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Criteria and Indicators to Improve the Ability to Monitor Forests and Promote Sustainable Forest Management:

Interchange of Ideas on the Processes of Montreal and Latin America

Including a Summary of the Workshop on "Use of Criteria and Indicators to Improve the Ability to Monitor Forests and Promote Sustainable Forest Management in Latin America," Held April 12–15, 2011, in Valdivia, Chile

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Acknowledgments

Summary

This document presents the current state of the various processes that include criteria and indicators (C&I) and their impacts on sustainable forest management in the Americas, giving greatest emphasis to the Montreal Process and to countries in Latin America. The document is divided into four sections and was developed as a discussion tool for the workshop entitled "Use of Criteria and Indicators to Improve the Ability to Monitor Forests and Promote Sustainable Forest Management in Latin America," which was held April 12–15 in Valdivia, Chile.

The first section is an introduction that briefly describes the most important C&I processes for the region, among them the Montreal Process (focused on the Southern Cone), the Lepaterique Process for Central America and the Tarapoto Process for Amazonia.

The second section offers a deeper comparative analysis of these processes, finding high compatibility among the processes at the level of criteria but almost no coincidence at the level of indicators. By all appearances, it is difficult to arrive at an appropriate balance between the sets of indicators based on science and those sets having a high level of participation by the stakeholders involved.

While the work of CIFOR tends to represent the first case, those of Lepaterique and Tarapoto are more representative of the second. A common problem in the design of standards for sustainable forest management is also adequate consideration of spatial scales. For example, environmental services normally require an optimization on larger spatial scales in relationship to optimization of sustainable use of wood. Because some priorities in management objectives can vary over time, C&I processes should include more elements for adaptive management.

In the literature, there is much agreement on the importance of C&I in improving perception about sustainable forest management (SFM) and in getting the principles of sustainability into forestry legislation and practical implementation in Neotropical countries. It is also worth noting that there are very few publications on the current official state of C&I processes (advances in SFM monitoring and reporting).

Although the benefits generated by C&I are obvious at national and global levels, it is more difficult to transfer the direct benefits to forest users and owners. Forest certification is a promising tool for this purpose, but because of common problems such as limited access to markets, saturated markets or high transaction costs, the certified area is quite limited. Despite the great advances in implementation, management plans exist only for limited areas and offer varying technical qualities. The road toward implementation of C&I in tropical countries is still a long one. Payments for environmental services as promising tools to promote SFM receive considerable attention in several countries of the region.

In the third section, the role of current tendencies in the forestry sector with respect to C&I is discussed, such as, for example, climate change or biodiversity conservation. In this context, the potential offered by REDD+ (reduction in emissions by deforestation and degradation, management, conservation and forest restoration) to mitigate the effects of climate change or for biodiversity conservation is quite interesting. REDD+ projects require high inputs and strict regulations to establish the baseline scenarios, showing the quantity of emissions under "business as usual" use.

Many international organizations invest time and economic resources in order to establish specific indicators that measure projects focused on mitigation of the effects of climate. This offers an opportunity to respond to and encourage use of C&I so that SFM is present in cases where necessary. Biodiversity conservation faces specific challenges in development of the C&I since many species are yet undiscovered or unknown to science. In addition, it is hard to adequately take dynamic aspects into account in C&I. Some indicators, such as forest cover and fragmentation or connectivity, probably will serve as estimators until science has advanced more in development of modern monitoring systems—for example, systems based on genetic methods. Moreover, legal aspects emerging in the political agenda have potential impacts for C&I, for instance the verification of legal timber trade or development of indicators for value chains. A special challenge for many tropical countries is the quantification of the informal sector, especially illegal logging, degradation processes and, most of all, indicators for good governance practices, which is considered to be the greatest obstacle to SFM. The importance of considering the rights and needs of indigenous peoples for SFM is also highlighted in this section.

The fourth section summarizes the discussions and agreements of the workshop "Use of Criteria and Indicators to Improve the Ability to Monitor Forests and Promote Sustainable Forest Management in Latin America," held April 12–14, 2011, in Valdivia, Chile. The sharing of experiences about progress on different C&I processes resulted in identification of several aspects (for example, institutional problems, lack of continuous national forest inventories or little knowledge about the potential benefits of C&I for SFM) that could generate a negative spiral of cause and effect and provoke erroneous decisions for SFM.

Two topics received consideration attention and discussion during the workshop: one was the importance of a functional chain between data and decision making and the other was the role of current tendencies in the forestry sector with respect to C&I. There was agreement among the participants regarding the need to strengthen, identify, communicate and improve the benefits of C&I for the stakeholders in different spatial levels, above all for those responsible for the in situ implementation of SFM. Other recommendations were to look for synergies with current global processes that mobilize great economic resources (for example REDD+ or payments for environmental services) and stimulate C&I processes for SFM. Finally, two priority opportunities were identified for possible improvements in the short term: 1) concrete opportunities to improve data and 2) the need to strengthen abilities to respond to C&I. Specific recommendations are summarized in the last section, under "Conclusions and Recommendations."

Introduction: What Is the Purpose of the Document?

This document is a summary of the advances in implementation of the various C&I processes in sustainable forest management (SFM) that currently exist in the Latin American region. It includes an analysis of the degree to which these processes incorporate new tendencies in the management of forest resources. The document was developed at the request of the United States Forest Service as a complementary document to the C&I workshop entitled "Use of Criteria and Indicators to Improve the Ability to Monitor Forests and Promote Sustainable Forest Management in Latin America," held in Valdivia, Chile, April 12–15, 2011.

The main purpose of the document is to contribute to the discussion on the effectiveness and efficiency of the implementation of C&I sets or standards,[1] in particular of the Montreal Process C&I, which were applied by several Latin American governments. Section I briefly presents the various C&I being used in the region. Section II contains a brief analysis of the common and differing aspects among the standards, including an analysis of the progress in implementation and the benefits, as well as comparison with private standards used in forest certification. Several lessons learned up to now are also discussed, especially those to do with collection of information, its analysis and reporting.

Section III is a summary of how the different standards incorporate or would incorporate current tendencies in forest management, selecting the topics of biodiversity, climate change and indigenous peoples as representative elements of the major conventions on forest resources discussed at the international level.
These three sections are based on a bibliographic analysis. The fourth and last section summarizes the results of the discussions held during the workshop in Valdivia about the progress made by the C&I processes, the influence of the new global tendencies and obstacles in the data-decision chain. The document ends with general conclusions and specific recommendations for improving C&I standards.

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[1] In the remainder of the document the term "standard" will be used to describe hierarchical sets of C&I or forest certification that aim to strengthen the monitoring of advances in forest management related to predetermined objectives: in this case, sustainable forest management.

Section I. Description and Discussion of the Different Processes of Criteria and Indicators for Sustainable Forest Management

1) Sustainability and C&I Processes

C&I Political and Historical Framework

The publication of *Sylvicultura Oeconomica (Economic Silviculture)* by Hans Carl von Carlowitz in 1713 established the principle of sustainable timber production in forest science. Consequently, this date is considered to mark the birth of the term "sustainability." The point of reference for centuries had almost exclusively been the production of timber. In 1987 the term was broadened in the Brundtland Report of the World Commission on Environment and Development (WCED), taking into account ecological, social, economic and institutional-political dimensions. That principle served as an important pillar for the "Rio 1992" conference—the United Nations Conference on Environment and Development (UNCED). This meeting became a historic milestone in the progress toward multilateral environmental agreements. Rio 1992 marked the first attempt to combine economic development with conservation goals under the umbrella of "sustainability."

Within the framework of the United Nations, three conventions directly relevant to forests were developed, building on the principles of the Rio Declaration:
- Convention on Biological Diversity (CBD)
- Framework Convention on Climate Change (UNFCCC)
- Convention to Combat Desertification (UNCCD)

Also at the 1992 conference in Rio, the first global strategy for forests emerged, along with various voluntary instruments directed to forest management. The importance of monitoring the tendencies and advances in sustainable forest management was recognized by the Intergovernmental Panel on Forests (1995–1997) and its successor, the Intergovernmental Forum on Forests (1997–2000), by the United Nations Forum on Forests (UNFF) and by the Food and Agriculture Organization (FAO) of the United Nations.

The UNFF has identified seven thematic elements for sustainable forest management, which have been the basis for development of the general principles for the different C&I processes. MPCI (2007) and FAO 2003a make reference to these seven elements: 1) extent of forest resources, 2) biological diversity, 3) forest health and vitality, 4) productive functions, 5) protective functions, 6) socioeconomic functions and 7) political, legal and institutional framework.

A profound understanding of the concepts of criteria and indicators is a prerequisite for development and implementation of the indicators (CBD 2001). There are different definitions for what is an indicator or a criterion (Meza 2005). In the hierarchical framework for forest management standards, Lammerts van Bueren and Blom (1997) define principles, criteria, indicators and verifiers in the following manner.

Principle
A law or fundamental rule serving as a basis for reasoning or action. It is an objective or attitude concerning the function of the forest ecosystem or a relevant aspect of the social system that interacts with the ecosystem—explicit elements of a goal.

Criterion
The state or aspect of the dynamic process of the forest ecosystem or state of the social system that interacts with the ecosystem, which should be in place as a result of complying with the principle. From the criteria comes the verdict on the degree of compliance with the principle in an actual situation.

Indicator
A quantitative or qualitative parameter that can be evaluated in relation to the criterion. It describes in a verifiable manner the characteristics of the ecosystem or the related social system and the elements of prevailing policy and management conditions and human-driven processes indicative of the state of the ecological and social system.

Verifier
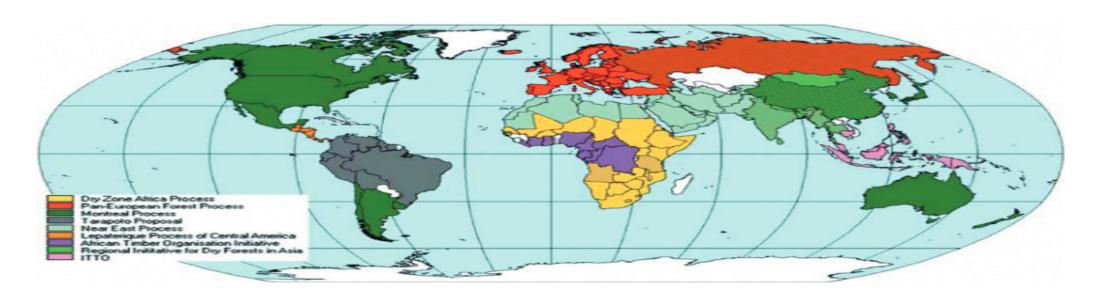Source of information or reference value for the indicator.

Figure 1. Map of the location of the nine existing intergovernmental C&I processes
Source: (Wilkie et al. 2003).

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Regional Initiatives

It is important to mention that in addition to global C&I processes, there also exist regional efforts at the level of legally binding agreements and accords, as well as ministerial meetings. The remainder of this document will focus on the instrument for intergovernmental processes of C&I.

Simultaneously with the development of global initiatives, a great variety of regional efforts and processes have emerged. The map in fig. 1 indicates C&I processes in different regions of the world. The most important processes in the Americas have been identified as the Montreal Process for boreal and temperate forests, the Lepaterique Process for Central America and the Tarapoto Process for Amazonia.

The following nine intergovernmental processes of C&I that currently exist cover all the ecoregions of the world:

1. International Tropical Timber Organization (ITTO)
2. Pan-European Process
3. Montreal Process
4. Tarapoto Process for Amazonia
5. Dry-Zone Africa Process
6. Near-East Process
7. Dry Forests in Asia Initiative
8. African Timber Organization (ATO)
9. Lepaterique Process for Central America

Only the processes relevant to Latin America are discussed in this document.

2) Montreal Process

Introduction to the Process and History

Twelve member countries participate in the Montreal Process (MP): Argentina, Australia, Canada, Chile, China, Japan, the Republic of Korea, Mexico, New Zealand, Russia, the United States and Uruguay. These countries represent 83% of all temperate and boreal forests, 49% of the world's forested area, 45% of all timber products and 33% of the world population (MPCI 2007).

Historical Process

1994   Launching of the process as a response to the Rio 1992 forest principles.

1995   Adaptation of the Santiago Declaration by the member countries, approving the seven criteria (more than 67 corresponding indicators).

2003   First national reports and publication of the Forest Overview Report in 2003.

2007   In Buenos Aires, a working group approved a revised package of indicators for criteria 1–6. A conceptual framework for the strategic action plan 2009–2015 was also approved.

2009   Publication of "Technical Notes on Implementation of the Montreal Process Criteria and Indicators," with seven principles and 54 indicators.

       Workshop in Asuncion, Paraguay, on identification and selection of common C&I for the Southern Cone countries (Argentina, Chile, Paraguay, Uruguay) and a final workshop in Montevideo, Uruguay.

List of criteria of the Montreal Process (MPCI 2009):
Criterion 1:   Conservation of biological diversity
Criterion 2:   Maintenance of productive capacity of forest ecosystems
Criterion 3:   Maintenance of forest ecosystem health and vitality
Criterion 4:   Conservation and maintenance of soil and water resources
Criterion 5:   Maintenance of forest contribution to global carbon cycles
Criterion 6:   Maintenance and enhancement of long-term multiple socioeconomic benefits to meet the needs
                of societies
Criterion 7:   Legal, institutional and economic framework for forest conservation and sustainable management

General Comments

- Outlined below is the conceptual basis of the Montreal Process, according to MPCI 2009:
- Forest ecosystems managed in a sustainable way can create multiple benefits for present and future generations.
- The C&I serve as a common framework for monitoring, assessing and reporting in member countries with respect to the full range of forest values and the progress of each country toward SFM (holistic concept).
- The seven criteria characterize the essential components of SFM. The 54 indicators open the pathway to measuring those components.
- The C&I are not performance standards but provide relevant information for decision makers. Some countries consider C&I as a useful concept for the development of subnational policies, management plans and inventories.
- Considering the great variability of environmental and social conditions among the member countries, the design of the C&I permits flexibility in their application.

Current Status of the Process

The MPCI technical notes (2009) describe in a general way how the information for each criterion and indicator should be collected, providing flexibility to the member countries but always putting emphasis on how to obtain quantitative and verifiable parameters. Canada, for example, adopted only six criteria and 46 indicators for its national C&I. At least five provinces in that country implement C&I to measure progress toward the goals of sustainability. Also the United States now has experiences with implantation of C&I at a subnational level. Other countries, too, are advancing in the process; for example, in 2009 the Southern Cone initiated the TCP/RLA/3203 project, entitled "Strengthening the Capacities of Southern Cone Countries in Monitoring, Evaluating and Reporting Progress in Sustainable Forest Management Through the Development, Use and Implementation of Criteria and Indicators." In Argentina, a country where a third workshop was held to initiate the process of reporting and informing, the Canadian national standards served as a reference for developing indicators at a local level.

Meza et al. (2009) indicate that the Montreal Process also helped the countries of the Southern Cone to identify shared goals and improve communication and agreement on forest sustainability. In addition, trust and agreement among the member countries was achieved and incorporation of the SFM concept in political and management instruments was stimulated. However, problems still exist with the generation of data and updated information.

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The latest meeting was held in June 2010 in Hawaii, during which the following future challenges were identified: improved communication among the various stakeholders involved in C&I, use of Web-based instruments for dissemination of national reports and the special challenges related to climate change, drought, water, conflicts over land use and changes in the forest industry (MPCI 2010).

3) The Montreal Process in the Southern Cone

Introduction to the Process and History

In 2001, the group in the Montreal Process formed by the Southern Cone countries (Argentina, Chile, Paraguay and Uruguay) identified the need to create a regional group to monitor the development of the processes at the level of the Southern Cone, considering their common characteristic in the area of forests and forest ecosystems. In the 22nd and 23rd meetings of the subgroup, held in 2002 and 2004, a focus was on the countries' need for easily accessible data and updated information in order to assess the progress toward SFM. The 24th meeting, held in the Dominican Republic, resulted in a proposal to develop strategic lines for an information system that embraces the Montreal Process criteria and indicators, looking at the total or partial construction of at least 15 of the indicators and incorporation of SFM within the realm of local populations.

