



Food and Agriculture
Organization of the
United Nations

Lesson 2

Forest and transparency under the Paris Agreement

Lesson 2: The National Forest Monitoring System

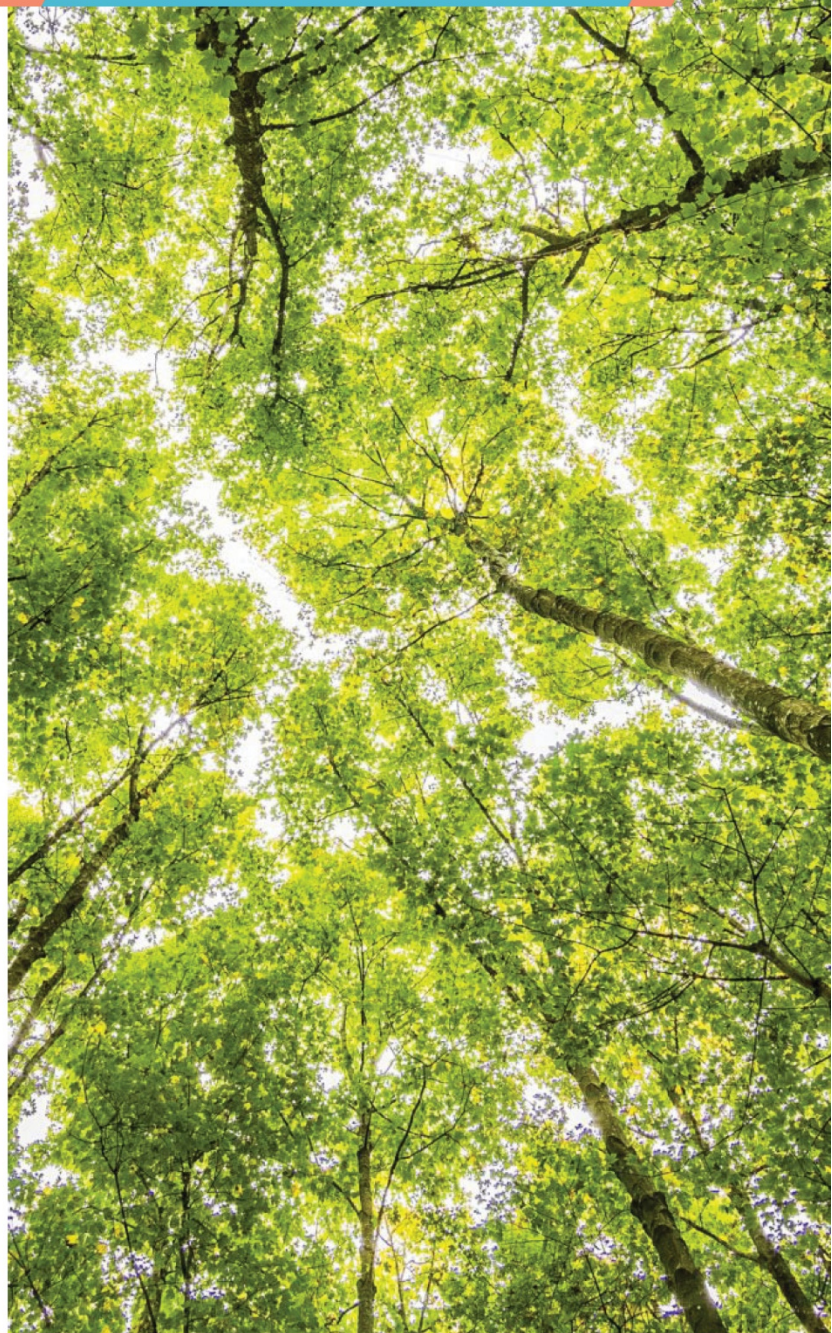
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This lesson reviews the National Forest Monitoring System, its goals and scope. It also illustrates the principles that should inform a sustainable National Forest Monitoring System and describes, through real examples, the key guidance elements required to strengthen national forest monitoring capacities, increasing their transparency and long-term reliability.

