Introducing criteria and indicators for monitoring and auditing forest management in the Brazilian Amazon

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Abstract

The improvement of internal and external control mechanisms for timber enterprise activities contribute essentially to the effective implementation of good forest management practices Under the principle that sustainability is a key value for good forest management, criteria and indicators (C&I) are ideal tools to assess sustainability through the development of simple and viable monitoring and auditing systems. The development of C&I was identified as one of the essential components of a research and demonstration project in the Brazilian Amazon under the leadership of Embrapa Eastern Amazon and CIFOR. Four steps were envisaged: (1) Definition of a preliminary list of regionally adapted C&I during an international expert workshop; (2) Evaluation and refinement of this list by four key stakeholder groups (researchers, government officials, managers, and local actors); (3) Development of monitoring and auditing prototypes (including management recommendations) based on the assessment results, and (4) Validation of the defined instruments through supervised application in different forest enterprises and auditing entities. As part of this process, a field-test of a preliminary list of C&I by stakeholder groups confirmed the high practicability of C&I based control activities as well as the need and potential of participatory methods in the development process. Further analysis confirmed that practical work on C&I systems will have to focus more at the verifiers level. Social and ecological Verifiers need to be more specific and practicable methods for their assessing will have to be developed. To ensure an effective interpretation of monitoring and auditing results it is recommended to structure the C&I in four categories: existence and quality of documentation, efficient implementation of plans, impact of enterprise activities, and external conditions for sustainability

Keywords: *Criteria and Indicators, sustainability, tropical forest management, monitoring, auditing*

Introdução de critérios e indicadores para o monitoramento e a auditoria do manejo florestal na Amazônia brasileira

Resumo

O desenvolvimento de mecanismos de controle internos e externos das atividades das indústrias madeireiras contribuem essencialmente para a implementação efetiva de práticas de bom manejo. Sob o princípio de que a sustentabilidade é a chave mestre para um bom manejo florestal, os critérios e indicadores (C&I) constituem uma ferramenta ideal para avaliar a sustentabilidade através do desenvolvimento de sistemas simples e viáveis de monitoramento e auditoria. O desenvolvimento de C&I para uso em monitoramento e para auditoria foi um dos focos principais de uma pesquisa de um projeto demonstrativo na Amazônia Brasileira coordenado pela EMBRAPA Amazônia Oriental e pelo CIFOR. Quatro pontos foram reportados: (1) Definição de uma lista preliminar de C&I adaptados regionalmente em uma oficina internacional com peritos na área de manejo florestal; (2) Avaliação e refinamento desta lista por quatro grupos interdisciplinares (pesquisadores, agentes governamentais, grupo operacional e atores locais); (3) Desenvolvimento de protótipos de monitoramento e auditoria (incluindo recomendações de manejo) baseado na avaliação dos resultados, e (4) Validação dos instrumentos definidos através da aplicação supervisionada em diferentes empresas florestais e entidades de auditoria. Como parte deste processo, o teste de campo de um conjunto preliminar de C&I realizado pelos diferentes grupos de atores, confirmou a maior praticidade de C&I baseado no controle de atividades, assim como o potencial e a necessidade de métodos participativos no desenvolvimento do processo. Além disso, as análises confirmam que os trabalhos prático com sistemas de C&I terão que focalizar mais a níveis de verificadores. Os verificadores sociais e ecológicos precisam ser mais específicos e terão que ser desenvolvidos métodos mais práticos para sua avaliação. Para assegurar uma interpretação efetiva dos resultados do monitoramento e auditoria recomenda-se estruturar os C&I em quatro categorias: existência e qualidade da documentação, implementação eficiente dos planos, impactos das atividades empresariais e condições externas para a sustentabilidade.

Palavras-Chaves: *Critérios e indicadores, sustentabilidade, manejo florestal, monitoramento, auditoria*

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Introduction

Despite growing international recognition of the economic, ecological and socio-cultural functions of tropical forests and their importance for regional development and global ecological cycles (UNCED 1992), the process of degradation and destruction of these valuable resources continues (e.g. FAO 1997). In the Brazilian Amazon, there are several reasons for this situation. Among the most important are the abundance of relatively cheap timber from unsustainable sources - i.e. through the conversion of forests to other uses, the value under estimation of non-timber forest resources to local livelihoods, and the weak capacity, infrastructure and institutions to manage forest resources sustainably (Embrapa 1996). Spurred by expectations of higher earnings through access to timber markets for certified timber, the strengthening of local institutions responsible for forest management and an emerging recognition in the Brazilian civil society of the importance of maintaining the Amazon forests, there has been a marked interest in improving systems of forest management.

In this paper we focus solely on the production of timber, recognizing that this is in itself too narrow a focus to assure a change in the prevailing management paradigms. However, our timber focus might be sufficient to illustrate the principal problem we seek to address: a significant portion of the failure of forest management can be ascribed to lacking or deficient internal and external control of forest management, i.e. in this case timber enterprise activities. System theory teaches us that a system without feedback is out of control – this perhaps is an appropriate and telling characterization of much of timber production in the Amazon. The development of simple and viable monitoring and auditing instruments could help mitigate this problem. The potential success of certification schemes based on criteria and indicators (C&I) for catalyzing the sustainability of forest management through third party inspection (or control) indicates the fundamentally important role C&I could play in this regard. They are potentially the information building blocks for the development of a viable monitoring and auditing framework.

The paper will discuss the possible contribution of monitoring and auditing instruments towards facilitating "good" forest management and examine the extent to which C&I might form the basis of such instruments. We then present a strategy for the development of monitoring and auditing instruments based on C&I for a joint project in the Brazilian Amazon, and highlight the first experiences in this attempt.

Why C&I for monitoring and auditing forest management?

Need for monitoring and auditing

As pointed out above, monitoring is a key management tool. It is part of the enterprise control process (˙ 1). Monitoring gives feedback on how far the enterprise objectives were reached, helps to detect problems and dangers and can be used to identify underutilized production potential. In this sense monitoring produces essential management information and is fundamental for flexibility and efficiency of enterprise activities.