At a May 2008 meeting in Colonia, Uruguay, the forest service directors of those countries determined the need to speak with a common voice about forests in international economic agreements, such as those of MERCOSUR.

General Comments

In response to the longstanding aspirations of this Southern Cone subgroup of the Latin America and the Caribbean Forestry Commission (LACFC), an agreement was signed in November 2008 to begin the TCP/RLA/3203 project, which includes the following objectives:

- Identify and update the needs for information on forest resources in the various institutions in terms of priority demands by the different types of users within the countries, especially the definition of strategies that reflect the countries' public policies and the application of criteria and indicators for SFM.
- Develop and implement a strategy for interregional cooperation (based on information technologies) that generates data and necessary information for the different users of the forestry sector in Southern Cone countries and serves as a tool for decision making and monitoring and for evaluating forest policies and strategies in the countries of the subregion.

The four countries approached the project, starting from a common premise: the search for common indicators for the Southern Cone would be based on the Montreal Process C&I.

In the case of Chile, 47 national indicators were selected to reflect progress toward SFM, 32 of them now with mechanisms for reliable measurements and 15 requiring improvement in such mechanisms. This selection process also took place in the other three countries. Then, in a subregional workshop facilitated by FAO, the proposals were analyzed, resulting in the definition of 16 key indicators common to all four countries.

These include (table 1):
- Four high-priority indicators common to the four countries
- Nine high-priority indicators common to three of the four countries
- Three indicators of high priority for two of the countries and of medium priority for the other two countries

As a fundamental part of the project, strategic guidelines were developed for the period 2011–2016, during which validation of the indicators was proposed. These guidelines have six central points.

1. Promote, consolidate and formalize the User Committees.
2. Work more intensively on the construction and assessment of agreed-upon key indicators.
3. Strengthen capacities to provide results of the assessment of key national indicators and periodically disseminate them in media easily accessible to decision makers and the general public.
4. Periodically review the indicators evaluated and integrated in an interconnected information system (continuous process) and generate the corresponding trends.
5. Encourage the consideration and incorporation of C&I in national policies and instruments related to conservation and sustainable management of forests.
6. Promote development of standardized teaching programs, training and refinement designed to strengthen knowledge about materials related not only to conservation and sustainable management of forests but also to management of monitoring instruments, follow-up and interpretation of the results of related implementation of instruments and policies.

4) The Lepaterique Process in Central America

Introduction to the Lepaterique Process and History

Central America covers more than 500,000 km², forming a bridge between the great continental blocks of North America and South America. Forest covers is 31% to 35% (ibid.). The decades of the sixties and seventies have been characterized by high rates of deforestation linked to converting forest to pasture for livestock and to cutting for firewood (ibid.). The name of this process recognizes the Honduran community of Lenca, which improved its quality of life through SFM.

Seven members make up the Lepaterique Process: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama. A peculiarity of this process is a differentiation of three spatial levels:
- Regional level: used for formulation of policies and proposals at the Central American level
- National level: used as a planning tool for SFM in each country
- Forest Planning Unit: used as a measuring tool in the field (FAO 2002)

Historical Process

1990: Establishment of the Central American Commission on Environment and Development (Comisión Centroamericana para el Ambiente y Desarrollo-CCAD).

Table 1.   Key indicators of sustainable forest management for Southern Cone countries

Criteria/Subcriterion	Indicators	No
1. Conservation of Biological Diversity		
1.1. According to ecosystems	Area and percentage by type of forest and by age class or succession type (and land ownership)	1
	Fragmentation of forest types	2
2. Productive capacity of forest ecosystems	Area of forest lands and net area of forest lands available for timber production	3
	Area and volume of plantations with native species and with exotic species	4
3. Maintenance of the health and vitality of the forest resource	Area and percentage of forests affected by abiotic agents (for example, fire, storms, clearing of land) beyond the terms of reference	5
4. Conservation and maintenance of soil and water resources	Area and percentage of forest lands with significant soil erosion (4.2.b. Degradation of soil)	6
	Area and percentage of forest lands managed mainly for protection. For example, watersheds, flood protection, protection against landslides, riparian zones (Protective Function)*	7
5. Maintenance of the contribution of forests to the global carbon cycle	Total biomass of forest ecosystems and carbon accumulation, if it is pertinent, by forest type, age class and succession stage (a. Total forest ecosystems carbon reserves and flows)	8
6. Maintenance and improvement of multiple socioeconomic benefits over the long term		
6.1. Production and consumption	Value and volume of timber production and timber products , including the added value of secondary processing (primary and secondary processing)	9
	Supply and consumption of timber and timber products, including per capita consumption (round timber)	10
6.3. Investment in forestry sector (6.2: 17° GT)	Value of investments, including investments in forest growing forests, forest health and management, planted forests, wood processing, recreation and tourism (a. Value of the capital investments and annual spending on forest management, timber and nontimber product industries, forest environmental services, recreation and tourism)	11
	Level of spending on research and development and on education (b. Annual investment and spending on research, extension and development, and education related to forests)	12
6.5. Employment and community needs (6.3: 17° GT)	Direct and indirect employment in the forestry sector and employment in the forestry sector as a percentage of total employment	13
	Average salaries and accident rates in the main categories of employment within the forestry sector	14
7. Legal, institutional and economic framework for the conservation and sustainable management of forests		
7.1. Legal policy framework	Legislation and policy that supports sustainable forest management y policy	15
7.3. Institutional framework	Application of the laws related to forests	16
7.5. Monitoring Capability	Monitoring, evaluation and preparation of reports on progress toward sustainable forest management	17
(*)Chile did not select indicator 4.b as a Southern Cone indicator during the national workshop. In that country, only 16 indicators will be analyzed as common indicators.		

Source: Pelissou (2009, 2010a, 2010b)

1992: Agreement on conservation of biodiversity and protection of priority wild areas in Central America and birth of the Central American Council on Protected Areas (Consejo Centroamericano para Áreas Protegidas-CCAP).

1993: Regional agreement on management and conservation of natural wild ecosystems, development of forest plantations and birth of the Central American Commission on Forests (Consejo Centroamericano para Bosques-CCAB).

1994: Presidential agreement on the Central American Alliance for Sustainable Development (Alianza Centroamericana para el Desarrollo Sostenible-ALIDES) compatible with Agenda 21.

This same year it was agreed that all state programs and initiatives should be based on the following seven principles: 1) respect for life, 2) improvement in quality of life, 3) use of an ecosystem's vitality and diversity in a sustainable manner, 4) promotion of peace and democracy, 5) respect for a multicultural society and ethnic diversity, 6) economic integration among countries of the region and with the rest of the world and 7) intergenerational responsibility for sustainable development. The alliance mandated the Central American Council on Forests and Protected Areas (CCAB-AP) to implement different strategic lines, such as development of criteria and indicators for SFM, among other things.

1996: Ninth meeting of the CCAB-AP in Panama: inclusion of sociocultural criteria in the C&I process for SFM.

1997: Tegucigalpa, Honduras. As a result of the TCP/RLA/5611 project, and with the support of FAO, four criteria and 40 indicators for SFM were defined at the national level (FAO 2002, Zapata 2005a and Zapata 2005b; table 2, annex 5). These C&I complemented the seven SFM principles: 1) political responsibility, 2) maintenance of vitality and forest cover, 3) forest contributions to environmental services, 4) maintenance of biological diversity, 5) forest productivity, 6) development of science and technology, 7) compliance with current and future social requirements.

1997–1999: Validation phase that applies the method after the Tarapoto Process, using four variables to classify the indicators (1 = not applicable, 2 = not very applicable, 3 = applicable, 4 = very applicable). Zapata (2005b) mentions two objectives of that classification for the example of Honduras: the first is to have indicators that are qualitatively and quantitatively sensitive so that they allow the effectiveness of its selection to be analyzed; the second is to consider as part of the validation and formulation the cost involved in obtaining and selecting this information. The results for Honduras were published in Santos (1999).

2000: National workshops in Honduras and Costa Rica with readjustments to the national indicators.

2005: Publication of the national reports of Honduras and Costa Rica.

General Comments

Other C&I processes were important to the development of C&I for the Lepaterique Process; they adopted several elements, for example, from the Montreal Process a justification for each criterion and a detailed list of methods for measuring.

In almost all of the countries of the region, news laws and forest policies either have been or are being made that include provisions and mandates for forest management, along with new institutional organizations that seek to slow down the rate of deforestation and generate jobs and other sets of management objectives that favor putting the rest of the recognized criteria into practice (FAO 2002).

Current Status of the Process

The current status of SFM in the region is explained in FAO (2008): "As a result of some research carried out in principal forest ecosystems in the Central American region, certain norms have been promoted that include clear differences in sampling, intensity, minimum cutting diameter (MCD) and silvicultural criteria. Without doubt, conifer forests are the most studied, with a better understanding of their management. In the case of broadleaf forests, management tends to be more complicated because of its composition and structure." This possibly indicates that implementation of C&I progresses more quickly along the most feasible road and consequently goes more slowly in ecosystems that present a greater threat or vulnerability.

In Costa Rica, on the other hand, there has been little follow-up to the C&I process, perhaps because in 1998 a standard for sustainable forest management was approved as a legal norm (CNCF 1999). Initially this standard followed more closely the structure of the forest certification standard of the Forest Stewardship Council (FSC), but the perception that it was too demanding for the small producer in Costa Rica pushed the development of a standard with only three principles, directed toward measuring the result of forest management more than the process. This new standard was approved in 2008 (Louman forthcoming). These principles, however, apply only to the management-unit level and have not contributed much to the collection of information about the status of forest management or forests at the national level.

In his national report on C&I for Costa Rica, Espinoza-Camacho (2005) concluded that "the Lepaterique Process has not had the expected institutional force and follow-up to be the driver and guide in development of criteria and indicators in each country." In this country the basis is more in the FSC standards because these criteria were considered to be directed more to the management unit. In contrast, Honduras complied with the regional commitment to support the Lepaterique Process's criteria and indicators for sustainable forest management (Zapata 2005b), considering forest certification as a complementary tool for SFM. Nevertheless, in the Lepaterique Process only two countries of the region have made efforts to adopt national standards, and between those two there was no common agreement on the usefulness of the C&I.

Table 2.   Number of indicators defined in the Central American Lepaterique Process, identified according to the thematic categories in the Tegucigalpa workshop in 1997.

Categories	Regional	National	Management Unit
Forest resources	4	7	–
Biodiversity	6	9	9
Forest use	–	1	1
Political-legal framework	6	12	1
Socioeconomics	16	17	16
Forest management	7	6	24
Total	**40**	**52**	**51**

Source: FAO (2002), Santos (1999)

In recent years a new initiative promoted by FAO was created, known as National Forest Monitoring and Assessment (NFMA). In spite of several possible synergies among experiences of C&I processes at the regional and global level and the possible enrichment of C&I by this new tool, the final report (Baeza 2009) does not even once mention the terms "criteria," "indicators," or Lepaterique," which indicates possible institutional problems in the synchronization of SFM efforts in the region. Apparently there is little cohesion or cooperation among these initiatives. Whether this represents a specific problem or rather a structural problem for the various C&I processes, there is plenty of room for discussion.

5) The Tarapoto Process in Amazonia

Introduction to the Process and History

The Amazon basin covers 6.5 million km^2, of which 5.5 million are forest. The population of Greater Amazonia, that is, the area covered by the Amazon basin and its contiguous area of influence, is estimated at more than 33.5 million inhabitants, of which 21 million live in cities (UNEP 2009). The Tarapoto Process was born in 1995 in the first meeting on C&I for the sustainability of forests in Amazonia, held in the city of Tarapoto, Peru. During that meeting 12 criteria and 77 indicators were identified, subdivided in three categories: global level, national level and management-unit level. Following is a synthesis of the historic process since then.

Historical Process

1995:   Tarapoto meeting, with the definition of 12 criteria and 77 indicators (ACTO 1995).

1995:   Declaration of Lima. Meeting of the ministers of foreign relations. Agreement on preparation of a regional document after the analysis at the national level.

1996–2000: Analysis through national discussions, involving 351 institutions and 830 persons representing the different stakeholders.

2000:   Agreement by the Amazon Cooperation Treaty Organization (ACTO) to adopt a set number of C&I, with emphasis on the search for mechanisms to permit validation of the standard.

2001:   Second Tarapoto meeting, resulting in identification of 15 indicators and eight criteria with a very high potential to be applied, out of a total of 77 indicators grouped in 12 categories. The decision was made to validate those 15 indicators in a regional project.

2004:   Regional validation project supported by FAO.

2004–2005: National activities to implement and validate the 15 indicators.

General Comments

The Tarapoto Process is closely linked to the creation in 1978 of ACTO, made up of the member countries of Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Surinam and Venezuela. One of the pivotal strategies of the organization is the topic that encompasses forests, soils and protected areas (Elías 2004, ACTO 2004). Development of SFM criteria, known as the Tarapoto Process, lies within this topic.

The criteria drawn up in the nineties were based on the experiences of the processes of Montreal and Helsinki (Pan-European Process on Criteria & Indicators) as well as the work on SFM carried out by ITTO. Among the

most important lessons ITTO learned was the recognition that the cultural, institutional and socioeconomic environment of Amazonia is different from that of other regions of the world. Therefore it was necessary to adapt the C&I toward specific requirements for this region—above all, to put major emphasis on poverty reduction and subsistence aspects (Elías 2004).

Current Status of the Process

There are few official documents on the results of the validation. For example, several advances toward sustainability were achieved in Ecuador, based on C&I. In this sense, the C&I served as a guide for the political process and the integration of sustainability principles into the political and management agenda. The validation of the indicators was done once the information from the different sources was gathered and analyzed, structuring a document for each indicator, preparing 15 validation documents. Results indicated two validated indicators, seven indicators observed and six indicators invalidated (FAO 2009c).

The ACTO strategic agenda, published in 2010, mentions as a general objective for the subtopic of forests: "Forest management that is integrated and holistic and sustainable for the management and conservation of forests, which results in real benefits to local populations." Among the short-term activities mentioned is monitoring of forest cover and forest control, while the topic of sustainability is included only in medium-term activities: "Promote SFM with social inclusion." In the 2004–2012 strategic plan, the terms "Tarapoto Process" and "C&I" do not appear (ACTO 2010), a situation similar to what occurred with the post-Lepaterique initiatives.

6) ITTO Criteria and Indicators

Introduction to the Process and History

The International Tropical Timber Organization (ITTO) is an organization that promotes the conservation, management, use and sustainable commerce of tropical forest resources. The 59 members represent more than 75% of the area and more than 90% of the world trade in tropical timber (ITTO 2005), which points to a special interest in commercialization of tropical woods.

Historical Process (ITTO 1998, ITTO 2005)

1991: Approval of the criteria to assess sustainable management of tropical forests by ITTO members.
1992: Publication of the criteria to assess sustainable management of tropical forests by ITTO members.
1997: Approval in Libreville (Gabon) of a new set of C&I.
1998: New publication of C&I in ITTO.
2001: Approval of national and unit-management level reports on progress in the C&I process.
2003: Mandate by the International Tropical Timber Council for assessment of results by a group or groups of experts.
2005: Publication of reviewed and evaluated C&I.
2011: New review of C&I to, among other reasons, review the validity of the C&I in the context of climate change (Mansur, personal communication).

General Comments

The first ITTO C&I publication was in 1992, with the name "Criteria for Assessment of Sustainable Management of Tropical Forests" (ITTO 2005). C&I standards should provide the member countries with a tool to assess and follow the tendencies and changes observed in forest conditions at the national level as well as at the level of the forest-management unit. The C&I should serve as a frame of reference so that each country can develop its own system. ITTO emphasizes the importance of C&I as an adaptive process, always reviewing the applicability of the indicators and the efficiency of the tool. In this sense, C&I are a dynamic tool.