Learning objectives

At the end of this lesson, you will be able to:

- understand the foundation and concept of a National Forest Monitoring System (NFMS);
- identify the principles for building a sustainable NFMS; and
- indicate the elements that guide the design and operation of a sustainable NFMS.

Introduction

Forests are important natural resources, which provide a multitude of ecosystem services essential to life. Forest monitoring is critical for countries for the sustainable management of this resource.

National forest monitoring has evolved over time. National forest monitoring (NFM) has been carried out for centuries, but the need for information relating to forests has grown in recent years, as well as awareness of and interest in the multitude of forest ecosystem services. National forest monitoring has evolved over time to respond to this, becoming increasingly multipurpose. National forest monitoring is multipurpose, for example, NFM can be aimed at obtaining information on existing tree species, on how people are using the forest, how forest area is changing, or how much carbon the forest is emitting into, or removing from the atmosphere.

How has forest monitoring evolved in recent years?

In the past the objective was mainly to quantify and track timber stocks.

Over the years, countries have increasingly included the monitoring of key aspects of sustainable forest management, such as the role of forests in the conservation of biodiversity and the provision of other ecosystem services, such as clean water or erosion control.

In recent years the collection of information on changes in carbon pools other than above-ground biomass, as well as in the use of forest land, forests' contribution to livelihoods and poverty reduction, and forest governance and broader land-use issues has become critical for national planning.

National forest inventory and national forest monitoring

Before examining the principles and elements that should guide the planning and implementation of national forest monitoring, let's review some important definitions.

National forest inventory (NFI)

is commonly used to describe the **technical process** of data compilation and analysis of forest resources from a multitude of data sources, including field inventories and remote sensing, to estimate relevant forest characteristics **at particular points in time**.

National forest monitoring (NFM)

is a **comprehensive process** that includes the systematic collection, analysis and dissemination of forest-related data and the derivation of information, usually from **repeated inventories** (of both remote-sensing and ground data) that allow forest changes and trends to be identified and quantified over time, together with the drivers of such changes and trends.



In many countries, however, the term NFI is also traditionally used to describe the whole process of national forest monitoring.

National Forest Monitoring System

To implement a monitoring process, people, institutions and resources are needed.

All this constitutes the National Forest Monitoring System.

National Forest Monitoring System (NFMS)

comprises the people, institutions and resources that implement national forest monitoring at country level, in collaboration with other stakeholders.

The NFMS has a direct link to policy, as it informs managers and decision-makers on the status and trends of forest resources, so that policies can be developed for their sustainable use and for the efficient conservation of forest ecosystems.

Accordingly, an NFMS supports governments in fulfilling their obligations to continually develop, monitor and report on forest resources, which may include trees outside forests, as well as other land-cover classes.

Generally, an NFMS is led by a **governing body** responsible for its conceptualization, planning and execution within a clear and well-defined mandate.

What is the aim of an NFMS?

The aim of an NFMS is to:

- provide baseline data to enable the measurement of progress towards sustainable forest management.
- generate reliable data to facilitate discussions and the development of agreements at international level and to submit regular reports.
- generate reliable data to inform citizens and stakeholders about the status, characteristics, services and development of national forest.

Data collected by the NFMS are used to support the formulation, monitoring and adjustment of national and subnational-level policies related to forests and forested landscapes, including, increasingly, sustainable development and policies.

What do we know about NFM worldwide?

Increased recognition of the importance of the role of forests in climate change mitigation and adaptation has led to the development of NFMS for **Measurement, Reporting and Verification (MRV) of REDD+**, which has resulted in an unprecedented increase in the availability and transparency of countries' forest-sector data and information.

In 2010, 45 **countries** were able to assess changes in forest area and characteristics through consecutive, systematic national forest inventories - and these were mainly developed countries.



