Forestry Department

Food and Agriculture Organization of the United Nations

BRIEF ON NATIONAL FOREST INVENTORY NFI

PAKISTAN

Forest Resources Development Service

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MAR-SFM Working Paper 25/ 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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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

Pakistan is a republic in South Asia, marking the region where South Asia converges with Central Asia and the Middle East. It has a 1,046 kilometer (650 mile) coastline along the Arabian Sea in the south, and is bordered by Afghanistan and Iran in the west, India in the east and China in the far northeast. Its largest city is Karachi and its capital is Islamabad.

Map of the Country

Figure 1. Map of Pakistan
(Source:https://www.cia.gov/library/publications/the-world-factbook/geos/bg.html)

Land Area and Land use

The total area of Pakistan is 796 100square km and the following table presents the categorisation and projection of land use in Pakistan for 1990, 2000 and 2005 (FRA 2005).

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

FRA 2005 Categories	Area (1000 hectares)		
	1990	2000	2005
Forest	2 527	2 116	1 902
Other wooded land	1 191	1 323	1 389
Other land	73 370	73 649	73 797
Other land of which with tree cover			
Inland water bodies	2 522	2 522	2 522
TOTAL	**79 610**	**79 610**	**79 610**

Forests

The forest resources of Pakistan are relatively limited with a total of nearly two millions ha. of forested area corresponding 2.5 percent of total country area (see figure 2 below). The forests in Pakistan are heterogeneous and reflect the great physiographic and climatic contrasts within the country. The main forest types include: *Coniferous Forests*, mostly growing in the north and North West hilly regions of Pakistan between an elevation of 1000m and 3500m. and include the following forest types: Sub-Alpine, Himalayan moist temperate, dry temperate and subtropical Pine. *Scrub forests*, growing up to 1000m in elevation in the north and north western regions of Pakistan and include as main species *Acacia modesta* (Phulai), *Olea ferruginea* (Kau) and *Acacia nilotica* (Kikar,Babul). Tropical Thorn forest type also is part of scrub forest and includes *Acacia* species. Other forest types are Riverain Forests, Mangroves, Irrigated plantations and Linear plantations, along canals, roads and railway lines.

Pakistan does not have primary forests (see Table 2 below). Most of the forests are modified or semi-natural. These forests are under great pressure because of human activities, population growth and increasing demand for fuel wood and timber. Forests, excluding irrigated plantations are classified as "modified forests".

Table 2. Characteristics of forests in Pakistan

Fra 2005 Categories	**Area (1000 ha.)**		
	1990	**2000**	**2005**
Primary			
Modified	2293	1820	1584
Semi-natural			
Productive plantation	234	296	318
Protective plantation			
TOTAL	2527	2116	1902

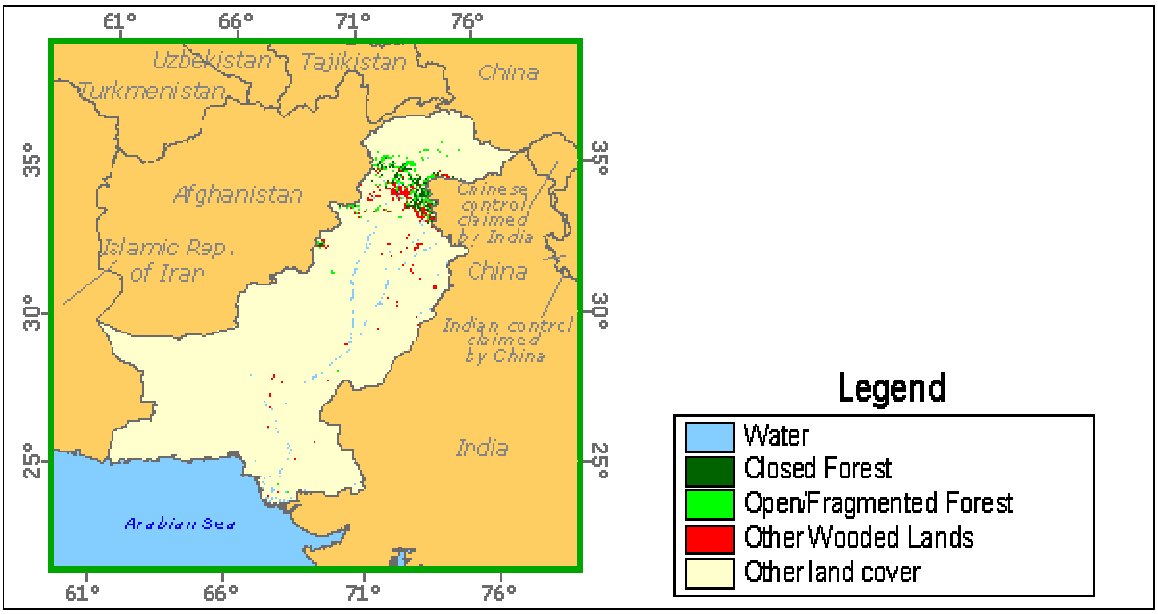

Figure 2. Map of Forest area in Pakistan (source: FAO - Global Forest Resources Assessment 2000)

Brief History of Forest Inventories

Forest inventories in Pakistan have been carried out for each designated forest located in a specific area since 1948. They are mainly done on the basis of compartments allotted to a specific working circle based on species.

In view of the country's problems relating to forest resources, including the difficulty of meeting fuel wood and timber demands, the Government decided to prepare a Master Plan for Forestry Development, covering the 25-year period from 1993 to 2018. This constitutes the latest forest assessment at national level based on Satellite Imagery interpretation and Field work. The interpretation was done in 1990/91 using 54 Land Satellite Images at a scale of 1:250,000 covering the whole Pakistan. The image quality was acceptable except for mountainous northern region. Sparse coniferous was not distinguishable from scrub forests, therefore of a total of 7.04 million hectare of Northern Areas about 4.7 million hectare remained unclassified. In 2004 National Forest and Rangeland Resource Assessment was carried out by the Pakistan Forest Institute, as outlined in Table 3 below.