The lack of monitoring in Amazon timber enterprises is one of the main reasons for the economic naivete of many timber enterprises and the ignorance of environmental and social problems caused by conventional timber exploitation (Embrapa 1996, Scholz 1999). A monitoring system is necessary not only for a more efficient management, but also to develop an awareness of what affects production and its impacts. The lack of planning and control could result t in serious economic problems.
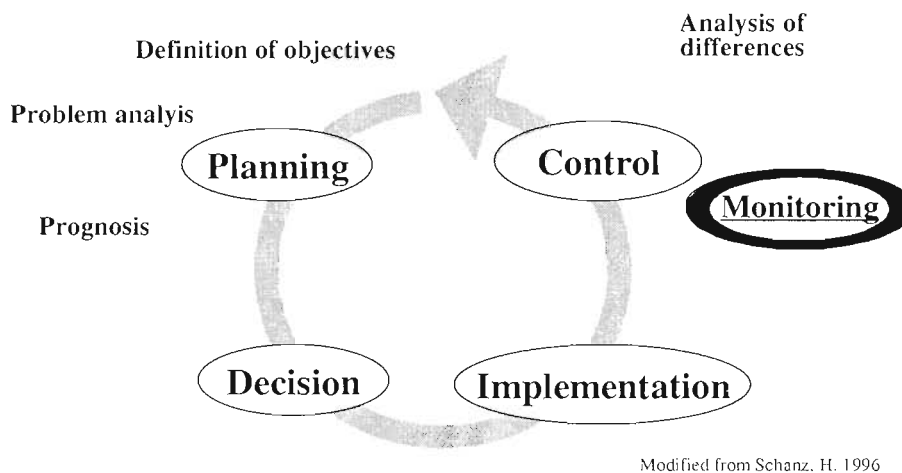
Figure 1. Position of monitoring in the management process

The expression "auditing" is used here to refer to activities carried out by government institutions to control the fulfillment by timber enterprises of legal regulations concerning forest management. Auditing instruments could play an important role in supporting private initiatives for implementing good forest management. On the basis of the auditing results, government institutions could decide on the need to either sanction bad practices of the timber enterprise or to provide incentives for good performance. This way the eventual competitive advantages caused by illegal forest management practices could be counter-balanced. In Brazil, the current auditing of forest management projects is not comprehensive. For example, a study on forest activities by timber enterprises in Paragominas, Eastern Amazon, revealed that none of the surveyed forest management projects was following the prescriptions set in the regulations (Embrapa 1996). Beyond insufficient in staff, restricted financial resources, and lack of clarity in competence, the weaknesses in the current auditing practice result mainly from the fact, that the existing auditing practice is restricted to the revision of documents (forest management plans, annual harvesting plans, production reports, etc.) in the office, and the measurement in the field of a few parameters such as tree diameters in permanent sample plots and quality of forest roads (IBAMA 1999).

Sustainability as a key value for monitoring and auditing

As part of internal and external control processes, monitoring and auditing have to be based on clearly defined objectives. This is important for the definition of relevant information and to ensure efficiency and quality of monitoring and auditing, specifically thinking of the restricted financial resources of private enterprises and government institutions. We assume that sustainability is such a guiding key objective. Sustainability is defined as the capacity to produce permanently and economically forest products and services for the present and all future generations (Speidel 1984). The concept of sustainability embodies economic/financial, ecological, political, social and cultural aspects (Schanz 1996). If only one of these areas of concern shows negative indications, sustainability as a whole is endangered.

Fundamental for setting sustainability as a key attribute for monitoring and auditing, is its acceptance by timber enterprises and government institutions. As sustainable forest management, because of its positive indirect environmental and socioeconomic effects, yield higher benefits to society than conventional exploitation with focus on short term income (Pearce 1999), it is directly understandable that sustainability is acceptable for auditing purposes based on public interests. For private enterprises,

the acceptance of sustainability as key objective is not that much clear. There is no doubt that enterprises exploiting cheap forest resources by conventional logging and illegally saving taxes and social costs have a competitive financial short-term advantage against those enterprises following the demands of sustainability. But even for the former kind of enterprises there are two important reasons to accept sustainability as an overall objective:

- *Increasing external pressure* - The awareness on the negative impacts of unsustainable forest use becomes more and more public. Not only are the environmental movements and NGOs imposing more pressure on the decision-makers in public and private sectors to reduce the negative ecological and social impacts of logging activities. For government organizations and for a wide portion of the population, the ecological and social-cultural issues are increasingly more relevant. This tendency is already being captured in a number of national laws and regulations. On the global level initiatives related to carbon trade and the boycott movement of tropical timber in some European countries indicate that tendency too.

- *Financial advantages* - Sustainable forest management could improve also the financial results of enterprises. As recent studies in the region have demonstrated (Barreto et al. 1998, TFF 2000) the application of *Reduced Impact Harvesting* (RIH) could be economically more attractive than conventional logging. Besides this it is very likely that enterprises working towards sustainability will in the future receive direct or indirect financing of their operations via state initiatives. Finally, the orientation of timber production towards sustainability will improve the chances for certification, which could result in commercial advantages by improving marketing conditions.

Potential of C&I for monitoring and auditing

Since the Rio Conference in 1992 efforts to develop instruments for supporting sustainable forest management have intensified. From the offset criteria and indicators to assess sustainability of forest management (C&I) were in the focus of research. Prabhu *et al.* (1998) characterized C&I as tools designed to deliver transparent and cost-effective information required to facilitate sustainable forest management. They have suggested that C&I represent a form of communication network with the special utility to facilitate cognition of the state of sustainability in the forest-human systems in question. In the context of this paper we use the term C&I to denote a hierarchy of linked concepts of principles, criteria, indicators and verifiers (see Box 1).

The development of indicators received an enormous boost following the *United Nations Conference on Environment and Development* (UNCED) in 1992. It was with the development of the *International Tropical Timber Organization* (ITTO) C&I that the current wave of indicator development for tropical forest management began (ITTO 1992). Prabhu and Tan (1996), Granholm *et al.* (1996), and Grayson and Maynard (1997) provide an overview of the various initiatives or processes. There is an extensive literature on environmental indicators (Bakkes *et al.*, 1994, McKenzie *et al.* 1992) and sustainable development indicators (SCOPE 1995, WRI 1995, OECD 1993), which will not be reviewed here. We will also not review alternative approaches to assessing the state of natural systems, such as the *AMOEBA* approach (Brink *et al.* 1991), the *Barometer* approach (Prescott-Allen 1995), corporate environmental performance reporting (Ditz and Ranganathan 1996, Cook and Stevens 1992), etc.

In this very dynamic process it became clear that C&I enable the discussion about the complex concepts related to sustainability and create a common understanding necessary for the definition of acceptable objectives of action. Through the evaluation of a higher number of clearly defined single characteristics of sustainability it was possible to evaluate sustainability itself. The clear hierarchical structure of C&I enables the cumulative use of information at higher stages of complexity

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BOX 1
The concept of Criteria and Indicator

Essential to the concept of C&I is the rule that no single criterion or indicator alone constitutes a complete measure of sustainability. An individual criterion or indicator needs to be considered in the context of a hierarchical system of principles, criteria, indicators and verifiers. These four hierarchical levels have been linked conceptually (Prabhu *et al* 1999) to the four basic entities (wisdom, knowledge, information, and data) following the information theory of Liang (1994). The elements of such a system could be described in the sense of Prabhu et al. (1996, 1999) as follows:

- **Principle -** A fundamental truth or law as the basis of reasoning or action. Principles in the context of sustainable forest management are seen as providing the primary framework for managing forests in a sustainable fashion. They provide the justification for criteria, indicators and verifiers. (For the study in question the highest hierarchical level of principles was not considered.)