NFMS FOR REDD+ UNDER THE UNFCCC

A National Forest Monitoring System is one of the elements to be developed by developing country Parties implementing REDD+ activities (according to paragraph 71 of decision 1/CP.16). The COP recognized the importance and necessity of adequate and predictable financial and technology support for developing the National Forest Monitoring System.

The key to any functional measurement and reporting of forest carbon is reliable data of forest area and forest area changes. Already in 2009, the COP adopted guidance on the establishment of robust and transparent National Forest Monitoring Systems. Depending on national circumstances, these systems may also be a result of combining subnational systems as part of National Forest Monitoring Systems. As an interim measure, subnational monitoring and reporting can be implemented in accordance with a stepwise approach.

More information on REDD+ <https://redd.unfccc.int/>

Countries have made great improvements in their ability to monitor forests in recent years, but there is still some way to go before all forests are adequately monitored. More recent assessments of NFM and reporting capacities have been implemented in developing countries, particularly those with tropical forests. The total tropical forest area **monitored with good to very good data on forest area change**, including remote-sensing capacities, increased from 69 percent in 2005 to 83 percent in 2015.

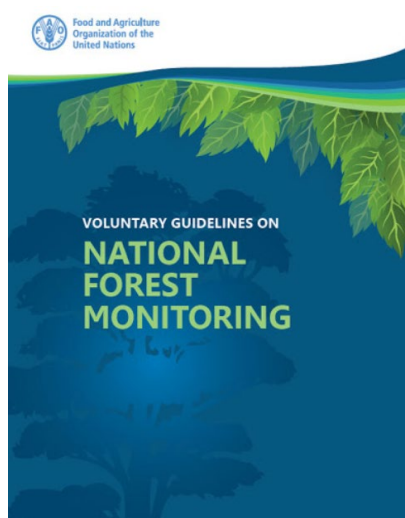
The total tropical forest area **monitored with good to very good forest inventory capacities** increased from 38 percent in 2005 to 66 percent in 2015.

However, the ability to measure carbon stocks in forests did not show as much improvement.

The majority of tropical forest countries use default data, called **Tier 1** level reporting by the Intergovernmental Panel on Climate Change (IPCC). This indicates the need for greater emphasis on producing more accurate, country-specific emission factors (i.e. at Tier 2 or Tier 3 level). Importantly, there is a need to improve the **institutionalization of forest monitoring**, including a better trust basis among those collaborating on forest monitoring. *Source: Romijn et al., 201*

Voluntary guidelines on national forest monitoring

For decades, the Food and Agriculture Organization of the United Nations (FAO) has been providing support to member countries on national forest monitoring.



Voluntary guidelines on national forest monitoring

www.fao.org/policy-support/tools-and-publications/resources-details/en/c/1027734/

Best practices and lessons learned from this support are summarized in FAO's **Voluntary guidelines on national forest monitoring** (VGNFM), which were presented and endorsed at the Committee on Forestry (COFO) in 2016. The Committee on Forestry (COFO) is the highest FAO Forestry statutory body. The biennial sessions of COFO bring together heads of forest services and other senior government officials to identify emerging policy and technical issues, seek solutions and advise FAO and others on appropriate action. The VGNFM were requested by countries during the 21st session of COFO, held in September 2012.

The VGNFM is a technical reference for government bodies, research institutes, the private sector and civil society, and provides principles, elements and best practices.

Principles for a sustainable NFMS

The VGNFM identify **five groups of principles**

Governance

Principle 1 Country ownership and responsibility:

implementing a National Forest Monitoring System and generating a reliable database on forests and their uses is primarily a domestic issue.

Principle 2 Legal and policy basis:

in some contexts, it may be helpful to establish a legal basis for national forest monitoring, for example, by adding a corresponding paragraph to a national forest law, as well as related policy.

Principle 3 Landscape view:

it is essential to look at forests as one component within a forested landscape.

