



Forestry Department

Food and Agriculture Organization of the United Nations

BRIEF ON NATIONAL FOREST INVENTORY NFI

NEPAL

Forest Resources Development Service

Rome, June 2007



Strengthening Monitoring, Assessment and Reporting (MAR) on Sustainable Forest Management (SFM)

FAO initiated activities to strengthen Monitoring, Assessment and Reporting on Sustainable Forest Management in January 2006 with the objective to facilitate development of harmonized forest related national monitoring, assessment and reporting (MAR) for contributing directly to the improvement of national sustainable forest management (SFM) regimes. It also aims to catalyze national discussions, analyses, policy actions and planning that promote national SFM regimes besides clarifying the contribution of forests to global environment and to human well-being. This initiative shares the ambition of the Collaborative Partnership on Forests (CPF) about simple, harmonised, efficient and action oriented MAR systems both at international and national levels and thus provides a response to some of the key recommendations made by the CPF task force on streamlining the reporting on forests with particular focus on national capacity building.

The MAR initiative has recently updated goals include country capacity building for better, consistent and regularly updated information to facilitate implementation of non-legally binding instrument (NLBI) on SFM, adopted at UNFF 6 (2007) that aims to,

- Strengthen political commitment and action at all levels to implement effectively sustainable management of all types of forests and to achieve the shared four global objectives ((a) reverse the loss of forest cover worldwide, (b) enhance forest-based economic, social and environmental benefits, (c) increase significantly the area of protected forests worldwide, and (d) reverse the decline in official development assistance for SFM;
- Enhance the contribution of forests to the achievement of the internationally agreed development goals, including the Millennium Development Goals, in particular with respect to poverty eradication and environmental sustainability; and
- Provide a framework for national action and international cooperation.

All countries can participate in this initiative, although the actual level and intensity of their involvement may vary among them. The initiative is organized under the Forest Resources Development Service (FOMR) of FAO Forestry Department. The contact persons are:

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The MAR-SFM Working Paper Series is designed to reflect the activities and progress of the MAR on SFM programme of FAO. Working Papers are not authoritative information sources – they *do not* reflect the official position of FAO and should not be used for official purposes. Please refer to the FAO forestry website (www.fao.org/forestry) for access to official information.

The MAR-SFM Working Paper Series provides an important forum for the rapid release of preliminary findings needed for validation and to facilitate the final development of official quality-controlled publications. Should users find any errors in the documents or have comments for improving their quality they should contact Kailash.Govil@fao.org or Dan.Altrell@fao.org.

Brief Note on MAR-SFM Working Paper Series (AP) on NFI- Brief

The NFI – Brief for a country attempts to provide a bird’s eye view of the National Forest inventories (NFI). However, some countries conduct forest inventories at sub-national and or field management unit level. Therefore, this brief presents brief information on the forest inventories in a country at national level, sub-national level and or field management level depending on the available information.

It is useful to regularly update our understanding of elements and specifications of forest inventories because the information generated by forest inventories is simply manifestation of its span, design and methods to collect and analyse the primary information during its implementation. This is important because the NFI provides information on the state and trends of forest resources, their goods and services, and other related variables that support. It also defines the policy and trade decisions, science and field initiatives, national and international reporting, and direct and indirect contribution of forests to society like poverty alleviation. Regular updates are necessary because countries do change the set of elements, their specifications, designs and methods over period of time to address new emerging demands and to take advantage of new technologies.

The purpose of developing the NFI-briefs is, therefore, to document (working paper) the current and historical span of elements (variables or fields), their specifications, sampling designs and methods used in NFI. The document may serve as data source as well as reference material.

These briefs have been initially developed on the basis of the country submission to FAO. The initial draft of this report was sent to following national focal point for review and country validation before its finalisation.

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B. Compilation and Supervision

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General Information

Nepal is a landlocked Himalayan country in South Asia. It is bordered by Tibet to the north and by India to the south, east and west. The Nepali landscape is extremely diverse, ranging from the humid Terai in the south to the lofty Himalayas in the north. Eight of the world's ten highest mountains are in Nepal, including Mount Everest. Its capital and largest city is Kathmandu.