The seven criteria are divided into three main categories. Criterion 1 has to do with the general legal, economic and institutional framework; criteria 2 and 3 are related to quantity, security and quality of the forest resources, while criteria 4 through 7 consider the different products and services that forests provide (ITTO 2005, table 3).

The definition of C&I at the operation level also has great importance for ITTO, but the specific characteristics of those units are left open, so that member countries have the freedom to create their own indicators and adapt them according to the size of the units, administrative forms, land ownership or ecological conditions. This was at least partially corrected when the revised C&I were published in 2005, including a format for reports. This revised version has seven criteria applicable both to the country scale and the management unit. Of a total of 57 indicators, only eight do not apply to the level of the management unit, while all apply to the national level (ITTO 2005).

Current Status of the Process

ITTO prepared standardized formats for writing C&I reports (similar to the Montreal Process). The forms are completed based on the presence or absence of the verifiers. The standardization ensures that the different national and international stakeholders use a common language concerning C&I although it does not guarantee an efficient application. To achieve a better adaptation of the standards, various workshops and trainings were held at the national level, involving different institutional and social stakeholders, to later use the national experiences in the writing of new standards. This adaptive process to develop C&I in ITTO was quite advanced in comparison with other C&I processes. In the case of Brazil, ITTO demonstrated that the development of C&I at the national level also served to promote the certification process (Schmid and Johnson 2005)—it is notable that no mention of the Tarapoto Process appeared in the publication cited.

Table 3: Seven ITTO criteria (ITTO 2005)

1) Enabling conditions for sustainable forest management (11 indicators)
2) Extent and condition of forests (six indicators)
3) Forest ecosystem health (two indicators)
4) Forest production (12 indicators)
5) Biological diversity (seven indicators)
6) Soil and water protection (five indicators)
7) Economic, social and cultural aspects (14 indicators)

Source: ITTO (2005)

7) The Role of CIFOR in C&I Development

Introduction to Process and History

The Center for International Forestry Research (CIFOR) is part of the Consultative Group on International Agricultural Research (CGIAR). CGIAR is an informal association of multiple donors from public and private sectors that support 15 research centers around the world; one of them is CIFOR, headquartered in Indonesia, that has more of a forestry approach than the other centers (Stork et al. 1997). The goal of CIFOR's research on C&I has been to contribute to the development and evaluation of technologies to determine the advance of SFM at the level of the management unit, setting it apart from the C&I processes previously described. The results should be linked with the respective initiatives at national and regional levels (Spilsbury 2005) as a scientific-technical process, not as a result of negotiation among stakeholders.

Historical Process

Considering that the CIFOR C&I are not a product of political negotiation among stakeholders but are based on science and research, few historical milestones exist:

1994–1996: Phase I: Evaluation of C&I in the field and development of different C&I sets.

1996–1999: Phase II: Development of tools to evaluate sustainability: CIFOR C&I Toolbox.

2000: Publication of users' experiences in applying the toolbox (Parasram 2000, Spilsbury 2005).

General Comments

Prabhu and collaborators (Prabhu et al. 1996) are among the initiators of the C&I activities at CIFOR. Interdisciplinary groups worked to integrate more than 1,100 C&I from different C&I systems that existed at that time. CIFOR C&Is were divided into three packages: biophysical, social and managerial. The indicators were evaluated in the field at the level of the management unit in Brazil, Indonesia and Ivory Coast, representing ecological and social contexts of the three tropical continents, although they were also evaluated in Germany and Austria. Such activity marked the beginning of comparison and harmonization of the various C&I standards and processes, based more on scientific principles and less on negotiation processes among social and institutional stakeholders. Even though some compatible indicators were found among the continents, it became clear that there was no complete universal catalog of C&I but that it was necessary to adapt them according to environmental and, especially, social characteristics. Another result of the analysis was that most of the indicators for biodiversity in those times were deficient (Prabhu et al. 1996, Stork et al. 1997). The results led to more field trials (Gabon, United States, Cameroon). In Phase II, eliminating C&I deficiencies in the social and biodiversity areas received greater emphasis. The result of this phase was the C&I Toolbox, which contains six principles and 25 criteria and is considered the point of departure for adaptation to local conditions. In addition, this toolbox contains recommendations for the process of standards construction and validation.

CIFOR adopted a transparent consultative approach to the research, creating the International Project Advisory Panel (IPAP), including experts from many organizations (for example: ITTO, the Helsinki Process, the Montreal Process, the African Timber Organization—ATO, FAO, the United Nations Intergovernmental Panel on Forests—IPF, the United Nations Forum on Forests—UNFF, FSC, and Rainforest Alliance's

Smartwood initiative, among others. IPAP provided advisory services to CIFOR and monitored the progress and evaluation of products and research advances (Spilsbury 2005).

Current Status

CIFOR's research process is considered to have generated valuable information rather than "finished technologies" (Spilsbury 2005). The author points out that the dissemination of the results has great impact on certification, especially that of the FSC and especially in countries where the C&I were applied. It also had considerable influence on organizations such as Smartwood, the Soil Association's Woodmark and SGS Qualiflor, among others. In an informal but nonetheless significant manner, the C&I processes influenced other countries—for example Guatemala, Costa Rica, Nicaragua and Guyana. Responses from the users of the C&I tools have been varied. The multidisciplinary concept was evaluated as positive, along with the scientific credibility and good dissemination of results at international, region, national and local levels. But there were also critical voices maintaining that the standards did not sufficiently represent the requirements of the users, especially the private sector. In addition, many considered the standards to be too complex for effective implementation (Spilsbury 2005). Spilsbury concluded that "the C&I project actively involved key users through its advisory panels, and this helped enhance research uptake, especially among certification bodies and the FSC."

Section II. Comparison and Analysis of the Processes

8) Comparison of the C&I Processes

McDermott et al. (2007) claim a lack of consensus about how to resolve the major global questions related to forests. The ITTO and Montreal Process criteria are largely based in the UNFF seven elements for sustainable forest management, while in the other processes, the emphasis on UNFF elements is quite variable. The consequence is an overlap, a fragmentation of initiatives and also conflicts among them. For example, it is notable that many C&I processes do not reach the level of the management unit (Orsi et al. 2011), which makes it difficult to verify in the field and to create links with certification processes.

Some authors also criticize the fact that many criteria are too general or too imprecise (Orsi et al. 2011, Wolfslehner et al. 2005). Pokorny and Adams (2003) add to the discussion, asking for specificity and practicality. The authors found that only 50% of the indicators and verifiers analyzed correspond to the category of specificity and scarcely 50% to the attribute of practicality. In all, only 14% were classified as specific and practicable. Nevertheless, it should be remembered that many C&I processes are developed as a negotiation among the stakeholders. Sheil et al. (2004) ask whether the result of the C&I should be "science or consensus." On the other hand, McCool and Stankey (2001) propose two major prerequisites for C&I:
- Consensus among scientists about cause and effect of the ecological and socioeconomic processes related to SFM.
- Politicial agreement on the objectives.

Therefore, the answer to Sheil et al. (2004) is probably science and consensus. Some highly technical processes, such as those of CIFOR, require a political mandate in order to be implemented. But processes of political negotiation, such as those of Tarapoto or Lepaterique, require involvement of scientists and experts at all stages of negotiation. As a principle, that was also considered in the C&I processes.

Table 4 analyzes the degree of similarity among various C&I processes at different levels. In the example of the topic of biodiversity, it demonstrates that at the level of criteria, it is partially possible to achieve a synchronization among the processes. In addition, the Lepaterique Process expresses, at the level of criteria, a methodology for how to achieve sustainability on the topic of biodiversity at the unit level through requirements for protected areas. In the other processes, that remains open or recommendations are made at the level of indicators. However, at the indicator level, there is not much coincidence. Many Montreal Process indicators do not find a match in the others and vice versa. For example, what the Montreal Process does not clearly specify are the indicators for regeneration and floristic composition, probably because temperate forests are much simpler floristically than tropical forests and there is not such a need to express specific indicators.

The Lepaterique and Tarapoto Processes practically do not touch the topic of genetic diversity, possibly because of the lack of systematic assessment of scientific data. A difficulty symptomatic of the intent to present similarities and differences of the different processes is reflected in the Lepaterique indicator 3.1 at the

national level, called "Regeneration and changes in the composition and structure of forests." While all the other indicators to do with the topic of biodiversity always belong to criterion 5, that indicator belongs to criterion 3, called "Forest health and vitality." However, the same indicator has greater similarity to the other indicators of the biodiversity topic (annexes 2–4).

Table 5 presents even better the similarities and differences between the Tarapoto and Lepaterique processes, taking as an example the indicators of Montreal's criterion 3, called "Maintenance of forest ecosystems health and vitality." In the Tarapoto Process there is no corresponding criterion. This topic, however, is covered with indicator 4 of the criterion called "Conservation of forest cover and biological diversity." In the same manner, there is no similar criterion for the Lepaterique Process at the level of management; in this case, indicator 2.2 of criterion 2, called "Sustainable forest production," offers the greatest similarity.

The work of Pokorny and Adams (2003) also reflects these differences. These authors compared different sets of C&I in detail in the context of the Brazilian Amazon: CIFOR, Tarapoto, ITTO, FSC and Collaborative Adaptive Management—CAM (as a subgroup of that developed by CIFOR). Each one of these sets had a different thematic focus: Tarapoto emphasized aspects on the socioeconomic impact (results); CAM put emphasis on management units; and CIFOR stressed ecological aspects more. In contrast, the ITTO and FSC sets referred more to the existence of documents and the application of guidelines. Hence the question arises of whether, instead of seeking synchronization to achieve greater similarity among the C&I of different regions, perhaps it would be more important to make them compatible with certification systems or other mechanisms that could generate more direct benefits to local users.

9) Spatial Scales and C&I

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C&I processes are designed as a top-down approach. Local participation is an important obstacle to their really getting to the management unit and include local users. The higher the hierarchical level of the decision, the more powerful the decisions tend to be. For communities at relatively low levels on these decision-making chains, it is supremely important to develop local monitoring systems that permit adapting decisions to local needs. The key to any participative monitoring system is that the indicators be oriented toward measures and actions that allow the user to have influence on his environment and report on the impacts in an objective manner (Garcia and Lescuyer 2008). The most important principles (based on Danielsen et al., 2005) are the following:

- The orientation is toward products and services that the community obtains from the ecosystem monitored.
- The benefits for the local people involved are greater than the costs.
- Conflicts between government and communities do not limit involvement of local stakeholders in the monitoring process.
- Data is stored, analyzed and made available where the monitoring is carried out.

Monitoring is based as much as possible in traditional institutions and other existing management structures.

Sherry et al. (2005) showed overlaps and differences, in the case of Tl'azt'en Nation in British Columbia, Canada, among the different C&I with a top-down approach and those C&I developed at the local level. They mention the great spatial and temporal variability in social, ecological and economic systems and underline the importance of calibrating larger-scale processes to local levels. Nevertheless, to adapt C&I in an individual manner for each community in the world with a potential for SFM is an enormous task—perhaps impossible.

However, bottom-up concepts have already demonstrated promising results. Hickey et al. (2005) compared the reports and monitoring systems of 22 European and North American businesses in 15 different judicial contexts and did not find big differences among businesses of different regions or sizes of property. It is worth pointing out that in this bottom-up focus, the monitoring of ecosystem services with regional impacts (contributions to global cycles, pollution, water) has a lower quality than that having aspects of local interest (security, infrastructure, wildlife, landscape value), which highlights the importance of combining top-down and bottom-up concepts.

Sheppard and Meitner (2005) proposed prioritizing sustainability criteria among the stakeholders involved, thus achieving a dialogue that facilitates participatory decision making. The success of participative concepts perhaps depends less on harmonization of C&I standards than on a stable and decentralized political system. Perhaps the C&I should also measure those aspects, similar to what the FSC refers to in its new standards proposal as "engagement" among stakeholders.

Another significant problem in this regard is the incompatibility of interests and priorities at different spatial scales. Conservation of biodiversity, for example, normally is more important in high spatial scales (global, regional, national), while subsistence is of more local interest. For example, in studies in rugged forest landscapes of East Kalimantan, Indonesia, local communities depend a lot on wild foods like the Eugeissona utilis palm. This sago-producing plant grows on forested ridgetops. Good practices for SFM calls for forest roads and skid trails to be located on ridgetops because this reduces maintenance costs and limits soil erosion. But that practice would, in this case, cause the destruction of the palms (Sheil et al. 2004).

Many such cases cannot be solved through local decisions but require optimization techniques at the landscape level and a combination of a top-down approach (the most common in C&I) and bottom-up approach (more frequent in certification or scientific case studies). In the worst of cases, C&I without an adequate local foundation (including ecological aspects but, above all, social and cultural aspects) may lead to "technological imperialism" (Sheil et al. 2004). Consideration of different scales and the combination of top-down and bottom-up approaches in SFM is frequently included in the concept of adaptive management (Günter et al. 2011, Heinimann 2010, McGinley and Finegan 2003, Püttmann 2009). This could also be included in the list of principles of the different C&I processes. Perhaps the search for a perfect standard for criteria and indicators should be complemented by a search for decision-making support systems, including instruments to manage uncertainties and lack of information.

Table 4. Comparison of C&I with respect to biodiversity in the Processes of Montreal, Tarapoto (at national/regional and management-unit levels) and Lepaterique (at national and management-unit levels)—original text adapted because of format

Montreal	Tarapoto (National/Global)	Tarapoto (Management Unit)	Lepaterique (National)	Lepaterique (Management Unit)
Criterion 1: Conservation of biological diversity	*Criterion 4: Conservation of forest cover and biological diversity*	*Criterion 10: Conservation of forest ecosystems*	*Criterion 5: Biological diversity of forest ecosystems + criterion 2: Forest cover*	*Criterion 3: Maintenance of biological diversity through protected areas*
1.1. Ecosystem diversity				
1.1.a. Area and percentage of forest by type of ecosystem, successional status, age and land ownership	4.a. Extent of areas by type of forests in the categories of conservation areas, in relation to total area of forests		5.5. Area and percentage of primary forests, secondary and artificial 2.1. Forest in relation to total area and forest vocation	
1.1.b. Area and percentage of forest in protected areas, by type of ecosystem and age or successional status		10.a. Proportion of environmental protection areas in comparison with areas of permanent production	5.1. Types of forest in protected areas 2.1.c. Forests in protected areas 2.2 Managed forests and forests within and outside of protected areas	3.1. Degree of fragility. 3.7. Area dedicated to protection 3.5. Surveillance and protection system of priority areas 3.13. Forest soils affected by management activities
1.1.c. Forest fragmentation	4.f. Rate of conversion of forest cover to other ends		2.1.d. Rate of reconversion of forest for other uses of soil	3.16. Change in land use or natural agents
1.2. Species diversity				3.8. Species of interest
1.2.a. Number of wild native species			5.3. Populations of species of wild fauna	
1.2.b. Number and status of endangered native species, by legislation or scientific evaluation	4.b. Measures for in situ conservation of species in danger of extinction	10.b. Protect, restore and use populations of wild species in danger of extinction	5.2. Number of endemic species, threatened species and species in danger of extinction	3.11./3.2. Protect threatened species, species in danger of extinction or key species
1.2.c. Status of in situ and ex situ efforts, focused on conservation of the diversity of species			5.6. Number of species conserved ex situ (for example, germplasm banks)	3.6. Restoration of areas or ecosystems of interest found to be in the process of degradation
1.3. Genetic diversity	4.c. Conservation of genetic resources.			
			5.4. Biological corridors	3.3. Habitats of migratory species

	4.e. Natural regeneration, composition of species	10.d. Regeneration rates and structure of forest ecosystems.	3.1. Regeneration and changes in composition and structure of forests	3.14. Areas in regeneration 3.15. Natural regeneration, floristic composition
	4. g. Forest lands with fundamental ecological changes			12. Follow-up for environmental or microclimatic changes
	4.h. Mining, farming, energy.			

