Forestry Department
Food and Agriculture Organization of the United Nations

FOREST RESOURCES ASSESSMENT

NATIONAL FOREST ASSESSMENT:
WORKING PAPER

NATIONAL FOREST AND TREE
RESOURCES ASSESSMENT 2003-05

Manila, February 2005

The Forest Resources Assessment Programme

Forests are crucial for the well being of humanity. They provide foundations for life on earth through ecological functions, by regulating the climate and water resources and by serving as habitats for plants and animals. Forests also furnish a wide range of essential goods such as wood, food, fodder and medicines, in addition to opportunities for recreation, spiritual renewal and other services.

Today, forests are under pressure from increasing demands of land-based products and services, which frequently leads to the conversion or degradation of forests into unsustainable forms of land use. When forests are lost or severely degraded, their capacity to function as regulators of the environment is also lost, increasing flood and erosion hazards, reducing soil fertility and contributing to the loss of plant and animal life. As a result, the sustainable provision of goods and services from forests is jeopardized.

In response to the growing demand for reliable information on forest and tree resources at country and global levels, FAO initiated a programme to provide support to national forest assessments (NFA). The programme includes developing a harmonized approach to NFAs, information management and support to policy impact analysis for national level decision-making.

The purpose of the initiative is to introduce countries to an alternative approach designed to generate cost-effective information on forests and trees outside forests, including all benefits, uses and users of the resources and their management. Special attention is placed on monitoring the state and changes of forests, and on their social, economic and environmental functions. Another main objective is to build national capacities and harmonize methods, forest related definitions and classification systems among countries.

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List of Acronym/Abbreviation

CBD	Conservation on Biological Diversity
CBFM	Community-Based Forest Management
CENRO	Community Environment and Natural Resources Office
COFO	Committee on Forestry
DENR	Department of Environment and Natural Resources
ENR	Environment and Natural Resources
EPE	Estimated Position Error
FAO	Food and Agriculture Organization of the United Nations
FASPO	Foreign Assisted and Special Projects Office
FMB	Forest Management Bureau
FRA	Forest Resources Assessment
FRA-NCO	Forest Resource Assessment-National Coordinating Office
FRA-SC	Forest Resource Assessment -Steering Committee
GEZ	Geographical Ecological Zone
GIS	Geographical Information System
GPS	Global Positioning System
IEC	Information Education & Communication
IFMA	Integrated Forest Management Agreement
ITTA	International Tropical Timber Agreement
IW	Inland Water
LGU	Local Government Unit
LOA	Letter of Agreement
LUS	Land Use Section
NAMRIA	National Mapping and Resources Information Authority
NFA	National Forest Assessment
NFI	National Forest Inventory
NP	Nested Plot
NSCB	National Statistics Coordination Board
NWFP	Non-wood Forest Product
OL	Other Land
OWL	Other Wooded Land
PAWB	Protected Areas and Wildlife Bureau
PENRO	Provincial Environment and Natural Resources Office
RED	Regional Executive Director
RFIT	Regional Field Inventory Team
SIFMA	Socialized Integrated Forest Management Agreement
TAR	Tropical Rain Forest
TM	Tropical Mountain Systems
TOF	Trees Outside Forest
UNCED	United Nation Conference on Environment and Development
UNFCC	United Nation Framework Convention on Climate Change
WFP	Work and Financial Plan

DEFINITION OF LAND USE CLASSES

1.   FOREST - Land with an area of more than 0.5 hectare and tree crown cover (or equivalent stocking level) of more than 10 percent. The trees should be able to reach minimum height of 5 meters at maturity *in situ*. It consists either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest formations with a continuous vegetation cover in which tree crown cover exceeds 10 percent. Young natural stands and all plantations established for forestry purposes which have yet to reach a crown density of more than 10 percent or tree height of 5 meters are included under forest, as are areas normally forming part of the forest area which are temporarily un-stocked as a result of human intervention or natural causes but which are expected to revert to forest.

It includes forest nurseries and seed orchards that constitute an integral part of the forest; forest roads, cleared tracks, firebreaks and other small open areas; forest within protected areas; windbreaks and shelter belts of trees with an area of more than 0.5 hectare and width of more than 20 meters; plantations primarily used for forestry purposes, including rubber wood plantations. It also includes bamboo, palm, and fern formations (except coconut and oil palm).

1.1   **Closed Broadleaved Forest (FBC) -** Formations where trees in the various storeys and the undergrowth cover a high proportion (>40 percent) of the ground and do not have a continuous dense grass layer. They are either managed or unmanaged forests in advanced state of succession and may have been logged-over one or more times, having kept their characteristics of forest stands, possibly with modified structure and composition.

1.2   **Open Broadleaved Forest (FBO) -** Formations with discontinuous tree layer but with a coverage of at least 10 percent and less than 40 percent. Generally there is a continuous grass layer allowing grazing and spreading of fires.