Map of the Country



Figure 1. Map of Nepal

(Source: <https://www.cia.gov/library/publications/the-world-factbook/geos/bg.html>)

Land Area and Landuse

The total area of Nepal is 147 718 square km and the following table presents the categorisation and projection of land use in Nepal for 1990, 2000 and 2005 (FRA 2005).

Table 1. Categorisation and projection of land use in Nepal (FRA 2005).

FRA 2005 Categories	Area (1000 hectares)		
	1990	2000	2005
Forest	4817	3900	3636
Other wooded land	1180	1753	1897
Other land	8303	8647	8767
Other land of which with tree cover			
Inland water bodies	418	418	418
TOTAL	14 718	14 718	14 718

Forests

Nepal is a small country but rich in biological diversity. It has 5400 vascular plants, including over 254 species of endemic plants and 700 species of medicinal plants. Within a distance of less than 150 km, the land rises dramatically from less than 100 m asl. in the tropical Terai in the south to the highest point in the world (8848 m), on the edge of the Tibetan plateau. With only 0.15 percent of the world's forest, Nepal has 2.2 percent of all known plants. Total forest area (3 636 000 ha) constitute 25 percent of country area (see figure 2 below). Many valuable genetic resources are conserved in the protected areas for their potential use in the future. Data from FRA 2005 indicate that at least 12% of forest area is designated to protection of soil and water, while an additional 21% is devoted to the conservation of biodiversity (see table 2 below). The diversity and great altitudinal range is reflected in the classification of forest types in Nepal which include the following:

Tropical forest (below 1000 m); Subtropical broadleaved forest (1000-2000m); Subtropical pine forest (1000-2200 m); Lower temperate broadleaved forest (1700-2700m); Lower temperate mixed broadleaved forest (1700-2200m); Upper temperate broadleaved forest (2200-3000m); Upper temperate mixed broadleaved forest (2500-3500m); Sub-alpine forest (3000-4100m); Alpine scrub. (Above 4100m)

Among these forest types the main species are: Sal (*Shorea robusta*), Oak (*Quercus spp.*) Asna (*Terminalia alata*), Chir Pine (*Pinus roxburghii*), *Abies spectabilis*, *Rhododendron spp.* and *Alnus nepalensis*.

Table 2. Designated function of forest

FRA 2005 Categories / Designated function of Forest	Area (1000 hectares)		
	Primary function		
	1990	2000	2005
Production	109	206	185
Protection of soil and water	571	491	440
Conservation of biodiversity	391	811	776
Multiple purpose	71	456	533
No or unknown function	3675	1936	1702
Total – Forest	4817	3900	3636