Table 5. Comparison of C&I related to health and vitality of ecosystems according to the processes of Montreal, Tarapoto (national/regional and management-unit levels) and Lepaterique (national and management-unit levels)

Montreal	Tarapoto (National/Global)	Tarapoto (Management Unit)	Lepaterique (National)	Lepaterique (Management Unit)
Criterion 3: Maintenance of ecosystem health and vitality			*Criterion 3: Forest health and vitality*	*2.2. Area and percentage of types of forests affected by forest fires, pests and diseases*
3.a. Area and percentage of forest affected by biotic processes or agents (for example, diseases, insects, invasive species) in comparison with control conditions	4.d. Area and percentage of forests affected by different processes or agents (pests, diseases, fire and flooding, among others)	10.c. Area and percentage of forests affected by natural processes and agents (pests, diseases and fire, among others) and by human action	2. Area and percentage of forests affected by different natural agents	2.3. Evaluation of damages and application of measures to mitigate impacts of forestry operations, fires, pests and diseases
3.b. Area and percentage of forest affected by abiotic agents (for example, fire, hurricanes, clear-cutting) in comparison with control conditions			2. Area and percentage of forests affected by different natural agents	3.9. Measures and application to prevent and control forest fires
			3. Area and percentage of forests affected by anthropogenic causes	3.16. Area and percentage of total forest affected by change in soil use or by natural agents
				2.7. Area and percentage of total forest affected by change in land use or by natural agents

10) Advances in Implementation

In addition to certification is the attribute of "good forestry practice" for forests that have a management plan. These plans are based on forestry regulations and norms and are linked to national laws. As a consequence of the C&I processes, these regulations are being enriched by the participation of the countries in the international dialogue on SFM. This, for example, has been the case in Costa Rica with the currently applied standard.

Table 6 shows, with the exception of Peru, Guyana and French Guiana, that no country exceeds the limit of 25% of forest area having management plans. An increase in the areas having management plans is apparently slow. During the past 10 years, Bolivia, for example, has increased the area by 5% and Honduras by 6%. Only in Peru did the area go from 2% in 2000 to 90% in 2010 (Castañeda 2004, FAO 2010b). However, the existence of a management plan does not guarantee "good" management, as Grossheim (2011) explained in his characterization of forest concessions in Peru.

It should be noted that Central American countries especially tend to declare a good part of their forests as protected areas. In that region, only Panama and Guatemala have made noteworthy efforts to expand areas of forest plantations (> 2.0% in the last few years). On the other hand, the great majority of countries in South America exceeded those rates, with the exception of Bolivia and Ecuador (and the Guyanas, which also have a high cover of natural forest). After 20 years of C&I processes, areas with management plans are limited and their quality is variable. One of the reasons could be the high transaction costs related to good management in comparison with other land uses (including unplanned extraction), with income that does not justify the additional costs (for example, Louman and Stoian 2002, Angelsen 2009). Regardless, there are promising examples. For instance, in 1998, Costa Rica established its legal C&I principles (CNCF 1999) and 10 years later simplified them based on the years of accumulated experience and taking into account complaints about the lack of adaptive elements, setting up general guidelines for all and including flexibility for those that can justify it (McGinley and Finegan 2003).

On the global scale, the National Forest Monitoring and Assessment (NFMA) is designed to coincide with the information needed for the five-year assessment of forest resources (Forest Resource Assessment–FRA). These are designed to provide relevant information for evaluation of the progress toward sustainable management of national forest resources. Initially, this information was directed more toward the needs of the Pan-European Process, but following the recommendation of Committee on Forestry (COFO) 2001 to take into account the international C&I processes (Luhtala and Varjo 2002), the seven elements of good forest management promoted by UNFF are also considered, similar to the seven revised criteria of the ITTO guidelines (ITTO 2005)[2] and the Montreal Process.

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2   Jim Carle, leader of the forest management team of the FAO Forestry Department, within which the NFMA team operates. Interviewed March 18, 2011, Rome.

Table 6. FAO data on the permanent forest zone, forests with management plans and protected areas.

Country/area	Permanent forest area		Forests in protected áreas		Forests with management plans	
	1,000 ha	% of forest area	1,000 ha	% of forest area	1,000 ha	% of forest area
Central America						
Costa Rica	-	-	-	-	-	-
El Salvador	-	-	32	11	3	1
Guatemala	-	-	-	-	-	-
Honduras	-	-	2,335	45	1,076	21
Nicaragua	-	-	2,01t8	65	100	3
Panama	164	5	2,116	65	68	2
South America						
Argentina	-	-	1,160	4	-	-
Bolivia (Plurinational status)	38,611	68	10,680	19	10,400	18
Brazil	242,986	47	89,541	17	30,543	6
Chile	13,634	84	3,992	25	2	n.s.
Colombia	-	-	-	-	-	-
Ecuador	9,221	93	-	-	-	-
French Guiana	6,598	82	2,418	30	2,222	27
Guyana	12,222	80	-	-	5,525	36
Paraguay	-	-	-	-	-	-
Peru	18,821	28	-	-	61,427	90
Surinam	6,689	45	2,015	14	-	-
Uruguay	752	43	-	-	-	-
Venezuela (Bolivarian Republica)	-	-	-	-	-	-

Source: FAO (2010b)

Through NFMA, data has been obtained in several tropical countries but with information for just a few indicators. FAO staff related to the process[3] say that, in general, it is difficult to obtain all of the data of the countries due to a lack of financial, human and/or institutional resources, and due to the countries do not give it the priority it merits. Many countries use C&I as a guiding framework for reporting progress toward sustainability. In Central America, for example, since 2000, FAO has supported carrying out national inventories in four countries, but in none of these were there clear agreements about the benefits and requirements of the REDD+ processes. Implementation of these processes will probably create more interest in gathering information and monitoring the changes, freeing up more resources at the country level and thus stimulating the SFM reporting process.

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[3] Jim Carle, leader of the FAO forest management group. Personal communication, March 18,2011, Rome.

11) General Benefits of C&I

To progress in implementation of C&I, it is indispensable to identify, communicate and expedite the benefits of C&I. Spilsbury (2005) has summarized the possible general benefits of the C&I, as follows:

- Evaluate the implementation of forest principles of the UNCED
- Negotiate financial support for SFM at the international level
- Standardize reports on timber certification processes
- Help compare the countries' progress in SFM
- Create and stimulate discussion about SFM
- Distinguish clearly between sustainable and unsustainable forest management to reduce uncertainties about social and environmental costs through set criteria, promoting a more productive and equitable use of forests
- Reduce environmental impacts and degradation
- Reduce social inequalities
- Promote opportunities to generate income and improve quality of life

It should be mentioned that most of the potential benefits are made at the national level rather than at the management-unit level since they do not automatically cause a more sustainable use in the field. For this reason, more mechanisms of direct payment are possibly required, such as, for example, payments for environmental services. However, those benefits will only be realized when C&I are combined with participation of local stakeholders and when they are combined with indicators for management units. García and Lescuyer (2008) stress the additional advantages of participatory management and greater community participation in monitoring:

- Increase in quality of life of rural populations
- Improvement in conservation of forest resources and biodiversity that depends on the knowledge of native communities
- Improvement in local government and democratic control of resource management
- Reduction in hierarchical obstacles (between government and communities)
- Creation of environmental awareness in the local population
- Reduction in bureaucracy
- Reduced costs related to management and monitoring by expert professionals

12) Certification, a Complementary Tool to C&I to Create Direct Benefits?

Certification is considered to be a possible complementary tool to promote direct benefits from sustainable use in the field. Forest certification was established in the 1990s to link marketing of forest products to good social and ecological development (table 7). This new instrument created many expectations, especially about obtaining additional monetary benefits for good forest management (Ozinda 2004). In a little more than two decades, more than 300 million hectares of the world's forests have been certified by some type of certifying mechanism (FCRC 2011). In one way, it is an impressive number, but it actually corresponds to less than 10% of total global forested area and covers mostly temperate regions.

Considering that the goal of certification is to promote SFM, it seems important to state that the total direct effect of the certification instruments is still quite limited. However, at the local level, the effect can be significant, and in some countries there are also indirect effects on discussions about forest management and possible improvements in both practices and legislation. As for complying with the objective of promoting biodiversity conservation, Rametsteiner and Simula (2003) believe that the instrument has failed, mostly because forests with the most biodiversity are found in the tropics, where less area has been certified (less than 10% of the total area).

These authors conclude that the great strength of that instrument is the creation of awareness about the SFM concept. Thus, the benefits of certification should be shared more with the consumers of forest products and services to stimulate participation of businesses and communities. Lammerts van Bueren (2010) confirms the limited potential of certification on biodiversity conservation since it is not an adequate instrument to stop the most important threat to forests, the conversion of natural forests: "Certification is not a tool for land-use planning at a landscape scale beyond the FMU [forest-management unit]." The different certification mechanisms have different rules at the level of the management unit. While FSC limits conversion to a fixed value of 0.5% of the certified area, the Program for the Endorsement of Certification (PEFC) is more general, without using critical values (ibid.)

Wood (2000) found several discrepancies among the various certification systems and regions, as well as among different standards in the same system, which causes problems in the international market. Just as in the C&I processes, there is little synchronization. While certification and C&I processes have standards to assess progress toward sustainable development, there are significant differences between certification and C&I (table 8).

In addition, certification requires making a decision about compliance with sustainability, which means having to choose among objectives that sometimes are contradictory and also to define critical values or acceptable standards. These standards are related to ISO 9000 and 14000 for quality and the environmental management system, respectively (Rametsteiner and Simula 2003). FSC follows ISO and SEAL recommendations for governance of standards, but standards 9000 and 14000 evaluate the existence of systems and not performance. In this sense, forest certification goes much further than the C&I processes, but , at least in theory, could be based in and linked to C&I process to create the effects of synergy. PEFC, for example, allows endorsement of national and regional standards, but FSC does not.

The certification process involves many stakeholders having different interests (Patosaari 2004):
- Buyers and consumers want information about the impact of the product.
- Owners and industry want better market access or market advantage.
- Governments see it as a soft policy tool to promote SFM.
- NGOs view it as a possible tool to influence management.

The audit of compliance with the rules established by the certifying body and an efficient in situ review are crucial components of certification mechanisms. C&I process are still far away from that, due not only to the larger areas of forests involved but also to the problem of financing verifications in the field. Obviously, C&I and certification have different stakeholders and objectives: certification seeks to promote private benefit to achieve a global benefit, while C&I seek common benefits. In certification processes, the better prices for

certified products could contribute to a direct benefit to stakeholders for implementation (if there is good market access), but what would be a direct benefits of the C&I processes? In other words, could the lack of direct benefits be a possible cause for a slow rate of implementation? A possible solution could be the path taken by Costa Rica. The country uses payments for environmental services (PES) as a form of compensation for restrictions on harvesting imposed by the national legal standard and to promote implementation of forest certification (Louman et al. 2005).

Sheil et al. (2004) mention that small producers in particular have a big problem in financing the high costs implied by certification, especially in the initial phase. According to Sheil et al. (ibid.), the few communities that achieve certification require external support for that process.

Table 7. Historical process of the creation of important certification mechanisms.

Certifying mechanism	Institution	Year created
Forest Stewardship Council (FSC)	NGO and forest industry	1993
Sustainable Forest Initiative (SFI)	American Forest and Paper Association	1995
Canadian Standards Association (CSA) Sustainable Forest Management System	Forest Products Association of Canada and Canadian government	1996
Malaysian Timber Certification Council (MTCC)	Malaysian Ministry of Primary Industries and Malaysian Timber Council	1998
Program for the Endorsement of Forest certification (PEFC)	National forest stakeholders, especially associations of owners of small forests	1999
CERTFOR	Government of Chile, Guild Association of Timber Industries (ASIMAD—Asociación Gremial de Industriales de la Madera), Chilean Association of Wood Manufacturers (Asociación Chilena de Fabricantes de Madera)	2002
Australian Forestry Standard AFS	Australia's Ministerial Council on Forestry, Fisheries, and Aquaculture and its industry	2003
CERFLOR	Brazilian Ministry of Development, Industry and Trade	2003

Source: Ozinga (2004)

Table 8. Major differences between C&I and forest certification

Criteria and indicators for SFM	Forest certification
Mostly at the national level	Obligatory subnational level (standards/requirements)
Descriptive concept	Used to establish proof of sustainable use
Mostly used to share information	Used by market stakeholders
Used by governments and decision makers	

Source: Rametsteiner and Simula (2003)

Section III. Relevancy of C&I to Current Forest Management

13) Conservation of Biodiversity

Even though the main goal of REDD+ is to mitigate the effects of climate change, as a "collateral effect," it also offers great potential for biodiversity conservation (Venter et al. 2009). But while it doesn't matter where emissions of a landscape or country are reduced in mitigation of climate change effects or where reforestation is carried out, the spatial location is highly important for conservation of biodiversity. According to these authors, in order that REDD+ have the most efficacious effects on the climate, the focus should be on areas with fewer opportunity costs.

At a global level, the largest beneficiary of possible REDD+ payments would be Brazil; however, other biodiversity "hotspots" in Asia would receive no compensation because of the high costs of opportunity (Venter et al. 2009). Nevertheless, these areas are also the least threatened—duly considering case by case the increase in preventing emissions or increasing capture that comes from each dollar invested. Venter et al (ibid.) recommend combining conservation with REDD+ payments, which would result in a duplication of the effects of conservation under a reduction in the effects of climate change by only 4% to 8%. Nevertheless, prioritizing certain countries with high opportunity costs for REDD+ probably will create much discussion in the political agenda. To lay the base for those discussions, a harmonization between C&I for REDD+ and C&I for biodiversity conservation is also required.

Lindenmayer et al. (2000) criticize the concept of indicator species and recommend applying structural indicators for areas under forest management, as, for example, forest complexity, connectivity and indicators of fragment heterogeneity. Those criteria can easily be compatible with a large majority of C&I for SFM, although their measurement and interpretation can be difficult and require establishment of thresholds according to the natural variability of each indicator (WWF 2004).

Direct payments for conservation are favored by Ferrao and Kiss (2002). The authors describe different approaches to benefits for biodiversity conservation and maintain that indirect benefits ("conservation by distraction") do not work. Those efforts include, for example, the combination of sustainable use by communities in return for social benefits such as schools, clinics and other infrastructure. The authors favor direct payments because they are more efficient in comparison with any indirect method. The prices for conservation in this study reached from US$1.25 in Kenya to US$35 in Costa Rica.

There is, however, a discrepancy between price and value. Biodiversity is a usually a noncommercial or non-market value. In addition, biodiversity value is often hard to quantify and it is difficult to set prices based on sale-purchase relationships because the "beneficiaries" of the biodiversity are not only the landowners or local users. To define global priorities for investments in conservation, Moran et al. (1997) proposed an index for investment priorities based on cost efficiency (CEPII: Cost-Effective Priority Investment Index), combining ecological vulnerability and economic viability. Nevertheless, the authors note the difficulty of

harmonizing decisions at local, national and international levels. While decisions can be made more efficiently at the national level, biodiversity is a global player, impacted by the needs of local people.

In national programs for compensation payments, such as in Costa Rica or Ecuador, the value of conservation of property is not normally done in a systematic way nor is it based on set criteria. Channeling those payments based on priority conservation areas (for example, biological corridors, step-stone areas, etc.) can multiply the efficiency, but a C&I standard is required to assess the potential for biodiversity conservation. ITTO and IUCN (2009) have drawn up a proposal for such a standard. Apart from the normal problems in the creation of criteria and indicators and/or certification, there are three in particular for those related to biodiversity conservation:

- Many species are still unknown to science; therefore, the biodiversity indicators always run the risk of being skewed. Modern methods of DNA barcoding could help solve this problem (Strutzenberger et al. 2011), but the method is still limited to scientific ends and lacks much development in order to serve as a large-scale monitoring instrument.
- It is difficult to consider the composition of species in C&I systems and to compare and value the consequences of management among world regions or among different ecosystems in an objective manner and under standardized criteria.
- Biodiversity is highly dynamic and the result of interactive processes. The actual distribution of species is the result of evolution, coevolution and migration during geologic time scales. It is hardly possible to consider such geologic time scales in C&I monitoring systems. This dynamic is also influenced by climate change and its impacts on ecology and evolution. Science is far from understanding the consequences for biodiversity.

