of traditional systems has been eclipsed by change or is disintegrating, knowledge about the stage of transformation is important to avoid inappropriate change imposed from above, and to ensure progress proceeds smoothly based on the experience of local people. Policy makers and legislators can only create laws and policies to secure conditions that encourage relatively sustainable, traditional CMF systems if they are aware of these conditions. It is important therefore, that they can access local knowledge. Participatory C&I development offers a means to do this.

### **Box 3. Forest management C&I of multiple use - Cameroon test**

Forest interest groups can rarely survive in isolation. They have to reach accords regarding inevitable competition and tradeoffs between various interests. This led to the proposal of the criterion '*different forest user and interest groups co-exist harmoniously*' in the Cameroonian test of C&I for community managed forests. One indicator of the fulfilment of this criterion is that '*.... 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.

The interdependence of various forest user groups was clearly evident at the Cameroonian test site, where the management of the natural forest helps to protect forest streams from siltation. These streams contain fish sought by fishermen 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 woven from fibres and canes from the forest, for transport to urban markets.

Clearly a large range of forest products, usually harvested by different groups, is used in the procurement, processing and dispatching of fish. Such long chains of operations show how the interests of individual groups depend upon each other and therefore upon the protection of the global value of the forest. Linkages and tradeoffs exist between factors of socio-economic, ecological and forest management importance, many of which have multiple implications for future sustainability. They are important in the development and testing of C&I for assessing or reporting the sustainability of CMFs. When well studied, these chains or pathways can be useful in establishing more specific qualitative and quantitative measures of sustainability.

## 5. TEST RESULTS: PARTICIPATION BY THE COMMUNITY

Two types of observation about community participation were possible:

- how, and to what degree, different community members participated in developing and critically screening C&I; and
- the type and level of emphasis placed on participation by the proposed C&I.

### 5.1 Community participation in developing and screening C&I

The way information on community input was recorded during the CIFOR tests makes it difficult to quantify this input. Weaknesses in the documentation processes and the lack of a stronger methodological foundation to facilitate and systematise community participation are at fault.

Although the professional teams spoke the national language of the respective country, some language barriers remained at the Cameroonian and Indonesian test sites where the local majority only spoke their tribal language. Clearly, these barriers were an obstacle to communication.

Despite efforts to encourage local people to participate in various ways, they were predominantly only providers of information. The most active participants tended to be the wealthier, politically more influential, or more outgoing community members. Less direct communication took place with women, children and the elderly. However, in the Brazilian test the social and forest management professional made a special effort to seek out the participation of women. In Indonesia, the whole test team organised special sessions to involve school children.

The specialists of the test teams and other professionals (at the concluding workshop) were inclined to evaluate the contributions of community members according to their own standards. Therefore, some of the C&I proposed and their evaluation methods are too complex for forest farmers to understand or apply. Attitudes of professional participants that appeared to inhibit greater community contributions included:

- use of complex academic theories and reluctance to fully explain the more basic academic foundations for selected C&I;
- substantial doubt about the validity and utility of local knowledge; and
- reluctance to allow local people to lead discussions for fear that some important questions would be under-addressed resulting in an unbalanced C&I set.

### 5.2 C&I of participation

The importance to sustainability of a broad participatory base for local social organisations and decision making processes is highlighted by many of the C&I generated by the CIFOR tests (see Table 1). Assessment of many of the C&I on social processes that do not mention the word participation will nonetheless inform on participation. Several of the Indonesian and Brazilian C&I on decision making, conflict management, rule enforcement, optimisation and monitoring explicitly refer to participation. Another substantial number of C&I pointed to the importance of communities participating in forest and land-use policy and law development. Although the word 'participation' is scarcely used in the C&I developed on Cameroonian test, several of the Cameroonian C&I on complementarity between customary regulations and State policies and legislation, and on negotiation processes, imply a need for inter-active communication, i.e. participation.

**Table 1. Selected C&I on participation**

<b>Indonesia</b>	<b>Cameroon</b>	<b>Brazil</b>
<p><b>Indicators:</b></p> <p>Meetings are organised on environment and land use problems.</p> <p>Participatory decision making.</p> <p>Women represented equally in meetings and decision making.</p> <p><b>Verifiers:</b></p> <p>There is full participation of local community in planning and implementation of development programmes.</p> <p>Participation in decision making on benefit sharing.</p> <p>Gender equality in all processes.</p> <p>There is no monopoly of discussion by authority.</p> <p>Decision making on tembawang enrichment (and conversion) is a social, not individual, occasion.</p>	<p><b>Criteria:</b></p> <p>Different forest users and forest interest groups coexist harmoniously.</p> <p>Villagers participate with other stakeholders in the protection of timber resources in their communities.</p> <p>Access to community forest commons is regulated through collective action and support.</p> <p><b>Indicator:</b></p> <p>Community dialogue structures exist for the negotiation / discussion of forest management issues with state service and NGOs.</p> <p><b>Verifier:</b></p> <p>Collectively organised patrols.</p>	<p><b>Criterion:</b></p> <p>The community participates in and monitors (patrols) all the planning processes of any management system to be executed within the agroforests it affects.</p> <p><b>Indicator:</b></p> <p>Active community participation in the conception and monitoring (patrolling) of agroforestry resource management systems.</p> <p><b>Verifiers:</b></p> <p>Participation of the community in decisions on which trees to extract.</p> <p>Participatory mapping of NTFP resources.</p> <p>Effective female participation in discussions and decisions concerned with community welfare.</p> <p>The history of the community's participation in the definition of public policies of local and regional impact.</p>

As a complete system, the C&I sets imply participation is critical to ensuring social processes result in tradeoffs that are environmentally and socially optimal in the light of available knowledge. The multiple-use nature of many community forests, which potentially face complex tradeoffs, reinforces the importance of local involvement. The overall results suggest the need for ongoing participation in monitoring forest management cost-benefit distribution, especially during times of change, so that:

- compensatory adjustments to changes are detected and understood in terms of their origin and impact and can be further adapted if necessary; and
- coordination between user group activities continues to uphold the common, joint goals of sustainability and equity.

The C&I developed suggest that participation can promote sustainability and equity by:

- establishing communication channels for information exchange between different stakeholders, thereby expanding the knowledge realms of each;
- helping communities plan strategies for participatory decision making, objective setting, and implementation and monitoring of decisions;

- conferring a greater sense of ownership of decisions, and therefore a responsibility to ensure they are followed;
- itself constituting a way to prevent and/or manage conflict;
- identifying and reinforcing common or complementary interests; and
- stimulating a stronger mutual interest in existing circumstances in order to develop C&I that can be used to improve current conditions.

The consecutive processes of 1) participatory C&I development, and 2) participatory C&I application can contribute to the realisation of sustainability and equity. Cyclically integrated and mutually reinforcing processes will foster continuous evolution of C&I. Such development reflects changes in local knowledge and experience at the pace as the community's understanding of the causes and effects of change evolves.

## **6. CLASSIFYING AND INTEGRATING KNOWLEDGE IN C&I DEVELOPMENT**

As already noted, one of the main reasons to use a participatory approach was to elicit local knowledge and integrate this with academic theory to generate easily understandable and widely acceptable C&I, that match the capabilities of diverse interest groups. The CIFOR tests identified how processes of C&I development can be expanded both to identify and realise learning potential. These are presented and discussed below. This is followed by suggestions for participatory methods to develop and/or apply C&I of sustainability. I believe these can be effectively used to explore the identify and transfer potentials for local knowledge development and transfer.

The C&I sets produced on the CIFOR tests are themselves knowledge composites, each representing an field of awareness derived from knowledge about factors critical to sustainability. Several C&I that address procedures rather than possession of knowledge, will generate responses that reflect knowledge by its application. However, a considerable number of C&I were created to directly establish the level of knowledge of forest interest groups within the community (see Table 2 for some examples). Knowledge exchange is essential for establishing fair, mutually acceptable tradeoffs. In multiple-use forestry, which is typically community managed, a complex multi-directional exchange of information is required to achieve a balance between a large and often diverse range of user groups.