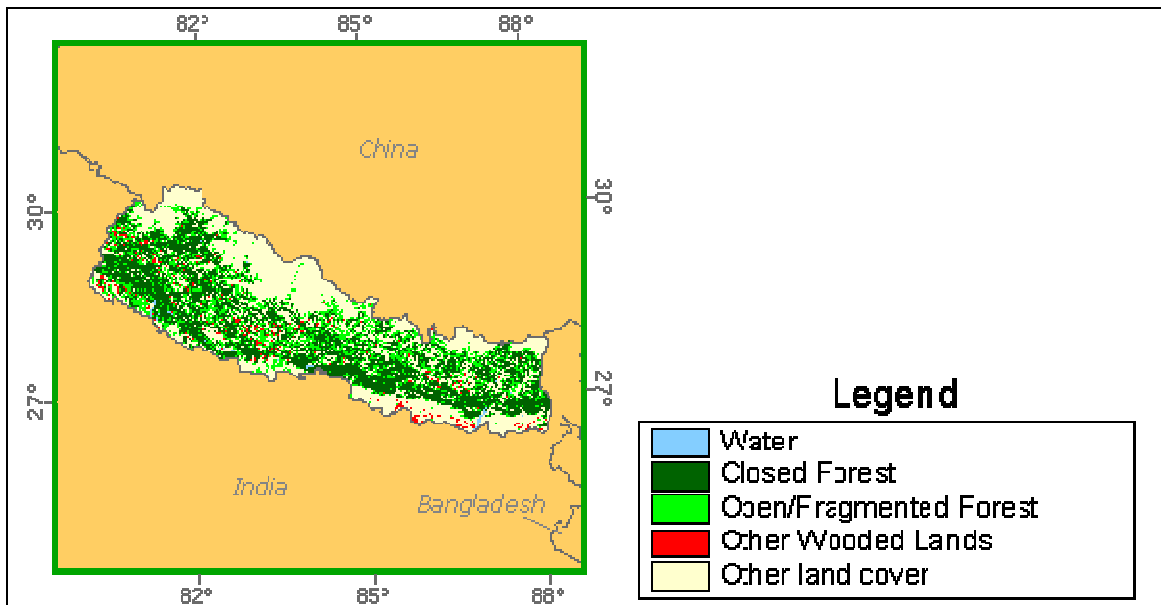


Figure 2. Nepal Forest Cover

Source: FAO Global Forest Resources Assessment 2000

Brief History of Forest Inventories

The history of Forest Resource Assessment in Nepal can be divided into the following time periods: (i) 1963-1967: the First National Forest Inventory (NFI) of Nepal was carried out with the technical collaboration of USAID and with the aid of aerial photographs. (ii) 1968-1989: a series of District-wise Forest Inventory (DFI) of most of the Terai (lowland plain area along the southern border of the country) districts and some hill districts were carried out. (iii) 1990-1993: deforestation analysis of the Terai districts and study of the forest and shrub cover of Nepal in technical collaboration with FRISP (Forest Resource Information System Project) and the Government of Finland. (iv) 1994-1998: Second NFI of the country in technical collaboration with FRISP, the Government of Finland; forest cover change analysis of some hilly districts using GIS; and Preparation of Operational Forest Management Plans (OFMPs) for the forests of some Terai districts. (v) 1999-2001: classification of the forest of Nepal using remote sensing satellite data in technical collaboration with Japan Forest Technical Association (JAFTA); and preparation of various forest resource maps of the country using GIS.

Table 3. History of Assessments

Publication Year ¹	Title ²	Institution ³	Ground Inv. Year(s) ⁴	Remote Sensing		Estimation Level ⁷	Country Coverage (Full/Partial, %) ⁸	Thematic cover ^{**}
				Data Year(s) ⁵	Scale of Interpretation ⁶			
1999	Forest Resources of Nepal (1987-1998): National Forest Inventory Main Report (II Draft Version)	FSD, Dept. of Forest Research and Survey/FRISP, FRISP	1987-1998	1987-1998		Regional	Complete	NF, OWL, FAC, TV, TB, CV
1999	Forest Resources of the Hilly Area of Nepal 1994-98	FSD, Dept. of Forest Research and Survey/FRISP	1992	1992		District	51 out of 55 Hilly districts of the country	NF, OWL, FAC, TV, TB, CV
1996	Forest Resources of Palpa District	FSD, Dept. of Forest Research and Survey/FRISP				District	Palpa District	NF, OWL, TV, TB, CV
1996	Forest Resources of Makwanpur District	FSD, Dept. of Forest Research and Survey/FRISP				District	Makwanpur District	NF, OWL, TV, TB, CV, PA
1996	Churia Forest Development Project, Pheasibility Study	Churia Forest Development,GTZ				District	Siraha, Saptari and Udayapur Districts	NF, OWL, TV, TB, CV
1995	Forest Resources of Chitwan District	FSD, Dept. of Forest Research and Survey/FRISP				District	Chitwan District	NF, OWL, TV, TB, CV, PA
1994	Forest Resources of Arghakhanchi District	FSD, Dept. of Forest Research and Survey/FRISP				District	Arghakhanchi District	NF, OWL, TV, TB, CV
1993	Forest Resources of Nawalparasi District	FSD, Dept. of Forest Research and Survey/FRISP				District	Nawalparasi District	NF, OWL, TV, TB, CV, PA
1993	Forest Resources of the Terai Districts 1990/91	FSD, Forest Research and Survey Center / FSISP	1990-91	1990-91		District	20 Terai districts bordering India	NF, FAC, TV, TB, CV, PA
1992	Forest Resources of Rupandehi District	FSD, Dept. of Forest Research and Survey/FRISP				District	Rupandehi District	NF, OWL, TV, TB, CV
1992	Forest Resources of Kapilvastu District	FSD, Dept. of Forest Research and Survey/FRISP				District	Kapilvastu District	NF, OWL, TV, TB, CV