Principle 4 Institutionalization of NFM:

one of the distinct features of forestry is its long-term character, which consequently requires a long-term structure, implemented through a permanent institution.

Principle 5 Research infrastructure and capacity-building:

any national survey requires appropriate national capacities and a research infrastructure in order to be successfully implemented under country ownership.

Scope**Principle 6 Participatory discussion process:**

National Forest Monitoring Systems generate data and information on forests and trees at national level through a participatory discussion process among national stakeholders on the scope and objectives of forest monitoring.

Principle 7 Satisfaction of national information needs:

Information needs regarding national forest and tree resources are manifold. Accordingly, the consensus-oriented discussion process (*Principle 6*) prepares the ground for a comprehensive identification of priority information needs at subnational and national level, while efficiently supporting international reporting commitments.

Design**Principle 8 Integration of and consistency with existing information sources:**

National forest monitoring should not be considered a stand-alone initiative, but in best case scenarios an undertaking that interlinks with other national and subnational initiatives that generate national-level information.

Principle 9 Flexible approach:

The technical and organizational design of an NFMS requires long-term efforts and must be able to integrate emerging issues and allow for periodic revisions.

Principle 10 Multipurpose approach:

Information and knowledge generated by National Forest Monitoring Systems need to feed into and support national and international forest-related processes. In order to serve these processes, National Forest Monitoring Systems need to be multipurpose.

Principle 11 Feasibility including cost-efficiency:

Information provision including data collection, storage and analysis and operation of a permanently

institutionalized forest-monitoring unit must be feasible and affordable, according to national circumstances.

Data

Principle 12 A well-defined data and information-sharing policy:

Data and information produced by National Forest Monitoring Systems are of interest to many different parties. They should be accessible to different users, either as original or aggregated data sets. This does not necessarily mean that public access is granted to a database, but that a clear data-sharing policy is formulated, to which national and international interested parties can refer.

Overall principles

Principle 13 Credibility through transparency and quality:

This implies that the results must be produced in a manner that is scientifically defensible, which means that each methodological and organizational step of the approach needs to be fully and transparently documented and justified.

Principle 14 Collaboration at the international level

Collaboration in planning, implementing, analysing and ensuring the quality of different National Forest Monitoring Systems constitutes an excellent means of knowledge exchange and avoiding common errors and pitfalls. In addition, it may also support national capacity-building.

Applying the principles

If the NFMS is not informed by these principles, its impact may be fragmented and ineffective.

‘We have not identified all possible stakeholders who may be interested in forest data, so we are not able to satisfy all the possible needs of forest-related data and information.’

How to avoid this?

You should consider these principles for the identification of information needs

‘There has been no planning of the NFMS and the entire system is currently of no use. Have we made some mistakes in its design?’

How to avoid this?

You should consider these principles for data collection and analyses

‘National data are not available and accessible in a systematic and well-defined policy.’

How to avoid this?

You should consider this principle for data availability

'It is not clear who certifies the quality of national data on forests.'

How to avoid this?

You should consider these general principles

'Forest monitoring activities have been implemented inconsistently over the years, due to lack of internal skills.'

How to avoid this?

You should consider these principles for the institutional settings and governance

Now think about your country and the status of national forest monitoring activities.

If you are not informed about your country's national forest monitoring activities, this may be the right time to collect more information and understand if and how it has been implemented.

Cross-cutting issues

Issues such as **gender and equity** cut across all the principles reviewed so far.

An NFMS should take account of gender equity and fair representation of minority groups, such as local communities and indigenous peoples.

A fully functioning NFMS that integrates a gender approach will enable countries to respond to their own multipurpose national data needs on forests, while also ensuring that it captures the perspectives and knowledge of women and men who depend on such forests for their livelihood.

The **VGNFM draw attention to the importance of gender in forest monitoring** and provide a useful list of potential entry points.