**Table 2. Selected C&I on knowledge possession and transmission**

Indonesia	Cameroon	Brazil
<p><b>Principle:</b></p> <p>A right educational system supports environmental sustainability.</p> <p><b>Indicators:</b></p> <p>Local knowledge on soil types and fertility/fallow vegetation.</p> <p>Local content curricula devoted to environmental consciousness building.</p> <p>Non-formal education is still functioning.</p> <p><b>Verifiers:</b></p> <p>Training in appropriate on- and off-farm technologies.</p> <p>Story telling is still performed by elders for the youngsters.</p> <p>Children of school age are regularly attending school.</p> <p>Knowledge on vegetation/species associations with soil fertility.</p> <p>Adult community members know the customary laws attached to land use systems.</p> <p>Participants understand the subjects under discussion.</p> <p>People can differentiate between traditional and new regulations/rules agreed upon by the community.</p> <p>Local knowledge on natural resource management is still being handed down to younger generations.</p> <p>Information exchange with entities outside the community.</p>	<p><b>Principles:</b></p> <p>Most villagers recognise and seek to maintain the global value of their forests as determined by its multiple uses.</p> <p>Community forest management practices and techniques fully incorporate indigenous knowledge systems.</p> <p><b>Criteria:</b></p> <p>Villagers have sufficient knowledge of the composition and distribution of different forest types.</p> <p>The forest boundaries and all those with neighbouring villages are known and respected by all concerned.</p> <p>The role of seasonality in the use of forest resources and farming activities is recognised.</p> <p>Social structures permit the transmission of existing knowledge systems.</p> <p><b>Indicator:</b></p> <p>Laws and regulations on hunting are known to all.</p> <p><b>Verifiers:</b></p> <p>Different types of forest e.g. swamps, secondary forests, species rich forest, and different plant and animal species are known with a high degree of precision.</p> <p>Knowledge of market value of forest resources.</p> <p>Appropriate development of educational programmes.</p>	<p><b>Criterion:</b></p> <p>Local conscience and knowledge of agroforestry resource use and management demonstrates an ethic of sustainable land use and conservation.</p> <p><b>Indicators:</b></p> <p>Knowledge of markets for forest and agricultural products.</p> <p>Knowledgeability about the costs of production (depreciation cost of equipment, reinvestments, maintenance).</p> <p>Transmission and perpetuation (written and oral) of traditional knowledge and mythology.</p> <p><b>Verifiers:</b></p> <p>Knowledge and application of the best harvesting practices.</p> <p>Survey of resident population's knowledge on harvested and/or managed species and on those of potential economic value.</p> <p>Knowledge and application of alternative agricultural practices.</p> <p>The community is knowledgeable on market alternatives, fluctuations and demands.</p> <p>Indigenous classification of agroforestry products.</p> <p>Young community members' level of interest in perpetuation of traditional knowledge and mythology on the natural environment.</p>

## 6.1 How people's knowledge fits together

Knowledge plays a major role in developing those C&I used as monitoring tools to generate more information. Our present concern is primarily to improve understanding of the way knowledge of different people fits together, and of what they can learn from each other and together. Initially, an awareness of the content of knowledge and its significance to its holders is necessary. The same knowledge may be held but used for different purposes by a range of

communities. An issue may be equally significant to various people, but people may arrive at a realisation of this significance via different routes, marked out by different knowledge sets.

Villagers are unlikely to possess the complex scientific analytical skills and knowledge to identify factors affecting sustainability locally. This does not mean that local knowledge is simplistic. On the contrary, it is often complex and rich in nuances. However, we need to remember knowledge is unevenly distributed, with various people possessing more or different information about individual issues. One useful distinction may therefore be between 'common' and 'specialised' local knowledge. The majority of community members have access to the former, whereas the latter is the precinct of smaller, specialist groups, e.g., boat builders, healers. To some extent knowledge possession reflects occupational knowledge requirements. It can be an indication of gender roles and the range of responsibilities assumed by different age groups. Differences in knowledge possession undoubtedly exert a potentially strong influence over the definition of trade-offs and, therefore, are likely to significantly affect wealth and power distributions.

All members of the test teams found access to local knowledge essential for a good understanding of the local situation. When cross-checked, this knowledge usually proved reliable. Local people have the benefit of hindsight with regard to the existing condition of their forest environment. Thus, they are usually knowledgeable about how and why the current state developed, reflecting their intimate coexistence with the forest environment. Limits of local knowledge can reflect prevailing constraints to more efficient use of forest resources. Villagers thus tend to have a realistic idea about the future or how to exercise greater control over the future.

As the intention was to integrate local and western scientific knowledge, it was important to document those who contributed or possessed the knowledge on the basis of which C&I were accepted. Such records facilitate identification of those who understand particular C&I sufficiently to use them. Although the documentation processes used could have been more systematic, they did allow some C&I to be classified into the following knowledge-based categories:

- local (traditional or indigenous) knowledge
- scientific knowledge

Based on the relationships between these two knowledge domains, we found that C&I reflected the following types of knowledge:

- common knowledge (local knowledge is the same as scientific knowledge);
- complementary or supplementary knowledge (where local and scientific knowledge relate to different issues or phenomena but do not disagree); and
- contradictory knowledge (local explanations or interpretations of a particular state, mechanism or phenomenon conflict with scientific explanations or interpretations).

The above three realms were included in knowledge-based systems developed to facilitate identification of topics suited to collaborative research (Preechapanya 1996). From that experience, we believe a further distinction may be useful where one party but not the other possess knowledge. It is useful to know whether the party without the information is:

- aware of the deficiency (evidenced by the search for knowledge, i.e., by questions asked); or

- not aware of the deficiency (often this means the existence of a problem is not recognised).

A final knowledge-related realm consists of what is unknown to both the local community and the scientific world. Obviously, we can only recognise those mutual knowledge deficiencies about which some awareness exists, asking by questions.

## 6.2 Classifying indicators according to knowledge realms

Before an indicator can be assessed or measured, its subject matter must be recognised. This requires knowledge of varying complexity depending on the nature of the indicator and can be obtained through learning processes integrating information from diverse sources.

Learning processes lay the foundations for future decision making and action. They provide explanations and meaning by combining previously unrelated information in different ways. Sustainability status is, therefore, a reflection of how successful these processes have been in addressing the changing social and environmental potentials for sustainable resource use and management. Not all explanations are based on commonly held information – there may be several explanations, based in different cultures, that correspond with different world views. Even if a cultural identity is shared, knowledge may differ, reflecting an individual's spheres of social interaction and economic specialisation. An important question is how does the knowledge of different groups within the community combine to determine the overall level of social welfare and environmental stewardship. The significance of processes for developing C&I for CMF takes on new dimensions when knowledge distribution is considered in the following ways:

- Greater conscious emphasis is placed on information exchange to establish differences in knowledge and opinion, thereby enhancing the educational dimension of C&I development processes.
- The knowledge realms of different groups can indicate their respective current capacities to understand and use C&I.
- Comparing the knowledge of different groups can reveal potential for information transfer to aid monitoring, comparative evaluation and the evolution of best practices.
- Comparing the knowledge of different groups can reveal knowledge erosion and gaps that could inform educationists and extension workers of educational needs.
- Comparing the knowledge bases of different groups can reveal contradictory knowledge or multilateral knowledge gaps. These could be addressed through collaborative research.
- It becomes possible to recognise ways in which knowledge is growing and spreading and who is affected and how by these developments.

## 6.3 Traditional and local knowledge

Much of the local knowledge explored during the tests was derived from, or referred to, easily observable states, cause and effect relationships or trends. Hunters at the Brazilian site, for instance, had a rough idea of the months when different wild animals mate. However they did not know precisely when mating takes place. Such information is only available for easily observable animals, such as domestic pigs. Depending on the community's isolation, information from external sources also formed an integral component of its knowledge base. At

all test sites local knowledge was embodied in locally defined codes of good management practice and natural resource access rules and regulations.

Inhabitants of Cachoeira do Maró and São Pedro recognise several factors that increase fire hazard. Taking account of these factors is part of local 'best practice' aimed at sustaining and efficiently using forest and agricultural resources. Logging activities are one of the factors locally recognised to increase fire hazard. By opening up the forest canopy and allowing greater penetration of solar radiation, the forest becomes drier and more flammable. Another hazard is hunters forgetting to extinguish their camping fires. A further danger is poor administration of agricultural fires. At the Brazilian site many fire control mechanisms, based entirely on local knowledge, are widely employed, including:

- Felling trees and cutting slash sufficiently early in the year to ensure time for it to dry out before the rains start – the exact time needed depends on the vegetation; young fallows require a week or two, tall secondary forest one month or more.
- Trees are felled towards the centre of the field designated for burning. This will direct the fire away from adjacent fields or forest and help prevent flames jumping fire breaks.
- Farmers have highly developed skills in directional felling. When felling trees towards the centre of the area designated for burning, much human energy can be conserved if farmers cut trees to fall onto other trees to 'send' them down. This, locally known as '*mandado*', is a common skill amongst farmers of the region.
- Fire belts, 1-2 metres wide, are cut and swept clear of debris.
- Neighbours and the community's leadership are informed of intended date of burning. This should be done some days in advance so that people can be available to assist with control of the fire.
- Burning is completed before rains commence to ensure slash is burnt well. A 'good burn' is seen as important for weed suppression and maximum ash production for soil nutrient enrichment.
- Wind direction and velocity must be appropriate. Fires should be timed when the moon is waning and winds are least fierce. Fires should be directed to move against the wind.

It would be interesting to assess whether these fire control mechanisms are implemented as rigorously in fields located at the edge of fallows, secondary or natural forest as they are in fields adjacent to those with tree crops or belonging to neighbouring farmers. In larger communities, more farms are likely to have more borders with neighbouring farms. Motivation for fire control itself may be an important variable (see Box 4 for application of knowledge for burning of agricultural land).