****Legend:** **NF**=Natural Forest; **PL**=Plantations; **OWL**=Other Wooded land; **FAC**=Forest Area Change; **TV**=Total Volume; **TB**=Total Biomass; **CV**=Commercial Value; **PA**=Protected Areas; **BD**=Biodiversity; **FO**=Forest Ownership; **WSP**=Wood Supply Potential; **NWGS**=Non-wood Goods and services; **TOF**=Trees outside of forest; **FF**=Forest Fires

Legend:

[1] Publication Year	Year in which the assessment was published
[2] Title	Title of the assessment
[3] Institution	Institution(s) responsible for the Assessment
[4] Ground Inventory Year(s)	Year or Interval of years during which the field inventory has been carried out
[5] Remote Sensing Data Year(s)	Year(s) of the Remote Sensing Images
[6] Remote Sensing Scale of Interpretation	Scale of Remote Sensing Images (e.g. 1:250,000)
[7] Estimation Level	Whether the Assessment was at National, Sub-national, District, Management Unit, etc. level
[8] Country Coverage (Full / Partial, %)	Amount of country area covered by the assessment (e.g. full, partial). If partial, indicated by % of total area.

National Forest Inventory Design

The latest National Forest Inventory (NFI) of Nepal was started in early 90s by the Forest Survey Division of the Forest Research and Survey Centre, assisted by the Forest Resources Information System (FRIS) Project. The first results of the southern Terai lowland belt were published in 1992. In 1994 the NFI was extended to the hilly area. Because of the hard terrain a new inventory method was designed. By the end of 1996 about 50% of the land area was covered by the new NFI. The whole country was covered and the findings published in 1999.

In summary, the successive steps occurred as follows: the forests of 14 out of 20 Terai districts were inventoried using satellite image of 1990/91 and the fieldwork was accomplished by 1993. The forests of 51 out of 55 Hill districts were inventoried using aerial photographs of 1992 through national forest inventory and the fieldwork was completed during 1994-1998. The remaining 10 districts (both in Terai and Hill) were inventoried using aerial photographs of 1992 through district forest inventory and the fieldwork was completed during 1991-1995. The protected areas have not been covered.

The logic steps followed to perform the inventory as presented in the following figure. Only the main steps are outlined in this report, while a complete account of the process can be found in the inventory manual listed in the bibliography.