1.3   **Closed Coniferous Forest (FCC) -** Forest with predominance (more than 75 percent of tree crown cover) of trees of coniferous species where trees in the various storeys and the undergrowth cover a high proportion (>40 percent) of the ground and do not have a continuous dense grass layer. They are either managed or unmanaged forests in advance state of succession and may have been logged-over one or more times, having kept their characteristics of forest stands, possibly with modified structure and composition.

1.4   **Open Coniferous Forest (FCO) -** Formations with discontinuous tree layer with a coverage of at least 10 percent and less than 40 percent. Generally there is a continuous grass layer allowing grazing and spreading of fires.

1.5   **Closed Mixed Forest (FMC) -** Forest in which neither coniferous nor broadleaved species nor palms nor bamboos account for more than 75 percent of the tree crown cover where trees in the various storeys and the undergrowth cover a high proportion (>40 percent) of the ground and do not have a continuous dense grass layer. They are either managed or unmanaged forests in advance state of succession and may have been logged-over one or more times, having kept their characteristics of forest stands, possibly with modified structure and composition.

1.6 **Open Mixed Forest (FMO) -** Formations with discontinuous tree layer with a coverage of at least 10 percent and less than 40 percent. Generally there is a continuous grass layer allowing grazing and spreading of fires.

1.7 **Closed Broadleaved Plantation (PBC) -** Forest stands of broadleaved species established by planting and/or seeding in the process of afforestation or reforestation which has more than 40 percent crown cover.

1.8 **Open Broadleaved Plantation (.PBO) -** Forest stands of broadleaved species established by planting and/or seeding in process of afforestation or reforestation which has less than 40 percent crown cover.

1.9 **Closed Coniferous Plantation (PCC) -** Forest stands of coniferous species established by planting and/or seeding in the process of afforestation or reforestation which has more than 40 percent crown cover.

1.10 **Open Coniferous Plantation (PCO) -** Forest stands of coniferous species established by planting and/or seeding in the process of afforestation or reforestation which has less than 40 percent crown cover.

1.11 **Closed Bamboo/Boho Formation (BBC) -** Forest on which more than 75% of the crown cover consists of tree species other than coniferous or broad-leaved species (e.g. tree-form species of the bamboo & boho) which has more than 40 percent crown cover.

1.12 **Open Bamboo/Boho Formation (BBO) -** Forest on which more than 75% of the crowncover consists of tree species other than coniferous or broad-leaved species (e.g. tree-form species of the bamboo & boho) which has less than 40 percent crown cover.

1.13 **Closed Mangrove Forest (MgC) -** Forested wetland growing along tidal mudflats and along shallow water coastal areas extending inland along rivers, streams and their tributaries where the water is generally brackish and composed mainly of Rhizopora, Bruguiera, Ceriops, Avicenia, Aegiceras, and Nipa species having more than 40 percent crown cover.

1.14 **Open Mangrove Forest (MgO) -** Forested wetland growing along tidal mudflats and along shallow water coastal areas extending inland along rivers, streams and their tributaries where the water is generally brackish and composed mainly of Rhizopora, Bruguiera, Ceriops, Avicenia, Aegiceras, and Nipa species having less than 40 percent crown cover.

2. **Other Wooded Land (OWL) -** Land that has either a crown cover (or equivalent stocking level) of 5-10 percent of trees able to reach a height of 5 meters at maturity *in situ*, or a crown cover (or equivalent stocking level) of more than 10 percent of trees not able to reach a height of 5 meters at maturity *in situ* (e.g. dwarf or stunted trees); or with shrub or bush cover of more than 10 percent.

2.1 **Shrubs (Sh) -** Refer to vegetation types where the dominant woody elements are shrubs i.e. woody perennial plants, generally of more than 0.5 meter and less

than 5 meters in height on maturity and without a definite crown. The growth habit can be erect, spreading or prostrate. The height limits for trees and shrubs should be interpreted with flexibility, particularly the minimum tree and maximum shrub height, which may vary between 5 and 7 meters approximately.

2.2 **Forest fallow system (Fa) -** Refers to all complexes of woody vegetation resulting from the clearing of natural forest for shifting agriculture. It is an intermediate class between forest and non-forest land uses. Part of the area, may have the appearance of a secondary forest.

2.3 **Wooded Grassland (WGL) -** Area predominantly vegetated with grasses, such as Imperata, Themeda, Saccharum; and where the trees cover 5 to 10 percent of the area and their height may reach 5 meters at maturity.

3. **Other Lands (OL) -** Land not classified as forest or other wooded land as defined above. It includes agricultural land, pastures, built-up areas, bare areas, grassland etc.

3.1 **Barren land (Bl) -** Land not covered by (semi) natural or artificial cover. This includes among others, sand dunes, riverwash and rocky or stony areas.

3.2 **Lahar (Lahar) -** Land covered with volcanic mudflows or debris flows.

3.3 **Grassland (Gl) –** Land predominantly vegetated with grasses such as Imperata, Themeda, Saccharum spp., among others.

3.4 **Marshland (ML) -** Natural land area usually dominated by grass-like plants such as cat tails and sedges which are rooted in bottom sediments but emerge above the surface of the water. It contains emergence vegetation and usually develop in zones progressing from terrestrial habitat to open water.