14) Legal Framework

With strategies like FLEGT (execution of forest laws, governance and timber commerce) in Europe and the Lacey Act in the United States the importance of demonstrating the legal origin of the wood used was increasingly emphasized. Therefore the component on the institutionality of the forest sector grows in importance. Several organizations (for example, Greenpeace, Smartwood) have developed proposals for verification of compliance with the legal framework and their own standards.

The analyses prior to proposals for standards has shown two things: 1) questions about optimization of added value in value chains should be considered in management and 2) government mechanisms and their respective links among different scales are of high importance. These two topics also have been identified as core to the implementation of strategies for mitigation of climate change related to forests and trees (for example, Angelsen 2009). However, these topics are a little weak in current C&I. They are implicit in some of the indicators, but if good guidelines do not exist for the collection of information, it will be difficult to ensure harmonization of the data.

To understand where a country is headed in terms of forest and plantation management, it is important to learn more about agents that motivate possible threats, such as illegal cutting, forest degradation, deforestation,

fires, etc. Those agents can vary, also depending on the development phase the country is in with relation to its development objectives. Not all of this information can be obtained from the C&I, but, for example, within the NFMA mechanism, socioeconomic information has already been gathered about the motivation for deforestation, with quite satisfactory results, such as in Tanzania.[4]

15) Climate Change and C&I

Forests are at the center of the discussion about mitigation of the effects of climate change. It is estimated that deforestation and forest degradation contribute 20% of climate change effects. Forests have a total potential to contribute a third of all the measures to reduce emissions of CO_2, divided into 35% for REDD+, 35% for improvement in management systems, including restoration of degraded forests, and 30% for reforestation and plantations (Cadman and Masareni 2011).

The C&I are a necessary tool for REDD+ processes. For example Cadman and Masareni (ibid.) used C&I to assess the quality of governance as a prerequisite for activities in REDD+. These proposals, however, are still experimental because the relationships between good governance and deforestation are not yet well-established and can vary by country according to its history and development objectives (Louman et al. 2011). In addition, the C&I standards for REDD+ objectives, restoration and reforestation are going to vary among themselves as well as in comparison with intergovernmental processes and other C&I processes at the global level. Apart from needing quantitative measures on gas emissions for deforestation and degradation, these standards also differ in that they must take into account the performance of policies, strategies and activities outside the forestry sector that influence the forest area and composition, diversity and structure. Permitting SFM in forests designed for REDD+, on the other hand, require harmonization among both standards and C&I.

The establishment of baselines is both a technical and political matter. The biggest challenge in this regard is the decision on the reference period (Bond et al. 2009). Many baselines are concentrated in the periods between 1990 and 2005. However, that can vary according to the characteristics and histories of use in a country or a region. The transaction costs for REDD+ are enormous (monitoring, verification and reporting) and tend to exclude small individual users.

Bond et al. (ibid.) recommend offering free access, or at least more economical access, to good-resolution satellite images. Huettner et al (2009) compare four different methods of calculating baselines: the simple historical approach, spatial historical approach, Joint Research Center Approach and a prospective method on dynamic modeling of land use. The four methods are currently being discussed under the REDD+ process of the UNFCCC. Some 17 indicators have been selected from the literature and evaluated by independent experts and political decision makers. Each method shows strengths and debilities. The more complex methods that have the capacity to take into account nonlinear tendencies in deforestation and opportunity costs show

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4   Jim Carle, leader of the FAO forest management group. Personal communication, March 18,2011, Rome.

weaknesses in transparency and clarity. While the ecological indicators received a higher rating by experts, indicators of the legal-political framework received a better rating by political decision makers. Similar to the C&I for SFM, it is supposed that the final list for a future REDD+ system will be negotiated by various global stakeholders and enriched by the experts. It is extremely important to include that REDD + discussion also in the C&I processes for SFM.

Direct benefits could be generated through PES (either through the funds or oriented toward the market), but Bond et al. (2009) and Louman et al. (2011) remind that that would only be effective when certain economic, institutional, informational and cultural conditions are met. If those conditions are not present at the national or subnational level, it would be more efficient to invest in improving governance or other measures.

Forests are also important for adaptation to climate change, and forest management may or may not contribute to the adaptive capacity of forests as well as the people living in these forests. The Collaborative Partnership of Forests" (CPF) carried out an analysis of existing scientific and technical knowledge regarding management options (Innes et al. 2009) and policies (Gluck et al. 2009) to increase these adaptive capacities. They did it more or less following the same UNFF scheme of important components for good forest management, and its publication could form a good basis for incorporating new indicators and identifying existing indicators that provide information about adaptive capacities and adaptation strategies under way.

16) Indigenous Peoples

In the international discussions on REDD+, the importance of indigenous peoples for the forest and of the forest for indigenous peoples has resurfaced. At least the role of indigenous peoples has also been discussed in relation to SFM, but in practice only the FSC standard explicitly recognizes the importance of identifying and respecting the rights of indigenous peoples in relation to managed forests. While at the management-unit level the demands of indigenous peoples can be attended to in a specific way to a certain extent, the discussions surrounding REDD+ indicate that at the national level, the response must be in a structured and institutional form. Over the past two decades, indigenous peoples in Latin America also have achieved greater recognition of their rights over the use of forests. Currently they are recognized legal owners of about 35% of tropical forests in the region (Sunderlin et al. 2008); however, this is not explicitly addressed in the different C&I processes.

Section IV. Executive Summary of the Workshop "Use of Criteria and Indicators to Improve the Ability to Monitor Forests and Promote Sustainable Forest Management in Latin America," Held April 12—15, 2011, in Valdivia, Chile

17) Advances in the Processes

Good data generate good discussions and good discussions lead to good decisions. That chain of cause and effect found much agreement among workshop participants. The entire process from the collection of data for the Montreal Process C&I to the publication of the results required three to four years in the United States. In developing countries with fewer resources and lower quality of the data, the process will probably require more time. To ensure good decisions in the area of SFM, the first big obstacle is the availability and quality of data, especially for many tropical countries. Workshop participants identified the tendencies to reduce the number of indicators and focus on a lower quantity of indicators, for example in FAO and the Southern Cone (chapter 3), which would make it easier to concentrate efforts on data that can be collected with an acceptable degree of reliability.

During workshop discussions, there was agreement among participants that in Latin America in general there is still much room to improve the application of C&I, with the following needs identified:
- Obtain more and better data in order to be able to quantify and qualify the indicators
- Increase number and areas of continuous forest inventories
- Attend to problems in monitoring of degradation, fragmentation, climate change, disturbances (abiotic and biotic)
- Improve interinstitutional cooperation, the need due partly to a scarcity of human and financial resources but also to governance problems
- Broaden knowledge about the benefits of C&I for SFM, mainly at a national level.
- Demonstrate that C&I can lead to SFM
- Increase interest in application—little direct impact in policies and strategies and a lack of more direct links with indigenous peoples (improve access to SFM information and benefits)

These needs can cause a negative spiral of cause and effect and provoke erroneous decisions, which in turn deepens the negative spiral even more. To strengthen a positive chain, it is obvious that good data are an initial, principal and vital piece. A positive chain also requires efficient reports in accordance with the institutional structure in each country and making them available to the different stakeholders. The third field of action is to promote SFM benefits at different spatial levels, from the national level to the level of the user (environmental services, certification, risk management, etc.) and above all to disseminate good SFM examples to a broader public. Such initiatives could serve as good examples of certification, progress in areas with management plans, established value chains, an opportunity map (such as produced by the Global Partnership on Forest Landscape Restoration (GPFLR), the international network and regional networks of Model Forests, etc. However, the discussion in the workshop pointed out that analysis of the weaknesses of the C&I processes were much more detailed than the analysis of concrete recommendations.

On the other hand, several presentations related to the gathering of data on SFM in Latin America showed positive advances, especially in relation to data on productivity and biodiversity. Criteria 1, 2, 3, 4, 5 and 7 of the Montreal Process are well-covered. Several countries are improving as far as providing data for the FRA, much of which is also relevant for the C&I of the Montreal Process. Unfortunately there are incongruities between the countries and FAO as far as forest classifications, so that the type of data collected for FRA is similar to that needed for C&I, but the areas over which the data apply differ. A reclassification is being sought at the global level that would permit maintaining national classifications but integrating them in a single classification for FRA. Some countries do not yet have access to high-resolution satellite images, largely due to their high costs, so that small forests are left out of the national figures.

For the C&I of a socioeconomic nature (especially criterion 6), many access restrictions exist. First, these data generally come from other state agencies that are not always willing to share information, and second, in some countries the data on private producers, by law, cannot be made public, preventing state agencies from sharing the data, much less publishing it.

On the other hand, criterion 7, related to legal institutionality, is covered well. Despite having the information and complying with the criterion, institutional deficiencies are the main obstacles in several Latin American countries to SFM and the implementation of C&I. The question then arises: For what and for whom are we monitoring if the institutions that should integrate the information in their decision-making process are themselves the principal hindrance to SFM application and monitoring?

Contrary to what happened in the United States, it seems that the main obstacles to generation of information for the C&I in the Southern Cone are rooted in the institutionality, formal collaboration among different agencies in charge of monitoring, and assessing the progress of the economy and the well-being of the countries. In the United States collaboration has been formalized and now the focus can move more to the technical aspects of the quality of the information.

To improve the situation in Latin America, the following actions are proposed:
- Improve the institutionality and leadership of the process within forestry administrations—for example, with larger budgets and more human resources (several countries have very small teams and little authority for coordination and collection of the data)
- Continue the search for greater synergy among forest information systems, projects and other agencies that generate socioeconomic information
- Obtain more support from international agencies to continue strengthening institutionality
- Look for groups to prepare the information, reports, etc.; to share resources; and standardize processes—for example, North America and Mexico, Mercosur and FAO's Technical Cooperation Program for the Southern Cone

18) Chain to Link Data and Decision Making

As stated in the introduction to the workshop summary, good data is necessary for making good decisions. However, there is an intermediate step: decision makers have to receive, understand and trust the data. This means that reports must be modified according to the target audience. A good example from Chile was highlighted during the workshop, where two types of reports are produced: a more technical one on the country's forest resources and another, aimed more at the general public, that focuses on the sustainability of the forest sector. The reports have different styles: the second, for example, uses sustainability indexes and cobweb diagrams to present results of the data analysis.

It is important to produce good reports with data useful for decision makers—thereby influencing them to designate resources for data gathering, analysis and reporting. A good use of the C&I can create a more objective picture of what the forestry sector is in each country and achieve due recognition of the value of forests and their management. Although several countries have their C&I User Committees, these do not necessarily function well for everybody; in some cases the committees have been seen as dominated by a few actors and do not reflect the needs of all. To improve the use of the C&I, a larger public needs to receive objective information on the forestry sector, such as through environmental education. The need to use professional communicators to achieve this has been highlighted. FAO, for example, used the FRA information in a magazine for young people. Another example comes from Uruguay, where people in the cities are more concerned about soil and water, but in the countryside the concern is more about the work force and the quality of work. The reports should take into account these different interests. This implies having reports that differ in style and content to complement the strictly technical reports.

Something else to consider is that the public or the society can have interests apart from those of scientists or foresters. One example presented in the workshop is the impact of plantations on the environment. Information such as this is more precise and can be gathered through routine monitoring of a certain type of users from the scientific world.

To improve communication of the data, the frequency of the different reports must be considered: it must be possible to show the differences between measurements, but reports should not be delayed so much that it would cause important changes to remain undetected.

19) How do global processes influence C&I processes?

The other transversal topic at the workshop was how current global challenges such as biodiversity conservation or climate change affect the evolution of the C&I. Are the new global challenges a problem or rather an opportunity for the development of C&I for SFM?

Without doubt, today's great global problems that have garnered political interest mobilize significant financial resources. If these topics are linked with development of C&I processes for SFM, there would be a great

potential for financing the costs of monitoring. On one hand, this is causing huge technical challenges, such as how disturbances, degradation, Redd+ aspects, nontimber forest produce (NTFPs) and indigenous knowledge can be monitored and how monitoring of these aspects can be combined with traditional forest inventories. On the other hand, that would imply a harmonization of standards for different objectives and thus cooperation among institutions that often are competing for the same funds. Workshop participants gave considerable attention to institutional problems.

With regard to NTFPs, it was pointed out that even in the United States, which is the country with the greatest advances in C&I processes in the Americas, only estimates are available and the database is very poor. This brings up the question for developing countries with a much higher diversity of NTFPs of whether it will be harder to monitor them in detail. A workshop subgroup came up with some measures to improve the data and information about these products:

- Define the minimum information on NTFPs
- Focus on an NTFP group of some importance (economic, ecological) to be included in the monitoring
- Include NTFPs in the national forest inventory or in farm censuses
- Gather data on NTFPs (quantity, prices, etc.) in local markets to complement the data already collected on some of the NTFPs exported

Also discussed was whether the growing importance of global themes—such as disturbances (abiotic and biotic), climate change, fragmentation or ecosystem services—in the forestry agenda means that today less importance is given to timber. It was asked whether, as a consequence, an adjustment in the C&I would be necessary, with possible positive effects for the coordination/systematization of objectives with the respective institutions involved and possible negative effects on rapid progress of C&I for SFM. The key question for international donors could be the choice between two opposing strategies: 1) whether the choice is to install "parallel structures" and therefore avoid resolving the big institutional obstacles and governance problems in the countries, in order to achieve a more rapid and efficient solution for its specific objective, or 2) whether it would be more sustainable to resolve existing structural problems in the countries at the cost of losing time. In this way the current global processes offer a great opportunity (not just financial), but at the same time present new obstacles to implementation.

20) Conclusions and Recommendations

Based on the workshop discussions, two priority topics were defined for possible improvements: 1) concrete opportunities to improve data and 2) the need to strengthen capacities to respond to the C&I. A summary of the proposals made for these two topics follow, based on the list of the C&I from the Montreal Process (annex 2). Five aspects important to creating concrete opportunities to improve data of C&I for SFM were identified:

1. National Forest Inventories (NFI): It is important to continue developing, improving and expanding the NFI in relation to C&I. Furthermore, the importance of a continuous, periodic, systematic and permanent NFI was highlighted. The workshop identified the necessity to define and classify ecosystems at the level of the country in order to carry out a comprehensive NFI.

2. Connection with other information systems: Several possible sources of information were identified to complement traditional systems (forest agency).
3. Collaboration with scientists: The importance of working and collaborating with scientists was emphasized.
4. Institutionality: Stress was placed on the importance of promoting the institutionality of the process of monitoring, analyzing and reporting the C&I of SFM and of improving or "institutionalizing" communication and intrainstitutional and interinstitutional coordination.
5. Qualitative and anecdotal data: It is important not to avoid indicators that currently do not have available or systematic information. It is better to begin measuring such indicators in a qualitative or anecdotal form and gradually move to a more systematic and eventually quantitative form.

Concrete opportunities to improve data for specific indicators and criteria according to the list of C&I for the Montreal Process (annex 2):

- Indicator 1.1.b. (type of ecosystem, protected area): Clear and standardized definitions and classifications are required by type of ecosystem and protection status.
- Indicator 1.1.c. (fragmentation):
  - It is necessary to reach agreement on the parameters to use for measurement and on what fragmentation is.
  - A definition of the respective temporal and spatial scales is required (for the solution to the problem, experiences in the United States could serve as a base).
  - This is an aspect of great importance for REDD+ è critical deficiency.
- Indicators 2.b./2.c. (volume and growth): Great deficiencies were identified, especially for tropical countries but also for temperate countries (for example, for native species). It is evident that continuous/periodic and systematic inventories are lacking. That requires networks of permanent plots and remediation funds as well as improved links with scientific studies.