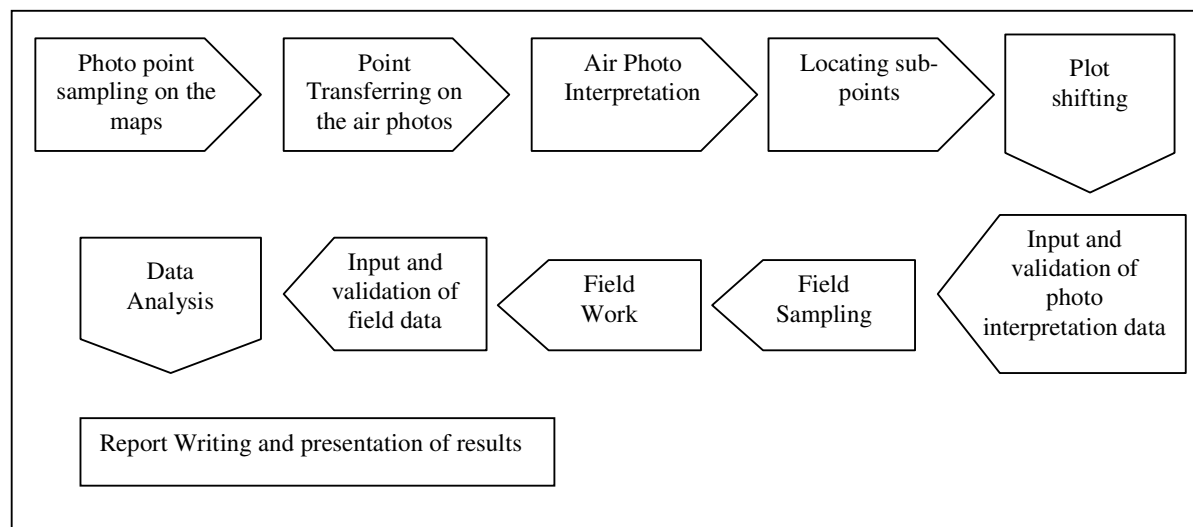


Figure 3. Logic steps of inventory process

Air Photographs and Map

The basic material for the implementation of the inventory were black and white air photographs taken by the Eastern Nepal Topographic Mapping Project (ENTMP) of scale 1:50,000 (or in some cases 1:60,000). The map material used was topographic maps of the Indian Survey from the 1950s as well as map sheets from the (ENTMP) as they became available.

Field Inventory

In order to make the field work more efficient with respect to the time spent for the inventory, the concept of a “camp unit” has been introduced. A **Camp Unit** is a group of four clusters in

a north-south aligned square 1 km apart from each other (see figure 4). The idea is to avoid loosing too much time for shifting campsites and travelling to survey plots since each cluster can be measured in one day and all four clusters can be reached from the same campsite.

A **cluster** consists of two square plots 50 metres apart from each other in a north-south direction (or east-west). The side of a plot is 30 metres and it is divided into three parts with help of diagonals (see figure 5). The sampling intensity of the NFI is about 0.01%. Thus about 225 camp units were measured to get a complete picture about the forest resources of the country.

Each **plot** has four parts (marked in figure 5 as I,II,III and Reg.). Part I coincides with the north western half of the plot, part II covers the bottom quarter of the plot and part three the eastern quarter. The Reg. plot is for measurement of regeneration and consists of a circle-shaped plot with 2 meter radius. This is laid 5 meters from the centre plot in direction north-east.

Measurements

Tree measurements on the different parts of the plot are done as follows:

Part	Tree dimension (dbh)	Action
I	30 cm and above	Measurement
II	20 cm and above	Measurement
III	10 cm and above	Measurement
III	above 1.3 mt. height and less then 10 cm dbh	Counting by species
Reg.	less then 1.3 mt. height	Counting by species