3.5 **Annual Crop (AC) -** Land cultivated with crops with a growing cycle under one year, which must be newly sown or planted for further production after harvesting.

3.6 **Perennial Crop (PCr) -** Land cultivated with long term crops that do not have to be replanted for several years after each harvest; harvesting components are not timber but fruits, latex and other products that do not significantly harm the growth of the planted trees or shrubs; orchards, vineyards and palm plantations, coffee, tea, sisal, banana, abaca, etc. are included in this category.

3.7 **Pastureland (Pa) -** Land managed for raising livestock.

3.8 **Built–up Area (BUA) -** Compose of areas of intensive use with much of the land covered by structures. It includes cities, towns, villages, strip developments along highways, transportation, power, and communication facilities, and areas occupied by mills, shopping centers, industrial and commercial complexes, and institutions that may, in some instances, be isolated from urban areas.

4. **Inland Water (IW) –** Area occupied by major rivers, lakes and reservoirs.

4.1   **Inland Water pond (Iwp) -** Body of water surrounded by land which is usually stagnant and is not intended for commercial raising of fish.

4.2   **Fishpond (FpW) -** Body of water surrounded by land mainly intended for commercial raising of fish.

Location Map (Tracts Distribution)

National forest inventory
Philippines

Sample plots (395 sampling units)

1: 7,500,000
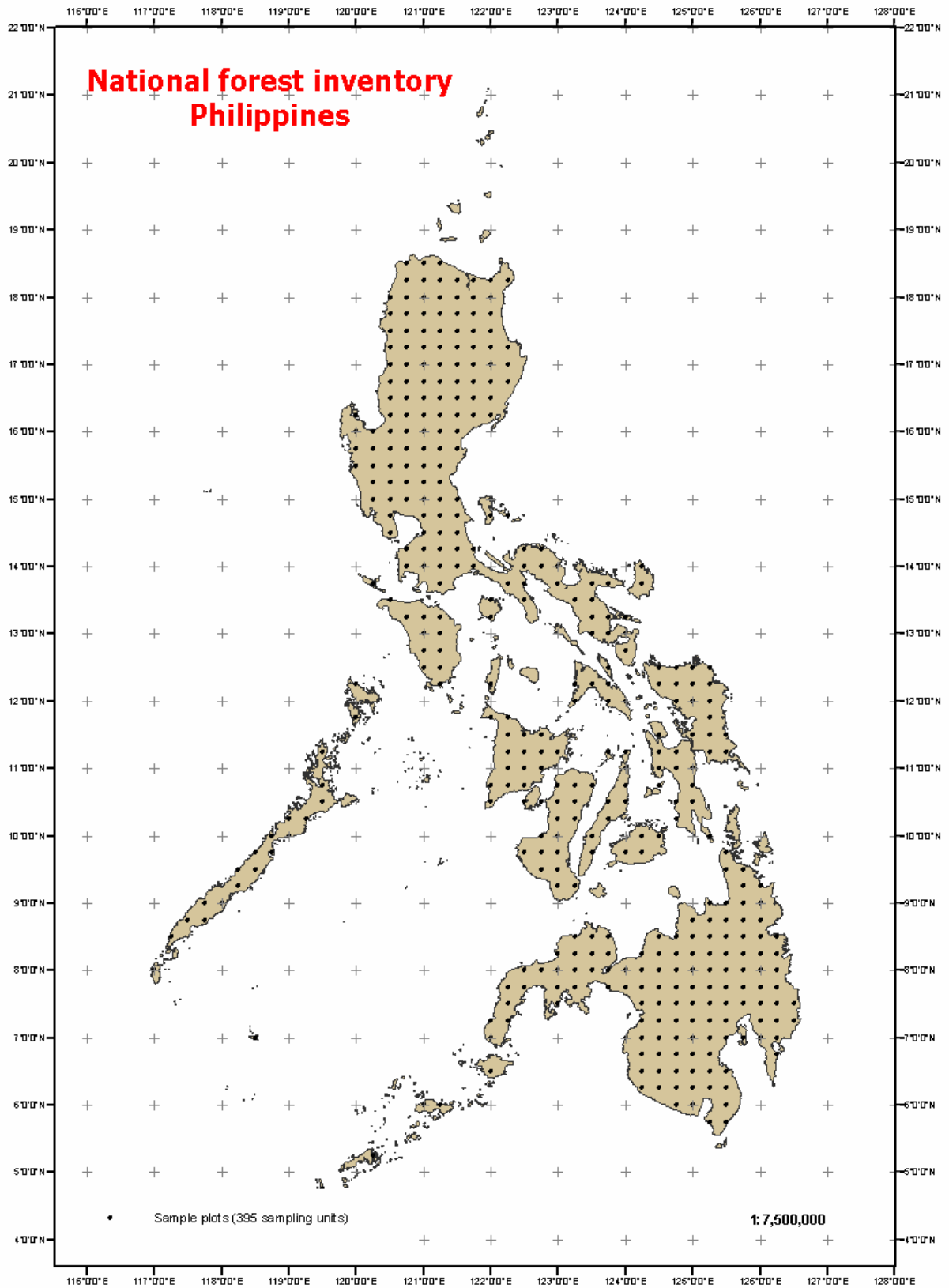
Executive Summary

The *Forest Resources Assessment* (FRA) Project in the Philippines was initiated in August 2002 for the assessment of Philippine forest and tree resources as part of the framework of the *Forest Resources Assessment Programme* of the *Food and Agriculture Organization of the United Nations* (FAO) to support *national forest assessments* (NFA).