#### **Box 4. Application of knowledge for burning of agricultural land**

Compared to methods used by some caboclo forest farmers at the Brazilian test site, some fire management techniques used at the Indonesian test site appear less sustainable as they promote soil erosion. For example, steep forested sites are sometimes selected for agriculture because trees can be felled to fall vertically onto the slope. This facilitates the burn as flames climb up the trunks, but intensifies the risk of subsequent erosion.

To reduce competition with food crops, Dayak shifting cultivators in East Kalimantan try to effectively kill coppice stools and weed seeds in the soil and keep wild animals from foraging in their fields (Mackie *et al.* 1987). They opted for large forest clearings, apparently because relatively few seeds reach the central area of large fields from the forest margins. The slash of large forest clearings also burns more fiercely, and this helps destroy soil seed reserves and coppice stools. Using this knowledge, some Dayak farmers in Central Kalimantan locate their small fields adjacent to each other (Kartawinata *et al.* 1984: 91). The larger forest gaps created allow farmers to reap the benefits of spatial scale but these areas take longer to revert to forest.

Brazilian migrant farmers in Amazonia specialising in cattle ranching typically convert relatively large forest areas to pasture. They attach minor importance to fire control measures, rarely perceiving the spread of agricultural fire as an obstacle to fulfilling their objectives. People are less likely to know about issues of little concern to them. Conversely, the reverse can also be true; people may care less about things of which they know little.

Empirical evidence exists to suggest that in many traditional cultures forest incursions made by shifting cultivators are small and rapidly recolonised once abandoned. Thus, small gaps cause minimal disturbance to forest cover. Some shifting cultivators are believed to deliberately opt for small, discrete agricultural clearings within the forest to maintain steady supplies of game meat, non-timber forest products and fodder for domestic animals. Another factor influencing choice of forest clearing size is the rate at which soil fertility recovers after cropping has been abandoned. Farmers using such knowledge tend to leave forest on infertile sandy soils relatively undisturbed, also incidentally conferring some degree of protection on particularly fragile areas. However, concentrating forest conversion to nutrient-rich soils can have devastating consequences for some forest species. Dayak farmers are aware that their conversion of forest on soils with clay content is contributing to the local extinction of their sacred bird, the hornbill, which they say cannot reproduce in forest on sandy soils as it needs clay to cement the nest.

Fire management practice is an indicator of sustainability. The interdisciplinary verification of such practice must take local perceptions of best practice into account. Best practice is a secondary form of knowledge; a way of using basic knowledge building blocks to achieve priorities. Different forms of best practice are thus knowledge applications that are themselves knowledge constructs. From the perspectives of labour efficiency and social collaboration, the Dayak practice of creating large forest clearings for agriculture, qualifies as 'best practice'. However, from an ecological viewpoint this practice is relatively incompatible with forest sustainability. Consideration has to be given to the social, technical and ecological significance of best practice in relation to the objectives it aims to achieve. Since ultimately environmental sustainability is necessary to sustain social welfare standards, we would expect many examples of best practice to combine the objectives of environmental stewardship and social efficiency.

Some local knowledge is based on supernatural phenomena that community members collectively imbue with socio-environmental significance. The hunting traditions of caboclos at the Brazilian test site offer many examples. Local hunters know, for instance, many reasons why it is wise to respect the wishes of the 'Curapira', the mother spirit of the forest. To avoid incurring her wrath, hunters restrict their catch to no more than they require for domestic consumption. Subservience to the Curapira, who theoretically regulates hunting pressure, is common in areas where the human population and hunting pressure are relatively low, i.e., in

the more isolated communities. The Curapira's role is a cultural creation that forces people, through fear, to moderate their behaviour so as not to abuse nature's bounty. It is a form of information designed to apply environmental knowledge. Especially in larger, more accessible communities, the belief in the Curapira is dying out. Some believe this fact is adding to growing hunting pressure.

#### **6.4 Knowledge gaps about which there is local awareness**

The conceptual and geographic scope of local knowledge can limit the type of contribution by local people to developing C&I, as well as their capacity for effective use. The extent of knowledge similarly determines the ability to monitor change over time – the slower patterns evolve, the less obvious their appearance is likely to be and the more difficult it becomes to regard them in perspective. Various options for responding to change are thus obscured by knowledge deficits. Inhabitants at all three test sites were aware of their lack of certain types of knowledge critical to sustainability.

Inhabitants of the Cameroonian test site stressed the need to improve all aspects of local infrastructure. They also wanted to access more labour-saving technologies, in particular chain saws. While aware that infrastructural improvements and an increase in chain saws could have adverse environmental consequences, the residents were not aware of the exact nature of these impacts. Thus they emphasised the need for educational programmes to make people aware of the dangers of abusing new facilities and technologies. This need, they claim, is widely recognised within the community, suggesting an appreciation of the relationship between knowledge content and the ability to make rational decisions.

In Cachoeira do Maró, inhabitants said they would like to know more about how to assess timber quality and about timber pricing structures. The *marreteiros* (river merchants) always buy their timber at a very low price, insisting it is of inferior quality. Locals have no way of knowing if they are being misled and are aware of this information deficit.

The importance of knowing the forest's true value was stressed several times during all tests. Historically, there has been a tendency to interpret a lack of awareness by local peoples about the commercial or use value of some forest products as meaning they do not value them at all. Undoubtedly, awareness of value allows people to protect themselves from being unjustly exploited. Knowledge of true value is also likely to enhance any commitment to protecting resources. At the Cameroonian test site, communities expelled logging companies from their forests on several occasions because they are aware of the value of their timber trees. At the time of the CIFOR test they were producing a management plan designed to bring profit from the sustainable extraction of their timber stocks. Observations of this type inspired the development of C&I about knowledge of the value of forest products. However, an awareness of the true value of high-value forest products may be antagonistic to sustainability. This appears to have been a historical fact in the Arapiuns valley where ephemeral markets for NTFPs including timbers (pau rosa and cedro), latexes (in particular macaranduba, *Manilkara huberi*) and animal skins have sprung up at various times since the turn of the century, drastically degrading the resource each time.

#### **6.5 Growing local awareness of knowledge gaps**

Seeking explanations for existing and relevant phenomena that are not understood is an acknowledgement of a knowledge gap. C&I of external causes of local change were rarely proposed by local people, especially in the more remote villages. The larger, more accessible

communities are more knowledgeable about the nature of external factors with influence locally. Prolonged and varied contact with the outside world, better schools and more teachers improve awareness of a community's situation in comparison others in the region, the reasons for differences and their negative and positive implications. External influences have more impact in these larger sites. However, the smaller, more isolated communities were also significantly influenced by external factors albeit in different, sometimes less visible ways. This will be discussed later.

Some changes initiated by outside forest stakeholder groups or arising from increased integration into the market economy, appeared to have out-stripped local capacity to respond quickly and effectively to change. This tends to happen when knowledge about the broader implications of change develops at a slower pace than the rate of change itself. The delayed responses of the communities of Darok (Kalimantan) and São Pedro (Brazil) to the activities of outside timber merchants operating in their forests are examples. Collective concern in these two communities about environmental impact and the depletion of forest timber stocks caused by external loggers and traders only really developed when forest degradation was already severe. By the time Darok expelled the ironwood exploiters, most of the village's ironwood reserves had been depleted. In São Pedro, the community responded to forest impoverishment only when the timber company had almost completely exploited the forest within and around the community, and was ready to move on to another location.

Frequently timber companies secure a foothold in a community-claimed area by offering local inhabitants wage-earning employment or by negotiating compensation packages. Many local communities have little idea of the true value of timber, or of how they could profit more from their timber stocks. This weakens their bargaining power. Rarely can they foresee the boom-and-bust nature of such employment opportunities, since these depend on the management plans of the timber companies, which are not usually explained to them.

In São Pedro, people explained how they slowly became aware of various problems caused by logging activity. The logged-over forest's increased fire susceptibility only gradually became apparent. An example of a delay between the logging event and the recognition of an associated change, is the way in which São Pedro's residents tried to explain the dramatic reduction in fruiting of Brazil nut trees in logged over Brazil groves. It was only a few years ago that forest farmers became aware that the drastic decline in Brazil nut production in logged-over forest was different to what could be expected from yield oscillations due to mast years. They now think selective logging is the cause of this decline and they are seeking to validate their opinion of this link. In addition, they wish to know whether and how the productivity in Brazil nuts of the logged-over groves can be recuperated. They are also seeking information to build a legal case against the timber company that extracted timber from their Brazil nut groves.

## **6.6 Knowledge gaps of which there is no local awareness**

Involving local people in development of C&I can identify issues of which they have no knowledge, but that are nonetheless relevant to their situation. While villagers cannot suggest indicators for condition they know nothing about, an outsider can do so by referring to information unavailable locally. Where there is no perceived basis for comparison, a knowledge gap may exist. Often awareness of a problem is limited to a perspective defined by a particular knowledge or culture. It is to be conscious of this as it determines the ease with which different groups can understand and implement specific C&I.