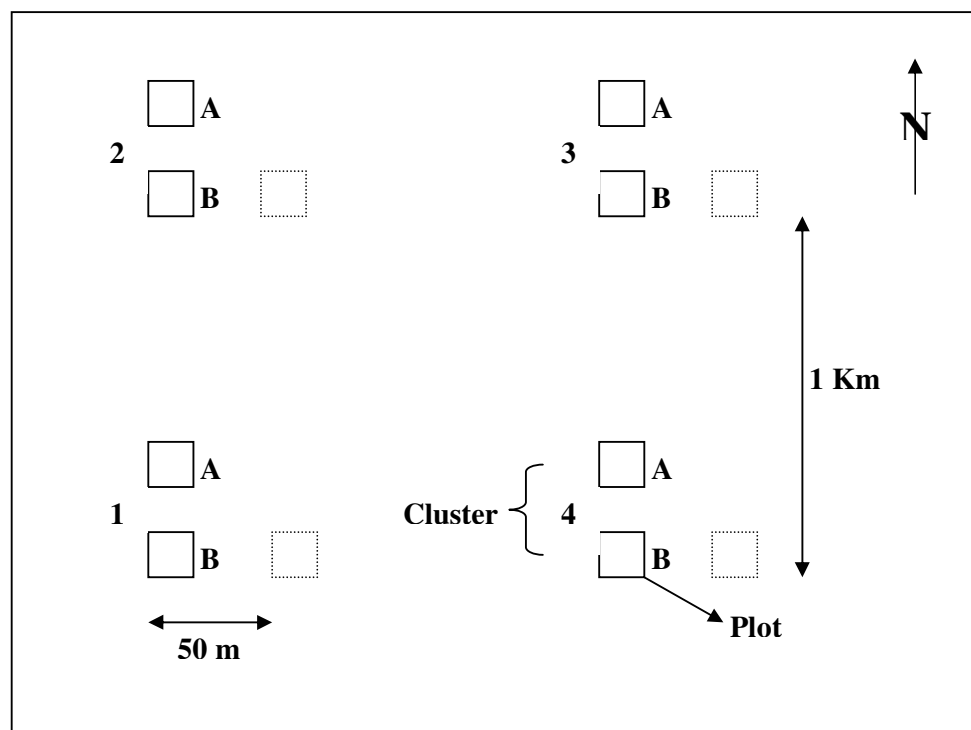


Figure 4. Camp Unit Design

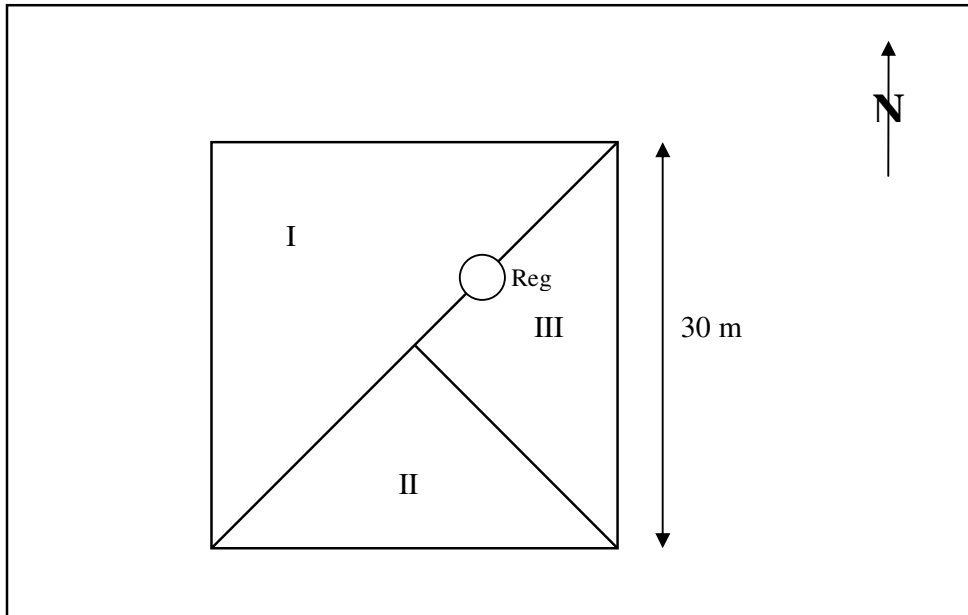


Figure 5. Plot Design

Variables

The variables measured at each field plot are listed in the table below:

Table 4. Variables measured in the field plot

1	Forest type	13	Witness trees (2 individuals)
2	Stand size class		- species
3	Stocking class		- distance from plot centre
4	Origin of the stand (natural, planted)		- azimuth from plot centre
5	Aspect of the plot		- diameter at breast height
6	Slope of 1 st diagonal	14	Tally trees
7	Slope of 2 nd diagonal		- tree number
8	Altitude of the plot		- species
9	Macrotopography (slope, ridges, etc.)		- dbh
10	Soil type		- quality class
11	Reason and intensity of human activities		- crown class
12	Occurrence of non timber forest products in abundance classes	15	Sample trees (same as tally trees plus the following)
			- height
			- base (if a leaning tree)
			- age (for coniferous trees only)

Content and Methodology of data collection in NFI

Note: [N=National; SN=Sub-National; MU=Management Unit]