The project aims to provide, among others, information on the distribution of forest and other wooded lands according to tree species composition, ownership and management status, size of holdings, designation/protection status, commercial volume and growing stock, and felling and/or removals.

The project was spearheaded by the *Forest Management Bureau* (FMB) and implemented in the field by the *Department of Environment and Natural Resources* (DENR) operating units (DENR regional offices), in collaboration with the Forestry Department of FAO.

The major emphasis of this report is to provide comprehensive information on the status of forest and trees outside forest in the country and analysis of the level of precision and reliability of generated data/information from forest inventory that is based on relatively low-intensity and systematic multi-stage sampling design.

Inventory Design

The inventory component of the project was based on relatively low intensity, systematic sampling method. Tracts measuring 1 km x 1 km were established in a national grid at 15' longitude and 15' latitude. Each tract consists of a cluster of 4 rectangular sample plots measuring 20 m x 250 m. Field measurements and data collection were carried out in these sample plots.

Field Survey

The forest inventory included both legally classified forestland and trees resources in alienable and disposable land and/or private land. Data collection focused on the measurement of the biophysical characteristics of the trees as well as in the documentation of the stock and flow of wood and non-wood forest products and services, through interviews with local forest users and external key informants.

Data collection commenced in November 2002 and terminated in July 2004. The field crews submitted to FMB field reports covering 367 tracts. Of this, 6 tracts totally fell in the sea (non-inland water), 4 tracts partially fell in the sea, and 5 tracts fell in inland water.

Data Entry and Data Processing

Data entry and data processing were centralized. The field data collected by the field crews were submitted to- and aggregated at FMB. Submitted field data were then electronically stored using both the NFI-Philippines database application software and the NFI-data database developed by FAO and FMB.

All data were entered into forms developed specifically for data entry by FAO-Forest Resource .Development Service (FORM). The form was structured to look like the original data registration forms (Field Forms).

The data were then assembled from the various tables by linking those tables by fields containing related data. By making queries, various information was generated from the data contained in the tables.

In the calculation of land use area, the project also included those land use sections where physical measurement of trees was not carried out (e.g. ravine, steep slopes). In the calculation of volume, however, the project included only those land use sections where physical measurement of trees was carried out in order to avoid underestimation of volume.

The data in the NFI-Philippines database was then exported to MS Excel for statistical analysis.

The FAO-FORM backstopping forestry officer travelled to the Philippines in February 2004 and October 2004 to introduce the statistical functions for the data processing and also to demonstrate to the staff of FRA-NCO the basic application of the NFI-Philippines database processing system.

Data Analysis and Data Interpretation

After the field data were collected, electronically stored and processed, data analysis and data interpretation was carried out.

Data analysis provided the following estimates:

Land Use Area

The Philippines has a total area of about 30 million hectares. Table 1.a shows the distribution by land use.

Tale 1a: Area distribution by land use

Land use	Area (ha)	Percent
Forest	7,162,560	23.9
Other Wooded Land (OWL)	3,611,204	12.0
Other Land (OL)	18,423,641	61.4
Inland Water (IW)	802,595	2.7
Total	30,000,000	100%

Forest Area

The total forest in the country is estimated at 7,162,560 ha. Of this, about 6,857,803 ha is broad-leaved forest; 221,971 ha is coniferous forest; and 82,786 ha is mixed forest. Broad-leaved forest includes bamboo/boho formation and mangrove forest.

Table 1b: Forest area by category

Forest by category	Area (ha)	Percent
Broad-leaved Forest	6,857,803	95.7
Coniferous Forest	221,971	3.1
Mixed Forest	82,786	1.2
Total	7,162,560	100%

- Of the broad-leaved forest, about 616,671 ha or 9% is plantation; and of the coniferous forest, about 10,521 ha or 4.7% is plantation.

Table 1c: Area by main forest type

	Broad-leaved Forest		Coniferous Forest	
	Natural	Plantation	Natural	Plantation
Area	6,241,132	616,671	211,450	10,521
Percent	87.1%	8.6%	2.9%	0.1%

- Of the forest area, about 4,826,007 ha or 67.4% is closed canopy forest and 2,336,553 ha or 32.6 % is open canopy forest.

Table 1d: Area by major forest type

Major Forest Type	Area (ha)	Percent
Closed Canopy Forest	4,826,007	67.4
Open Canopy Forest	2,336,553	32.6
Total	7,162,560	100%

- Of the forest area, about 6,087,029 ha or 85% is owned by the state, 1,044,486 ha or 14.6% is privately owned, 9,486 ha or 0.1% is municipality owned and about 21,559 ha or 0.3% is owned by the community.