Women in the relatively isolated Dayak community of Bedigong did not seem to recognise an under-five child mortality rate of almost 30% as high. Consequently, they did not perceive the 'under-five child mortality rate' as an indicator of social welfare. With no basis for comparison

and no noticeable change in mortality rates in their living memory, the rate was not considered high but normal. Despite this, the poor health of children is of constant concern to Bedigong's people who therefore seek medicines and information of the causes of illness. The effectiveness of health education and services are thus recognised locally as indicative of progress. Such perception discrepancies typically relate to the visibility of phenomena: a sick child is clearly visible, the under-five mortality rate is less so.

Some local explanations of disease and infections contrast starkly with scientific theory. In Bedigong a number of children suffered from a scaly skin disorder that, in some cases, covered the entire body. Enquiries within the village did not establish whether the disease was genetic or contagious. A dermatologist later explained that it is an infection caused by the fungus *Trichophyton mentagrophytes* which is fairly common throughout Kalimantan (pers. comm. W. Subiyanto). During his research on the fungal infection in local communities, Subiyanto found Dayaks believe the infection is symptomatic of possession by the spirit of God. Rather than being shunned because of their unsightliness, infected people are revered and treated with special respect, because they are believed to have supernatural powers. Elimination of the fungus requires prolonged treatment with antibiotics. However, the local explanation of the agent of infection serves as a disincentive to seeking and administering a cure.

In São Pedro forest foods in the local diet are being increasingly replaced by modern and, in many cases, processed foods. The reasons are numerous. The consumption of game meat is declining because hunting pressure has reduced game populations to levels where yields are low, and offer barely acceptable returns to inputs. Forest conversion to agriculture has led to a local scarcity of certain other forest foods. As already noted, logging activities appear to have reduced Brazil nut production. For poorer families, less able to afford imported foods, the reduced availability of forest foods is likely to have a deleterious effect on their health. Unless aware of the nutrient composition of different foods, people are unlikely to recognise changes in diet as indicative of health status.

## 6.7 Where 'no knowledge' exists

Complications surround the identification of multilateral knowledge gaps. These are clearly evident when all parties confess their ignorance on a particular topic. Sometimes, however, the gaps are masked by problems recognising erroneous knowledge, i.e., knowledge that is misleading or can be shown to be illogical. Some incorrect scientific theories are identifiable by applying to rigorous criteria. However, should any local knowledge count as insignificant or inappropriate because it does not correspond with scientific theory? Access to information that contributes to the content of knowledge clarifies underlying assumptions. Therefore the building blocks and processes by which these are combined need to be shared for a set body of knowledge.

A question raised on the Brazilian test was what standards should apply where the understanding of response curves or cause and effect relationships is imperfect. Presently there is no scientific proof that logging adversely affects Brazil nut production. Many of São Pedro's inhabitants feel, however, that logging in Brazil nut groves should be prohibited until it has been scientifically established that it does not impair seed set in trees. They felt strongly about this as, until recently, Brazil nuts were an extremely important food, gathered in copious quantities and stored for use over several months following the harvesting season. Local people are aware of the nut's high protein and vitamin content. It is a central ingredient of many traditional recipes that also include other forest herbs and species.

## 6.8 Cultural erosion and loss of knowledge

Where traditional practices are losing their purpose, the preservation and transmission of traditional knowledge remains worthwhile from the standpoint of sustainability, as it maintains options for natural resource use by future generations, cultivates an appreciation of nature-based socialisation processes and provides frames of reference for evaluating change. In São Pedro, residents recognised the connection between diet, perception of forest value and cultural reproduction. They agreed that dietary changes can indicate loss of cultural heritage including knowledge associated with abandoned forms of forest use. Disappearance from local cuisine eliminates not only a source of health but also historical heritage.

## 7. KNOWLEDGE ACQUISITION, TRANSFER AND DISSEMINATION

Local people are sensitive to indications of change provided these are detectable and can be observed. At the Brazilian test site cyclical changes such as the passage of the moon and changes in river tide levels, strongly influence daily life. They provide fundamental structures for the explanation of nature, coordinating productive activities around them. We would expect sensitivity to change to be greatest if is likely to adversely affect dependence on forests to maintain or raise their living standards. Villagers clearly recognised many kinds of change during their lifetimes and typically have sought explanations for these changes. They are thus likely to pay close attention to the consequences of their forest resource interventions, and are in fact, and therefore informally monitor change.

### **Box 5. Intercommunity 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 difference applied in the two Brazilian communities. In São Pedro, the larger site, had more contact with the Rural Workers' Union (STR) which has increased the community's awareness of its regional context. In recent years, it has received information and logistical support from the Rural Workers' Union to help prepare a case against the timber company it accuses of unjustly degrading 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 first-hand experience of logging damage, increased local awareness of the potential regional impact of the company's plans. The leadership in São Pedro undertook a two-week river excursion to visit all the communities located along the Arapiuns, Arua and Maró rivers (all part of the Arapiuns river watershed), to discuss the timber company's plans. Because of their greater isolation, the communities along the Maró and Arua rivers had hitherto not been able to substantiate rumours of a timber company's intentions to move into their forest. All the community leaders agreed that the company should be expelled from the region. Today, approximately two years later, these communities are jointly negotiating with government departments to demarcate an extractive reserve to cover their forest, from which third-party timber harvesters will be excluded.

The case presented in Box 5 exemplifies how information can be disseminated through different channels. It shows how one community recognised information or knowledge gaps in other communities and then acted to transfer its own knowledge to fill gaps. São Pedro residents passed on their understanding about the impact of logging on their forests to communities living in areas where the timber company plans to extend its operations. They warned these communities to take measures to retain control over their forests, to avert environmental problems and explained how collaboration would strengthen their negotiating powers.

The participatory processes of developing C&I brought to notice various other items of knowledge, skills and codes of practice that could be beneficially transferred between communities. The fire management methods described by the Brazilian forest farmers, for instance, could be of educational value in other areas where less effective fire control mechanisms are used.

The Cameroonian village participants mentioned the transferability of skills. They planned to use knowledge and experience gained in administering agricultural group credit, to manage credit for investment in their forest timber management plan. The skill required for directional felling is also applicable to low-impact logging. Applying C&I will identify further possibilities for knowledge transfer within and between communities.

## **7.1 C&I as tools for communicating and learning**

Participatory processes of C&I development bring people together to learn from each other. Collaboration in applying C&I either for research or monitoring extends the possibilities for people to learn new things together. In this way, the process itself is content and goal rich.

The test results suggest that spatial, temporal and conceptual scales are important considerations in assessing sustainability. Locals and outsiders commonly hold different perceptions of scale. These relate to and result in varying knowledge constructions that form culturally defined contexts and offer diverse perspectives on reality. Parallels have been drawn between the dichotomy presented by the extremes of scale and that of the bottom-up and top-down approaches to studying and intervening in rural communities. Botkin (1993: 17) states that the top-down approach 'begins with the characteristics at the largest spatial scale and attempts to explain phenomena at each lower scale from the understanding achieved at the higher level'. By contrast, the bottom-up approach sees the roles and behaviour of individual species and components within a system as a basis for understanding the overall dynamics of the forest ecosystem. These two approaches, when used to study local phenomena may lead to different conclusions because lines of inquiry fail to converge or conclusions of other approach may be faulty. Because of the possibility of diverging conclusions, the learning potentials of these approaches warrant closer examination. In Box 6 we consider some attributes of C&I created by local people using their own knowledge and which may have wider application.

### Box 6. Relationships identified using local knowledge

Local people, because of prolonged contact and interaction with their environment and community, can identify linkages between variables that outsiders are unlikely to notice. These may represent direct cause-and-effect relationships or indirect connections where additional factors play a role in mediating the outcome. The following are some indicators proposed by local people based on their local knowledge of relationships:

- **The age of fallow when brought back into cultivation is an indicator of women's agricultural labour expenditure** (São Pedro, Arapiuns, Brazil). Nutrient-poor soils, such as those commonly associated with short fallows, are reportedly more susceptible to weed infestation. To combat the decline in production, more weeding is needed. Weeding, one of the more labour-intensive tasks, is a female role. On the other hand, male agricultural labour, which includes land clearance, declines with a decrease in fallow length as younger fallow regrowth is easier to clear.
- **Preferential conversion of forest on clay soils for agriculture is a predictive indicator of the local extinction of hornbills** (Bedigong, Sanggau, West Kalimantan). Hornbills, nest in forest tree hollows and need clay to build their nests.
- **Household use of cow dung rather than wood for fuel indicates irregular school attendance of children** (Pasipamire, Chiota Communal Lands, Zimbabwe). Children are kept home from school to collect cow dung (but not for the collection of firewood).
- **Overhunting is indicated by the proportion of preferred species in total game consumed** (São Pedro, Arapiuns, Brazil). As hunting depletes stocks of preferred species, less-preferred species assume greater prominence in the local diet.

The measurement classes of the independent variables that feature in these relationships are generic, meaning they are relevant in different geographic locations and socio-economic contexts. The dependent variables are more locally pertinent. This suggests that the former could be developed as generic indicators, while the dependent variables are more likely to serve as relatively site-specific indicators.

