Forest Monitoring and Assessment for Climate Change Reporting: Partnerships, Capacity Building and Delivery

P. Holmgren, L-G. Marklund, M. Saket & M.L. Wilkie

November, 2007

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Bibliographic citation:

Holmgren, P., Marklund, L-G., Saket, M. & Wilkie, M.L. 2007. Forest Monitoring and Assessment for Climate Change Reporting: Partnerships, Capacity Building and Delivery. Forest Resources Assessment Working Paper 142. FAO, Rome.
www.fao.org/forestry/fra

Forestry Department
Food and Agriculture Organization of the United Nations

Forest Resources Assessment Working Paper

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Forest Resources Assessment Programme **Working Paper 142**
Rome, Italy, 2007

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Abstract

This working paper was prepared in light of the upcoming Conference of the Parties of the UNFCCC in December 2007 to inform about the status and ongoing efforts in the field of forest monitoring, assessment and reporting at national and international levels.
Part I is a review of partnerships between FAO and countries for building capacity and supporting implementation of forest monitoring, assessment and reporting, to meet requirements at national and international levels. At national level, FAO works with countries to establish long-term and robust monitoring systems, based on systematic field sampling and data collection. At international level, FAO supports countries to report to the Global Forest Resources Assessments, which is the leading global reporting process on forests, their management and use. Part II presents basic requirements for national forest monitoring systems, seen from a broader policy context. It reviews the current status in countries with respect to two variables that are important for climate change reporting – forest area changes and forest carbon stock. It is concluded that in most developing countries the quality of current forest monitoring would not be satisfactory for an accounting system of carbon credits. However, it is also suggested that investment in national forest monitoring is attracting greater interest, as exemplified by the increasing number of countries requesting support from FAO. FAO continues to work in close collaboration with its member countries to improve forest monitoring, assessment and reporting, including helping them to meet requirements for forest carbon reporting.

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Introduction

This working paper was prepared in light of the upcoming Conference of the Parties of the UNFCCC in December 2007 to inform about the status and ongoing efforts in the field of forest monitoring, assessment and reporting at national and international levels.

Part I is a review of FAO's role in providing support to developing countries seeking to enhance their capacity to monitor, assess and report on forest resources and forest carbon. It was originally prepared in response to a request from the Coalition for Rainforest Nations.

Part II presents basic requirements for national forest monitoring systems, seen in a broader policy context. The text of this section was originally prepared for an OECD conference in November 2006, and later published in the book "Forestry & Climate Change" (CAB International, 2007). This part reviews the current status in countries with respect to variables that are important for climate change reporting – forest area changes and forest carbon stock. It is concluded that in most developing countries the quality of current forest monitoring would not be satisfactory for an accounting system of carbon credits. However, it is also suggested that investment in national forest monitoring is attracting greater interest, as exemplified by the increasing number of countries requesting support from FAO.

The current emphasis on climate change issues has raised interest in forest monitoring, assessment and reporting. Forests store considerably more carbon than the atmosphere. Forests are also under pressure that leads to deforestation and forest degradation, and consequently emissions of greenhouse gases. Current estimates suggest that deforestation accounts for one fifth of human induced emissions of carbon dioxide. It is therefore no surprise that there is political interest to seek incentives to reduce deforestation and forest degradation. Within the Climate Change Convention (UNFCCC) circles this has become known as REDD. At the Conference of Parties in December 2007, it is expected that countries will start negotiations towards an agreement that would provide financial incentives to developing countries to reduce deforestation and/or forest degradation.

Such an agreement would have to rest on mechanisms that allow for progress to be measured and accounted for in a way that is acceptable for all parties. Over the past years, there have been considerable efforts made to develop standards (especially by IPCC) as well as methodologies (involving the science community) for forest carbon monitoring.

Forest monitoring has, however, a much longer history. National forest inventories have been applied for the past 100 years in some countries. FAO, through its Forestry Department, has been involved in national and global forest monitoring and assessment for the past 60 years and has formal working arrangements in this area with almost all countries.

While the current focus on climate change is driving methodology developments and, to some extent, investments, the overall scope of national forest monitoring is much broader, covering social, environmental as well as economics aspects of forests and forestry. At the same time, the parameters sought for forest carbon monitoring and reporting correspond well to traditional forest management parameters, such as forest area, growing stock and removals. It is evident that the requirements for forest carbon monitoring should build on these experiences. The current emphasis on climate change issues provides opportunities for increased and improved forest monitoring and assessment, that is likely to benefit forestry at large.

This working paper carries two key messages to those engaged in monitoring of forests in relation to climate change agreements:

1. It is important to acknowledge that national and international processes to deliver forest and forestry information needed in the climate change context are largely in place, as exemplified by the work of FAO and its member countries.

2. Considerable synergies can materialize when MAR efforts related to climate change are integrated with broader information and knowledge needs in forestry.

FAO continues to work in close collaboration with its member countries to improve forest monitoring, assessment and reporting, including helping to meet requirements for forest carbon reporting. There is a clear positive development in the interest expressed by many countries to improve the quality and detail of forest information and knowledge.

This is partly due to the focus on climate change issues, but also in recognition of the broader and considerable benefits that forests and forestry can provide for achieving overall sustainable development.

Part I: FAO's partnership with developing countries – opportunities for the REDD process

1 Background

This brief is provided (28 September 2007) to the Coalition for Rainforest Nations to inform about FAO's work in partnership with countries to monitor, assess and report on national forest resources.

Comprehensive forest monitoring, assessment and reporting (MAR) is required for wise decision-making, to have forests and forestry significantly contribute to livelihoods, sustainable development and poverty reduction. The specific rationale for this brief is narrower and focuses on the Coalition's efforts to incorporate certified emissions offsets related to deforestation and forest degradation within global carbon emissions markets through a negotiated agreement under the UNFCCC.

Such an agreement would have to include approaches for accounting of progress that are approved by the parties as a basis for calculating financial transactions. General and agreed standards for national forest carbon monitoring exist (e.g. IPCC). However, the implementation of forest monitoring in most developing countries is less advanced and would for the vast majority of countries not be sufficient for verifiable carbon accounting schemes (Holmgren & Marklund 2007).

FAO works actively and globally in partnership with, currently, 55 countries to improve national forest monitoring and assessment. The objective is to enrich the policy dialogue by enhancing the knowledge base, better profile forestry in mainstream politics and national accounting, and help facilitate compliance with international commitments. In 47 of these countries, of which 13 are members of the Coalition, the joint effort aims at establishing comprehensive, sophisticated, long-term and cost-efficient national forest monitoring systems on the ground. Such systems maximize the contribution of remote sensing technologies, but at the same time rely on systematic field data collection as the fundamental input.

Further, FAO, countries and partner organizations implement the Global Forest Resources Assessment (FRA), which is the leading international reporting process on forests and forestry. Results from the global FRA are used, e.g., in most global climate change models. The global FRA involves national institutions and expertise, and provides the acknowledged global baseline of forest resources status and trends including information on forest area changes and carbon stocks. The next global assessment (FRA 2010) will also establish a systematic global survey of forests – linked to national monitoring systems and designed to provide improved information on forest area dynamics (past and current).

This brief conveys that FAO is already an essential partner of countries in establishing forest monitoring and assessment systems, and that there are excellent opportunities to deepen these partnerships to comply with monitoring, assessment and reporting requirements under an agreement on reduced emissions from deforestation and forest degradation.