Table 1e: Forest area by ownership

Land Tenure	Area (ha)	Percent
State owned	6,087,029	85.0%
Privately owned	1,044,486	14.6%
Municipality owned	9,846	0.1%
Community owned	21,559	0.3%
Total	7,162,560	100%

- Of the forest area, about 2,102,942 or 29.4% is under formal management and 5,059,618 ha or 70.6% is without formal management.

Table 1f: Forest area by management system

Management System	Area (ha)	Percent
With Management Plan	2,101,942	29.4%
Without Management Plan	5,059,618	70.6%
Total	7,162,560	100%

Volume (Gross Volume: DBH ≥ 10 cm; Commercial Volume: DBH ≥ 50 cm)

- In forest, the estimated gross volume of all trees with dbh ≥ 10 cm is 1,247,858,946 m^3 or an average volume per ha of 174.22 m^3. Of this, about 1,217,435,273 m^3 is in broad-leaved forest; 29,147,047.49 m^3 is in coniferous forest, and 1,276,625.85 m^3 is in mixed forest.

Table 1g: Gross volume by forest category

Forest Category	Gross Vol. (m^3)	Percent
Broad-leaved forest	1,217,435,273.00	97.6%
Coniferous forest	29,147,047.49	2.3%
Mixed forest	1,276,625.85	0.1%
Total	1,247,858,946.00	100%

The estimated commercial volume of all trees with dbh ≥ 50 cm is 386,956,668.6 m^3 or an average volume per hectare of 54.02 m^3. Of this, about 371,612,834 m^3 is in broad-leaved forest, 15,291,282.78 m^3 is in coniferous forest, and about 52,551.83 m^3 is in mixed forest.

Table 1h: Commercial volume by forest category

Forest Category	Comm. Vol. (m^3)	Percent
Broad-leaved forest	371,612,834	96.0%
Coniferous forest	15,291,282.78	4.0%
Mixed forest	52,551.83	0.1%
Total	386,956,668.6	100.1%

- In trees outside forest, the estimated gross volume of all trees with dbh ≥ 10 cm is 444,666,003.5 m^3 or an average volume per ha of 19.47 m^3. Of this, about 76,059,664.46 m^3 is in OWL; 365,030,730.4 m^3 is in OL; and 3,575,608.63 m^3 is in IW.

Table 1i: Gross volume of trees outside forest

	Gross Vol. (m^3)	Percent
Other wooded land	76,059,664.46	17.1%
Other land	365,030,730.40	82.1%
Inland water	3,575,608.63	0.8%
Total	444,666,003.50	100%

The estimated commercial volume of trees outside forest with dbh ≥ 50 cm is 38,104,529.82 m^3 or an average volume per ha of 1.67 m^3. Of this, about 13,351,271.42 m^3 is in OWL; 24,080,987.47 m^3 is in OL; and 672,270.93 m^3 is in IW.

Table 1l: Commercial volume of trees outside forest

	Comm. Vol. (m^3)	Percent
Other wooded land	13,351,271.42	35.0%
Other land	24,080,987.47	63.2%
Inland water	672,270.93	1.8%
Total	38,104,529.82	100%

Forest Resources Assessment
(Main Report)

1. Introduction

Forest resources assessment is essential in the sustainable management of forest resources. One of the most important objectives of forest resources assessment is to provide forest resources information to support for the development of forestry policies and programs for the management, sustainable development and conservation of forest resources.

The periodic conduct of forest resources assessment is consistent with the principles of the *United Nations Conference on Environment and Development* (UNCED) held in Rio de Janeiro, Brazil in 1992 which provides: "*The provision of timely, reliable and accurate information on forests and forest ecosystems is essential for public understanding and informed decision-making and should be ensured.*"

Practically, since FAO was created in 1948, it has been reporting on the worldwide status and trends of forest resources, their management and uses. All countries are involved in the process. They are the key players in data generation. Global assessment reports have been published at approximately 10 years interval. The latest of these reports (FRA 2000) concluded, however, that the level of availability and reliability of information is still low in developing countries.

In view of this, the FRA Programme of FAO conceived an approach to support national forest inventories through helping countries in developing or strengthening their capacities for continued national inventories. The FRA approach is founded on collaborative partnership between concerned governments and donors, with FAO facilitating the cooperation.

In March 2001, the *FRA Programme* of FAO informed the *Committee on Forestry* (COFO), the primary statutory body of the FAO Council that deals with forestry matters, of the FRA approach to support national forest assessment for country capacity building. The long-term objective of the approach will be "*to contribute to the sustainable management of forests and trees outside forest by providing decision makers and stakeholders with the best possible, most relevant and cost-effective information for their purposes at local, national and international levels*". COFO supported in principle the idea.

Consequently, FAO embarked on a pilot program for the implementation of the FAO approach, as part of the framework of the *FAO-FRA Programme* to support national forest assessments.