- **Criterion -** A principle or standard that a thing is judged by. A criterion can therefore be seen as a 'second order' principle, one that adds meaning and operationally 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 crystallizes.

- **Indicator -** An indicator is any variable or component of the forest ecosystem or management system used to infer the status of a particular criterion. Indicators should convey a 'single meaningful message. Indicators can be quantitative or descriptive.

- **Verifier -** Data or information that enhances the specificity or the ease of assessment of an indicator. Verifiers provide specific details that would indicate or reflect a desired condition of an indicator. They add meaning, precision and usually also site-specificity to an indicator.

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and an improved understanding about the relation between the different aspects of sustainability. If sustainability as overall objective is accepted, C&I represents an ideal system of objectives as a base for designing efficient and effective monitoring and auditing instruments.

Demands on C&I in monitoring and auditing

To use C&I for monitoring and auditing, they have to be adapted to the demands and restrictions of enterprises and government institutions. The most important considerations are related to the gap between the approach of sustainability and the actual forest management practice in the Brazilian Amazon and the specific characteristics and objectives of the involved actors, who will become users of C&I.

Gap between approach and reality

The current use of forest resources in the Brazilian Amazon is quite destructive. Timber enterprises in general neglect ecological and social issues in their operations. Even financial aspects, probably the most important for private investors, aren't considered adequately in planning. The approach of sustainability is located on the other extreme. As a result, the gap between this approach and the current forest management practice could be immense. For this, an uncritical application of C&I would unambiguously cause a high degree of resistance by forest enterprises as well as government institutions. Beside this, C&I assessing only the fulfillment of high-level objectives aren't suitable to detect dynamic and progress happening under this level. In that case the practical use of C&I would be quite restricted.

To ensure the acceptance and the function of C&I for monitoring and auditing, C&I have to consider the *status quo* of forest management practices in a given region, the Brazilian Amazon in our case. Thereby a differentiated picture of the quality of forest management could be drawn and effects on motivation and management quality could be expected. The need for adaptation to "reality" through the selection of C&I and the definition of adequate (periodic) thresholds has to be questioned for

each single criteria, indicator and verifier. A periodic control of these adaptations in order to correspond to the dynamics resulting from the operational modifications of forest management will be necessary.

Objectives and characteristics of the actors involved

Following Prabhu et al. (1998) the utility of C&I depends on their relevance to the monitoring or auditing goal and on the level of benefits result by their evaluation. Therefore the set of C&I has to deliver meaningful information for the clients about the development trends in the underlying ecological and social systems and also ensure the determination of policy/management responses. This makes extremely necessary to understand the specific objectives and characteristics of the clients of C&I in monitoring and auditing instruments. Only if their demands on C&I are considered in the definition of the instruments, acceptance and viability could be ensured. It is likely that C&I, which up to now have been mainly used for certification, will have to be adjusted to the new approaches. To clarify these specific needs it is important to identify the relevant parameters. Table 1 presents some of these parameters in a comparative way to highlight the different demands on C&I as a result of different functions.

Table 1. Comparative demands on C&I for use in monitoring, auditing or certification.

	Certification	Monitoring	Auditing
		Main actors	
Actor	Consultants	Forest enterprises	Government institutions
		Approaches	
Final objective	Decide about the certification of production	Support enterprise management	Ensure that the enterprise follows the regulations
Application	Regular supervision	Latent 'online'	Once during the management plan
Costs/Benefits	Determined by the approach	Efficiency more important than effectiveness	Limited by restricted resources
		Restrictions	
Knowledge	High educated and experienced personnel	Very restricted, often no professionals	Often with university degree; lack of knowledge about sustainability
Time	Consultants are employed only for certification	Untrained personnel are well available, but no staff for co-ordination, organization, analysis and supervision	Only very few people have to control a lot of projects in very big regions

The approaches and restrictions presented in Table 1 result in various implications for monitoring and auditing instruments. The following are mentioned in particular:

→ **Final objectives**
- *Certification:* The C&I assessment in certification process aims on the decision of certifying the production as sustainable or not. Objectives and interests of other groups don't play a role.
- *Monitoring:* Monitoring supports the enterprise in defining and achieving its management objectives. C&I have therefore to consider the specific needs of the whole enterprise.
- *Auditing:* For auditing the C&I should assist government organizations in controlling whether timber enterprises are working according to the existing legislation. As the legislation represents the desire of the society as a whole, the intention is to proof whether the enterprise contributes sufficiently to the social welcome.

→ **Application**

- *Certification:* During a pre-certification, the assessment of C&I should detect main failures and the overall potential of the forest management unit in relation to certification. Later on an in-depth analysis of the enterprise's activities is carried out. The fulfillment of recommendations given by the certifier and the quality of the forest operations are controlled regularly.
- *Monitoring:* C&I for monitoring will be assessed permanently in order to draw an actual picture. Additional half year or yearly evaluations of the monitoring information are scheduled. The whole monitoring process has to be integrated in the management process.
- *Auditing:* For auditing the data is collected only one or two times through the whole project duration. The time available for auditing the enterprise's activities is only 2 to 4 days. The emphasis relies in a fast and punctual capture of data.

→ **Cost/Benefits**

- *Certification:* For certification purposes the relation between cost and benefits is only relevant for the decision on when to initiate the certification; i.e. whether the demands identified by the certifiers are worth to fulfill or not. The benefits and costs related to the C&I assessment are clear and more or less fixed.
- *Monitoring:* The relation between costs and benefits is an important factor for the application of C&I at enterprise level. The enterprise will pay the cost of monitoring as long as the benefits exceed the costs.
- *Auditing:* The benefits related to effective auditing, is the protection of society by the identification of non-sustainable forest management projects and the corresponding sanction measures. The definition of management recommendation could be a potential benefit for enterprises. The very restricted financial resources determine the cost side.

→ **Restriction in knowledge**

The use of C&I requires extensive knowledge of social, ecological and economic areas as well as methodological and technical details for the assessment process. In addition the level of education, knowledge and know-how of the different clients is quite distinct.

- *Certification*: Certification is carried out by consultants who normally are well educated and experienced. Their capacity to use C&I is high.
- *Monitoring*: In enterprises there are only few professionals. This fact may result in the need to downgrade the C&I to ensure practicability and understanding. The methods for using C&I have to be clearly defined and simple. In some cases the hiring of external might be necessary. There is the danger that the emphasis on practical needs results in a loss of system integrity.
- *Auditing*: In contrast to enterprises in government institutions more academic staff are employed. Therefore a higher capacity of abstract understanding is probable.