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]			
1992	Forestry Sector Master Plan: National Perspective	Reid, Collins and Associates, Canada, and Silviconsult Ltd. Sweden - Asian Development Bank and UNDP		1990/91	1:250,000	National and Province	Full	NF, PL, OWL, FAC, TV, PA, FO, WSP, TOF
1994	Institutional strengthening of Sindh Forest Department – Forest Inventory	Swedforest International AB					Partial	
2004	National Forest and Rangeland Resource Assessment	Pakistan Forest Institute, Peshawar						

****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

A complete national inventory of forest growing stock is not available. Within the Forest Sector Master Plan (FSMP) it was possible to compile data for 1.3 million ha area of working plans in several provinces (29 in NWFP province, 3 in Punjab and 4 in AJK) as well as 3 working schemes in Northern Areas. Species-wise composition and estimates of growing stock of coniferous forests was also performed. The sampling design most commonly for inventories in forest divisions is simple random sampling with a sampling intensity of 0.01%. These inventories, when funds are available are generally performed every ten or more years.

Aerial Photography and satellite imagery availability

Remote sensing has been used for forest assessments since the early nineties. The Forest Sector Master Plan (FSMP) allowed the interpretation of Satellite Imagery as an independent estimate of forest cover. This exercise was carried out with the goal of providing an independent assessment and comparison with existing records and to provide a valuable starting point for monitoring forest cover changes in the future.

The FSMP interpretation was carried out in 1990/91 using 54 Landsat Satellite Thematic Mapper images at a scale of 1:250,000 covering the whole the whole of Pakistan. Forests were grouped into broad forest types and density classes, identified and delineated on the images. Information was transferred to maps and area summaries of each type were compiled by province. Image quality was acceptable overall, except for the mountains of Northern Areas. Rapid visual interpretation of satellite imagery was suitable for national planning purposes and for monitoring future change in forest cover. But it was not precise enough for operational planning.

Field Inventory

During field inventory the crews generally record species-wise diameter and use local volume tables for each species to estimate volume and growing stock for present and future. Diameter threshold is set a 4 cm for growing stock and 5 cm for commercial stock. The main measurements done in the field are summarized below.

Specification of country threshold values	Unit	Value
minimum dbh of trees included in growing stock	cm	> 4
minimum dbh at top end of stem for calculation of growing stock	cm	> 1
minimum diameter of branches included in growing stock (at thin end)	cm	5
minimum dbh of trees in commercial growing stock	cm	>5

Content and Methodology of data collection in NFI

Geo-physical

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

Bio-Physical

	N	SN	MU	Methodology
Number of trees		X		Field inventory (census)
Diameter of trees		X		Field inventory (census)
Height of trees		X		Field inventory (sampling)
Length of stem		X		Field inventory (sampling)
Stump height		X		
Age class		X		Field inventory (sampling)
Twigs		X		
Bark		X		
Leaves				

Forest extent

	N	SN	MU	Methodology
Forest land area				
Area of forest canopy/crown cover		X		Survey
Area under forest management		X		Map
Area under formal forest management plan		X		Survey, Records
Area under sustainable forest management		X		Survey, Record, Map
Forest area with certification		X		Record
Area under public owned forest		X		Record
Area under private owned forest				

Forest characteristics (Naturalness) and forest type

	N	SN	MU	Methodology
Primary forest		X		Field Survey
Modified natural forest		X		Field Survey
Semi-natural forest		X		Field Survey

Productive plantation		X		Field Survey
Protective plantation		X		Field Survey
Coniferous		X		Field Survey and Map
Broadleaved		X		Field Survey and Map
Mixed forest		X		Field Survey and Map
Forest area by dominant species (bamboo, mangroves, rubber)		X		Field Survey and Map
Forest area by ecological zone (tropical, subtropical, temperate, boreal, polar)		X		Field Survey

Use (designated functions) of forests

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

Social Services

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

Mapping of forest distribution

	N	SN	MU	Methodology
Distribution of forests		X		Field Survey / RS
Forest Characteristics		X		Field Survey / reports
Land use		X		Field Survey / reports / RS
Administrative/political/legal boundaries		X		Field Survey / reports
Designated functions of forests		X		Field Survey / reports
Other wooded land		X		Field Survey / reports / records
Other land with tree cover		X		Field Survey / reports / records
Other land		X		Field Survey / reports / records / interviews

Status of the forest and disturbances affecting forest health and vitality

	N	SN	MU	Methodology
Disturbance by insects		X		survey / RS
Disturbance by diseases		X		survey / national expert estimation / records

Disturbance by other biotic agents		X		survey / national expert estimation / records
Disturbance by fire		X		survey / national expert estimation / records
Disturbance caused by other abiotic factors		X		survey / national expert estimation

Biodiversity

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

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		X		expert estimate
Removal of fuelwood		X		expert estimate
Removal of other wood products		X		expert estimate
Removal of wood products derived from forest under sustainable management		X		expert estimate
Removal of wood products derived from forest plantations		X		expert estimate
Removal of non wood forest products		X		expert estimate
Annual allowable cuts/yields		X		expert estimate
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		X		reports / expert opinion
Forest legislation		X		reports / expert opinion
Forest administration		X		reports / expert opinion
Forest education and research		X		reports / expert opinion
Annual outlay, expenditure, investment in forestry sector		X		release of funds and target achieved

Bibliographies and References for further reading

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