Geo-physical

	N	SN	MU	Methodology
Geo-Coordinates				
Altitude	X			Map
Topography	X			
Orientation (or Aspect)	X			
Slope	X			
Soil	X			
Geological structure				
Rainfall				

Bio-Physical

	N	SN	MU	Methodology
Number of trees	X			Field Measurement
Diameter of trees	X			Field Measurement
Height of trees	X			Field Measurement
Length of stem				
Stump height				
Age class				
Twigs				
Bark				
Leaves				

Forest extent

	N	SN	MU	Methodology
Forest land area	X			Aerial photo and maps
Area of forest canopy/crown cover	X			Sterioscopic vision
Area under forest management				
Area under formal forest management plan				
Area under sustainable forest management				
Forest area with certification				
Area under public owned forest				
Area under private owned forest				

Forest characteristics (Naturalness) and forest type

	N	SN	MU	Methodology
Primary forest	X			Aerial photos and field sampling
Modified natural forest	X			Aerial photos and field sampling
Semi-natural forest	X			Aerial photos and field sampling
Productive plantation	X			Aerial photos and field sampling

Protective plantation	X			Aerial photos and field sampling
Coniferous	X			Aerial photos and field sampling
Broadleaved	X			Aerial photos and field sampling
Mixed forest	X			Aerial photos and field sampling
Forest area by dominant species (bamboo, mangroves, rubber)				
Forest area by ecological zone (tropical, subtropical, temperate, boreal, polar)				

Use (designated functions) of forests

	N	SN	MU	Methodology
Area of forest under production	X			Aerial photos and maps
Area of forest for protection of soil and water	X			
Area of forest for conservation of biodiversity				
Area of forest for social services				
Area of forest for multiple purpose				
Forest area available for wood supply				
Forest area within protected areas				

Social Services

	N	SN	MU	Methodology
Area of forest managed for recreation				
Area of forest managed for tourism				
Area of forest used for education				
Area of forest managed for conservation of cultural/spiritual site				

Mapping of forest distribution

	N	SN	MU	Methodology
Distribution of forests	X			Aerial Photographs and Field verification
Forest Characteristics	X			Aerial Photographs and Field verification
Land use	X			Aerial Photographs and Field verification
Administrative/political/legal boundaries	X			Aerial Photographs and Field verification
Designated functions of forests	X			Aerial Photographs and Field verification
Other wooded land				
Other land with tree cover				
Other land				

Status of the forest and disturbances affecting forest health and vitality

	N	SN	MU	Methodology
Disturbance by insects				
Disturbance by diseases				
Disturbance by other biotic agents	X			
Disturbance by fire	X			

Disturbance caused by other abiotic factors				
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Biodiversity

	N	SN	MU	Methodology
Tree species	X			
Shrub species	X			
Herbs species				
Endangered species				
Critically endangered species				
Vulnerable species				
Native species				
Endemic species				
Introduced species				

Beneficiaries of forest goods and services

	N	SN	MU	Methodology
By locality of user (e.g. indigenous/local/national)?				
By good/service (e.g. timber, fuelwood, NWFP, bamboo/rattan, water, etc) used by them				
By economic class of the beneficiaries (high, medium, low income)				
By level of dependency on forest (as percentage of total employment)				
By physical accessibility to the forest (distance from forest)				

Economic value

	N	SN	MU	Methodology
Removal of timber				
Removal of fuelwood				
Removal of other wood products				
Removal of wood products derived from forest under sustainable management				
Removal of wood products derived from forest plantations				
Removal of non wood forest products				
Annual allowable cuts/yields				
Social services				
Environmental services				
Employment				
Support to livelihood of communities				
Market price/cost of wood in forest				
Market price/cost of non wood forest products				
Estimate of value of social services				
Estimate of value of environmental services				

Estimate of value of employment				
Estimate of the contribution of forest sector to national economy				

Policy, legal and institutions (PLI) framework

	N	SN	MU	Methodology
Forest policy				
Forest legislation				
Forest administration				
Forest education and research				
Annual outlay, expenditure, investment in forestry sector				

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