State and pressure indicators frequently encompass independent variables (e.g., soil fertility, fallow length, substitution series, relative poverty). Response indicators reflect the reaction of dependent functions to changes in the independent variables. Additional factors make the behaviour of the dependent variable sit-specific. For example, the impact of fallow period on women's agricultural labour is moderated by the division of labour, a culture-specific and therefore geographically restricted phenomenon. Soil preference in forest conversion can also be classified as a generic indicator of biodiversity. It is the independent variable in the example above. The relevance of the dependent variable, population of hornbills, is restricted to the distribution range of that species.

While variables of significant relationships may not represent a direct cause-and-effect linkage, they can still be surrogate indicators for each other. In Zimbabwe, both 'use of cow dung for fuel' and 'school attendance' are dependent responses affected by the independent variable 'relative poverty'. They are correlated via their common association with relative poverty and may be used as surrogate indicators for each other where appropriate. By focussing on locally understood relationships, indicators can be developed that are helpful in studying the scale of problems and their social and environmental consequences or tradeoffs. These indicators can reveal information highly relevant to the development of well-targeted rural development policies and projects. The site-specific activity, 'use of cow dung for fuel', is a powerful indicator at sites where it presents an alternative to more costly, less pungent smelling fuels.

Local people can easily use their knowledge to create categories of forest product substitutes to verify indicators as in the Brazilian overhunting example. The concept of 'substitution series' is generically applicable for different types of forest products (e.g., game meat, house construction materials, boat building materials). However, the actual substitution series that indicate harvesting pressure will vary from one geographic location to another because of differences in the range of products available. Where the same products occur in substitution series for various locations, there may still be differences in the order or rate at which they replace each other. This, in turn, will depend partly on the relative abundance and vigour of the species under climatic and edaphic conditions at the respective locations. The indicative value of hunting pressure of variables such as 'the average value to capture cost ratio' of adults of different animal species appears to be pan-geographically applicable. However, in the Brazilian test, meat of certain large species is locally known to be 'remoso', i.e., it causes inflammation of wounds and other forms of physical discomfort. This factor reduces power of 'the average value to capture cost ratio' as an indicator of hunting pressure.

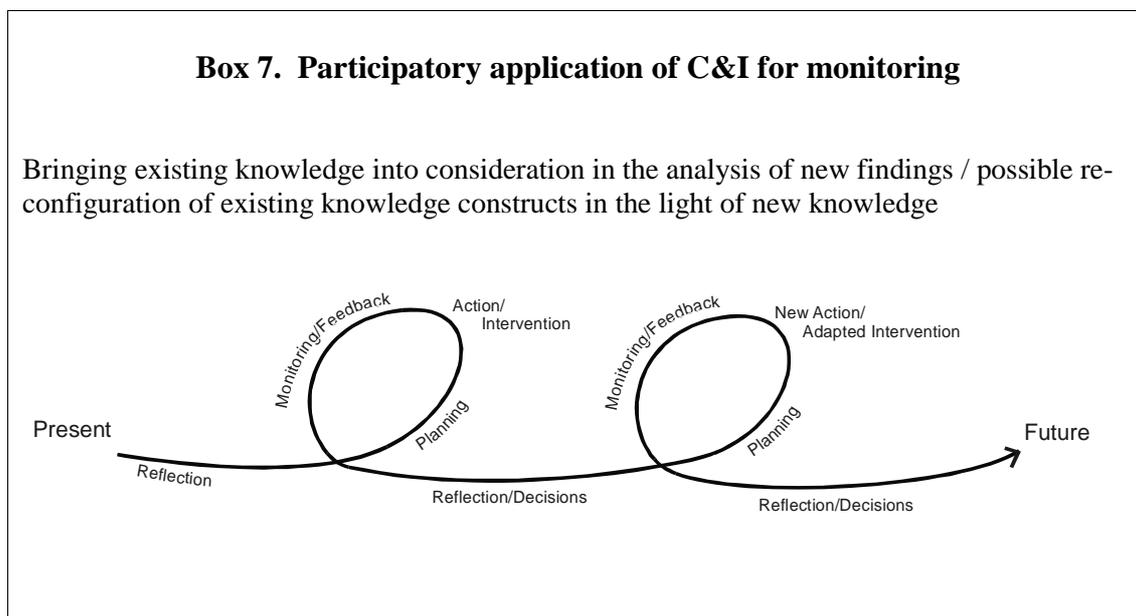
For more examples of relationships recognised by local people that have indicative value see Abbot and Guijt (1998).

## 8. INTRODUCING THE DEVELOPMENT AND USE OF C&I INTO THE EDUCATIONAL / LEARNING CURRICULA

Participatory processes of developing and using C&I, may be incorporated into the educational curriculum to more actively explore the learning opportunities they provide. Two potentially overlapping educational curricula of interest here are the partnership and popular curricula identified by Groombridge (1993) and discussed by Fagan (1996). Although they may be explored within the formal education system, they can also be regarded as curricula for open-ended learning through inter-personal contact and communication in different formal and informal settings.

### 8.1 The popular education curriculum

When people develop and use their own C&I as monitoring tools, they are engaged in a form of action research that corresponds with the popular curriculum approach. No external teaching component is introduced. This form of research instigates learning cycles, such as that diagrammatically represented in Box 7, where reflection on the outcomes of actions or behaviour leads to revised or new decisions. These decisions are then translated into action leading to another outcome which again is assessed and so the cycle is repeated. In the environmental context, this cyclical reflective process allows a constant re-evaluation of cause-and-effect relationships and, in the pursuit of perfection, nurtures an environmental ethic.



The underlying premise of the popular education curriculum is that learning must be founded on local realities if it is to help people enter into sensible and enduring relationships with each other and nature. It focuses on states and change as perceived by local people. Perceptions of factors contributing to circumstance gradually gain depth and breadth as the urge to inquire spontaneously leads to communication within and beyond the community. Thus, consultation, information sharing and joint evaluation takes place, leading inquiries in different directions. With the popular curriculum the pace at which knowledge evolves and at which its transfer takes place is determined by the community.

In most rural communities the popular education curriculum forms an integral part of daily life. The aim of outside intervention should be restricted to facilitating the realisation of the curriculum's full potential. For C&I, facilitation would take the form of explaining some definitions of terms and techniques that could be used to generate and verify indicators. Outside facilitators refrain from suggesting C&I they believe would be most suited for the assessment of local circumstances.

## 8.2 The partnership education curriculum

The partnership education curriculum involves a community, or group within the community, developing a curriculum for environmental monitoring in partnership with an outside organisation. Partnership education can take place either through informal channels (village group meetings) or formal channels (rural schools, teacher training courses). Likely partners to rural communities or groups within them may include non-governmental organisations, teaching establishments, extension workers, individual researchers or interdisciplinary research teams. The partners negotiate the learning content of the curriculum, and in so doing can identify knowledge gaps, contradictions, etc. Processes of testing and developing C&I would present a way of articulating the negotiation process and leading it on to partnership monitoring and research (see Table 3).

**Table 3. Potential roles of C&I in partnership education**

	<b>Manifestation</b>	<b>C&amp;I implications</b>	<b>Education Curriculum</b>
<b>Common knowledge</b>	Same knowledge possessed by all partners.	C&I easily agreed.* C&I can be used by all partners independently or collaboratively.	Platform for monitoring change jointly. May be valuable for knowledge transfer to other communities.
<b>Complementary knowledge</b>	Partners possess different knowledge about the same issue. This can help fill in the picture for all partners.	Partners have to explain their choice of C&I to each other, whereupon they should be mutually acceptable.	Partners all learn from each other as a result of knowledge exchange
<b>Contradictory knowledge</b>	Partners possess conflicting knowledge or ideas on one or more issues	Disagreement on the validity, appropriateness or fairness of C&I. C&I not multilaterally accepted as valid.	Collaborative research to establish the truth and convert this to common knowledge.
<b>Knowledge gaps</b>	One or more partners is unaware of certain information/knowledge – possibly things from a specific, limited perspective.	C&I not recognised by one or more partners/groups, who therefore cannot propose or know how to use them.	Knowledge transfer and collaborative research to fill multilateral knowledge gaps.

\*Regulation of competing interests and tradeoffs would have to be within the bounds of acceptability of all concerned.

With the external partner acting as a mediator, the partnership approach offers more opportunity for information transfer between communities, and between them and policy makers, than does the popular approach. Hence, it seems the most suited for the development and communication of knowledge about to the broader context of local realities and questions of temporal and spatial scale. It can be helpful in widening horizons of local people, thereby providing information that will help them understand the behaviour and intentions of outside forest interest groups.

The partnership curriculum can provide external partners with information to allow them to make effective contributions to rural development. It provides the opportunity to explore with people the local implications of market- or policy-induced macro trends, including population growth, migration trends, regional employment market and pricing policies. Where the effect of slow-acting change is not quickly observable, response may be delayed. In this situation the partnership approach is more likely to recognise and deal with and change expeditiously.