2 Improving national forest monitoring and assessment

Forestry is increasingly expected to address broader policy issues, including poverty alleviation, climate mitigation, energy supply and other fundamental issues on the development agenda. As a consequence forestry, in addition to traditional wood production and conservation objectives, needs to be mainstreamed across sectors and issues.

To meet requirements in this more complex policy environment, forest resources monitoring and assessment must evolve. In addition to traditional biophysical parameters, monitoring systems must address the full range of products and services, their management, categories of users, ownership and tenure, as well as conflicts in the use of forest resources. Monitoring of forest carbon stocks, forest degradation and forest area changes are, consequently, considered to be integral components of comprehensive forest monitoring.

FAO's programme to support national forest monitoring and assessment (NFMA) works with countries to develop and implement forest monitoring systems that respond to these new requirements. A methodology and approach has been developed and applied in partner

countries, based on the up to century-long experiences of national forest monitoring in some countries, and on state-of-the-art science.

The approach has been developed in relation to the following success parameters:

Parameter	**Comment**
National ownership and participation	National project steering committees include wide range of stakeholders.
Long-term monitoring objective	Monitoring of changes and trends in forests and forestry is a long term prospect that normally must survive several elections and other political changes. Institutionalizing the monitoring process is therefore crucial. FAO provides a long-term commitment for its engagement with countries.
Timely results	While there must be a long-term objective to the monitoring, it is also essential that (first) results can be delivered within a reasonable timeframe to support imminent decisions and provide feedback for making methodological adjustments. One complete phase of the national monitoring should normally not take more than two years to implement.
Addressing broad policy issues	Addressing social, environmental as well as economical issues in forests and forestry requires that a large number of relevant variables are included in the monitoring and assessment design relating to, e.g., biophysical as well as socio-cultural dimensions.
Focus on impact of findings	Results must actively be fed to the policy dialogue and the debate on implications and responses must be stimulated. These tasks are considered as integral parts of the monitoring and assessment process.
Relevant data collection	The wide range and complexity of variables to cover imply (a) that systematic field data collection using statistically sound sampling is necessary, (b) that data must be recorded through measurements, observations as well as interviews, (c) that due to complexities in and overlaps between land uses, data should be collected on all land, i.e. also outside the forests, and also that non-forest parameters could be considered to find synergies through integrated land use monitoring.
Appropriate use of remote sensing	Remote sensing technologies have strengths and weaknesses. They are suitable and effective for monitoring trends in vegetation cover (if sufficient

	reference data from the field are provided) and can complement field data collection and enhance estimates. However, for most variables included in the monitoring and assessment, remote sensing methods can not contribute additional information. The focus and relative cost of remote sensing components must take this into consideration. The remote sensing survey approach described elsewhere in this brief attempts to find an appropriate balance.
Moderate cost	Precision requirements must be balanced with cost and timely delivery of results. The FAO approach described here prioritizes the big picture and strategic aspects of decision making. It does not give detailed information on, e.g., small ecosystems. This keeps the cost at a moderate level.
International cooperation	Enhanced country – country collaboration and exchanges stimulates the monitoring process in many ways. FAO has a role to facilitate such collaboration over the long term.

More details on the methodology and approach to improve national forest monitoring and assessment are available at www.fao.org/forestry/nfms .

Current collaboration with countries, focusing on Coalition countries is described in Appendix 1.

Sample grid Bangladesh

Field measurements Guatemala

Interview with stakeholders Honduras

Figure 1. Illustration of methodology components for national forest monitoring and assessment

3 Global forest resources assessments and international forest reporting

FAO, at the request of its Member Countries, has carried out global forest resources assessments at 5 to 10 year intervals since 1946. The latest assessment (FRA 2005) covered 229 countries and territories and involved more than 800 people – including officially nominated national correspondents and their teams in 172 countries. The process is guided by an external Advisory Group, a series of Expert Consultations and by FAO Member Countries through statutory bodies including the Committee on Forestry and the Regional Forestry Commissions.

The FRA reports are the main authoritative source of global data on forest resources, and are widely used by countries and international organizations and processes for policy development and implementation. In particular, FRA data are used for monitoring progress towards the Millennium Development Goals, by the international environmental conventions (The United Nations Framework Convention on Climate Change (UNFCCC) the United Nations Convention to Combat Desertification (UNCCD) and the Convention on Biological Diversity (CBD)) and by the United Nations Forum on Forests (UNFF) and the International Tropical Timber Organization (ITTO).

The well-established FRA process provides two specific opportunities for improving the availability and quality of data related to forest carbon stocks in compliance with existing requirements under the UNFCCC and in support of the REDD process:

Increasing the capacity for forest reporting using existing information

Strengthening the capacity in developing countries forms an integral part of the country reporting process of the Global Forest Resources Assessment and the network of national correspondents worked in close collaboration with FAO staff to finalise their country reports for FRA 2005. Detailed guidelines, specifications and reporting formats for analyzing and reporting information on forest resources were prepared in English, French, Spanish, Arabic and Russian and were disseminated to all national correspondents.

Three training workshops were held prior to the launch of FRA 2005 involving 122 national correspondents and eight (sub-) regional workshops were held to review draft country reports with a total of 133 national correspondents participating in these. As part of these workshops, country representatives shared experiences and discussed how to make the best use of existing information sources and how to best present the results of such analysis covering a broad variety of priority topics related to the status and trends of forest resources, their condition, management, uses and users. Specific topics related to REDD include forest area, growing stock, biomass and carbon stocks. The IPCC Good Practice Guidance was used for reporting on all forest carbon stocks.

The training as well as the comprehensive review and quality control of the draft reports undertaken by FAO staff and consultants in the regional workshops and through regular correspondence allowed for discussions on data sources and their reliability, on how to analyze and present data, what assumptions can be reasonably made to provide the best reliable estimate when information is incomplete etc. and resulted in substantial increases in capacities for forest carbon monitoring and reporting in many developing countries. An analysis of data availability and quality for various parameters including forest carbon was also prepared and included in the main report of FRA 2005 (FAO, 2006), which is available at www.fao.org/forestry/fra2005.

Plans for the next assessment (FRA 2010) are currently well underway and will follow the same general approach as used for FRA 2005 for the country reporting process. The formal launch of FRA 2010 will take place during a global training workshop in March 2008 with regional workshops scheduled for later that year and early 2009. The main report is scheduled for release in late 2010.

Determining historical trends of deforestation and establishing a common framework and methodology for future monitoring

Estimating changes in forest area where a national forest monitoring system is not in place, or where it has only been installed recently, is a great challenge since past inventories, where existing, may have used different definitions and methodologies and may only provide information on the net change in forest area and not on the deforestation

rate[1]. Fortunately, worldwide coverage of satellite imagery is available starting from the mid 1970s and this can help determine the historical, or baseline, trends in deforestation.

As part of the Global Forest Resources Assessment 2010, FAO and its member countries and partners will undertake a global remote sensing survey of forests. This survey is aimed at substantially improving the knowledge on land use change dynamics over time, including deforestation, afforestation and natural expansion of forests. Building on the large existing network of national correspondents and other contacts and using a participatory process, the capacities of developing countries to determine historical rates of deforestation and monitoring current and future rates using a common framework and agreed methodology will be considerably strengthened.

A systematic sampling design will be used based on each longitude and latitude intersect and will cover the whole land surface of the Earth – or about 13,500 sample sites. The area covered at each sample site is 10 km x 10 km, providing a sampling intensity of about 1 percent of the global land surface. This grid of sample plots is the same as used for the national forest assessments supported by FAO (see above) and by many national forest inventory programmes.