- NTFP (2.e.):
  - The topic of nontimber forest products is not included in a clear way in some C&I sets, so there are shortcomings in reporting progress toward their management, conservation and sustainable use.
  - Defining a list of NFTPs is recommended.
  - Some local organizations do register NTFPs but in a scattered fashion (for example, honey) Possible solutions are based on creating links with agricultural surveys, export statistics, interviews or forest inventories.

➔ In many cases it is possible to report on that indicator, pulling together different sources of information, but leadership of a specified institution is required.

- Indicator 3.b. (abiotic agents):
  - Focus on fires: Specifics are possible: for example, number of forest fires per year, average size, total area burned by the fire, intensity (treetops, brush, soil).
  - Setting a baseline is problematic: How can the degree of disturbances from fires that is "natural" for a management unit be quantified?
  - Similar to the monitoring problem of the NTFP report, the information needed is not included in classic inventories; additional information is required, such as remote sensing.

- Indicator 3. (biotic agents): National workshops are recommended for developing biotic indicators (insects, diseases), especially for monitoring the impacts of climate change.
- Indicator 4.2.b. (soil degradation): The key solution for this indicator is to include the assessment in the inventories (in the United States, for example, compaction, erosion and chemical analysis are monitored).
  - Involve scientists in defining the parameters.
  - A topic for discussion at the workshop was the term "significant." The report should not be based on critical values that are too high, in order to avoid irreversible environmental changes.
  - Recommendation: Include simple chemical parameters (for example, carbon).
- Indicator 4.1.a. (area designated for soil and water protection): Reporting problems due to a lack of legislative mandate.
- Criterion 5: Use biomass equations instead of direct measurements of carbon—information on carbon in the soil is often missing.
  - It is necessary to involve scientists in monitoring activities to improve quality and accuracy (for example, wood density, allometric equations, soil).
- Criterion 6 (products and consumption):
  - Obtaining small-business information was identified as a weakness.
  - Many times this depends on sources outside of the world of forestry (the same as for NTFP).
  - A possible solution is to improve the ability to systematize, gather and report on available information from different institutions.
- Criterion 7 (institutional, legal and economic framework):
  - Good information was gathered in Chile/Southern Cone through interviews. The methodology can also be a model for other countries (including the United States).
  - Existence of records on user access to laws and regulations (new indicator).
  - Learn about other initiatives (FLEGT and others).

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Concrete proposals for strengthening abilities to respond to C&I

These proposals to strengthen the abilities of governments and/or forest services to respond to C&I have been identified:

- The need to stabilize and solidify human and financial resources at a national level and through international cooperation.
- The importance of improving socialization and communication of the C&I process through dissemination at several levels, in various languages and for different user types.
- The importance of improving follow-up to the C&I processes recently completed and in progress.

Specifically, there was agreement on the lack of coordination and institutionality of the organization of the process. That is demonstrated, for example, by the fact that participation in the processes is principally by national experts, when what is needed is to promote the institutionality of the process and improve interinstitutional coordination. The following concrete measures were proposed:

- Institutionalize the Montreal Process within the official entities having responsibility in this area (Argentina is on this path)
- Make efforts to ensure the stability and continuity of human resources

- Improve coordination and communication at internal and interinstitutional levels
- Ensure appropriate financing
- Reinforce implementation of the strategy of regional cooperation

Another point of weakness is the lack of communication of results to decision makers and other possible beneficiaries. This requires a communication strategy as well as training on how to transmit the information to different levels and how to use language appropriate for the respective beneficiaries or users (decision makers, general public, etc.). To improve the benefits of implementing SFM for forest users and owners, creation of more links with certification programs is required (PEFC, FSC and others).

References

Angelsen, A. 2009. Policy options to reduce deforestation. *In* Angelsen, A. with Brockhaus, M; Kanninen, M; Sills, E; Sunderlin, WD; Wertz-Kanounnikoff, S. (eds) Realizing REDD+. National strategy and policy options. Bogor, Indonesia, CIFOR. p. 125-138.

Aide memoire 21st Montreal Process Working Group Meeting (1-4 June 2010, Hilo, Hawaii,USA). Consultado set. 2011. Disponible en http://www.rinya.maff.go.jp/mpci/meetings/21.pdf.

Baeza, P. 2009. National Forest Monitoring and Assessment. Promoting and mainstreaming information on NFMA projects in Central America. Food and Agriculture Organization of the United Nations. Working Paper NFMA 42. Rome, IT. 61 p.

Bond, I; Grieg-Gran, M; Wertz-Kanounnikoff, Hazlewood P; Wunder, S; Angelsen, A. 2009. Incentives to sustainforest ecosystem services. A review and lessons learned for REDD. International Institute for Environment and Development (IIED). London, UK. 62 p.

Cadman, T; Maraseni, T. 2011. The governance of climate change: evaluating the governance quality and legitimacy of the United Nations REDD plus programme. The International Journal of Climate Change: Impacts and Responses 2(3): 103-124.

Castañeda, F. 2000. Criteria and indicators for sustainable forest management: international processes, current status and the way ahead. Unasylva 203(51): 34-40.

_____. 2004. Tendencias y perspectivas para las iniciativas de criterios e indicadores para la ordenación sostenible. Recursos Naturales y Ambiente 42: 51-59.

CBD (Convention on Biological Diversity, CA). 2001. Assessment, conservation and sustainable use of forest biodiversity. (Technical Series No. 3), Roma Italia. 120 p..

CNCF (Comisión Nacional de Certificación Forestal, CR). 1999. Estándares y procedimientos para el manejo sostenible y la certificación forestal en Costa Rica. San José, CR. 54 p.

Elías, E. 2004. The Tarapoto Process: establishing criteria and indicators for the sustainable management of Amazon forests. Unasylva 218(55): 47-52.

Espinoza Camacho, M. 2005. Costa Rica: criterios e indicadores para el manejo forestal. Informe nacional sobre criterios e indicadores para el manejo forestal sostenible. San Jose, CR, CCAD/EFCA/UICN. 34 p.

FAO (Organización de las Naciones Unidas para la Alimentación y la Agricultura, IT). 2002. Directrices prácticas para la evaluación, medición, aplicación y seguimiento de criterios e indicadores, a nivel nacional, para la ordenación sostenible de los bosques de Centroamérica. Roma, IT. 78 p.

_____. 2008. Planificación e implementación del manejo forestal al nivel operacional en Centroamérica: compendio técnico de los planes de manejo forestal en Centroamérica (Belice, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, y Panamá); basado en el trabajo realizado por José Aroldo Santos Zelaya, Consultor. Documento de trabajo sobre ordenación forestal FM/34; Servicio de Desarrollo de Recursos Forestales; Dirección de Ordenación Forestal. Roma, IT, 105 p.

_____. 2009a. PROYECTO TCP/RLA/3203. Fortalecimiento de las capacidades de los países del Cono Sur para el monitoreo, evaluación y reporte del progreso alcanzado en el manejo forestal sostenible mediante el desarrollo, uso e implementación de los criterios e indicadores. Plan de Trabajo. s.n.t. 22 p.

_____. 2009b. Contribución de los criterios e indicadores hacia la sostenibilidad del manejo forestal: el caso de Ecuador. Basado en el trabajo realizado por Alba Sarango Valverde, Consultora. Documento de trabajo sobre ordenación forestal FM/38. Servicio de Desarrollo de Recursos Forestales; Dirección de Ordenación Forestal. Roma, IT. 53 p.

_____. 2010a. Fortalecimiento de las capacidades de los países del Cono Sur para el monitoreo, evaluación y reporte del progreso alcanzado en el manejo forestal sostenible mediante el desarrollo, uso e implementación de los criterios e indicadores.s.n.t.

_____. 2010b. Global Forest Ressource Assessment. Main Report. Rome, IT. 340 p. (Forestry Paper 163).

FCRC (Forest Concessions Review Committee, FAO), 2011. www.metafore.org/?p=Global+Certified+Forest+Area&s=485.

Ferrao, PJ; Kiss, A. 2002. Direct payments to conserve biodiversity. Science No. 298: 1718-1719.

García, CA; Lescuyer, G. 2008.Monitoring, indicators and community based forest management in the tropics: pretext or red herrings? Biodiversity Conservation No. 17: 1303-1317.

Gluck, P; Rayner, J; Berghall, O; Braatz, S; Robledo, C;Wreford, A. 2009. Governance and policies for adaptation. In Seppälä, Buck, A; Katila, P. Adaptation of forests and people to climate change. A global Assessment Report. Helsinki, Finland. p. 187-210. IUFRO World Series Vol. 22.

Grossheim, C. 2011. Forest Concessions in Peru. *In* Günter, S; Weber, M; Stimm, B; Mosandl, R. (eds). Silviculture in the tropics. Springer, Berlin, Heidelberg, DE. 559 p. (Tropical Forestry Series Vol. 8).

Günter, S; Weber, M; Stimm, B; Mosandl, R. 2011. Five recommendations to improve tropical silviculture. In Günter, S; Weber, M; Stimm, B; Mosandl, R. (eds). Silviculture in the Tropics. Springer, Berlin, Heidelberg, DE. 559 p. (Tropical Forestry Series Vol. 8)

Heinimann, HR. 2010. A concept in adaptive ecosystem management- an engineering perspective. Forest Ecology and Management No. 259:848-856.

Hickey, GM; Innes, JL; Kozak, RA; Bull, GQ; Vertinsky, I. 2005. Monitoring and information reporting for sustainable forest management: An international multiple case study analysis. Forest Ecology and Management 209:237-259.

Huettner, M; Leemans, R; Kok, K; Ebeling, J. 2009. A comparison of baseline methodologies for "Reducing emissions from Deforestation and Degradation" (en línea). Carbon Balance and Management 4:4. Consultado set. 2011. Disponible en http://www.cbmjournal.com/content/4/1/4.

Innes, J; Joyce, LA; Kellomäki, S; Louman, B; Ogden, A; Parrotta, J; Thompson, I; Ayres, M; Ong, C; Santoso, H; Sohngen, B; Wreford, A. 2009. Management for adaptation. *In* Seppälä, R; Buck, A; Katila, P. Adaptation of forests and people to climate change. Helsiski, Finland p. 135-185 (IUFRO World Series Vol. 22).

Lammerts van Bueren, E. 2010. Forest related standards and certification schemes. ETFRN News 51: 11-19.

_____. 1997. Hierarchical framework for the formulation of sustainable forest management standards. Principles criteria indicators. Wageningen, NL, The Tropenbos Foundation. 82 p.

Lindenmayer, DB; Margules, CR; Botkin, DB. 2000. Indicators of biodiversity for ecologically sustainable forest management. Conservation Biology 14(4): 941-950.

Louman, B; Cifuentes, M; Chacón, M. 2011. REDD+, RFM, development and carbon markets. *Forests* 2(1) 357-372.

_____; Garay, M; Yalle, S; Campos, JJ; Locatelli, B; Villalobos, R; López, G; Carrera, F. 2005. Efectos del pago por servicios ambientales y la certificación forestal en el desempeño ambiental y socioeconómico del manejo de bosques naturales en Costa Rica. Turrialba, Costa Rica, CATIE. 31 p. (Colección Manejo Diversificado de Bosques Naturales no. 30. Serie Técnica. Informe Técnico No. 338).

_____; Stoian, D. 2002. Manejo forestal sostenible en América Latina: ¿económicamente viable o utopía? Revista Forestal Centroamericana 39-40: 25-32.

Luhtala, A; Varjo J. (eds) 2002. Proceedings of FAO expert consultation on global forest resources assessment. Held in Kotka, FI, Finnish Forest Research Institute. 406 p. (Research paper 889).

Martin, RM. 2004. Regional approaches: bridging national and global efforts. Unasylva 218 (55): 3-8.

McCool, S; Stankey, G. 2001. Representing the future: a framework for evaluating the utility of indicators in the search for sustainable forest management. In Raison, RJ; Brown, A. (eds). Criteria and indicators for sustainable forest management. Oxford, UK, CAB. p. 93-105. (IUFRO Series 7).

McDermott, CL; O´Carroll, A; Wood, P. 2007. International Forest Policy – the instruments, agreements and processes that shape it. s.l. Department of Economic and Social Affairs United Nations Forum on Forests Secretariat. 139 p.

McGinley, K; Finegan, B. 2003. The ecological sustainability of tropical forest management: evaluation of the national forest management standards of Costa Rica and Nicaragua, with emphasis on the need for adaptive management. Forest Policy and Economics 5: 421-431.

Meza, A. 2005. Normes de gestion durable et politiques forestières : le cas des forêts de montagne en Europe. Tesis de doctorado. Paris, FR. Ecole National du Génie Rural des Eaux et des Forêts. AgroParisTech-ENGREF. 258 p.

Montréal Process First Forest Overview Report 2003 and Country Forest Reports 2003 (en línea). Consultado dic. 2011. Disponible en http://www.mpci.org/rep-pub/2003/contents_e.html

Moran, D; Pearce, D; Wendelaar, A. 1997. Investing in biodiversity: an economic perspective on global priority setting. Biodiversity and Conservation 6: 1219-1243.

MPCI. 2007. The Montreal Process. Criteria and Indicators for the Conservation and sustainable management of temperate and boreal forests. Montreal, CA (en línea=. Consultado set. 2011. Disponible en www.rinya.maff.go.jp/mpci.

MPCI. 2009. Montreal Process Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests. Technical notes on implementation of the Montreal Process Criteria and Indicators (en línea). Consultado set. 2011. Disponible en www.rinya.maff.go.jp/mpci/2009p_2.pdf.

Nasi, R. 2010. Safeguards and REDD+: potential of voluntary standards (en línea). CBD COP 10, Nagoya, Oct 21, 2010. Consultado set. 2011. Disponible en www.cbd.int/cooperation/pavilion/nagoya-presentations/2010-10-21-session3-Nasi-en.pdf.

OIMT (Organización Internacional de Maderas Tropicales). 1998. Criterios e indicadores para la ordenación sostenible de los bosques tropicales naturales. Yokahama, JP. 23 p. (Serie OIMT de políticas forestales No. 7).

_____; IUCN. 2009. ITTO/IUCN Guidelines for the conservation and sustainable use of biodiversity in tropical timber in production forests. OIMT, JP. 118 p. (Policy and Development Series No. 17).

_____. 2005. Criterios e indicadores revisados de la OIMT para la ordenación sostenible de los bosques tropicales con inclusión de un formato de informes. OIMT, JP. 40 p. (Serie políticas forestales No. 15).

OTCA (Organización de Tratado de Cooperación Amazónica). 1995. Propuesta de Tarapoto sobre Criterios e Indicadores de Sostenibilidad del Bosque Amazónico (en línea). Consultad set. 2011. Disponible en www.otca.info

_____. 2004. Plan Estratégico de la Organización del Tratado de Cooperación Amazónica (2004-2012) (en línea). Brasilia, BR. Consultado set. 2011. Disponible en http://www.otca.info/PDF/Strategic_Plan.pdf

_____. 2010. Agenda Estratégica de Cooperación Amazónica (en línea). Consultado set. 2011. Disponible en www.otca.info

Ozinga, S. 2004. Time to measure the impact of certification on sustainable forest management. Unasylva 219(55): 33-38.

Parasram AR. 2000. Adoption of the CIFOR Criteria & Indicators for Sustainable Forest Management (SFM): A Case Study of CIFOR research. (Associate Professional Officer's final report to DFID). Unpublished.

Patosaari, P. 2004. Forest certification in developing and transitioning societies. Connecticut, US, Yale University, New Haven. 6 p.

Pélissou, F. 2009. Informe Etapa I – Primera fase de consultoría de septiembre-noviembre 2009. Proyecto FAO/TCP/3203 "Fortalecimiento de las capacidades de los países del Cono Sur para el monitoreo, evaluación y reporte del progreso alcanzado en el manejo forestal sustentable mediante el desarrollo, uso e implementación de los criterios e indicadores". 38 p. y anexos.

_____. 2010a. Informe Etapa II – Segunda fase de consultoría de marzo-mayo 2010. Proyecto FAO/TCP/3203 "Fortalecimiento de las capacidades de los países del Cono Sur para el monitoreo, evaluación y reporte del progreso alcanzado en el manejo forestal sustentable mediante el desarrollo, uso e implementación de los criterios e indicadores". 81p. y anexos.