→ **Restrictions in time and equipment**

- *Certification*: The certifying agency defines the availability of resources. If the calculated costs exceed the willingness to pay of the enterprise, the certification process will be stopped.
- *Monitoring*: Enterprises employ people, when benefits could be expected. In this sense restriction could result from the relatively low availability of qualified staff.
- *Auditing*: In government auditing institutions. only a quite restricted number of people are employed for auditing. Because of financial problems it is unlikely that more personnel will have to be hired, although this depends on political willingness. The restriction in time, as well as for equipment, is significative.

The brief analysis above shows essential differences in the demands on C&I for different areas of application: The demands for enterprise's monitoring as part of management have to reflect the specific enterprise's objectives. It has to be ensured that all relevant areas of the enterprise are

included. Benefits and costs have to be clearly defined to evaluate the efficiency of C&I application. The optimized application of low qualified personal will be of high importance. In contrast, auditing controls the fulfillment of state regulation. Because of restricted resources, the assessment must be cheap and fast.

Introducing C&I for monitoring and auditing

The Embrapa/CIFOR project: Sustainable Management of Production Forests at the Commercial-Scale in the Eastern Brazilian Amazon

The use of C&I for monitoring and auditing forest management is one of the issues of a research and demonstration project aiming at improving conditions for implementing good forest management practices at the commercial scale in the Brazilian Amazon. This project, leaded by Embrapa and CIFOR and funded by the ITTO, will develop, validate and disseminate a *Forest Management System* (FMS) involving two areas of intervention, silviculture and control and economic planning of enterprise's operations, each one with a set of specific tools as key elements (Figure 2).
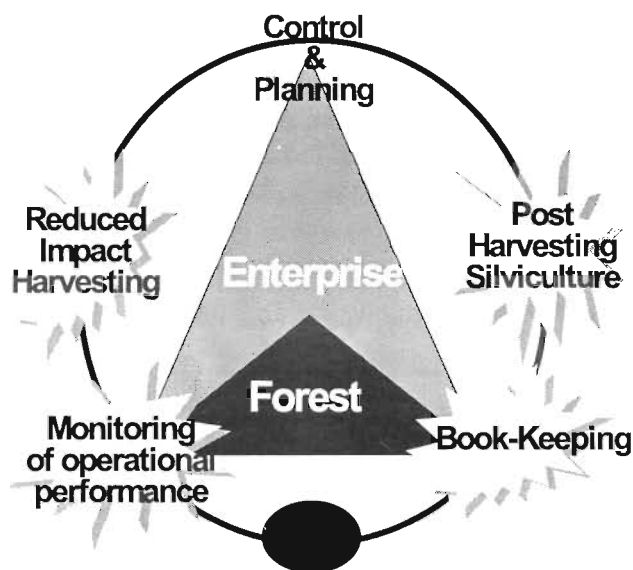

Figure 2. Tools for good forest management

The **silviculture** area use or adapt techniques and tools to improve the economic efficiency and working conditions of forest operations (pre-harvesting, harvesting and post-harvesting silviculture) and reduce their negative environmental impacts. The following tools are elements of the silvicultural area:

- *Technical guidelines for reduced impact harvesting (RIH)* - Set of procedures regulating harvesting operations in order to: a) minimize the environmental damage, conserve the potential for the next commercial harvesting and maintain basic ecological services; b) reduce operational costs. and c) increase efficiency of harvesting operations and reduce waste.
- *Technical guidelines for post-harvesting silviculture* - Set of procedures regulating post-harvesting silvicultural interventions in order to: a) increase growth rates of desired timber species, thus shortening the estimated cutting cycle; b) influence composition and dynamics of regeneration. and c) increase the quality of the future crop.

- *Software for planning forest operations: the Tree Mapping System, TREMA* - TREMA is a database software for spatial managing botanical or forestry related sample data. Typical uses include management of inventory data, PSP data, stock maps and biodiversity samples.
- *Guidelines for the establishment of permanent sample plots and software for monitoring growth and yield:* the continuous forest inventory system, SFC - SFC is a software for managing permanent sample plot data. Its main outputs are stand tables, growth, mortality and recruitment.

The area **of control and economic planning of enterprise's operations** is conceived as an integrative system of reports and analysis of the enterprise's production and financial movements to support efficiently the control and planning process by the enterprise. In this area the following managerial tools will be defined:

- *Manual for monitoring enterprise's operational performance* - A set of procedures linked to a computer-based software to record, analyze and report the operational performance of enterprise's operations in order to control quality and quantity of achievement and support management decisions.
- *Manual and corresponding software for book-keeping* - A set of accounts linked to a computer-based software documenting in a structured form all financial movements in the enterprise in order to allow for a transparent accountability of all enterprise's activities and as a base for cost and investment calculation.
- *Manual for controlling and planning enterprise's operations* - An integrated computer based information system to assist the enterprise in control and planning operations, e.g. cost-benefit calculation, investment analyses, documentation of production process and planning schemes.

The above tools are in different stages of development. The silvicultural tools are practically ready for implementation (validation) by the selected timber enterprise, while parts of the managerial tools are still in the conceptual stage.

To operate and evaluate the FMS and promote its dissemination, four project components are envisaged (Figure 3).
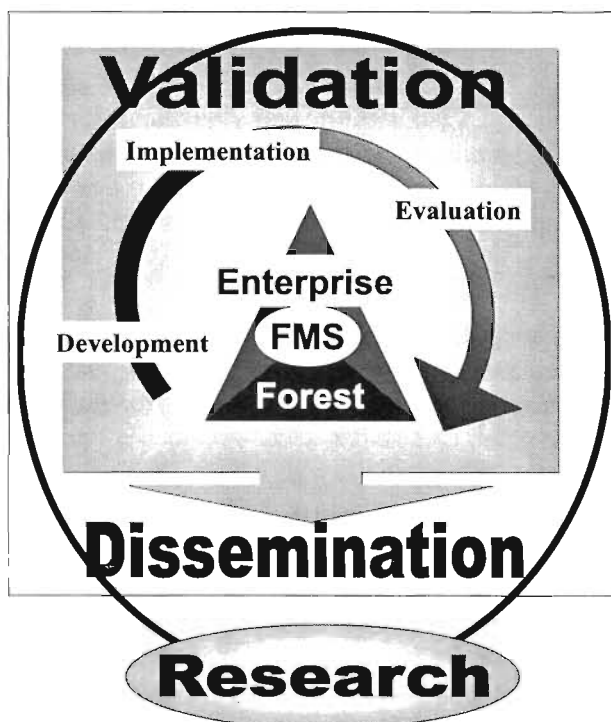

Figure 3. The components of the Embrapa-CIFOR project.