For each sample plot, four Landsat images - dating from around 1975, 1990, 2000 and 2005 -will be interpreted and classified and a change matrix prepared providing quantitative information on the magnitude of different land use change processes.

To facilitate this ambitious task, FAO and its partner organizations will make rectified and pre-processed imagery available through an on-line information gateway and develop training materials and tools to aid the interpretation process. The interpretation of the imagery and the development of the change matrices will be undertaken by national teams thus making the best use of local knowledge (including information from existing and past national forest assessments and inventories) and facilitating transfer of technology and capacity building in mapping, monitoring, reporting and inventory techniques, where needed, through a

[1] The net change in forest area is calculated as the difference in forest area between two points in time and represents a combination of changes due to deforestation, afforestation and natural expansion of forests.

series of regional training workshops. This initiative is expected to form a pilot for the establishment or strengthening of national remote sensing based forest and land use monitoring systems in many developing countries. It will be possible for larger countries to derive statistically valid estimates of past and current deforestation rates at the national level as part of this survey should they so wish. For smaller countries, the costs of providing additional pre-processed imagery to enable the generation of statistically valid national level estimates will be marginal. A process to meet such demands will be in place in 2008.

The expected duration is 4 years starting in mid 2007. Refer to Appendix 2 for further details.

4 Opportunities for future collaboration with countries

At a general level, the table below summarizes information requirements under an anticipated REDD agreement, and how FAO's collaboration with countries, as outlined in this brief, fits in.

Information requirement	**Suitable approach**	**Link to FAO's collaboration with countries**
Past deforestation rates (land use/forest area dynamics)	Remote sensing with strong involvement of local expertise and/or field data.	FRA 2010 remote sensing survey framework, adapted for national application, e.g. within a NFMA project.
Current and future deforestation rates (land use/forest area dynamics)	Field based national inventories combined with remote sensing.	NFMA combined with FRA remote sensing survey approach.
State and trends of Biomass and Carbon stocks (forest degradation/improvement)	Field based national inventories (systematic field measurements is an absolute requirement).	The NFMA approach provides this information.
International, peer reviewed reporting	Active support to national expertise in producing quality controlled reports.	The global FRA process generates such reports for all countries.

There are, conclusively, a number of areas where FAO's collaboration and partnership with Coalition countries (as well as with other FAO Member Countries) can strengthen countries in complying with international commitments, particularly those related to UNFCCC and REDD. These include:

- adjust and enhance the FAO support to national forest monitoring and assessment, to meet specific information requirements under a REDD agreement;

- help bridge between national forestry institutions and institutions tasked to handle climate change negotiations and policies;

- apply the proposed remote sensing survey at international and national levels to establish baselines for forest area dynamics, including past and present deforestation rates;

- use the leverage of REDD requirements to increase support for and funding of overall forest monitoring and assessment, in which forest carbon monitoring is an integral part;

- establish the FRA process as the international reporting channel for REDD related information;

- further enhance cooperation and exchange between countries related to forest monitoring and assessment under the coordination and leadership of FAO.

FAO stands ready to discuss with the Coalition and its members on further actions and initiatives to take in the field of forest monitoring, assessment and reporting.

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Part II: National forest monitoring systems – purposes, options and status

Original reference:

Holmgren, P. & Marklund, L-G. 2007. National Forest Monitoring Systems - purposes, options and status. In: *Forestry & Climate Change* edited by P.H. Freer-Smith, M.S.J. Broadmeadow & J.M. Lynch, pp 163-173. CAB International. ISBN 139781845932947.

1 Introduction

Forests and forestry are subjects to a variety of political processes and high-level decision making that affect literally everyone's habitat and/or livelihood. But do we actually know what we need to know for dealing soundly with forests and forestry? Are there monitoring processes in place to ensure that sufficient knowledge about forests and forestry is generated to reduce uncertainties and support wise decisions?

Over the past decades, at least ten legal international instruments were established that address specific aspects of forest resources, their management and uses (Ruis 2001). Efforts to agree on an overall forest convention, on the other hand, failed at the United Nation's Conference on Environment and Development (UNCED) in 1992. Although alternative explanations of this failure exist (Davenport 2005), it is commonly acknowledged that the main argument against a forest convention was – and remains – the protection of national sovereignty. Many countries wanted to retain governance over national forest resources and not surrender decision-making to a binding international agreement.

The UNCED negotiations thereby reinforced the national-level nature of forest policy and legislation. Over the following fourteen years, the international dialogue has not closed in on any international and legally binding arrangement on forests (Persson 2005). A starting point for this paper is, consequently, that forest policy and legislation are inherently national-level processes, and further that these processes depend on some

form of national forest monitoring systems that meet defined requirements for the necessary decision-making.

At the same time, the numerous forest-related international agreements that have been successfully established require parties (countries) to verify and substantiate their compliance through specified reporting arrangements (CPF 2006). One key agreement relating to forests and forestry is the United Nations Framework Convention on Climate Change (UNFCCC) where a current debate concerns potential avoidance of carbon emissions from deforestation and from forest degradation. While interpretation and application of these concepts are to be negotiated, it is clear that national forest monitoring systems must be in place to follow and document the extent to which parties have followed the agreed intentions.

The question examined in this paper is whether current national forest monitoring systems, or national forest inventories, respond to requirements from national policy decisions as well as international reporting requirements. National forest monitoring systems are defined for this paper as processes that support strategic decision-making by:

- systematically and repeatedly measuring and observing forest resources, their management, uses and users;
- periodically delivering valid, representative and relevant information on status and trends for the country as a whole.

For the purpose of this paper, monitoring of operational forest management, including of legal compliance, early warning systems for example forest fires, of value-adding processing beyond the forest gate and of forest products are not included.

The paper determines the purposes of national forest monitoring. It evaluates technical options and approaches for monitoring systems against these aims. Finally, the situation of national forest monitoring is reviewed with special reference to the current discussion on avoiding carbon emissions from deforestation and from forest degradation within the UNFCCC.

2 Purposes of national forest monitoring

The purposes of national forest monitoring can be defined by objectives as expressed by relevant policy processes, under the assumption that such objectives also, implicitly, express a demand for systematic and quality-controlled information. Examining forest policy documents, including national communications to the United Nations Forum on Forests (CPF 2006), national forest programme updates (FAO 2006a), regional reviews (e.g. FAO 1998), and global overviews (e.g. FAO 2005), makes clear that forest policies are concerned with socio-cultural, economic as well as environmental dimensions (Table 1). Further, it is often emphasized that the forest sector interacts with several other sectors, e.g. agriculture, energy, tourism and transport.

Table 1. Issues frequently mentioned in recent expressions of forest policy objectives

Dimension	Issues
Socio-cultural	Rural livelihoods, Indigenous people's rights, Rights of access, Tenure and land ownership
Economic	Poverty, Food security, Wood productivity and supply, Valuation of forest products and services, Equity, Trade, Energy
Environmental	Biological diversity, Soil and water protection, Climate change, Desertification, Air pollution, Invasive species, Wildfire, Pests

Sources: CPF (2006), FAO (1998, 2005, 2006a)

The broad set of forest policy objectives at national level resonates well with statements in the international dialogue on forests. Sustainable forest management, an umbrella concept for forestry ambitions, has been defined by seven themes (FAO 2006b) which also contribute to overall sustainable development aspirations. The framework of sustainable forest management has been used to define information requirements for the Global Forest Resources Assessment process, in which countries report based on their national information sources (FAO 2006c).