_____. 2010b. Lineamientos estratégicos para la cooperación en información, uso, monitoreo y evaluación de C&I para la conservación y el manejo sustentable de los bosques entre los países del Cono Sur en los países: Argentina, Chile, Paraguay y Uruguay. Elaborado bajo la coordinación de la Oficina Regional de la FAO para América Latina y el Caribe y la colaboración de Jessica Casaza, coordinadora regional y de los coordinadores nacionales del proyecto TCP/RLA/3203. 17 p. y anexos.

Pokorny, B; Adams, M. 2003. What do criteria and indicators assess? An analysis of five sets relevant for forest management in the Brazilian Amazon. International Forestry Review 5(1): 20-28.

Prabhu, R; Colfer, CJP; Venkateswarlu, P; Tan, LC; Soekmadi, R; Wollenberg, E. 1996. Testing criteria and indicators for the sustainable management of forests: phase 1 (Final report). CIFOR, Bongor, ID. 217 p. (CIFOR special publication.)

Puettmann, KJ; Coates, KD; Messier, C. 2009. A critique of silviculture: Managing for complexity. Washington, US, Island Press.

Rametsteiner, E; Simula, M. 2003. Forest certification—an instrument to promote sustainable forest management? Journal for Environmental Management. 67: 87–98.

Sabogal, C; Casaza, J. 2010. Casos ejemplares del manejo forestal sostenible en América Latina y el Caribe (en línea). Roma, IT, FAO. Consultado set. 2011. Disponible en http://www.rlc.fao.org/es/bosques/manejo/pdf/casejes.pdf

Santos Z, JA. 1999. Validación y formulación de criterios e indicadores para la ordenación forestal sostenible y monitoreo de áreas protegidas en Honduras. Proceso Centroamericano de Lepaterique. Consulta Nacional. Tegucigalpa, Honduras. 105 p.

Schmid, M; Johnson, S. 2005. Brazil develops national C&I. Tropical Forest Update 15(3):15-16.

Sheil, D; Nasi, R; Johnson, B. 2004. Ecological criteria and indicators for tropical forest landscapes: challenges in the search for progress. Ecology and Society 9(1): 7.

Sherry, E; Halseth, R; Fondahl, G; Karjala, M; Leon, B. 2005. Local-level criteria and indicators: an aboriginal perspective on sustainable forest management. Forestry 78(5): 513-539.

Sheppard, SRJ; Meitner M. 2005. Using multi-criteria analysis and visualization for sustainable forest management planning with stakeholder groups. Forest Ecology and Management 207: 171-187.

Spilsbury, MJ. 2005. The sustainability of forest management. Assessing the impact of CIFOR's criteria and indicators research. Bogor, Indonesia, CIFOR. 126 p. (Impact assessment Papers No. 4).

Stork, NE; Boyle, TJB; Dale, V; Eeley, H; Finegan, B; Lawes, M; Manokaran, N; Prabhu, R; Soberon, J. 1997. Criteria and indicators for assessing the sustainability of forest management: conservation of biodiversity. Bogor, Indonesia, CIFOR. 29 p. (CIFOR Working paper 17).

Strutzenberger, P; Brehm, G; Fiedler, K. 2011. DNA barcoding-based species delimitation increases species count of Eois (Geometridae) moths in a well-studied tropical mountain forest by up to 50%. Insect Science 18: 349-362.

Sunderlin, W; Hatcher, J; Liddle, M. 2008. From exclusion to ownership. Challenges and opportunities in advancing forest tenure reform. Rights and resources Initiative. (in line). Washington DC, US. Consultado set. 2011. Disponible en http://www.rightsandresources.org/documents/files/doc_736.pdf

Venter, O; Laurance, WF; Iwamura, T; Wilson, KA; Fuller, RA; Possingham, HP. 2009. Harnessing carbon payments to protect biodiversity. Science 326: 1368

Wilkie, ML; Holmgren, P; Castañeda, F. 2003. Sustainable forest management and the ecosystem approach: two concepts, one goal. FAO, Rome, IT. 31 p. (Forest Management Working Paper FM 25).

Wolfslehner, B; Vacik, H; Lexer, MJ. 2005. Application of the analytical network process in multi-criteria analysis of sustainable forest management. Forest Ecology and Management 207: 157-170.

Wood, P. 2000. A comparative analysis of selected international forestry certification schemes. British Columbia, CA, Ministry of Employment and Investment. 59 p.

WWF (World Wildlife Fund, Centroamérica). 2004. Monitoreo ecológico del manejo forestal en el trópico húmedo: Una guía para operadores forestales y certificadores con énfasis en Bosques de Alto Valor para la Conservación. San José, Costa Rica, WWFCA. 116 p.

Zapata, JP. 2005a. The Central American Process of Lepaterique (in line). Consultadoset. 2011. Disponible en http://www.fao.org/forestry/docrep/wfcxi/PUBLI/PDF/V6E_T375.PDF.

_____. 2005b Honduras, criterios e indicadores para el manejo forestal sostenible. Sistematización de la Experiencia del Proceso Nacional de Criterios e Indicadores para el Manejo Forestal Sostenible. Tegucigalpa, HN, CCAD, EFCA, IUCN. 29 p.

Annex

Annex 1. List of Forest-Related Instruments, Agreements and Processes Covered in Thematic Analyses (McDermott et al. 2007)

Global, Legally-Binding Forest-Related Instruments
6. Convention on Biodiversity (CBD)
7. United Nations Framework Convention on Climate Change (UNFCCC)
8. United Nations Convention to Combat Desertification (UNCCD)
9. Convention on International Trade in Endangered Species (CITES)
10. World Heritage Convention (WHC)
11. The Ramsar Convention on Wetlands (Ramsar)
12. International Tropical Timber Agreement (ITTA)
13. World Trade Agreement (WTA)

Global, Nonlegally Binding Forest-Related Instruments
1. Intergovernmental Panel on Forests (IPF)
2. Intergovernmental Forum on Forests (IFF)
3. United Nations Forum on Forests (UNFF)

Regional Forest-Related Instruments
1. Regional Convention for the Management and Conservation of Natural Forest Ecosystems and the Development of Forest Plantations (Central American Forest Convention)
2. Amazon Cooperation Treaty (ACT)
3. Ministerial Conference for the Protection of Forests in Europe (MCPFE)
4. European Union Action Plan for Forest Law Enforcement, Governance and Trade (FLEGT)
5. Europe and North Asia Forest Law Enforcement and Governance (ENAFLEG)
6. Association of Southeast Asian Nations Agreement on the Conservation of Nature and Natural Resources (ASEAN Agreement)

7. South African Development Community's Forestry Protocol (SADC Forestry Protocol)
8. The East Asia Forest Law Enforcement and Governance Initiative (FLEG)
9. Africa Forest Law Enforcement and Governance initiative (AFLEG)

Criteria and Indicator Processes for Forest Management Abbreviation
1. Montreal Process Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests (Montreal Process)
2. Lepaterique Process of Central America on Criteria and Indicators for Sustainable Forest Management (Lepaterique Process)
3. Tarapoto Proposal of Criteria and Indicators for Sustainability of the Amazon Forest (Tarapoto Proposal)
4. Ministerial Conference for the Protection of Forests in Europe Improved Pan-European Indicators for Sustainable Management (MCPFE C&I)
5. ATTO/ITTO principles, criteria, and indicators for the sustainable management of African natural tropical forests (ATO/ITTO C&I)
6. International Tropical Timber Organization Criteria and Indicators (ITTO C&I)

Global Forest Certification Systems Abbreviation
1. The Programme for the Endorsement of Forest Certification Schemes (PEFC)
2. The Forest Stewardship Council (FSC)

Annex 2: List of Montreal Process Criteria and Indicators (Criteria 1–7) 2009

Criterion 1: Conservation of biological diversity

1.1   Ecosystem diversity

1.1.a. Area and percent of forest by forest ecosystem type, successional stage, age class, and forest ownership or tenure

1.1.b. Area and percent of forest in protected areas by forest ecosystem type and by age class or successional stage

1.1.c. Fragmentation of forests

1.2.   Species diversity

1.2.a. Number of native forest-associated species

1.2.b. Number and status of native forest-associated species at risk, as determined by legislation or scientific assessment

1.2.c. Status of on-site and off-site efforts focused on conservation of species diversity

1.3.   Genetic diversity

1.3.a. Number and geographic distribution of forest-associated species at risk of losing genetic variation and locally adapted genotypes

1.3.b. Population levels of selected representative forest-associated species to describe genetic diversity

1.3.c. Status of on-site and off-site efforts focused on conservation of genetic diversity

Criterion 2: Maintenance of productive capacity of forest ecosystems

2.a.   Area and percent of forest land and net area of forest land available for wood production

2.b.   Total growing stock and annual increment of both merchantable and nonmerchantable tree species in forests available for wood production

2.c.   Area, percent and growing stock of plantations of native and exotic species

2.d.   Annual harvest of wood products by volume and as a percentage of net growth or sustained yield

2.e.   Annual harvest of nonwood forest products

Criterion 3: Maintenance of ecosystem health and vitality

3.a.   Area and percent of forest affected by biotic processes and agents (e.g. disease, insects, invasive species) beyond reference conditions

3.b.   Area and percent of forest affected by abiotic agents (e.g. fire, storm, land clearance) beyond reference conditions

Criterion 4: Conservation and maintenance of soil and water resources

4.1.   Protective function

4.1.a. Area and percent of forest whose designation or land management focus is the protection of soil or water resources

4.2.   Soil

4.2.a. Proportion of forest management activities that meet best management practices or other relevant legislation to protect soil resources

4.2.b. Area and percent of forest land with significant soil degradation

4.3.   Water

4.3.a. Proportion of forest management activities that meet best management practices, or other relevant legislation, to protect water-related resources

4.3.b   Area and percent of water bodies, or stream length, in forest areas with significant change in physical, chemical or biological properties from reference conditions

Criterion 5: Maintenance of forest contribution to global carbon cycles

5.a.   Total forest ecosystem carbon pools and fluxes

5.b.   Total forest product carbon pools and fluxes

5.c.   Avoided fossil fuel carbon emissions by using forest biomass for energy

Criterion 6: Maintenance and enhancement of long-term multiple socioeconomic benefits to meet the needs of societies

6.1   Production and consumption
6.1.a. Value and volume of wood and wood products production, including primary and secondary processing
6.1.b. Value of nonwood forest products produced or collected
6.1.c. Revenue from forest-based environmental services
6.1.d. Total and per capita consumption of wood and wood products in round wood equivalents
6.1.e. Total and per capita consumption of non-wood products
6.1.f. Value and volume in round wood equivalents of exports and imports of wood products
6.1.g. Value of exports and imports of nonwood forest products
6.1.h. Exports as a share of wood and wood products production and imports as a share of wood and wood products consumption
6.1.i. Recovery or recycling of forest products as a percent of total forest products consumption

6.2.   Investment in the forest sector
6.2.a. Value of capital investment and annual expenditure in forest management, wood and nonwood forest product industries, forest-based environmental services, recreation and tourism
6.2.b. Annual investment and expenditure in forest-related research, extension and development, and education
6.3.   Employment and community needs
6.3.a. Employment in the forest sector
6.3.b. Average wage rates, annual average income and annual injury rates in major forest employment categories
6.3.c. Resilience of forest-dependent communities
6.3.d. Area and percent of forests used for subsistence purposes

6.3.e. Distribution of revenues derived from forest management
6.4.   Recreation and tourism
6.4.a. Area and percent of forests available and/or managed for public recreation and tourism
6.4.b. Number, type, and geographic distribution of visits attributed to recreation and tourism and related to facilities available
6.5.   Cultural, social and spiritual needs and values
6.5.a. Area and percent of forests managed primarily to protect the range of cultural, social and spiritual needs and values
6.5.b. The importance of forests to people

Criterion 7: Legal, institutional, and economic framework for forest conservation and sustainable management

7.1.a. Legislation and policies supporting the sustainable management of forests
7.1.b. Cross-sectoral policy and program coordination
7.2.a. Taxation and other economic strategies that affect the sustainable management of forests
7.3.a. Clarity and security of land and resource tenure and property rights
7.3.b. Enforcement of laws related to forests
7.4.a. Programs, services and other resources supporting the sustainable management of forests
7.4.b. Development and application of research and technologies for the sustainable management of forests
7.5.a. Partnerships to support the sustainable management of forests
7.5.b. Public participation and conflict resolution in forest-related decision making
7.5.c. Monitoring, assessment and reporting on progress toward sustainable management of forests

Annex 3. Tarapoto Criteria 1995: Relation of Criteria and Indicators for Sustainability of the Amazon Forest

I. NATIONAL LEVEL

Criterion 1. Socioeconomic Benefits

Indicators of Income, Production and Consumption

a. Economic profitability of management and sustainable use of the forests
b. Sustainable production, consumption and extraction of forest products
c. Value of forest products from sustainable sources and from unsustainable sources as percentages of Gross National Product
d. Employment and direct and indirect income from sustainable activities in the forest sector and generation of forest-based employment in relation to total national employment
e. Average per capita income in different forest sector activities
f. Efficiency and competitiveness of forest product production and processing systems
g. Impact of the economic use of forests on the availability of forest resources of importance to local populations
h. Relationship between direct and indirect uses of the forests

Indicators of Investment and Economic Growth in the Forest Sector

a. Proportion of annual investment in plantations, sustainable forest management and conservation in relation to total forest sector investment
b. Aggregate value of sustainable forest sector production
c. Rate of return on investment of the distinct economic activities in the sustainable forest sector, compared with rates of return in other sectors of the economy, considering all costs and benefits
d. Rate of increase of sustainable recreation and tourism activities

Indicators of Cultural, Social and Spiritual Needs and Values

a. Area and percentage of forest lands, in relation to total forest lands area, managed to protect cultural, social and spiritual needs and values
b. Area and percentage of forest lands use for purposes of supporting local populations
c. Level of participation of local populations in the management and in the benefits generated by forest activities
d. Development of productive alternatives to illicit crops and mining

Criterion 2. Policies and legal-institutional framework for sustainable development of forests

Indicators

a. Appropriate political and legal framework that stimulates sustainable development as a joint effort between the various levels of government and nongovernmental groups
b. Policies and legal framework for environmental planning through ecological-economic zoning
c. Capacity to implement international instruments of which the country is a part
d. Harmonization and implementation of existing legislation in the country

Criterion 3. sustainable forest production

Indicators

a. Extension and proportion of forest lands and forests dedicated to sustainable production in relation to the total permanent production area
b. Quantity and proportion of sustainable forest production in comparison with the national total forest production
c. Quantity and proportion of productive units of sustainable production, by area class, compared to the national total

d. Area and percentage of forest lands managed for recreation and tourism, in relation to total forest area
e. Level of diversification of sustainable forest production

Criterion 4. Conservation Of Forest Cover And Biological Diversity
Indicators
a. Area, by forest type, in categories of protected areas, in relation to total forest area
b. Measures for in situ conservation of species in danger of extinction
c. Measures for the conservation of genetic resources
d. Area and percentage of forest affected by processes or other agents (insect attack, disease, fire, flooding, etc.)
e. Rate of natural regeneration, species composition and survival
f. Rate of conversion of forest cover to other uses
g. Area and percentage of forest lands with fundamental ecological changes
h. Impact of activities in other sectors on the conservation of forest ecosystems (mining, farming and ranching, energy, infrastructure, etc.)