The Philippines is one of the countries within that pilot program.

2.   Background

The presently available information on the extent, location, volume and condition of the Philippine forest resources was obtained in the second national forest inventory that was carried out in 1979 to 1988. As a consequence, the data and information used to prepare plans and programmes on the management, development, protection and utilisation of forest resources are not up-to-date and do not reflect the current situation on the ground. In addition, the information from the latest national forest inventory refers only to designated "forestland", and only to the biophysical resources of the forest. Current information requirements intend to cover forest and tree resources on all types of land, and to include information on management and uses of the resources, including changes over time.

The second NFI was carried out with the assistance of donor funding institutions. It was designed as a conventional national forest inventory, based on a large number of sample plots, backed up with full-cover aerial photo interpretation. The inventory covered the legally designated "forestland", i.e. about 19.4% of the land area (FRA 2000). The inventory was designed mainly to support decisions related to the production of wood. The 2nd NFI was an ambitious project, following the state-of-the-art of the discipline at the time.   In the present situation, however, some modifications to the approach must be considered. Information from all land is requested, related to all products and services obtained from the forest. Also, the information is required urgently, which means that national level results should be made available in much shorter time than the nine years used for the second NFI.

Two donor-assisted attempts have been made to update some of the national level information, using satellite remote sensing to map the land cover/land use for the entire country.   In 1987/88, *SPOT* images were interpreted to map the vegetation in the entire country, and to provide a new set of land cover statistics, 5 years after the average inventory year of the preceding NFI. Unfortunately, the information was not compatible with the NFI and could not be used to establish trends. Since 1997, a project using recent *Landsat* images from recent years has produced another land cover map, presently covering about 80% of the country, mainly in the scale 1:100,000. Also this information showed to be incompatible with previous surveys, and reliable calculations of land use area changes can still not be made. Also, the precision and accuracy of area classifications are unknown in the two map sets. These two projects illustrate difficulties when relying on satellite remote sensing alone for area statistics generation. They also cover only the area aspect, and no new information on the attributes or use of forest resources has been obtained.

Necessarily, an updated national forest assessment was very much needed for the Philippines.

3.   Objectives of the Study

The project aims at attaining the following development objective: Enhance the social, economic and environmental functions of forest and trees resources through their sustainable management on the basis of better knowledge of their qualitative and quantitative importance.   The project also aims at improving contribution of these resources in the national economy.

The project would contribute in achieving the development objective through implementation of the activities of the following specific objectives:

a) to develop and reinforce capacities of the national forestry institutions in the Philippines to design, plan, implement forest inventory projects and manage information;
b) to design and carry out a forest inventory project that satisfies national needs in information and reliability and set up a monitoring system for future surveys. The inventory will cover a large array of biophysical and economic variables with emphasis on management and use of resources; and
c) to design and set up a forestry information system to process field data and manage the generated information.

4.   Resources for the Implementation of the NFA

4.1   Institutions

The *Forest Management Bureau* (FMB) led the NFA project and was implemented in the field by the DENR operating units (DENR regional offices) in collaboration with the Forestry Department of FAO. FMB had the overall co-ordinating role, including design and planning of the assessment. It had the *Letter of Agreement* (LOA) with FAO. FMB organized the field teams, making use of the staff of the DENR regional offices. FMB also provided staff and training for locating and establishing field plots using GPS receiver and other measurement techniques. The DENR Regional Offices provided staff for locating and establishing sample plots and collecting field data. DENR field teams conducted biophysical measurements/observations and field interviews at all sites.

The *National Mapping and Resource Information Authority* (NAMRIA), through its Remote Sensing and Resource Data Analysis Department, provided spatial information required for the design and implementation of the assessment.

The DENR Regional Offices provided staff for locating and establishing sample plots and collecting field data.

The *FRA-Steering Committee* (FRA-SC) was created and had the overall supervision over the project activities. The FRA-SC is composed of representatives from: the Office of the DENR Secretary for ENR Operations; the Office of the DENR Undersecretary for Planning and Policy*; Foreign-Assisted and Special Projects Office* (FASPO) of the DENR; *National Mapping and Resource Information Authority* (NAMRIA); the *National Statistics Coordination Board* (NSCB) and/or the *National Statistics Office* (NSO); the *Protected Areas and Wildlife Bureau* (PAWB); and the *Forest Management Bureau* (FMB). The Director of FMB is the Chairman of the Steering Committee.

FAO provided financial contribution in support of the project as well as expert technical assistance to all phases of the assessment, including ensuring compatibility with international information standards.

4.2   Staff

The *FRA National Coordinating* Office (FRA-NCO) was created in FMB to coordinate the project activities. The mandates of FRA-NCO are to: i) plan the project activities, ii) co-ordinate interventions of the involved national institutions and individuals, iii) train field crew members, iv) organise and supervise fieldwork and provide necessary logistical support to the field teams, v) assist in designing and developing the forest information system, and vi) process the field data and report project findings.