Therefore, national forest monitoring systems need to be designed to deliver cost-effective and quality-controlled information across the issues listed in Table 1. These systems must include a wide range of variables addressing biophysical as well as socio-cultural and economic issues. In response to these requirements, the scope of the national forest inventory concept has recently been expanded from traditional measurements of

trees and other biological features, to include also interviews with local forest managers and stakeholders. (Kleinn et al. 2005, FAO 2006d).

Other emerging foci of forest monitoring relates to climate change. On one hand the health of forests under potentially changing climate need to be monitor for informed decisions and guidelines on adaptation of forest management practises. On the other, and as stated above, the mitigation of climate change through forest management by storing carbon in the forest ecosystem may become an economic and financial tool for forestry. Monitoring of carbon storage in the forest is closely related to variables covered by conventional national forest inventories, such as growing stock, growth and yield and forest area.

3 Options for national forest monitoring

This overview of technical options for national forest monitoring covers (a) methods for data collection, and (b) approaches to the national monitoring task.

Data collection methods

The wide range of social, economic and environmental issues to be addressed, imply a similarly wide variety of variables to be observed. Cost-effective methods for data collection have been a major focus in forest monitoring research (e.g. Ranneby *et al*. 1987, Gillis *et al*. 2005, Kleinn *et al*. 2005). Balancing requirements on accuracy and precision for the monitored variables with the cost of obtaining data from the field poses a classical problem of forest inventory. Cost may be prohibitive for systematic observations of some variables, e.g. soil carbon content. For others, key shortcuts include (a) applying statistical sampling – out of a wide variety of existing methods, (b) using subjective observations rather than more costly measurements, and (c) remote sensing to reduce the need for field work. Further, some variables are not directly observable as they reflect human perceptions and values, so data have to be collected through interviews with local stakeholders. Table 2 summarizes basic methods of data collection that are used in national forest monitoring systems. It is well established that a combination of these methods is required to monitor the range of identified forest and forestry issues at the national level.

Table 2. Basic data collection methods for national forest monitoring systems

Data collection method	Feasible variables	Pros	Cons
Field measurements	Biophysical properties	Precise	High cost Limited to measurable variables
Field observations	Biophysical properties, Land use	Wide range of variables possible	Relies on field staff judgements
Remote sensing	Area measures for some variables	Cost-effective (?) Supports field work performance	Low accuracy Few relevant parameters possible
Interviews	Resource uses, users, values, tenure, conflicts	Only way to capture local socio-economic information	Demanding methodology, Difficult to control bias

Source: Builds on Holmgren & Thuresson (1998), Kleinn (2006) and Andersson (2006).

Approaches

National forest monitoring systems, as defined above, should systematically and repeatedly measure and observe forest resources, their management, uses and users. However, many countries have not established such systems, or have systems that only partially can be characterized as a national forest monitoring system (FAO 2006c).

The design and implementation of national monitoring of forests can be seen as an investment in information that pays off through increased future benefits to society accruing from forest resources. However, these increased benefits, and thereby the return of the investment, are often not well known and can not be easily generalized. The monitoring approach and ambition chosen by a country will depend on many internal factors that are not analysed here.

Instead, a generic range of available approaches, currently in use, has been developed for this paper (Table 3), based on country reports to the Global Forest Resources Assessment 2005. While no comprehensive evaluations of these approaches are made here, Table 3 indicates a measure of quality and reliability in the derived information, with the highest quality and reliability at the top and the lowest at the bottom.

Table 3. Optional approaches to generate national forest information, with examples from sources for the Global Forest Resources Assessment 2005

Approach	Typical properties	Pros	Cons	Examples (FAO 2006c, 2006d)
1. National forest inventory				
Traditional national forest inventory	Many (>10000) systematically sampled field plots; Focus on biophysical variables	High precision and accuracy	High cost; Long implementation; Normally limited to biophysical variables	Sweden Finland
FAO-supported national forest assessment	Few (150-500) systematically sampled tracts; Measurements observations and interviews	High accuracy; Covers wide range of variables; Medium cost, Short implementation	Low precision for rare events; Trends not yet available	Guatemala Philippines
2. Other approaches				
Compilations of forest management plans	Assembly of information obtained from obligatory management planning activities	Strong link to policy implementation	Scope normally limited to forest operations planning; May not cover all forests	Russia
Remote sensing based	Trends in land cover and land use from image classifications	Full cover information, Comparable time series	Limited scope of variables	Brazil
Independent reports over time	Not fully compatible surveys, often based on remote sensing, are compared with help of assumptions	Pragmatic (only) option in many countries	Relies on assumptions for comparisons	Ecuador
Case studies and/or Models	Conditions at selected sites are extrapolated	In-depth information for selected sites	Not represent-ative for entire country	Zambia

Expert estimates	Qualified guesses where only scant information exists	Quick and inexpensive	Unknown information quality	Sudan

4 Status of national forest monitoring

Two basic forest parameters were selected for this paper to illustrate the current status of national forest monitoring. These are highly relevant to the current discussions on deforestation and forest degradation in the climate change context:

1. Forest area change, i.e. the aggregated area change (net change) resulting from deforestation, afforestation and natural expansion of forests (FAO 2006c, p. 14)
2. Forest carbon stock changes (FAO 2006c, p. 31)

For each parameter, the monitoring approach was classified according to the categories in Table 3 for all countries and areas that reported to the Global Forest Resources Assessment 2005 (FRA 2005). It is assumed that essentially all available and relevant information have been used for the FRA 2005 reporting from countries (FAO 2006c). To make the results relevant in the climate change context, countries were grouped into those that are listed in the Annex I of the Kyoto Protocol, and those that are not. Broadly speaking this also divides the world into developed and developing countries.

229 countries and areas reported to FRA 2005. Of these, 41, mainly dependent territories, are not parties to the UNFCCC and are excluded in the presentations below; they represent only 0.5% of the global forest area. 148 countries of those reporting to FRA 2005 have signed the climate change convention, but are not "Annex 1" parties of the Kyoto Protocol and are therefore referred to as "non-Annex I countries". 40 countries have signed both the convention and are listed in Annex I of the Kyoto Protocol and are referred to as "Annex I countries".

The world's forest area is nearly evenly distributed between Annex I countries (1.8 billion ha) and non-Annex I countries (2.1 billion ha). However, almost all current net loss of forest area occur in non-Annex I, i.e. developing, countries.

Figure 1 illustrates how the world's countries monitor their forests with respect to the two selected parameters. Annex I countries have an even distribution of approaches across the monitoring categories, while the majority of non-Annex I countries (85% of countries in the case of forest area and 92% of countries in the case of carbon stock) rely on independent assessments, models or expert estimates rather than systematic inventories. Figure 2 illustrates examples of countries that have recently adopted systematic monitoring, but where trend estimates based on the systematic sample can not be determined until a second inventory round is completed. For non-Annex I countries, the monitoring of carbon stock is dominated by lack of data and expert estimates.

Table 4 provides the same breakdown, but shows the proportion of global forest area subject to the different monitoring approaches. The distribution is similar to that shown in Figure 1, implying that the lack of systematic monitoring approaches is spread among larger as well as smaller countries.