GOVERNANCE → GENDER	
Principle 1: Country ownership and responsibility	Engage with the national ministry responsible for gender issues
Principle 2: Legal and policy basis	Include gender as a key information need as part of a wider socio-economic mandate
Principle 3: Landscape view	<ul style="list-style-type: none"> • What are the different roles of women and men in shaping the landscape? • What are the differences in how men and women depend on the landscape?

Principle 4: Institutionalization of NFM	Structures should welcome women as well as men, especially in professional and decision-making positions
Principle 5: Research infrastructure and capacity-building	Ensure that women are also included or encouraged to participate in the capacity-building activities.
SCOPE→ GENDER	
Principle 6: Participatory discussion process	<p>Include civil society and other grassroots women's organizations, as well as government authorities related to gender.</p> <p>A participatory discussion process involving women's groups could be used to define (gender-related) data needs through a consultative information needs assessment process, ensuring that women's needs are addressed, as well as those of men.</p>
Principle 7: Satisfaction of national information needs	Include sex-disaggregated data on forest use and socio-economic information
DESIGN→ GENDER	
Principle 9: Flexible approaches	Social sectors may want to use the data to understand issues of equity and to plan interventions
Principle 10: Multipurpose approach	Socio-economic surveys on women can be included in data collection processes and some data can be gender-disaggregated
DATA→ GENDER	
Principle 12: A well-defined data and information-sharing policy	Publicly available information promotes more equitable access to forest resources

Elements for a sustainable NFMS

While the principles of an NFMS are the general guidelines or ideals which, if followed, would make it sustainable, the elements are what is actually needed to implement an NFMS. The specific goals or framework conditions of different NFMS may focus more on some elements and less on others.

There are **three type of element**:

1. Foundation elements

Foundation elements refer to the organizational and technical framework conditions within which an NFMS is implemented. They include activities such as:

➡ Institutionalization

institutionalization means that the NFMS is formally, firmly and permanently embedded within a country's administration - usually the forest administration.

➡ Developing national capacities

National ownership and sustainability of an NFMS depend on institutional capacities to meet the forest information needs of users. This calls for continuous strengthening of human capacities in the technical fields of forest monitoring, programme management, administration and operation.

➡ Developing partnerships and collaboration

More and more countries are implementing full National Forest Monitoring Systems, providing excellent opportunities for international and regional collaboration and the sharing of experiences regarding planning, implementation, analyses, capacity-building, technical expertise and lessons learned - both success stories and failures. Networks may be actively developed in all fields relevant to forest monitoring.

➡ Strengthening research and research institutions in forest monitoring

The planning and successful long-term implementation of an NFMS requires accompanying research in all cases, albeit to a varying degree. Generic research questions include how to optimize technical design elements of forest inventories, the development of locally-specific models to predict biomass or carbon stocks, and the development of optimal remote-sensing analysis approaches.

These activities prepare the ground for subsequent technical implementation work. As such, they require careful planning and sufficient time, as you can read in the example about Colombia. If carefully prepared, the foundation elements will play a key role in ensuring the operation and sustainability of the forest monitoring system.

Example: Columbia

The Colombian Government aimed to develop a decree to regulate and articulate the forest and carbon monitoring system (F&CMS), the National Forest Inventory (NFI) and the National Forest Information System (NFIS). In December 2016, Colombia drafted a **first decree** regulating the links between the F&CMS, NFI and NFIS, taking into consideration each specificity and setting in place

adequate interinstitutional mechanisms, as well as the legal and institutional framework mandated by law. Accordingly, a road map has been developed to ensure the inclusion of relevant stakeholders. Following this road map, the Ministry of Environment adopted the decree in 2017.

2. Strategic elements

Strategic elements refer to organizational and planning actions for data collection activities within a National Forest Monitoring System. These actions include:

➔ Mandate

The implementation of an NFMS requires a clear political mandate, which can only be issued by a government body. Mandates also usually imply the definition of a vision, goals, targets and available resources, including budget, personnel and infrastructure. In some cases, legal regulations are also necessary.