FRA-NCO is composed of the national coordinator who is assisted by 7 professional foresters (FMB: 5; NAMRIA: 2) and 1 database expert hired on contractual basis. The Director of FMB is the national coordinator. FRA-NCO is based at the FMB building.

4.3   Equipment, supplies and materials used

The instruments, supplies and materials used to carry out the inventory are:
- Box Compass (Suunto)
- GPS receiver (Garmin)
- Measurement tape (50 meters)
- Diameter tape
- Haga altimeter
- Galvanized steel bars for permanent plot marking (50 cm length)
- Topographic maps
- Regional and provincial maps
- Clipboards
- Field Forms (data registration forms)
- Philippines National Forest Inventory Field Manual
- A Dictionary of Philippine Plant Names (Volumes I & II)
- Backpacks
- Tents
- Sleeping bags
- First-Aid kits

5.   Preparations

In order to attain the objectives of the project, careful planning and thorough preparation was undertaken. The planning focused on the type of data to be gathered, the method and strategy to be adopted in collecting field data, the task that each member of the field crews should performed, the equipment and supplies needed, and the timetable.

5.1   NFI-Philippines Field Manual

The Philippine's National Forest Inventory (NFI) Field Manual was prepared by FMB in collaboration with FAO. The field manual was prepared following the NFI Field Manual used in the pilot study conducted in Costa Rica and Cameroon. These NFI Field Manuals were refined to conform to the Philippine situation, taking into account the national as well as international information requirements.

The NFI Field Manual contains the definitions, land use and forest type classification, and procedures used to carry out the national forest inventory. The first part of the manual describes the sampling design adopted. The second part deals with the land use classification adopted to carry out the inventory. The third part shows the recommendations to undertake data collection in the field.

5.2   Field Forms

The Field Forms (Data Registration Forms) were prepared by FAO in collaboration with FMB.

FMB printed and distributed a set of Field Forms to each RFIT. A set of Field Forms consists of 8 Forms (F1, F2, F3a, F3b, F4a, F4b, F5 & F6). The crew leaders then reproduced the field forms according to the needs in each tract.

Description of Field Forms:

- Form F1: Tract

   This form contains data related to the tract identification and location, reference points in accessing the tract, list of people involved in the inventory or related to the area, population size within the tract, and proximity to structures.

- Form F2: Plot

   This form contains data related to the plot identification, plot start point description, time record of work in the plot, plot plan, and other general observations in the plot.

- Form F3a: Plot

   This form consists of a table where data related to all trees and stumps with 10 cm dbh and larger found in the plot are entered.

- Form F3b: Rectangular subplot (Nested Plot Level 1)

   This form consists of a table where data of relevant non-wood forest products (NWFP) like bamboo, erect palms, and rattan are recorded.

- Form F4a: Circular subplot (Nested Plot Level 2)

   This form contains a table where data related to tree regeneration (sapling ≥ 1.3 m height and trees with dbh < 10 cm) as well as edaphic variables are entered.

- Form F4b: Circular subplot (Nested Plot Level 2)

19

This form contains a table where data related to other NWFP, excluding bamboo, erect palms & rattan, gathered in the circular subplot are recorded.

- Form F5: Land Use Section

  This form contains data related to land use section, designation/protection status, land tenure, disturbances, fire, and forest management and structure (i.e. stand origin, stand structure, canopy coverage, management system, disturbances, timber exploitation, silvicultural treatment & harvesting technology).

- Form F6: Land Use Section

  This form consists of a table where data related to the use of forest resources (i.e. products and services, users, user rights, supply and demand trend, harvesting activity, & species) gathered in each land use section are recorded.

1. NFI Philippines
2. **Tract No** ....

- F1 -
TRACT

A. Tract Location

7. State ....
8. Province ....
9. District ....
10. Locality ....

11. GEZ C

12. Altitude Tract centre .... m

Co-ordinates Tract south-west corner
14a. Latitude _ _ , _ _ _ _ _ °
14b. Longitude _ _ , _ _ _ _ _ °

	18. Crew	19. Owner	20. Informant*

B. Crew/Owner/Informant list

15. **Name**	16. **Address**	17. **Phone number**			C

* Code indicates the informant's relation to the area, i.e. O=Estate Owner, E=Employee, M=Manager of site, S=Settler, X= External key informant

C. Population

21. Population on track
22. Population since
23. Population dynamics ☐ C
24. Population main activity ☐ C
25. Settlement history ☐ C

D. Proximity to Infrastructure

Distance from Tract centre to:

26. All weather road _ _ , _ km
27. Seasonal road _ _ , _ km
28. Settlement _ _ , _ km

29. Hospital _ _ , _ km
30. School _ _ , _ km
31. Market _ _ , _ km

E. Tract Access

Position when leaving road
32a. Latitude _ _ , _ _ _ _ _ °
32b. Longitude _ _ , _ _ _ _ _ °

Time:
33. When leaving road _ _ _ _
34. When getting to plot N° ☐ _ _ _ _

Reference points of access path

35. **ID**	36. **Description**	37a. **Latitude**	37b. **Longitude**

38. *Notes*:
....
....