Table 4. Global forest area subject to monitoring approaches for the two parameters forest area change (ha/year) and forest carbon stock change (tonnes/ha/year)

	Forest area subject to monitoring approach, million hectares							
	Parameter: Forest area change				**Parameter: Forest carbon stock trend**			
Monitoring approach	**non-Annex I**	**Annex I**	**Total**	**% of total**	**non-Annex I**	**Annex I**	**Total**	**% of total**
National forest inventory	216	370	586	10	216	370	586	10
Forest management plans	49	859	908	2	16	853	869	1
Maps	129	164	292	6	0	0	0	0
Independent reports	883	85	968	42	744	65	810	35
Case studies / Models	622	11	633	29	30	30	60	1
Expert estimates	218	326	544	10	852	15	867	40
No data	0	0	0	0	258	482	741	12
Total	**2,118**	**1,815**	**3,932**	**100**	**2,118**	**1,815**	**3,932**	**100**

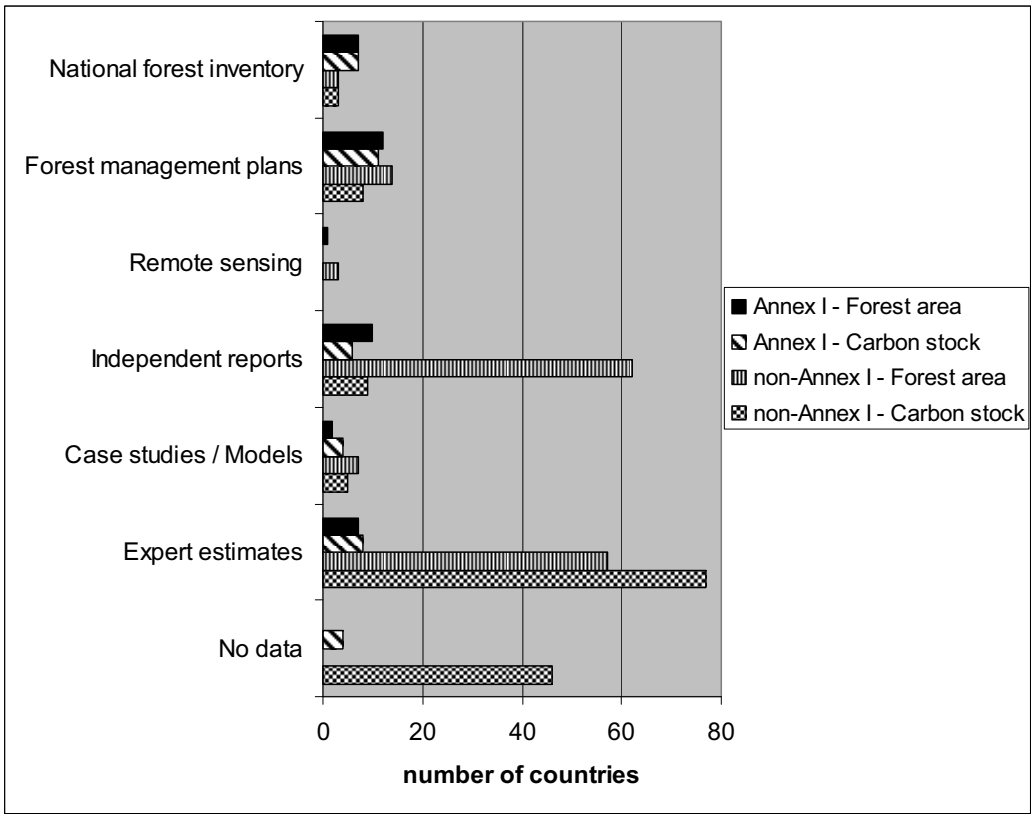

Figure 1. Forest monitoring approaches as applied by countries to estimate forest area change and forest carbon stock change. Based on FAO (2006c). Annex I indicates countries that are listed in Annex I of the Kyoto Protocol, Non-Annex I indicates countries that are not.

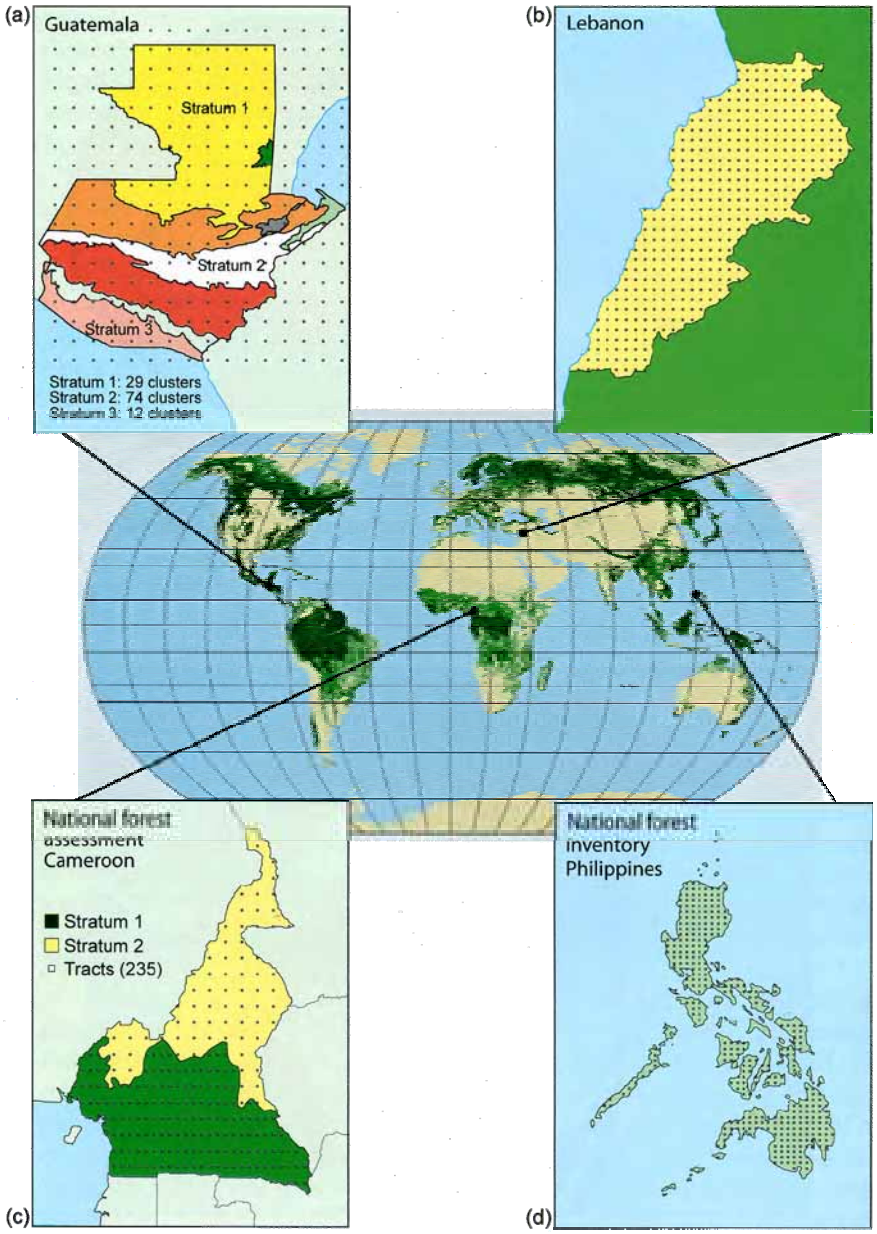

Figure 2. In centre, the World's distribution of forests according to the FAO-led Global Forest Resources Assessment 2000. Clock-wise from top left, sample grids for national forest inventories in Guatemala, Lebanon, The Philippines and Cameroon as applied in FAO-supported national assessments between 2001 and 2005.

5 Discussion

Conclusions

The results show that forests are not systematically monitored in the majority of countries and especially not in non-Annex I countries on which current discussions on deforestation and forest degradation in the UNFCCC context focus. This means that accuracy and precision of reported information is not possible to determine for most countries. The quality problem of relying on independent assessments or expert estimates is well illustrated by Global Forest Resources Assessment 2000 findings, where the forest area change reported by African countries was overestimated by more than a factor two, compared with a systematic remote sensing survey (FAO 2001).