### **8.3 Monitoring the ongoing relevance of C&I**

After C&I have been applied, their ongoing relevance should be monitored. Especially under conditions of rapid change, C&I are likely to need periodic updating to ensure they continue to embrace all factors, including new factors, with a major influence on sustainability.

## **9. PLANNING PARTICIPATORY C&I DEVELOPMENT**

Some ways in which knowledge can be identified and classified to facilitate knowledge transfer and the identification of issues that could be the valuable focus of collaborative research initiatives were reviewed above. Attention will now be given to some preliminary considerations for implementing participatory C&I development and application, such as how to select communities and invite participation. This is followed by a brief description of some ways to stimulate and guide community participation. Some ideas originated in the methodologies tested during the CIFOR tests.

Motivation needs to be sustained throughout the exercise if the community's interest is to extend from developing to applying C&I. As a minimum requirement the purposes and methods of the exercise must be understood by all participants. Some of these suggestions arise from the potential for methodological development highlighted by the CIFOR tests. All suggestions can be applied to either the Popular or the Partnership Educational Curricula.

### **9.1 Selection of communities**

Creative involvement in decision making processes that affect one's life has been regarded as a basic human right. Criteria for selecting communities to develop C&I should not be construed to mean some communities are unsuitable. Careful selection of the initial groups to participate can bring about methodological improvements that will help other communities understand the processes and effectively contribute to the exercises.

Participatory methods should not present challenges likely to result in failure. The difficulty of an activity depends on the community's past experience. Some communities will find it easier than others to understand how C&I can be developed and the purposes for which they can be used. Some have greater facility than others to creatively contribute to methodology development. Community traits likely to influence this ability include:

- a recent history of active involvement in negotiations with NGOs and/or government agencies concerning regional or national policy or law reform;
- involvement in legal battles over land and resource tenure, including interactive participation in legal processes to create extractive or production reserves; and
- involvement in planning and managing community or intercommunity-based projects, e.g., cooperatives, credit schemes and health, educational or environmental projects.

Communities to which one or more of the above traits apply are more likely to:

- have made previous conscious efforts to articulate their understanding of the cause and effect relationships governing their biophysical and social environments;
- communicate confidently with outsiders;
- want to participate in defining their own role in the process of C&I development rather than merely having this prescribed to them; and
- adjust their activities to participate in the exercise because they appreciate its value.

The above traits mainly apply to communities within relatively easy access of urban centres. Additional features often set these communities apart from more isolated ones. They tend to be larger, have a greater percentage of speakers of the national language and have more trade links with urban areas. Often more knowledgeable about regional factors, their educational and health facilities and infrastructure tend to be better. Literacy rates are usually higher, access to investment capital better and opportunities for alternative livelihoods more abundant. However, their natural resource base tends to be more severely overexploited caused by population pressure and/or a greater market demand for local forest products.

By focusing on communities either involved or due to become involved in forestry or natural resource management projects in collaboration with a rural workers' organisations, NGO or government agency, C&I used for back-casting can be developed specifically to monitor the project's progress.

More remote communities have less contact with outsiders but are nonetheless often substantially influenced by regional policies. This influence is usually more coincidental than planned. Their peripheral participation in markets with urban epicentres tends to undermine their bargaining power. This is one problem that participation in C&I development could solve. Involvement can help people identify and avoid some of the social and environmental problems suffered by less isolated communities in consequence of their greater monetary integration, or as the case may be, failure at attempted greater integration. Knowledge exchange between forest communities at different development stages, and between them and outsiders, can result in new knowledge being acquired by all involved. This may be newly discovered or introduced information. Alternatively, it can be the result of recombining the elements of existing knowledge in novel ways. In either case new possibilities for overcoming constraints emerge. It then becomes possible to create C&I to monitor the effectiveness of new approaches. Initially, however, several communication barriers may need to be overcome as residents of remote communities may be:

- especially daunted by the alien idea of developing C&I; and/or
- unable to speak the national language

Of paramount importance is that a relationship of trust is established between outside participants and the community. This will determine the effort expended by participants in trying to make themselves understood and to understand each other.

## 9.2 Approaching the community

Communities may be difficult to convince that there are no hidden motives attached to external interest in their participation in developing C&I. Such suspicions can be alleviated by collaborating with an organisation that the community trusts. Where this is possible, the normal procedure would be for that organisation to introduce the proposal to the community.

Initial impressions are important bases for future collaboration. A community should be approached to participate in developing C&I with a proposal that clearly explains:

- the objectives – a general synopsis of what is to be done, how and why;
- why the community's participation is being sought;
- how community members may participate including some suggestions – flexibility should be stressed so that people see there is opportunity for adapting proposed processes to match their interests and capabilities;
- the roles of non-community members;
- what the community can expect to gain in return for its input of information, time and energy – any unwarranted expectations of the community should be dispelled; and
- how and in what way the results of the exercise will be used.

Preferably the proposal will be in written form. This would help ensure expectations of participants are clearly understood and respected. In most cases, the proposal should be handed to a respected community leader who will be asked to call a general community meeting to present the proposal. A resource person familiar with the proposal should attend the meeting to provide extra information if required. Community members should be encouraged at this meeting to express their reservations about the proposal. There may be scope for adaptation although as the initial proposal will have been fairly open ended, adaptations will mainly be of logistical nature. The community should be given some time (usually a few weeks) to decide whether to accept the proposal.

## 10. ENGENDERING A BROAD PARTICIPATORY BASE

Not all community members will participate. Some may be committed to other responsibilities. Cultural constraints sometimes make it difficult to reach particular segments of the community. Others will lack motivation because they fail to understand the objectives and processes of the exercise. There will also be people who will simply find the idea uninteresting or think it does not relate to their priorities.

There are good reasons for involving a broad cross-section of the community, beyond the obvious ones that all those who participate can contribute knowledge to, and learn from the experience. A broad participatory base, apart from abiding with democratic principles, expands methodological options available and offers more scope for cross checking information. Interviewers can triangulate by asking different groups about the impact of others on their interests and then comparing the respective responses for consistency. Not only does the involvement of children and the elderly increase the chances of capturing variables of special importance to these groups, it expands the period over which developments can be traced. Oral testimonies of the elderly may not be reliable. Changes in forms of social organisation and value systems can be studied in collaboration with elders and young people.

Widespread participation also increases the options for group activities. Sessions held with large groups sometimes are advantageous as people are less likely to lie in the presence of people that know the truth of what their statements. On the negative side, it is most unlikely that anyone will admit to partaking in activities prohibited by the community or that are illegal.

### **10.1 Identifying intracommunity stakeholder groups**

During the development stage, the scope of assessment procedures is laid out, including the grounds for subsequent collaboration in C&I applications. Some participatory research methods limit the depth of individual contributions. Therefore careful screening of methods is important at the outset since interest groups and issues overlooked during initial assessments may be later manifested as gaps in data collected. To deduce their significance from other data obtained may be costly or not possible. Some consequences of delaying knowledge/data collection include the promotion of or failure to amend or discontinue inappropriate activities, projects or policies.

The issue of community participation needs to be resolved. If the community participates as a single entity, measures are necessary to ensure all interest groups, with their different perspectives, are adequately represented. This fact adds to their uniqueness. Individuals and groups enter various social relationships and interact with the environment in different ways for different reasons. Lifestyles and life histories may contrast, reflecting variations in upbringing, access to resources and capacity to choose and influence their fate. Correspondingly, unique values, priorities and objectives influence decisions in different ways. In order to maintain harmony, their diverse and sometimes competing interests must not conflict. It therefore makes sense to maximise complementarity between interests under constraints such as environmental carrying capacity.

A prerequisite to understanding the potential for harmony is the identification of existing stakeholder groups and how their respective interests and associated knowledge sets interrelate. Changes in stakeholder relationships is a major issue in the social domain of forest resource management. The processes and outcomes of both participatory C&I development and applications can theoretically influence stakeholder relationships and interactions. Because of their individual values and objectives, and therefore interpretations of success, each interest group will propose different C&I (Abbot and Guijt 1998). Consequently the objectives to which the C&I are to relate will need to be negotiated collaboratively. In stimulating knowledge exchange, C&I development processes offer opportunities for co-learning and discovering new possibilities to better integrate diverse interests. Participants are thus able to engage in the creation of 'common mental maps'.

Identifying stakeholders is rarely straightforward as a population can be divided along many lines, with a number of inter-group relationships. Most people fall into several stakeholder categories. The way a community is divided can strongly influence the effectiveness of the C&I developed in capturing factors underlying conflicts. Interest groups who are not part of the participatory processes (for whatever reasons) risk being adversely affected as a result. These groups and groups whose participation is superficial (i.e., restricted to providing information and opinions), should be noted along with observations about the significance of their full or partial exclusion.