➔ Identification of information needs

The NFMS should be demand-driven in line with a clearly stated and formally mandated mission. Its objective should be to produce the best possible information within the given resource constraints. An information needs assessment process is a key step in identifying which information the NFMS should produce on a regular basis.

➔ Stakeholder identification and engagement

The involvement of stakeholders may extend far beyond expectations stated during the information needs assessment. Depending on their interest, representatives of stakeholder groups may be invited to or integrated into the strategic or technical planning of the NFMS.

➔ Communication and dissemination

Proactive communication and dissemination is crucial to ensure that potentially interested stakeholders are adequately aware of the existence of the NFMS.

➔ Integration of young experts

Being involved in an NFMS offers excellent vocational training and educational opportunities for students and young experts in the early stages of their careers. They can engage in various functions to further develop their knowledge and expertise, not only of national forest monitoring, but also of the forest resources of their country.

➔ Data management and archiving

Provisions need to be made for long-term data management to allow analyses to be repeated and time series to be built from inventories at earlier points in time.

➡ Impact assessment

Although not a standard component of an NFMS as yet, it is recommended to plan a systematic impact assessment of the process itself. This helps to streamline improvement of the NFMS and to analyse its overall usefulness.

Strategic elements must be considered during the preparation and implementation of a national forest monitoring programme, but do not address detailed technical-scientific aspects, which are dealt with under operational elements.

Example: Madagascar

An example of how needs assessment can be conducted is presented in the case of Madagascar.

In establishing its NFMS, Madagascar conducted a needs assessment

(<http://www.fao.org/3/CA2754FR/ca2754fr.pdf>). The NFMS was developed in the context of REDD+, but in order to be sustainable, an NFMS should respond to broader national needs. A review was conducted of pre-existing data and capacities available, as well as a broad stakeholders consultation, involving the public sector, regional and international organizations, non-governmental organizations (NGOs) and the private sector.

Based on the consultation, needs besides the requirements for REDD+ were identified, such as harvestable timber and biodiversity, and the relevant required data for each need were defined, including periodicity and level of quality. In turn, the way in which all the data required to address the needs would be collected and stored was identified.

3. Operational elements

Operational elements refer to actions for the optimization and definition of technical design elements of field and remote-sensing data collection and analysis. These actions include:

➡ Preparation

The preparatory steps of the NFMS design focus on the operational and target-oriented definition of terms, the identification of variables to be observed to meet information needs and their subsequent prioritization, the definition of data sources to be accessed to observe these variables, including available information, and the assessment of available expertise and other country resources.

➡ Statistical design

Planning, definition and implementation of the scientific design can commence once the preparatory work and assessments are complete (the identified information needs, the set of variables to be

observed derived from the expected products, and the available resources in terms of prior information, expertise and budget, which will define the framework within which detailed planning of the statistical design will take place).

➡ Operational design

Operational design refers to all activities involved in setting up fieldwork and the information management system of an NFMS. It is indispensable for the successful implementation of the NFMS. The elements of operational design relate to standard project planning, which requires skills in all issues related to project implementation, including human resources, communication and logistics.

➡ Data management, data analyses, documentation and reporting

Once the field data are collected, they must be safely and permanently stored to ensure that they are easily accessible for reference and further analyses.

Permanence of data availability is one of the constituent elements of an efficient NFMS.