Conclusively, current monitoring of forests seems not sufficiently accurate or precise for an international protocol that would administer finances based on monitoring results of forest area or forest carbon storage.

In addition, at least one of the two parameters examined above, forest area, is very basic and usually the first to be considered in a national forest monitoring system. While carbon stock is a more novel forest parameter of interest, it is according to the applicable guidelines (IPCC 2003) simply a deterministic function of forest growing stock, another basic component of national forest inventories. Conclusively, there appear to be considerable opportunities for synergies between general requirements of national forest monitoring and the specific requirements of the climate change related arrangements.

Underlying causes

The call for better forest information for policy making is not new (e.g. Pinchot 1923). What may be surprising is that so astonishingly little has been done over the past decades to ensure the supply of solid forestry information – despite the considerable attention and focus on forestry in a large number of international fora as described above, and despite the considerable international development assistance provided to the forest sector (Holmgren & Persson 2002).

Before marching ahead and implementing national forest monitoring systems, however, there may be reason to investigate further why investments in such systems have not been sufficient in the past. As proposals for future studies, the following hypotheses are suggested:

- The politically driven demand for national forest and forestry information for policy-related decision making is smaller than the international dialogue on forests suggests. In competition with other Government activities, the monitoring of forests and forestry to determine actions that pay off in a relatively distant future are not prioritised;

- The awareness, knowledge, experience, engagement, opportunity or influence of forestry professionals and their institutions are insufficient to establish commitments to long-term national forest monitoring efforts;

- Methodologies to meet relatively new, and constantly changing, demands for information take time to develop, share and implement and may be outdated when finally delivered. Method developments may also have been biased by an over belief in the technical performance of remote sensing methods, which has slowed down the development of field-based monitoring.

Opportunities and challenges

To end this paper with some positive outlooks, there is reason to believe that awareness and prioritization of national forest monitoring systems are on the rise; examples include Brazil and Russia that have recently made decisions to invest in national forest inventories. Several developing countries work at institutional as well as field level to improve national forest monitoring in collaboration with FAO (FAO 2006d).

Integrated approaches to national forest monitoring promise to be effective. One reason is that many variables overlap between the policy issues to be addressed. As mentioned above, key variables for carbon monitoring are also key variables for monitoring productive functions of forests as well as biological diversity. Further, given that field sampling and inventory is the preferred approach to national forest monitoring, the benefits of the considerable effort of reaching field sample locations should be maximized by collecting many parameters while there. In conclusion, there appear to be strong arguments to incorporate currently debated requirements for forest carbon monitoring in the established

general approach to national forest monitoring, thereby potentially improving the financial base for monitoring as well as enhancing future benefits of overall forest management.

There are further opportunities for integrating national monitoring approaches, extending beyond forests and forestry, to other land uses and related natural environments. In many countries, the forest resources extend over all land, including woodlands and trees outside of forests. As these resources are important to forest-sector policies, national forest monitoring often extend to all land. Sampling all land provides opportunities for development and implementation of inter-sectoral national land-use monitoring as the additional cost to collect, e.g., agriculture variables may be small. Such inter-sectoral approaches may (a) help enhance institutional collaboration in countries, (b) make better use of scarce inventory resources and (c) provide improved possibilities for inter-sectoral land use analyses and policy formulation (FAO 2006d).

Providing the relevant information to the relevant people at the relevant point in time at relevant cost are fundamental challenges for national forest monitoring systems. Competition for public finances and the fact that returns on the monitoring investment accrue in a relatively distant future add to the difficulties. Yet, our livelihoods depend heavily on the future of forest resources and the environment, calling for wise decisions on all levels, which suggests that the market for monitoring and quality information could expand.

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Appendix 1. Progress in countries of the Coalition for Rainforest Nations working with FAO to establish comprehensive national forest monitoring and assessment systems

National forest monitoring and assessment is a participatory process

The programme of support to National Forest Monitoring and Assessment (NFMA) in member countries evolves around an approach, designed by FAO with the help of a panel of international inventory experts and forest managers (decision makers) from all regions. The approach was developed to generate information on forest and trees outside forest (TOF) biophysical and socio-economic properties needed by the national decision makers at optimised cost and to set up long term monitoring of the resources. The approach is based on systematic field sampling complemented by remote sensing for a wall-to-wall mapping or land use and landscape analysis from e.g.10x10km sites linked with the field sample. The field sampling constitutes a network of permanent sample sites for the monitoring of the land uses and forest and tree cover changes. The generated information is harmonised with the existing national information framework and in consideration of the international reporting requirements e.g. FRA, CBD, CCB, UNCCC, etc.

One of the key outcomes of the NFMA programme is the enhanced south-south collaborations between participating countries, including exchange of experiences and expertise and establishing a foundation for maintaining a critical mass of competence and capacity over the long-term.

In the below, progress is presented for the 13 Coalition countries (out of totally 30 listed on the Coalition website) working with FAO in establishing comprehensive NFMA processes since 2001. This includes countries where results are already being used in the policy dialogue and reporting, as well as countries where the process have only been initiated. In some of these countries, Guatemala, Honduras and Costa Rica, a second phase of the NMFA is currently initiated, which will allow for estimates of trends for key forest parameters.

1. Bangladesh

Bangladesh has completed its first national forest assessment (NFA) in 2005-2007 using funds from the Technical Cooperation Programme (TCP) of FAO. The Government contributed about 50% of the project cost. The NMFA was carried out through a wall-to-wall mapping of the land use/land cover systems and a systematic field sampling covering the entire country. The project focussed on building the national capacity and developing a database with a rich information on the state, management, uses and users of the forest and trees outside forest (TOF) resources. The forest types and land uses classification system was harmonised with the historical national information as well as with the international reporting formats.

The results of the project encompassed a wide range of information such as forest and other land use area, tree species composition and distribution by land use category and forest type, growing stock (volume, biomass and carbon), health of the forests and trees, natural and man caused disturbances in forests and trees, management, uses and users of the resources, etc. For instance, the total aboveground woody biomass in forests and TOF in Bangladesh was estimated at 209 millions tons and 427 millions tons respectively.

Focal point: Ishtiaq Uddin Ahmad, National Project Director, Ministry of Environment and Forests.

2. Cameroon:

Cameroon has completed its first NFMA in 2003-04 using funds from the FAO/Netherlands Partnership Programme (FNPP) and about US$ 450,000 contribution from the Government. The central and northern regions of the country were inventoried for the first time. The project followed the FAO approach to NFMA.
The field inventory encompassed a large array of biophysical and socio-economic variables (about ninety variables) of the forest and TOF resources. The results included tree species composition in forests (by forest type) and non-forest lands (other land, other wooded land and inland water); wood volume, above ground biomass and carbon in forests and trees; non-wood forest .products and services (wide range of products and services); management, uses and users of the resources.
At present, Cameroon holds a database with very rich field data that can generate a considerable volume of information on different aspects of the

resources. The stock of aboveground woody biomass in forests and TOF was estimated at 6.2 billions tons and 0.8 billions tons respectively.

Focal point: Joseph Abena, Directeur des Forêts, Ministère de l'Environnement et des Forêts.

3. Colombia

In 2004, Colombia requested the technical and financial support from FAO to plan and undertake NFMA and build her capacity in this area. A mission was carried out during that year to Bogotá to discuss with the nationals the request and explore the options of funding. The national authorities remained with the responsibility to find funds for the activity. Until now, no further action was taken.