- *Tool development* – It comprises those activities related to the development and operationalization of the elements forming part of the FMS. The project will prepare or adapt technical guidelines, software and field manuals.
- *Tool implementation* – It embraces all activities for implementation of the developed tools in the partner enterprises. This component is divided into three sub-components: training, supervision (control of the transfer process), and evaluation (assessment of the knowledge/ technology adoption).
- *Project monitoring* – This component includes the assessment of the direct and indirect impacts of FMS implementation by the partner enterprise and the adaptation of the silvicultural and managerial tools on ecological, economic and socio-cultural aspects.
- *Tool dissemination* – The dissemination includes project outcomes directly distributed by the project as well as activities to support the transfer and dissemination of the FMS.

Definition of monitoring and auditing tools

The monitoring and auditing tools to be developed in the mentioned project should enable the internal and external control of enterprise operations. This includes a complete and systematic reporting and assessment of enterprise activities and external conditions affecting the sustainability of the enterprise operations. A reporting and analysis system of productivity and costs of the forest management will be created separately. Tool development for assessing sustainability will follow four steps in the project: (1) Definition of a preliminary set of C&I for discussion, (2) Consideration of different social perspectives, (3) Definition of final C&I lists for monitoring and auditing, and (4) Validation of the defined C&I.

Definition of a preliminary set of C&I for discussion

The first important step in the development of C&I for monitoring and auditing was a preliminary selection of C&I suitable for the local conditions in the region and relevant for monitoring and auditing. As a base for this definition process the 'CIFOR Generic Template of Criteria and Indicators' was used (Prabhu *et al* 1998, CIFOR C&I Team 1999). This model set of C&I present a starting point for the development of locally adapted sets of C&I in tropical moist forest areas. It raises from a CIFOR research project on testing C&I for the sustainable management of forests involving several governmental and non-governmental partners in industrialized and developing countries since 1994. This research has taken place in Indonesia, India, Côte d'Ivoire, Cameroon, Brazil, Austria, Germany and USA (Prabhu *et al* 1996, 1998).

More than 40 experts, mainly researchers and key actors in the process of C&I development, met three days in a workshop in Barcarena-Para, Brazil, to discuss specific definitions and excluding aspects of the Generic Template of C&I (Sabogal et al., forthcoming) as a point of departure and to define a list of C&I potentially appropriate for monitoring and auditing issues in the Eastern Brazilian Amazon region. With the assistance of secondary information (Prabhu and Tan 1995, CIFOR C&I team 1999, FSC 2000) and expert consultation via Internet, the C&I list was completed including proposals of assessment methods for all verifiers. The C&I were defined to be discussed and progressively adapted to the specific needs by redefinition and complementation in later steps of the development process.

Consideration of different social perspectives

In the application of C&I for monitoring and auditing, enterprises and government institutions will be involved. In order for any assessment of forest management to have a wide social acceptability - in itself a condition for sustainability - there must be an adequate understanding of the different social perspectives on sustainable forest management. A failure in achieving this would result in monitoring and auditing instruments that are unable to satisfy these diverse information needs (Pokorny et al. Forthcoming). Such information and communication deficiencies would result internally in biased or erroneous feedback to management and externally in miscommunications and distrust. Any monitoring or auditing instrument has to be designed with the given resource and knowledge constraints in mind.

In order to better understand the differences between key stakeholder groups involved in forest management, we designed a 'test' (Prabhu 1998 *Terms of reference*, Donovan 1999, Pokorny and Bauch 2000, Pokorny et al. forthcoming) in which four different stakeholder groups evaluate and discuss the preliminary set of C&I defined in the Barcarena workshop: 1) researchers, as key actors for the development of C&I; representatives from 2) timber enterprises, as potential clients for the monitoring tools, 3) government auditing institutions, as potential clients for the auditing tools, and finally 4) local actors, as those who will receive a high level of impact. The test (here designed as the "*Stakeholder Test*") was carried out in early 1999 (see Box 2).

BOX 2
The four phases of the "Stakeholder test" in Tailândia (Pará) 1999

1. **Preparation** - Three to four participants of each of the four stakeholder groups were prepared for the test during a workshop held in Belém (Pará). During the workshop the test's objectives and methods were explained and the groups received a short introduction to current international definitions and perceptions of sustainable forest management. The workshop was intended to familiarize the groups with the preliminary set of C&I and allow them to begin considering how they might suitably adapt it. In addition each group was assisted in the planning of the field assessments and the development of an appropriate action plan.

2. **Assessment of forest management operations of a timber enterprise** - Based on the action plan worked out in the preparation workshop each group independently visited the field site of a timber enterprise in the municipality of Tailândia, roughly 250 km southwest of Belém, the capital of Brazil's Pará state for a period of not less than two days. During this trip they had to rapidly capture information they required in order to assess the sustainability of the forest management based on the preliminary list of C&I.

3. **Evaluation of C&I** - Following the field assessment, the groups evaluated the C&I considering a variety of attributes. Each attribute was classified according to the four categories: very positive, more or less positive, more or less negative, and very negative. The evaluation process was structured from the bottom to the top (Verifier → Indicator → Criterion) to support an understanding of the C&I hierarchy.

4. **Discussion of results** - Following completion of activities as independent groups, the four groups came together at the end of the exercise to discuss the results of the evaluations. The aim was to discuss the reasons for different C&I evaluation and to define a final list of verifiers for monitoring and auditing. For this final round of discussions three new groups were constituted, with one participant from each of the stakeholder groups.

Definition of final C&I list for monitoring and auditing.-

Based on the results of the Barcarena Workshop and the *Stakeholder Test*, C&I for monitoring and auditing will be defined to be field tested considering the following four aspects:

- *Viable structure of C&I* – The C&I have to be structured in a way that reflects the specific objectives and demands of the related actors, as shown in section 0, and guarantee the clear operational and hierarchical relationship between the C&I.

- *Quality of C&I* - The C&I have to be tested for clearness, sufficiency and practicability and if necessary re-defined or completed.

- *Definition of verifiers* – For each indicator it has to be proofed whether the verifiers are sufficient to ensure an objective evaluation at the indicator level. If not, practicable verifiers have to be defined.
- *Definition of assessment methods* – For each verifier, the assessment method has to be defined. This is not only necessary to qualify unambiguously the evaluation quality at the verifier level, but also for objective testing and cost calculation.

At the end of this phase a C&I for monitoring and auditing are defined including a comprehensive list of verifiers and assessment methods to be tested in the field.

Validation of the C&I for monitoring and auditing

The C&I for monitoring and auditing will be field tested during the first two years of the project outlined above. The field test will focus mainly on three aspects: resources spent to collect and analyze the field data, benefits resulting from the monitoring and auditing information, and problems in the application and understanding of monitoring and auditing results

To ensure the generation of benefits from the monitoring and auditing, policy and management recommendations directly linked to the assessment results will be formulated. This will be supported by the high specificity of the assessment information. Due to the different characteristics of monitoring and auditing, different levels of recommendation will have to be discussed.