Criterion 5. Conservation And Integrated Management Of Water And Soil Resources
Indicators
a. Measures for soil conservation
b. Area and percentage of forest lands managed for environmental protection
c. Percentage of water masses in forested areas in relation to the historical range of variability and maintenance of the relation between the forest and hydrobiological resources
d. Effects of forest conservation on the integrated management of water resources

Criterion 6. Science and technology for the sustainable development of forests
Indicators
a. Quantity and quality of adequate technology for forest management and sustainable production
b. Level of recuperation and degree of use of indigenous technologies
c. Investment in research, education and technology transfer
d. Quantity and quality of research and sustainable development underway
e. Mechanisms for remuneration for traditional knowledge
f. Degree of access to technology and information by different social groups

Criterion 7. Institutional capacity to promote sustainable development in amazonia
Indicators
a. Quantity and quality of institutions and of their intersectoral and interinstitutional coordination
b. Existence of plans and their degree of execution
c. Quantity and quality of education and research programs
d. Degree of effective participation by civil society (academic institutions, grassroots groups, NGOs, trade unions and the private sector)

II. MANAGEMENT UNIT LEVEL

Criterion 8. Legal and institutional framework
Indicators
a. Forest management plan approved by the competent authorities
b. Periodicity of evaluation of management plan implementation and average percent; age of implementation
c. Legal framework that guarantees the stability of long-term investments in the forest sector

Criterion 9. Sustainabile Forest Production
Indicators
a. Annual extraction of timber and nontimber forest products compatible with the sustainability capacity of the resource base
b. Area and percentage of forest soils affected by significant alterations in physical-chemical properties and erosion
c. Effectiveness of systems of administration and control
d. Degree of diversification of production
e. Degree of use of environmentally friendly technologies

Criterion 10. Conservation of forest ecosystems
Indicators
a. Proportion of area of permanent production in areas of environmental protection
b. Measures to protect, recuperate and sustainably use wild populations of species in danger of extinction
c. Area and percentage of forest affected by processes or other natural agents (insect attack, disease, fire, etc.) and by human actions
d. Rates of regeneration and forest ecosystem structure
e. Soil conservation measures
f. Measures for protection of water courses from forest activities

Criterion 11. Local socioeconomic benefits
Indicators
a. Quality of life of local populations
b. Profitability and rate of return of forest management

c. Efficiency of systems of production and transformation of forest products
d. Impact of the economic use of the forest on the availability of forest resources of importance to local populations
e. Amount of direct and indirect employment and income level
f. Nature and quantity of benefits deriving from forest management
g. Annual quantity of products extracted per hectare
h. Added value of production
i. Mechanisms for consultation and the effective participation of local communities in the management of forest resources, depending upon the scale of management

III. SERVICES AT THE GLOBAL LEVEL

Criterion 12. Economic, social and environmental services from the amazon forest
Indicators
a. Contribution to satisfying the global demand for sustainably produced timber and nontimber forest products
b. Contribution to the global carbon balance
c. Contribution to the global water cycle
d. Contribution to the conservation of biological diversity
e. Contribution to radiation balance and regulation
f. Contribution to the maintenance of cultural values and diversity and of indigenous and local populations' knowledge
g. Contribution to the economy, health, culture, science and recreation

Annex 4: Criteria at the Regional, National and Management-Unit Scale for Sustainable Forest Management in Central America: Lepaterique Process

Workshop Involving Experts, Tegucigalpa, January 20–24, 1997
(Source: http://rds.hn/index.php?documento=545&hl=lepaterique, 2002)

Regional Scale	National Scale	Management Unit
Criterion 1 Existence of a political, legal, institutional, technical, economic and social framework that ensures and promotes sustainable management and conservation of forests	**Criterion 1** Existence of a political, legal, institutional, technical, economic and social framework that ensures and promotes sustainable management and conservation of forests	**Criterion 1** Political, legal and institutional framework to favor sustainable forest management
Criterion 2 Conservation and maintenance of the environmental services provided by forest resources	**Criterion 2** Forest cover **Criterion 3** Forest health and vitality	**Criterion 2** Sustainable forest production
Criterion 3 Maintenance of the productive capacity of forest ecosystems	**Criterion 4** Contribution of forest ecosystems to environmental services **Criterion 5** Biological diversity in forest ecosystems	**Criterion 3** Maintenance of biological diversity in forest ecosystems
Criterion 4 Maintenance and improvement of the multiple beneficial social, economic and cultural services of forest ecosystems that attend to the needs of different human groups	**Criterion 6** Productive functions of forest ecosystems **Criterion 7** Scientific and technological capacity for development of forest resources **Criterion 8** Maintenance and improvement in the multiple social, economic and cultural benefits of forest ecosystems to attend to the needs of different human groups	**Criterion 4** Production of soil and water **Criterion 5** Maintenance and improvement in local socioeconomic benefits

Annex 5 (a): List of the Lepaterique Process Criteria and Indicators at the National Level (FAO 2002)

Criterion 1: Existence of a legal, political, institutional, technical and socioeconomic framework that promotes and ensures the sustainability of forest management and the conservation of forest resources
Indicators

1. A dynamic and participative forest policy integrated with other sectors and implemented to support sustainable use of forest resources
2. Legislation that facilitates the implementation of national forest policies and forest management plans
3. Technical and financial resources available to governmental and nongovernmental institutions that permit implementation and supervision of forest policy
4. Updating of curricula in educational institutions related to sustainable management of resources
5. Economic policies that promote the sustainable management of forest resources
6. National Forest Research Plan for natural resources that aims at strengthening the capacity for research and transfer of technology
7. Norms that regulate forestry practices in a manner that ensures sustainable forest management
8. A legal framework that guarantees respect for cultural values and for the use of forest resources in territories belonging to local people, with emphasis on indigenous communities
9. Strengthen participation of civil society and local governments that can support and promote sustainable management of forest resources

Criterion 2: Forest cover
Indicators

1. Total area of the country's forest in relation to—
   a. Total land area of the country
   b. Area suitable for forestry
   c. Area of forests in protected areas
   d. Rate of change from forest to other land uses
2. Area of managed forest in relation to—
   a. Area of forests within protected areas
   b. Area of forests outside of protected areas

Criterion 3: Forest health and vitality
Indicators:

1. Regeneration and changes in composition and structure of forests
2. Area and percentage of forest affected by different natural agents
3. Area and percentage of forest affected by anthropogenic means

Criterion 4: Contribution of forest ecosystems to environmental services
Indicators:

1. Number and area of protected areas with management plans, operating plans and monitoring plans being implemented
2. Area and percentage of forests managed for recreation and tourism in relation to the total national land area
3. Number, area and percentage of watersheds with applied management plans
4. Area and percentage of forest cover managed for soil and water conservation
5. Relation between forest cover by watershed and frequency of flooding
6. Estimates of biomass in forest ecosystems as a function of carbon capture and carbon sinks

Criterion 5: Biological diversity of forest ecosystems
Indicators:

1. Percentage and area of forest types in the various categories of managed protected areas

2. Number of endemic, threatened and/or endangered species
3. Estimates on wildlife species dependent on forest habitats
4. Area and length of biological corridors per forest ecosystem
5. Area and percentage of primary and secondary forests and plantations
6. Number of species conserved ex-situ (for example, in germplasm banks)

Criterion 6: Productive functions of forest ecosystems
Indicators:
1. Forest area with legally authorized management plans under implementation
2. Goods and services provided by forest ecosystems
3. Annual harvest of timber and nontimber forest products in relation to the amount defined as sustainable
4. Production of energy products (firewood and charcoal) coming from forest ecosystems according to its management class
5. Diversification of forest products: timber and nontimber products
6. Production from managed forests in relation to forest production at the national level
7. Growth and yield of forest species and stands
8. Silvicultural prescriptions for each type of forest

Criterion 7: Scientific and technological capacities for the development of forest resources
Indicators:
1. Common terminology for forest resources
2. Implementation of an information system on productive capacity of forest ecosystems
3. Degree of investment in research, education and technology transfer

4. Implementation of a national research and training plan on natural resources
5. Implementation of mechanisms of horizontal cooperation
6. Level of access and interchange of information technology

Criterion 8: Maintenance and improvement of the multiple socioeconomic and cultural benefits of the forest ecosystems required to attend to the needs of different human groups
Indicators:
1. Amount of investments in forestry in relation to the Gross National Product (GNP)
2. Contribution of environmental services and timber and nontimber products to the GNP
3. Employment opportunities, direct and indirect, for women in forest activities
4. Quality of life of local communities involved in sustainable forest management activities
5. Balance of commerce in the forestry sector
6. Value added by carbon fixation
7. Value of firewood for domestic and industrial use
8. Rate of growth in and benefits of ecotourism activities
9. Instrumentalization to ensure application of agreements and contracts in relation to the recognition of indigenous property rights (Convention 169)
10. Equitable distribution of the benefits of access and use of the forest resources, with consideration of gender issues
11. Local participation in activities of the forestry sector and in the distribution of benefits
12. Internalization of costs in benefit of local communities

Annex 5 (b): List of Criteria and Indicators at the Level of the Management Unit, by Country (FAO 2002)

The following set of criteria and indicators at the level of the management unit was proposed as part of the development of the subregional workshops celebrated in Costa Rica and Honduras during February 1997.

Criterion 1. Political, legal and institutional framework to promote sustainable forest management5
Indicators

1. Legal framework to ensure participation of local governments and proprietors in forest management
2. Frequent reviews of technical norms and regulations of management plans
3. Percentage of updates of the land registry in the forest management unit
4. Percentage of investment in management destined to applied research and collection of data for follow-up to productivity
5. Technical, human and financial resources in governmental and nongovernmental institutions that enable evaluation and control in compliance with management plans
6. Area and percentage of area colonized illegally
7. Management plan approved by the state forestry administration
8. Frequency of assessment and control of compliance with the management plan and average percentage of compliance
9. Level of investment in direct and indirect incentives in the regeneration management and conservation of threatened natural resources in the forest management unit

Criterion 2. Sustainable forest production6
Indicators
Annual use of timber and nontimber products compatible with the sustainable capacity of the resource

1. Rate of basal area harvested
2. Number of remnant seed trees per hectare
3. Rate of volume harvested
4. Number of extracted trees per hectare
5. Percentage of area occupied by clearings
6. Relation among commercial species and total species

Rate of natural regeneration per hectare

1. Areas and percentages of forest soils affected by activities of forest exploitation
2. Area and percentage of types of forest affected by forest fires, pests and diseases
3. Evaluation of damages and application of measures to mitigate the impact of forest operations, fires, pests and diseases
4. Training programs directed to personnel involved in forest operations and to the general population
5. Level of diversification of forest production
6. Yield from use and transformation of timber and nontimber products
7. Area and percentage of total forest affected by change in land use or by natural agents

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5 Indicators 1,2,3,5 and 6 were proposed only in the subregional workshop in Honduras, and 4,7, 8 and 9 were proposed in the regional workshops in both Costa Rica and Honduras.

6 Indicators 2, 6, 9, 11 and 12 were proposed only in the subregional workshop in Costa Rica; 4 and 7 were proposed only in the subregional workshop in Honduras. And 1, 3, 5, 8, 10 and 13 were proposed in the subregional workshops in both Costa Rica and Honduras

8. Implementation of measures to diminish the impact of forest operation on the ecosystem (for example, logging, dragging, loading)
9. Level of execution and compliance with forest management plans
10. Delimitation of the management units and the annual cutting units
11. Monitoring of floristic composition, structure and growth of the forest through establishment of permanent demonstration plots
12. Area of damaged areas rehabilitated in relation to the total use area

Criterion 3. Maintenance of biological diversity in forest systems[7]

Indicators

Establishment of protected areas duly delimited and marked on the ground in terms of

1. Degree of fragility
2. Number of species threatened or in danger of extinction
3. Refuges and habitats for migratory species
4. Types of service (water, landscape, air, etc.)
5. Measures and application of a monitoring system and protection of priority areas
6. Measures aimed at restoring areas or ecosystems in the process of degradation
7. Area and percentage of total area dedicated to absolute protection
8. Number of species of interest and abundance before and after use
9. Measures and their implementation for the prevention and control of forest fires
10. Measures and their implementation for conservation of watersheds

11. Measures and their implementation for protections of plant and animal species that are threatened or in danger of extinction or key species
12. Monitoring of environmental or microclimatic changes
13. Areas and percentage of forest soils affected by management activities
14. Area and percentage of areas in regeneration
15. Rates of natural regeneration and floristic composition before and after use
16. Area and percentage of the total forest affected by change in land use or by natural agents

Criterion 4. Soil and water protection[8]

Indicators

1. Density of infrastructure in accordance with the category assigned to the management unit
2. Area of nonintervened forest areas along waterways and at their sources
3. Area under soil and water conservation after forest operations
4. Measures and implementation to reduce environmental contamination and the use of chemical products

Criterion 5. Maintenance and improvement of local socio-economic benefits[9]

Indicators

1. Mechanisms for information and for consultation with local communities in the process of sustainable forest management
2. Number and percentage of local organizations linked to forest management and commercialization of forest products

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7 Indicators 4, 10, 11 and 12 were proposed only in the subregional workshop in Costa Rica; 1, 2, 3, 5 and 9 were proposed only in the subregional workshop in Honduras. And indicators 6, 7, 8 and 13 were proposed in the subregional workshops in both Costa Rica and Honduras.

8 This criterion was proposed only in the subregional workshop in Honduras. Indicator 4 was also proposed in the regional workshop in Costa Rica, where it was included in the criterion on Management of Biological Diversity in Forest Ecosystems.

9 Indicator 12 was proposed only in the subregional workshop in Costa Rica; numbers 6 and 11, only in the subregional workshop in Honduras. Numbers 1, 2, 3, 4, 5, 7, 8, 9 and 10 were proposed by both subregional workshops.

3. Areas of forest managed by the community
4. Number of direct and indirect jobs and incomes generated by forest activity and ecotourism
5. Level of participation, according to gender, in different forest activities
6. Degree of diversification of forest production
7. Degree of participation and negotiation by local governments, nongovernmental organizations, owners and communities in the management of forest resources

8. Level of contribution to quality of life of the populations involved in sustainable forest management
9. Profitability of forest management
10. Degree of distribution of economic benefits derived from use of the forest
11. Degree of contribution to the local economy from use of the forest
12. Measures and implementation to conserve the historical and cultural characteristics of the forest

Abbreviations

ACM	Adaptive Collaborative Management
ACTO	Amazon Cooperation Treaty Organization (OCTA, Spanish acronym)
ALIDES	Alianza Centroamericana para el Desarrollo Sostenible (Central American Alliance for Sustainable Development)
ATO	African Timber Organization
CBD	Convention on Biological Biodiversity
CCAB	Comisión Centroamericana para Bosques (Central American Commission on Forests)
CCAD	Comisión Centroamericana de Ambiente y Desarrollo (Central American Commission on Environment and Development)
CCAP	Comisión Centroamericana para Áreas Protegidas (Central American Council on Protected Areas)
CEPII	Cost-Effective Priority Investment Index
CERFLOR	Programa de Certificação de Manejo Florestal (Brazilian National Forest Certification Program)
CERTFOR	Sistema Chileno de Certificación de Manejo Forestal Sostenible (Chilean System for Sustainable Forest Management Certification)
C&I	Criteria and indicators
CIFOR	Center for International Forestry Research
COFLAC	Comisión Forestal para América Latina y el Caribe (Latin America and the Caribbean Forestry Commission)
COFO	Committee on Forestry
CPF	Collaborative Partnership of Forests
CSA	Canadian Standards Association
DNA	Deoxyribonucleic acid
FAO	Food and Agriculture Organization
FLEGT	Forest Law Enforcement, Governance and Trade

FRA	Forest Resources Assessment
FSC	Forest Stewardship Council
GRFLR	Global Partnership on Forest Landscape Restoration
IP	Indigenous peoples
IPF	Intergovernmental Panel on Forests
ISO	International Organization for Standardization
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature
MERCOSUR	Mercado Común del Sur (Southern Common Market)
MP	Montreal Process
MTCC	Malaysian Timber Certification Council
NFI	National forest inventories
NFMA	National Forest Monitoring and Assessment
NTFP	Non-Timber Forest Products
PEFC	Programme for the Endorsement of Certification
PES	Payments for Environmental Services
REDD	Reducing Emissions from Deforestation and Forest Degradation
SFI	Sustainable Forest Initiative
SFM	Sustainable Forest Management
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on Environment and Development
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
WCED	World Commission on Environment and Development