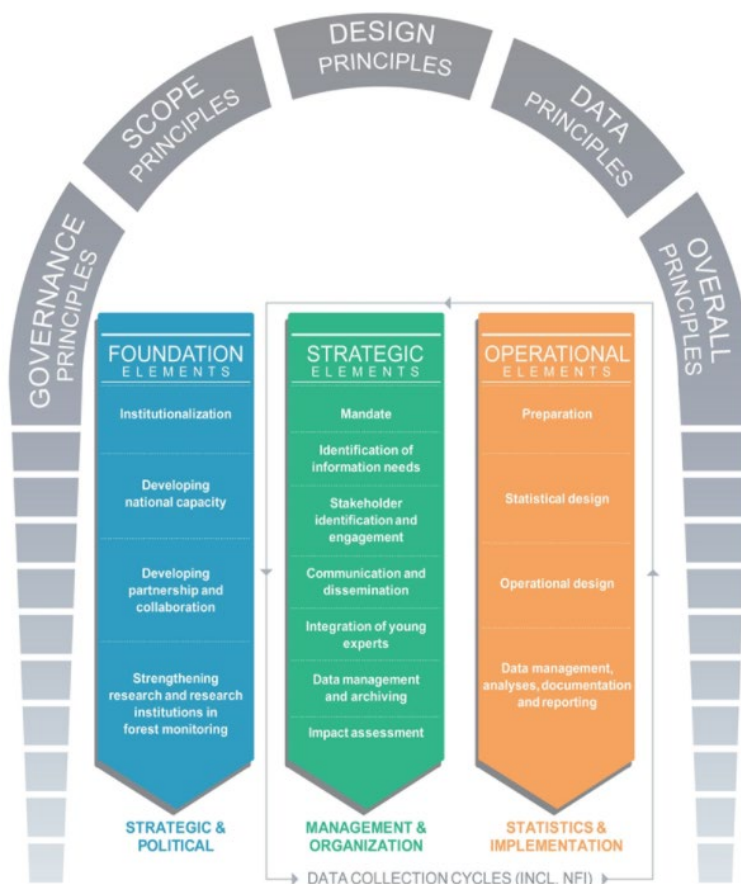
In order to meet the technical goals of an NFMS, it is necessary to define complex data acquisition and analysis strategies that will eventually lead to the desired products, as shown in the example of Papua New Guinea.

Example Papua New Guinea

As part of its NFMS, in 2016 Papua New Guinea (PNG) established an online data portal that is publicly accessible, so as to ensure data transparency. PNG's Satellite Land Monitoring System combines wall-to-wall mapping with stratified sampling and uploads the information to its online data viewer, providing links to the original sources. The Satellite Land Monitoring System is an important part of the NFMS, enabling landscape-scale trends to be observed and the drivers to be identified. Indeed, the same year, 2016, PNG launched its first national forest inventory, which was highly comprehensive, collecting data not only on trees but also on herbs, insects and birds. Data from the NFMS have already been used to report a forest reference level and a Biennial Update Report to the UNFCCC.

Principles and elements of a sustainable NFMS

Typically, an NFMS requires a long-term vision and interdisciplinary collaboration, and should inform the principles and include the elements reviewed in this lesson. These are schematically presented in this diagram.



They refer to a variety of planning issues, some of which are technical in nature, while others are organizational or strategic.

The overall aim is to provide detailed and comprehensive guidance for establishing a sustainable NFMS.

THE NFMS ASSESSMENT TOOL

FAO's new NFMS Assessment Tool can help in the task of identifying needs and gaps in order to establish or strengthen a country's NFMS.

The tool is based on FAO's Voluntary guidelines on national forest monitoring (VGNFM), reinforced with the [REDDcompass](https://www.fao.org/gfoi/components/methods-and-guidance-documentation/en/) resources of the Global Forest Observation Initiative (GFOI)

www.fao.org/gfoi/components/methods-and-guidance-documentation/en/

Summary

National forest monitoring is a comprehensive process that includes the systematic collection, analysis and dissemination of forest-related data and the derivation of information to identify forest changes and trends over time. A **National Forest Monitoring System** indicates the people, institutions and resources that implement national forest monitoring.

Achieving a sustainable NFMS is challenging.

The FAO's Voluntary guidelines on national forest monitoring (VGNFM) are a technical reference for countries and other different stakeholders interested in establishing or implementing a multipurpose NFMS. The VGNFM provide principles, elements and guidelines that help to achieve a sustainable NFMS.