Considering the low level of experience with the application of C&I and the lack of qualified personal in Brazilian timber enterprises (Embrapa 1996, Scholz 1999), the recommendations derived from monitoring information has to be clear and linear. It seems necessary that all weaknesses identified during the assessment be translated in guidelines. Independently from these guidelines, it is expected, that the monitoring process itself would induce own management initiatives.

In relation to the information raised by auditing, three levels of recommendation could be considered regarding the objective and available financial and personal resources:
- A purely positive or negative judgement of the forest management. If the judgement is negative, the forest management project will be stopped.
- Specific recommendations to timber enterprises. In this regard the knowledge of the auditing institution could be used. In this case the existence of well-educated forestry experts is essential.
- Besides the recommendations to timber enterprises, the auditing information could also be used to evaluate the needs and possibilities to influence external conditions in a way that facilitates the application of sustainable forest management. In this case an integration of different governmental institutions would be necessary.

A variety of tools such as guidelines, methodological handbooks, demonstration areas and educational videos will also be developed. During the second three-year project phase, this tools will be validated though its application in a larger universe of forest enterprises.

First results

As mentioned above the first two steps for developing C&I-based monitoring and auditing instruments already took place. A preliminary list of C&I was defined and discussed by four stakeholder groups. In this process a number of interesting experiences were made, specifically in about the practicability of C&I assessment and the evaluation of C&I in relation to monitoring and auditing

Practicability of C&I assessment

The preliminary C&I defined in the Barcarena Workshop were assessed by the four different stakeholder groups (see 0) to evaluate the sustainability of a forest management unit located in Tailândia. During the field trip the groups had to capture the required information in only 2 days. Basically four methods were used: *observations*, *interviews* and *check documents and review of secondary data*. The groups evaluated observations as most efficient because of the good relation between time spent and information. Although each group spent only between 9 and 13 working hours in the field, all groups felt more or less satisfied with the level of information (Figure 4).
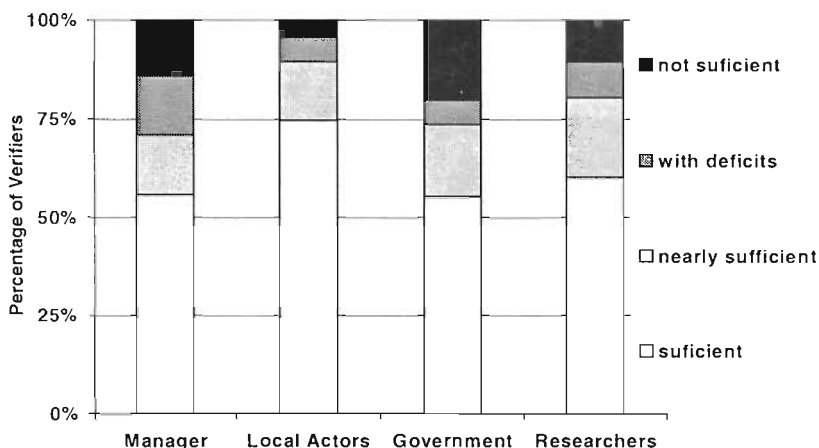

Figure 4. Sufficiency of information to assess sustainability

All groups categorized the level of information collected to assess the 114 verifiers of the preliminary set of C&I as being *sufficient* or *nearly sufficient* for the most part. The information level in less than 20% of the verifiers was assessed as *not sufficient*. The manager and government groups were more likely to criticize the inadequacy of the information collected than the other two groups, possibly because they had more specific or more extensive information needs resulting from their practical experience. Considering the low level of familiarity of the participants with regards to the use of C&I and the time constraints during the test, the high level of sufficiency stresses the practicability of working with C&I. The assessment of the sustainability of the management project by the four groups was very uniform (Figure 5).
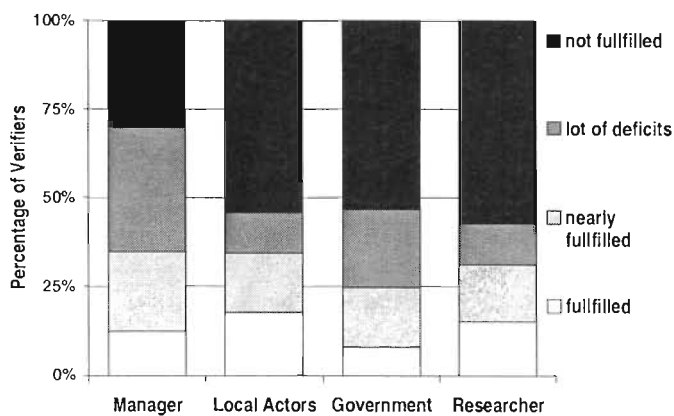

Figure 5: Assessment result of a forest management unit in Tailândia, Pará.

All stakeholder groups assessed only about 25-30% of the verifiers as having been *fulfilled* or *nearly fulfilled*. Differences between the groups existed only in relation to verifiers evaluated in the categories *not fulfilled* and *with lot of deficits*. Based on the evaluation of each single verifiers, it was possible to have a detailed description of the strengths and weaknesses of forest management together with a detailed identification of deficiencies. The fact that most verifiers were assessed as *with a lot of deficits* or *not fulfilled* demonstrates unambiguously that all groups considered that the FMU was not managed in a sustainable manner. This result demonstrates the ease with which non-sustainable use of the forest can be identified. It also revealed lack of efficient governmental control. Especially if we consider that the controlling institution checked the management plan of the tested FMU and certifies it as fulfilling their sustainability criteria.

Evaluation of C&I

Based on the experiences made during the assessment of C&I in practice, each group evaluated the C&I considering the following aspects: (a) value of information for evaluating the indicator, (b) easiness of understanding, (c) precision, (d) simplicity of the suggested monitoring method, (e) recommendation for monitoring, (f) simplicity of the suggested auditing method, and (g) recommendation for auditing. Figure 6 shows in how far the stakeholders would recommend the tested verifiers for monitoring and auditing.
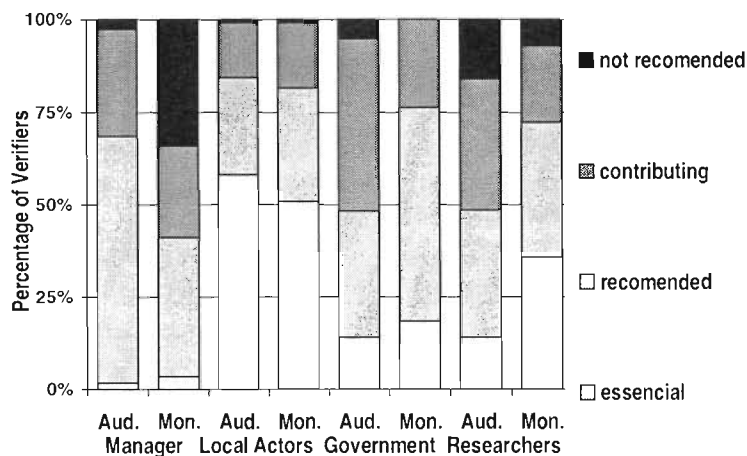

Figure 6: Degree of recommendation of verifiers for monitoring and auditing by stakeholder groups.