Indicators for monitoring should include some designed to assess the collaborative monitoring processes used. These would identify who participates in monitoring, to what degree, and how the knowledge gained is shared, applied and disseminated. Information on these variables is needed to understand the success of participants at integrating their respective objectives and priorities, and subordinating them to larger, commonly held end-goals such as sustainability and equity. It assists understanding of how participation influences ecological processes and the

dependence of different community groups on the forest. They could raise awareness of how the changes in knowledge content and distribution relate to changes in authority and its distribution.

## 10.2 Directing inquiries

Detecting sustainability requires observation or monitoring over a period of time. It can vary from being causal and informal to highly scientific and formal. Both formal and informal forms of observation can range from superficial to in-depth. The field of observation, its detail and scope, partly determines the extent to which change is linked into an integrated, evolutionary learning process that expands the margin of choice in adaptation.

Indicators can be derived from key variables or composites of variables that have either been responsible for change or have been strongly affected by it. A good starting point is to ask people what changes have taken place in their environments, causes of these changes and their environmental, social and economic consequences. Questions to direct and expand these inquiries could include: Why did people alter certain behaviour or activities? How was a particular piece of knowledge discovered? What activities have been tried and why did these succeed or fail? From this stage, distinctions can be drawn and classified by interest group, between changes whose causes and effects are understood and those that are not. Topics and themes that could benefit from knowledge exchange or collaborative research can thus be identified.

The significance of sustainability will be fully realised in the in the future. C&I could also therefore be developed from factors or composites of factors that are strong determinants of the future. These include states, processes and inputs whose relationships are sufficiently well understood to make rough predictions of future interactions between factors and their outcome possible. Another approach therefore is to ask people to consider what the future holds for them, whether things will improve or deteriorate and for what reasons. If a change in living standards or in the resource capacity is expected, how large is the envisaged deviation from present conditions? Other questions that could lead to variables about ongoing or future significance are: If you could change the future, what would you change, why, how and with what? What is causing the disintegration of best practice? What can be done to prevent/solve major problems? What is needed for success? How can these needs be met?

Some people find it difficult to explain themselves to outsiders. They may be shy or simply unaccustomed to putting into words certain knowledge they use daily. Commonly, people fail to mention issues they feel are obvious and unremarkable, not realising that outsiders may not share their fundamental knowledge. These considerations need to be kept in mind during discussions with local people.

## 10.3 Communication

### *Language*

C&I must be worded simply for easy understanding. Academic jargon should be avoided and local terms should replace scientific language. A glossary of local terms should be produced for the benefit of academics, policy makers and other stakeholders, if needed. The wording of C&I should be precise enough to prevent varied interpretations. Some words mean different things to different people, e.g., the words 'laws' and 'rules'. The usual connotation of the word 'law' is that of the national legal or judicial system. By comparison, the meaning of the word 'rules' tends to be more comprehensive. It can include formal laws and by-laws, as well as informally

endorsed procedures, such as ‘rules of thumb’. The wording of the criterion or indicator must clarify the intended meaning of such words. These conditions are necessary if C&I are to constitute a common language understood by all groups likely to be affected by decisions arising from C&I guided monitoring. A common language or vocabulary is required where meaningful collaboration in the analysis of C&I application results is intended.

#### *Points of reference, prioritisation and yardsticks*

Points of reference are issues or values that serve as entry points to domains of interrelated and interdependent variables. They may be local priorities. Alternatively, they may be measurement gradients or continua that offer possibilities for comparative evaluation. From these, inquiries can branch out into related issues and in different directions. They help to develop and organise C&I around sets of core issues or questions. Spheres of factors associated with specified issues, expand to eventually overlap at different points.

By approaching issues from different perspectives, points of reference change and draw out variations in meaning or significance. Points of reference should be selected that are familiar to the community; i.e., that conform with their perspective on life. We propose that community definitions of ‘best practice’ can constitute good points of reference to start.

‘Best practice’ is the current state-of-the-art knowledge that has evolved with experience and experimentation. How people would, if they can, manage forest resources to minimise risk and maintain or rehabilitate carrying capacity, in their view, constitutes ‘best practice’. Inevitably it relates to the specific perception of reality, priorities and objectives of the person who conceived the ‘best practice’. It is context defined and limited to available knowledge. Although many forms of best practice may have certain premises in common, including concordance with scientific theory, there may be pronounced differences in their social and ecological impacts that can be traced to their subordination to different objectives. Local notions of best practice are apt to change and evolve in concert with other currents of local change. They can also evolve with the application of new information that increases forest resource use options. All these facets of best practice make it an interesting point of reference around which to develop C&I. The process of development and the results of C&I-guided monitoring processes are themselves capable of changing or adapting local notions of best practice.

In relation to a specific best practice, questions that identify variables around which C&I can be developed are:

- What are the technical ingredients of the best practice?
- What objectives is it designed to fulfil?
- Who participates in its application? What do they gain as a result?
- Which aspects are the most crucial for risk minimisation?
- What disruptive factors are operating?
- What impediments exist to control these disruptive factors?
- What are the signs of deterioration/improvement attributable to changes in best practice?

Simple, descriptive C&I can sometimes generate a great deal of useful baseline information. It is important that the information captured reveals the suitability of resources for different types of uses and use intensities. Matching land and forest use with resource capabilities is central to achieving sustainability. Specific lines of inquiry into best practice can establish how it is adapted to match different resource conditions. Potentially, this will yield information useful to developing C&I as well as standards by which to judge assessment results.

## 11. PARTICIPATORY METHODS FOR DEVELOPING AND/OR APPLYING C&I OF FOREST MANAGEMENT

Previous CIFOR research on C&I included testing methods with different levels of participation to elicit local knowledge critical for evaluating social C&I of commercially managed timber concessions (Colfer *et al.* 1999). Here the primary concern is with methods and activities that can generate C&I involving a broad participatory base. Brief descriptions follow of some research activities that can involve a broad cross-section of the community in developing C&I, and in which outsider participation can be either restricted to facilitating or be of a more interactive nature. Some of these activities' applications can be extended to collaboration in using C&I for monitoring.

Some basic materials can improve the effectiveness of all these activities or help with documentation and storage of results. Ingenious use of visual aids can assist explanations to local people as well as help them articulate their ideas. Large sheets of thick paper and coloured markers can be used by community members in many ways: to draw maps of residential areas and lands; or make visual representations to illustrate or emphasise points. This can sometimes help clarify ideas. Matrices, charts and graphs, that the community is able to keep, can be produced with these basic materials.

### 11.1 Matrix ranking

Various participatory rural appraisal techniques can be used to identify major issues of local relevance for defining criteria. Matrix ranking is highly effective in identifying major issues and dividing them into categories at the beginning of fieldwork. Once identified and ranked, the issues can be disaggregated into their contributory factors and variables for which indicators and verifiers can be created.

Communities can develop matrices to rank types of activities or variables in order of importance, abundance or some other criteria. For instance, matrices can be used to rank:

- economic activities in order of the severity of their environmental impact;
- habitats in terms of human intervention pressure;
- factors leading to an increase in harvesting pressure;
- relative dependence of different groups on various forest products or services;
- problems in order of severity or nature and/or groups of people afflicted;
- forest products in order of importance or abundance; and
- labour contributions to a particular production or extraction activity (agriculture, fishing) made by different groups (children, women, men).

The basic information obtained with this method can provide some yardsticks against which the relative dependence on forests for products and services may be assessed for different groups. It can help place the cost-benefit distribution patterns of forest management into perspective.

Using a matrix preference ranking method, villagers on the Cameroonian test identified seven sectors in their rural economy which they ranked in the following order of importance: agriculture, hunting, livestock, fishing, non-timber forest product (NTFP) collection, petty trading and timber production.

Of potential usefulness to future tests for the development of C&I for CMF would be a hierarchy of PRA techniques, to first establish major local and external concerns and then as

springboards to direct inquiries. Such a hierarchy would resemble a 'nesting' of PRA techniques. A purposeful sequencing of selected techniques will facilitate information gathering on key questions. If possible, the techniques should be adapted to incorporate bridging mechanisms for transforming information generated into C&I. Integrating the information-seeking and information-conversion-into-C&I steps may help local people understand processes of C&I development. It can help create and pass on awareness of the different reasons why certain information is of interest to different groups. Furthermore, it will turn PRA techniques into tools for communities to either formulate their own C&I or, to apply C&I to monitor their performance as resource managers. Testing modifications to PRA methods with this aim in mind is recommended.

Any PRA exercise to be undertaken needs to be carefully explained so that the mechanics of the exercise do not distract from perception of the patterns revealed by the results.

## 11.2 Co-investigation

Co-investigation is an integral part of all methods described below. It can also be treated as a 'stand-alone' exercise. One natural venue for its introduction is in rural schools, where pairs or groups children of different ages can be guided to undertake projects on selected topics of environmental or social significance. These they can develop and investigate/execute the issues together, then present the results of their projects to other groups to elicit feedback.

### *Problem mapping*

Problem mapping whereby people select a particular problem (perhaps through matrix ranking) and then proceed to list all its causative factors and consequences, is a co-investigation exercise. The problem attributes can be ranked in order of importance. Indicators and verifiers can then be developed for monitoring the more important attributes and how they are affected by different activities.