Focal point: Carlos Costa Posada, Director General del Instituto de Hidrología, Meteorología y Estudios Ambientales (IHMEA).

4. Congo

In late 2006, the Republic of Congo started its NFMA with the financial and technical support from TCP of FAO. The Government is contributing funds, staff and facilities to carry out the NFMA. The project has completed its first phase which focussed on capacity building, developing manuals and field forms, procuring equipments, designing and harmonising land use classification system with the historical information in the country and planning the project activities including the fieldwork. The second phase was initiated recently by sending the inventory teams to the field for data collection in the selected sample sites.
Like the NFMA projects in the other countries supported by FAO, the NFMA project of Congo is planned to generate a wide range of information on forest and other land use areas, tree species composition and distribution by land use category, growing stock (volume, biomass and carbon), health of the forests and trees, natural and man induced disturbances in forests and trees, management, uses and users of the resources, etc.

Focal point: Grégoire Nkéoua, Directeur des forêts, Ministère de l'Economie.

5. Costa Rica

Following the approach developed for the NFMA, Costa Rica was the first country to carry a national forest assessment. The project was intended to test the approach with funds and technical assistance from FAO and facilitation by the Centro "Agronómico Tropical de Investigación y Enseñanza" (CATIE).
The project was designed to build the capacity of "Sistema Nacional de Áreas de Conservación" (SINAC) and to generate the information needed by the country for national decision making and for reporting to the international processes. Considerable amount of information was produced by the project from the systematic sample plots materialised in all land uses. It included area of forest types and other land uses, wood volume and corresponding biomass and carbon, tree species composition, management, uses and users of the resources in forests and TOF. The stock of aboveground woody biomass in forests and TOF was estimated at 222 millions tons and 29 millions tons respectively.

Focal point: Jorge Rodriguez, Viceministro del Sistema Nacional de Áreas de Conservación.

6. Ecuador

In 2006, Ecuador requested the technical and financial support from FAO to plan and undertake the NFMA and build its capacity in this area. A mission was carried out during that year to Quito to discuss with the nationals the request and explore the funding options. A national workshop was organised with assistance from FAO where partners and stakeholders in the forestry sector took part and discussed the need of and requirements from a NFMA and the approach that can be applied. The workshop recommended that the Directorate of Forests takes the lead in the development of the NFMA programme in Ecuador in coordination with FAO and continue the dialogue with the stakeholders and partners in a Working Group (WG) set up for the purpose to develop a comprehensive programme and a long term strategy for NFMA and monitoring of forests and trees.
The Directorate of Forests remained with the responsibility to find funds for the programme. Until now, no further action was taken.

Focal point: Christian Velasco, Director Nacional Forestal.

7. Guatemala

Guatemala was the second country to carry out a NFMA and set up a long monitoring system of the forestry resources. The first NFMA of the country was completed by the "Instituto Nacional de Bosques" INAB in 2002-2003 using funds from the FNPP. INAB worked in this project with two other major national partners namely the Consejo Nacional de Areas Protegidas (CONAP) and the Universidad del Valle de Guatemala.
The NFMA was carried out through a systematic sampling covering the entire country. The project focussed on building the national capacity and developing a database with rich information on the state, management, uses and users of the forest and TOF resources. The forest type and land use classification system was harmonised with the historical national information as well as to meet the international reporting formats.
The results of the project included a wide range of information e.g. forest and other land use areas, tree species composition and distribution by forest type and land use category, growing stock (volume, biomass and carbon), health of the forests and trees, natural and man induced disturbances in forests and trees, management, uses and users of the resources. For instance, the total aboveground woody biomass estimated in Guatemala in forests and TOF is 502 millions tons and 204 millions tons respectively. About 50% of the natural forest is moderately (23%) to highly (27%) disturbed mainly by human activities. Fires run every year over about 25% of the natural forest.

Focal point: Claudio Cabrera, Viceministro de Agricultura, Recursos Naturales y Alimentación.

8. Honduras

In 2005-2006, Honduras has carried out its first NFMA and set up a long monitoring system of the forestry resources. The NFMA was completed by the Administración Forestal del Estado – Corporación Hondureña de Desarrollo Forestal (AFE-COHDEFOR) using TCP funds from FAO. AFE-COHDEFOR worked with the Agenda Forestal in Honduras to implement the project.

The NFMA was carried out through a systematic sampling covering the entire country. The project focussed on building the national capacity and developing a database with wide information on the state, management, uses and users of the forest and TOF resources. The forest type and land

use classification system was harmonised with the historical national information framework and with the international reporting formats. The results of the project covered a wide range of information e.g. forest and other land use areas, tree species composition and distribution by forest type and land use category, growing stock (volume, biomass and carbon), health of the forests and trees, natural and man induced disturbances in forests and trees, management, uses and users of the resources. For instance, the forests and TOF retain a total 563 millions tons and 104 millions tons respectively of aboveground woody biomass. About 48% of the natural forest is disturbed mainly human activities (74%). 61% of the disturbances were caused by fires and 18% by the livestock.

Focal point: Ramón Alvarez, Director, COHDEFOR.

9. Kenya

Kenya negotiated with FAO a project for forestry resources assessment. As the approach to be followed is build on nationwide systematic sampling covering all land uses, the Government of Kenya opted for a broader assessment of natural resources to optimise the cost and generate wider scope of information not only on forests and TOF but also on wildlife, livestock, crop, soil and water. An Integrated Natural Assessment project was designed and a pilot phase in three districts was funded by FAO through the FNPP and by the Government. The ongoing pilot phase is expected to extend to the rest of the country using Government funds.
The project will yield the usual information produced by a NFMA on forestry biodiversity, growing stock, areas, etc. It will generate considerable information from non-forest land use for national integrated policies.

Focal Point: James L. ole Kiyiapi, Permanent Secretary, Ministry of Environment and Natural Resources

10. Nicaragua

In December 2006, the Instituto Nacional Forestal (INAFOR) co-signed with FAO a project funded totally by the Government of Nicaragua to plan and carry out the NFMA. The project was launched in Mars 2007. The first phase of the project was implemented focussing on building the national capacity, developing manuals and field forms, procuring

equipments, designing a harmonised land use classification system with the historical information in the country and planning the project activities including the fieldwork. The second phase was just initiated by sending the inventory teams to the field for data collection in the selected sample sites

Focal point: William Schwartz, Director Ejecutivo, Instituto Nacional Forestal, INAFOR.

11. Nigeria

Upon request from the Government of Nigeria in 2003, FAO fielded a mission to Abuja to assist the forestry personnel in formulating a project proposal for NFMA. A two-phase project was agreed. For the first phase, a small size project was formulated for implementation in ONDO and BORNO States. ONDO is located in the humid ecological zone in the south with high forest formation. While BORNO is located in the north-eastern reaches of the country and makes border with Niger and Chad in the North and Cameroon in the East. It falls in the drier part of the country where vegetation is of Savannah woodland type. The project could not materialise for lack of funds.

Focal point: M. A. Obeyo, Director, Federal Department of Forestry, FME.

12. Uruguay

Upon request from the forestry authorities in Uruguay, a mission was fielded to Montevideo in 2006 to work on the formulation of NFMA project and identify the funding sources. The NFMA was identified as a priority of the Directorate of Forests since accurate forestry information, except for the plantations, is widely lacking.
A concept note of the project was prepared by the FAO mission and left with the forestry authorities for use in approaching donors like the Government of Finland. So far, there is no indication that the Government has identified reliable source of funding.