Several verifiers of the preliminary C&I set were not recommended for monitoring or auditing. For auditing purposes, the government representatives and researchers recommended only 50% of the verifiers suggested, whereas local managers and actors did it for up to 70 to 80 % of them. For monitoring all groups but the local managers recommended about 75 % of the suggested verifiers. The group of local managers selected only 40 % of the suggested verifiers as appropriate for monitoring. Specifically the evaluation by the government and local managers showed a strong influence of group specific interests. Each group tended to reduce the number of verifiers related to their "own" evaluation instrument.

A more in depth analysis of the stakeholders' specific evaluation carried out for each verifier how many of the seven evaluation aspects were evaluated differently. A different evaluation was detected if at least one group assessed an aspect more or less negatively while the others assessed the same aspect more or less positively. Figure 7 presents for the three areas of concern the percentage of verifiers categorized by the number of differences among the stakeholder evaluations.
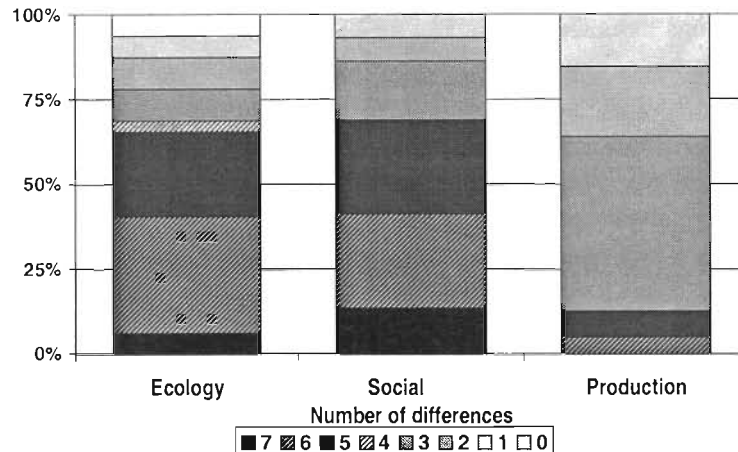
Figure 7: Detected differences of verifier evaluation among stakeholder groups by areas of concern.

As shown in the figure, only very few verifiers were evaluated in the same way by the groups (colored bright). Most verifiers showed a high degree of differences in evaluation (colored dark). In the ecological and social areas almost two thirds of all verifiers were assessed differently for four and more aspects. In contrast, in the production area nearly 90% of all verifiers were evaluated with less than four differences. These findings point out at the higher level of discrepancy for the social and ecological areas than for the production area. This observation was confirmed by a more in depth analysis of the assessment of social verifiers, by which the group of local managers recommended only five verifiers for monitoring, while other groups nearly 30. Table 2 summarizes the reasons for the different evaluations.

Table 2: Reasons for the different evaluations at the verifier level.

Area of concern	Total number	Differences in evaluation	Differences in understanding	Others
Ecology	38	13	20	
Social	37	35	29	2
Production	42	39	18	1

Table 2 shows that nearly all detected differences were explained by differences in evaluation or differences in understanding. Differences in evaluation were caused by different points of view, interests and values, while differences in understanding resulted from unclear definition of verifies. The analysis shows that the interpretations of expressions such as ´local actors´, ´stakeholder´ etc. were a source of misunderstanding and different interpretation. For ecological verifiers the different understanding resulted very often from the use of scientific expressions. Furthermore the lack of specificity like ´natural limits´ or ´not significantly´ indicate possibilities for different interpretation. The huge number of verifiers which were interpreted differently indicates the need of better, unambiguous verifier definition.

Definition of final C&I lists for monitoring and auditing

One of the main objectives of the stakeholder test was the definition of a final list of verifiers as a base for further development of the C&I prototypes for monitoring and auditing. Therefore, after discussing the reasons for the differences in evaluation in mixed groups. a final list of verifiers and methods for monitoring and auditing was defined.

C&I sets resulting from the stakeholder test

Figure 8 shows the number of principles, criteria, indicators and verifiers considered in the different stages of the definition process: Generic Template → Preliminary "Barcarena" list → Stakeholder discussed lists of C&I for monitoring and auditing.
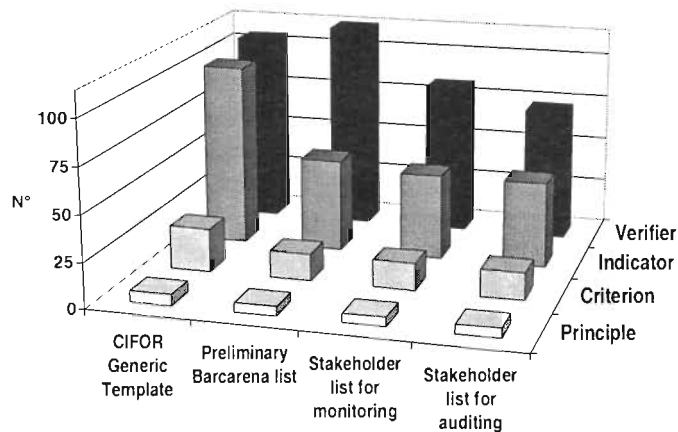

Figure 8 Number of principles, criteria, indicators and verifiers at different stages of the definition process

It is obvious that the number of items changed essentially during the test. In particular we can highlight the following two aspects:

I) CIFOR *Generic Template* to *Preliminary Barcarena List*

In the Barcarena Workshop, the total number of C&I was reduced. In particular the number of indicators decreased notably, while the number of verifiers increased strongly. In general the experts concentrate on the improvement of low hierarchical levels through the definition of feasible and practical verifiers to be assessed in the field.

- The only **principle** eliminated by the experts during the *Barcarena Workshop* was from the policy area of concern. Because of their partly general level and the lack of possibilities to influence its characteristics by single forest enterprises it was considered as not relevant. In contrast, all other areas of concern were suggested as highly relevant.

- Only few **criteria** were eliminated. The high hierarchical level was accepted as more or less fix. The criterion of the ecological set „*Conservation of the processes that maintain genetic variation*" was eliminated from the *Generic Template* because it was considered as too sophisticated for monitoring and auditing by non-experts. Two of the social criteria were also deleted. Another two were unified and one was reclassified as an indicator.