## 11.3 Photo deconstruction

The scenes shown in photographs taken by local people can be deconstructed into elements. The significance of each element to the scene can be considered first separately and then in different combinations to examine interactions and relationships between represented variables. This activity can generate a lot of baseline and historical information which should be recorded.

If carried out by groups of people with different backgrounds, selected issues exposed by the deconstruction can become the focus for collaborative monitoring and planning initiatives. Photos bypass restrictions imposed by illiteracy. The photograph can be taken to various places, e.g., the school classroom, a friend's house, a meeting of the village council, the front page of a community newsletter, where different groups can further examine its subject matter.

For the potential of photo-deconstruction to be fully realised, a partner organisation usually has to be involved. Commonly, this organisation will have sufficient contact with the community to assume responsibility for:

- provision of a camera;
- instruction in the use of the camera;
- purchase of film and cost of developing prints; and
- provision of storage facilities for film and prints, either by or for the community.

## 11.4 Stories

Story telling is an effective way to gain peoples' attention. Sharing the enjoyment of a story told well can strengthen friendship and trust. Story tellers and listeners can examine story content together with the view of distilling any moral messages or lessons the story is meant to convey. Another option is to review a range of stories to examine the faint line between true-life stories and myths.

The close scrutiny of story content can lead to examination of local application of the moral and practical lessons expressed, and to identification of the factors that illustrate application. These can then be transformed into indicators. If the signs are that these lessons are not being taken as seriously as in the past, then the reasons for this change can be reviewed and become the subject of indicators.

## 11.5 Photo journalism and newsletter reporting

Photo journalism combines the activities of photo deconstruction and true-life story telling. The production of a community newsletter provides a channel for recording events and the follow-up of their developments. It is an ideal media to pass on results of monitoring. Significant resource-monitoring projects can provide a stimulus for keeping newsletters in production.

Photo journalism and videotaping special news reports or documentaries on local circumstances are activities that easily capture the imagination of adolescents and young adults. These activities can be linked to C&I – the topics covered can be deconstructed into cause and effect variables for which C&I can be developed to periodically reassess the circumstances and report on the findings. Photo journalism and the use of video, like photo deconstruction, have the obvious advantage of being more accessible to illiterate people than newsletters. As well as communicating information, they provide a form of information storage.

## 11.6 Drawing maps

The issue of participatory mapping was the subject of C&I developed on the Indonesian and Brazilian C&I for CMF tests. The approach is frequently applied to determine the territorial extent of customary tenure for its inclusion on official maps. Participatory mapping is a technique that has been successfully used to assist the resolution of internal territorial conflicts (IMAFLORA 1996; Stockdale and Ambrose 1996).

## 11.7 Remote sensing image interpretation

Aerial and satellite images can be examined and, if images for different years are available, the history of land and forest use traced in this way. Features on the images can be selected for ground checking. Particularly interesting to compare images for different years to identify major changes and explain the contributing factors. Where undesirable changes are evident, the possibilities for reversal, or for a new and more constructive way of responding, can be considered. This can be used as a platform for futuring and developing C&I with which to undertake back-casting (these terms are defined below).

Features on the images can be ground proofed and linked to photographs taken at the sites. C&I deemed appropriate for the assessment of the state and sustainability of characteristics encountered at the sites can be annexed to the photographs. Depending on the frequency with

which remotely sensed images are taken, the exercise can be repeated periodically to measure and document change.

## 11.8 Futuring and back-casting

### *Futuring*

Futuring is the process whereby people, usually in a group, select an activity they would like to improve or a problem they wish to resolve. Focusing on this problem or activity, they develop a range of alternative courses of action, also known as 'scenarios', to achieve their objective. For each alternative course they will devise a plan that includes provisions for acquiring any of the resources and materials identified as essential to implementing the plan. They then compare the pros and cons of the various courses, by considering practical factors, returns to inputs, the distribution of responsibilities, time needed for results to materialise and other variables. Finally, a consensus is reached as to which course of action is the most attractive. This becomes the course to be adopted.

### *Back-casting*

The adopted course is put into action according to the plan devised. C&I are developed at the outset specifically to monitor progress or obstacles to the implementation of the different components. After events have taken place these C&I are used to evaluate their success or outcome; whether this meets with expectations and if not, why. This retrospective evaluation process is known as back-casting. The frequency of back casting evaluations would depend on the temporal nature of the phenomena or variables being assessed. The plan is adapted in the light of information revealed by the monitoring with the back-casting process. Thus, the influence of any faulty assumptions or expectations underlying the original plan is gradually eradicated and new provisions are incorporated for unforeseen circumstances or developments. Simultaneously, C&I are adapted or new ones developed, also by way of futuring, to monitor the appropriateness of the changes made to the original plan. We recommend that the indicators used have the power to reveal linkages and relationships between different aspects of the activity or problem being monitored.

To date few community managed forest systems have been formalised to the point of having written management plans that outline operations and schedule activities according to target dates. However, where a written management plan exists, back-casting with C&I can be used to assess the plan's effectiveness and identify weak areas that need to be amended.

Projects are becoming increasingly common where communities develop written management plans in collaboration with NGOs and sometimes with some State assistance. Most of these initiatives are only beginning to be put into practice, and so it was not possible to field test the proposed C&I on the basis of performance and impact of these projects

However, as an alternative for the future, community participatory exercises could be instigated as a complement to formal management plans that are about to be launched into action. The assessment technique perhaps most appropriate would be that of 'Back-casting'. C&I are formulated of variables whose measurement at repeated intervals allows the forest managers to register whether all important operational and organisational aspects are going to plan, and performing according to expectation. Weaknesses in the system, obstacles and unforeseen complications or, on the more positive side, opportunities can thus be identified and accommodated by making planning adjustments.

## 12. CONCLUSIONS

Participatory processes of developing and using C&I can engender joint exploration of forest stakeholders' contrasting and sometimes contradictory perceptions of the changing social, economic, technical and ecological dimensions of local realities. Normally one or more participants will learn something as a result, either through knowledge transfer or through their complementary participation in the development of knowledge (co-learning). This became apparent during C&I field testing on the CIFOR-coordinated C&I for Community Managed Forests tests in Cameroon, Kalimantan and Brazil. On these tests participation was identified as a variable significant to the sustainability and social equity impact of community managed forests. Correspondingly, the tests generated a considerable number of C&I that address, either directly or indirectly, participation in various forest management activities and associated decision making. Participation in developing C&I as communication, learning and development tools, helps satisfy needs implied by several of the C&I proposed on the tests. Knowledge and education were also prominent themes identified as significant and around which C&I were developed. A broad participation base to development and application on these themes can also help achieve positive ratings for some of the indicators proposed.

In particular, the tests drew attention to how knowledge and knowledge deficits can be classified along some simple, rudimentary lines. Dialogue between stakeholder groups in the process of developing C&I reveals their knowledge differences (contradictory or complementary knowledge, or unilateral knowledge gaps) and commonalities (common knowledge or multilateral knowledge gaps). From these differences, issues can be identified that could benefit from collaborative research and knowledge development and dissemination pathways. C&I can be developed for monitoring 1) the behaviour of variables under changing circumstances, and 2) the collaborative processes used to assess and monitor these things. Information produced by the monitoring of collaboration in C&I development, application and use of results can be used to adapt the objectives, direction and methods of collaborative research to keep these relevant and appropriate.

Participating in C&I development implies sharing information and comparing different viewpoints, values and priorities. This nurtures appreciation of tradeoffs between participants' competing or conflicting objectives, and it is an important step towards negotiating fair tradeoffs. Decisions taken without complete awareness of the knowledge, capabilities and interests of certain stakeholder groups can inadvertently reinforce inequitable power balances and conceal the need for more research.

Access to the right sort of education is important to raise people's awareness of the interests of diverse groups. We have described two educational curricula, the popular and the partnership models into which we feel participatory processes of developing and using C&I can be fruitfully introduced as co-learning techniques. Both curricula advocate participatory action research. Since many rural areas are undergoing rapid change and coming increasingly under the influence of regional and national policies and economic forces, the partnership curricula presents more opportunities for knowledge exchange across community borders. Partners can aim to achieve compatibility between C&I developed to monitor conditions locally according to locally agreed objectives, and C&I developed to monitor regional policy and economic impacts. Thus, it offers wider scope for addressing community cultural and economic integration and community participation in policy reform. How to realise the potential of the partnership curriculum is a question forest communities can explore together with one or more partner organisations. The partner organisations can be rural development, non-governmental organisations (including grassroots groups), government natural resource and education departments, and universities.

Additionally, the results of the CIFOR C&I tests clarify practical and methodological aspects of participation in C&I development, identifying opportunities for methodological improvement and variety. Several participatory methods exist that can easily be adapted for C&I development and use. An important factor for consideration is the extent to which methodological design will influence the participatory base and catalyse communication between diverse groups from within and outside the community. The methods vary in this respect. Extra measures to bring people to interactively participate will often be required.

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