Focal point: Andrés Berterreche, General Director of Forests.

13. Uganda

In 2006, FAO helped the National Forestry Authority of the Ministry of Water and Environment of Uganda in formulating a project proposal for funding by FAO through the Technical Cooperation Programme (TCP). The project was designed to improve the information framework in the country since the historical data focussed essentially on woodfuel biomass. The FAO approach to NFMA will be followed by the project.

The document of the project is still in the hands of the national authority for submission to FAO once the national counterpart contribution is secured.

Focal point: Paul Drichi, Ag. Director, Plantations Division, National Forestry Authority.

Global status of Cooperation between FAO and its Member Countries in Improving National Forest Monitoring and Assessment (as of 28 September 2007)

Status of project	Countries	Scope	Sources of funds
completed	Costa Rica, Guatemala, Cameroon, Philippines	NFA	TF + Government
	Lebanon, Honduras	NFA	TCP + Government
Ongoing	Kenya	INRA	FNPP + Government
	Zambia	ILUA	TCP + GCP+ FNPP + Government
	Bangladesh, Congo	NFA	TCP + Government
	Nicaragua	NFA	UTF
	Algeria	NFI + Policy	TCP + Government
Funding approved	Kyrgyzstan, Angola	NFA	TCP + Government
Projects submitted to FAO	Brazil	FA - Pilot	TCP + Government
		NFA	GEF ? + Government
Projects formulated	Cuba, Nigeria, Uganda	NFA	TCP proposals
	Vietnam, South Africa, Tanzania	NFA	UTF or GCP?
	Regional project: Burkina Faso, Cape Verde, Chad, Gambia, Guinea Bissau, Guinea, Mali, Niger & Senegal	NFA + Manage ment	n.i. GEF?
	7 Near East countries: Egypt, Iran, Jordan, Oman, Syria and Yemen	NFRLA + Policy	n.i. (UTF/GEF?)
Project under formulation	Macedonia	NFI	WB(?)

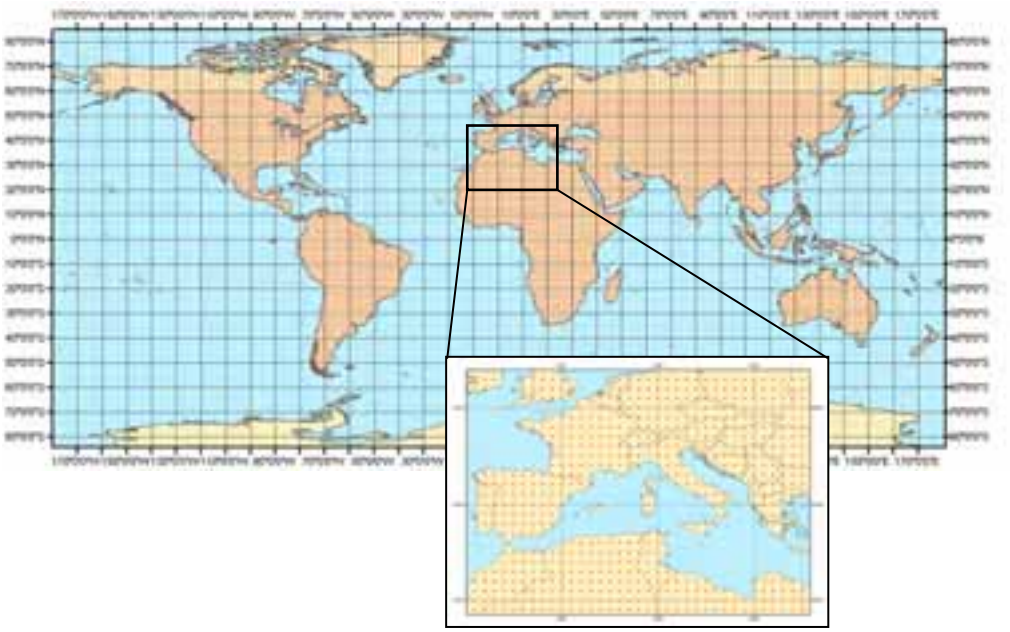
Concepts	Uruguay, Ecuador	NFA	n.i.
Countries' requests pending	Uzbekistan, Rwanda, Rep. Central Africa, Colombia, Myanmar, Dominican Republic, Trinidad and Tobago	NFA	n.i.

FA: Forest Assessment
FNPP: FAO Netherlands Partnership Programme
GCP: Government Cooperation Programme
GEF: Global Environment Facility
INRA: Integrated Natural Resources Assessment
ILUA: Integrated Land Use Assessment
NFA: National Forest Assessment
NFI: National Forest Inventory
n.i: Not identified
TCP: Technical Cooperation Programme of FAO
UTF: Unilateral Trust Funds
WB: World Bank

Appendix 2. Method and approach of the FRA 2010 Remote Sensing Survey

The FRA 2010 Remote Sensing Survey builds on the experiences from the remote sensing components for the tropical region undertaken as part of previous global forest resources assessments and on recent advances in methodologies and availability of imagery.

The survey will primarily be based on the use of available Landsat imagery, but will incorporate auxiliary information including other remote sensing images, results from existing and past field inventories etc. A systematic sampling design will be used based on each longitude and latitude intersects as illustrated below, with a reduced intensity above 60 degrees North due to the curvature of the Earth. The assessment will cover the whole land surface of the Earth and will consist of about 13,500 samples, of which about 9,000 samples are outside deserts and areas with permanent ice. The area covered at each sample site is 10 km x 10 km, providing a sampling intensity of about 1 percent of the global land surface. This grid of sample plots is the same as used for the national forest assessments supported by FAO and by many national forest inventory programmes.



For each sample plot, four Landsat images - dating from around 1975, 1990, 2000 and 2005 -will be interpreted and classified and a change matrix prepared providing quantitative information on the magnitude of different land use change processes.

FAO and its partner organizations will make rectified and pre-processed imagery available through an on-line information gateway and will develop the necessary training material. The evaluation and development of different tools to aid the interpretation process are currently underway. The interpretation of the imagery and the development of the change matrices will be based on a decentralised, participatory approach and undertaken through contracts with national teams, thus making the best use of local knowledge and existing information from past and current national forest assessment and inventories while facilitating transfer of technology and capacity building in mapping, monitoring, reporting and inventory techniques, where needed, through a series of regional training workshops. This initiative is expected to form a pilot for the establishment or strengthening of national remote sensing based monitoring systems in many developing countries.

Key outputs and outcomes of the FRA 2010 Remote Sensing Survey will be:

- Improved knowledge on global forest and land use changes, especially patterns and processes of deforestation, afforestation and natural expansion of forests;
- Baseline information at the global, biome and regional level on trends in the rate of deforestation over the past 30 years;
- A global framework and commonly agreed methodology for monitoring forest change, which can easily be replicated and expanded to generate statistically valid estimates at country level;
- An information gateway providing easy access to remote sensing imagery, which can also be used for other studies and monitoring purposes;
- Enhanced capacity in all countries for monitoring, assessing and reporting on forests and land use changes.

Although the focus of the survey is to generate information at regional and biome levels, it will be possible for larger countries to derive statistically valid estimates of past and current deforestation rates at the national level as part of this survey should they so wish.

For smaller countries, the costs of providing additional pre-processed imagery to enable the generation of statistically valid national level estimates will be marginal. A process to meet such demands will be in place in 2008.

Additional details of the approach are described in the FAO working paper "FRA 2010 Global Remote Sensing Assessment: Approach and Implementation Partnership" available on request.

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