- As a consequence of deleting criteria the number of **indicators** was reduced too. Some indicators in the social and production areas were eliminated because they seemed to be not relevant or too difficult to assess. Especially in the social set some of the indicators were downgraded to the more specific verifier level.

- At the level of **verifiers** there were two tendencies to be observed.
  - In the ecological area of concern a high number of verifiers were eliminated, either because of the difficulty for their assessment or because they were considered as not relevant for the assessment of the related indicator.
  - On the contrary, in the social set the number of verifiers increased strongly because the four verifiers suggested by the *Generic Template* were considered not to be sufficient.
  - The larger number of verifiers in the area of production of goods and services resulted from the explicit consideration of technical guidelines for RIH.

II) *Preliminary Barcarena List* to *Stakeholder Lists*

The changes from the *Preliminary Barcarena List* to the monitoring and auditing list defined by the four stakeholder groups concentrated on verifier level. The analysis showed the following:

- At the level of **principles** and **criteria** there was neither elimination nor complementation. Obviously the pre-selection from the *Generic Template* was acceptable for the participants. The elimination of criteria for genetic aspects as well as the merging of criteria in the social set was not perceived as a problem.
- Only four **indicators** were eliminated from the *Preliminary Barcarena List*:
  - The ecological indicators related to community guild structures and status of decomposition and nutrient cycling were deleted, mainly because of the lack of practicable methods for the purpose of monitoring and auditing.
  - The indicator eliminated from the social area regarding the level of cultural satisfaction was not considered as relevant for monitoring or auditing.
  - From the set of production of goods and services the indicator about the involvement of the actors in the development of the management plan was eliminated, because already considered in the social set.
- The number of **verifiers** for monitoring and auditing in the area of production of goods and services remained high, which expresses high relevance. A reason could be that the majority of verifiers of this area depends directly from the management. Most social verifiers were not recommended for auditing because in spite of having a strong influence on sustainability, no direct responsibility of the timber enterprise was seen. Due to the fact, that for the evaluation of most of the ecological verifiers permanent sampling plots needed, only very few of them were considered for auditing.

Adaptation of C&I structure for monitoring and auditing

As a result of the changes made during the *Expert Workshop* and the *Stakeholder Test* the clearness of hierarchical structure and relationship between the C&I was reduced significantly. In some cases there was only one indicator per criteria left and even for some principles the number of criteria was strongly reduced, too. A difficulty emerged from the fact that for many social and ecological criteria expressing impacts of forest management, only technical issues were evaluated, such as the existence of documents. This demonstrate a general problem related to the assessment of C&I in practice. Due to the constraints associated in defining and measuring social, ecological and economic impacts of forest management, the assessment of impacts is widely substituted by the assessment of the actual application of forest management techniques and guidelines. In other words, most C&I sets in use imply that „good" forest management results in sustainability, but don't proof this (Pokorny et al. forthcoming). Because of the lack of scientific knowledge and the uncertainties and risks related to forest management, the ignorance of verifying impact parameters could result in a wrong evaluation. Worse, the acceptance of these implications takes away the chance of adapting forest management to the dynamics and specific local conditions due to a lack of knowledge about how the system responds to management interventions. One of the most important functions of C&I-based management tools would thus be lost. Therefore it seemed to be necessary to distinguish clearly between C&I for assessing the quality of activities and C&I for assessing the impacts of these activities. To ensure this, the C&I of the monitoring and auditing lists were structured into four categories:

- *Existence and quality of documentation* – This category contains C&I treating the existence and quality of all available documents (such as programs, plans, maps etc.) needed for a "good" forest management.

- *Efficient implementation of plans* – Under this category the C&I are listed to control the implementation and performance of planned activities.
- *Impact of enterprise activities* – Here C&I assess if the activities carried out by the enterprise have the desired ecological, economic and social impact.
- *External conditions for sustainability* – Finally there are C&I relevant to check conditions outside the forest management unit relevant for sustainability.

Due to the fact, that a lot of the C&I selected by the stakeholder groups were related to auditing issues such as checking of documents, it was much easier to adapt the structure of the C&I for auditing than for monitoring. For monitoring it wouldn't make sense, to check the existence of documents such as management plan or vegetation map. In relation to monitoring the documents have three important functions. Firstly to define and crosscheck the list of verifiers to be monitored, secondly to support the implementation of monitoring, and finally to operationalize the monitoring results.

Due to the fact that auditing control the fulfillment of legal regulations concerning forest management by timber enterprises (chapter 0) for auditing purpose, C&I to assess impacts or external conditions are from secondary importance. Therefore many C&I of these categories could be ignored an even eliminated.

Once the C&I for monitoring and auditing were structured and clearly defined, the methods and proceedings for evaluation will be defined and to be systematically tested in the field.

Conclusions

The development of C&I for monitoring and auditing indicated the following preliminary conclusions:
- The development of instruments for monitoring and auditing forest management activities is important for supporting the implementation of a more efficient and sustainable use of forest resources.
- Sustainability has to be accepted as a key value for good forest management. Thus legislation has to provide adequate stimulation for the acceptance of this objective by private enterprises. Thereby this objective will be essential for the definition of monitoring and auditing issues.
- Criteria and indicators to assess the sustainability of forest management are ideal for the development of monitoring and auditing tools.
- The C&I have to reflected the specific approaches and restrictions related to monitoring and auditing, as well as the relatively low quality of the current forest management practices.
- The evaluation of costs and benefits is highly important for the acceptance of monitoring and auditing tools in practice.
- The benefits of C&I based monitoring and auditing could be increased by the formulation of management recommendations based on the assessment results.

The Embrapa-CIFOR project on the implementation of good forest management at the commercial scale in the Brazilian Amazon may provide an inter-institutional platform for introducing and validating C&I for monitoring and auditing. The international expert workshop in Barcarena as well as a C&I test by four different stakeholder groups during the first project phase showed interesting results:
- *High practicability* - The stakeholder test confirmed the potential of C&I to assess forest management operations. In relatively short time, even not trained groups managed to work out a differentiated assessment of the forest management activities.

- *Strong participation of users* - The large number of differences between the stakeholder evaluation as well as the high quality of discussions during the workshop highlighted the absolute need and the potential of participatory methods in the process of C&I development.

- *Emphasis in the definition of verifiers and methods* - C&I build complex hierarchical systems which may exceed the qualification and intellectual facilities of the users of monitoring and auditing tools. The focus of future work has to be on the verifier level and methods. Specifically the need for definition of thresholds and non-expert assessment methods for ecological C&I was identified. The implementation has to be accompanied by training activities to avoid the danger to restrict monitoring and auditing to the assessment of technical values given by experts.

- *Separation of C&I for the evaluation of action and impacts* – Adaptability is an important feature of C&I. The measurement and evaluation of impacts is essential for this function. Therefore a clear and operational separation between C&I for the evaluation of activities and documents, and C&I for the evaluation of impacts is necessary.

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