1. NFI Philippines

2. **Tract No** ...... 3. **Plot No** ☐

- F2 -
PLOT

A. Plot start point description

Plot starting point (calculated):

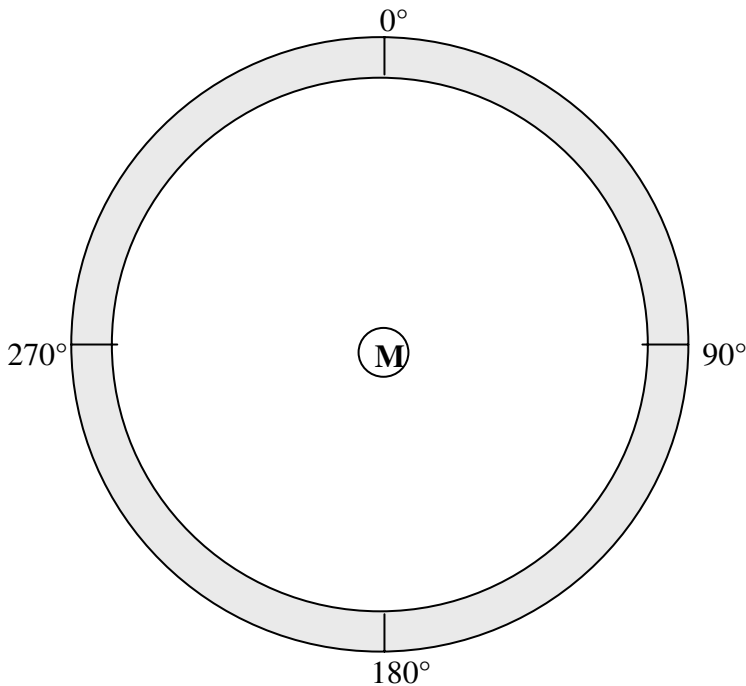39a. Latitude $\_\_ , \_\_\_\_\_$ °

39b. Longitude $\_\_ , \_\_\_\_\_$ °

Marker position (GPS reading):

40a. Latitude $\_\_ , \_\_\_\_\_$ °

40b. Longitude $\_\_ , \_\_\_\_\_$ °

41. Distance from Marker to Plot start point ☐ m

42. Bearing from Marker to Plot start point ☐ °

Central line bearing:
Plot # 1 = 0°
Plot # 2 = 90°
Plot # 3 = 180°
Plot # 4 = 270°

M = Marker position
P = Plot starting point, if P ≠ M for any reason

43. Plot starting point plan

0°

270°

M

90°

180°

Reference points surrounding Marker position

44. **W**	45. **Description**	46. **Bearing*** (°)	47. **Distance*** (m)

* From Marker position

B. Time record of work within

Starting:

48. Date $\_\_$ / $\_\_$ / $\_\_$

49. Time: $\_\_ \_\_$

Ending:

50. Date: $\_\_$ / $\_\_$ / $\_\_$

51. Time: $\_\_ \_\_$

C. Plot plan (52.)

-10 m   0 m   +10 m

250 m = Plot End
245 m
(Measurement point 3)

200 m

150 m

125 m
(Measurement point 2)

100 m

50 m

(Measurement point 1)
5 m
0 m = Plot Start

-10 m   0 m   +10 m

Starting point

—— LU (Land use limit)

———— Rd1 (Paved road)

- - - Rd2 (Primary road unpaved)
Rd3 (Secondary road)
Rd4 (Track)

53. *Notes*:

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1. NFI Philippines   **- F3a -**
2. **Tract No** ....   3. **Plot No** ☐   **PLOT**

D. Tree measurement

4. Sub-plot No	54a. Nested Plot L1 Width	54b. Nested Plot L1 Length	55. Tree No	56a. Common name	56b. Scientific name	57a. Along Plot axis (m)	57b. Left axis (−) (m)	57b. Right axis (+) (m)	58. Dbh[1] (cm)	59. Dbh height[2] (m)	60. Year(s) since cut	61. Total height (m)	62. Commercial height (m)	63. Stem quality C	64. Health state C	65. Causing element[3] C

[1] Stump diameter respectively   [2] Stump height respectively   [3] Multiple choice

68. *Notes*:

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BAMBOO, ERECT PALMS and RATTAN
(For 10m x 20m Nested Plot only)

1. NFI Philippines   **- F3b -**

2. **Tract No ....**   3. **Plot No** ☐   **PLOT**

Notes:..

Sub-plot No	Nested Plot L1 Width	Nested Plot L1 Length	Clump No	Common name	Scientific name	Along Plot axis	Left axis (−)	Right axis (+)	Average Stem Diameter	Total No. of stems/clump
						(m)	(m)	(m)	(cm)	(m)

....
....
....
....

1. NFI Philippines

2. **Tract No** ...... 3. **Plot No** ☐

A. Topography and soil

Measurement point No 1	**Measurement point No2**	**Measurement point No3**
4a. Sub-Plot No ☐	4b. Sub-Plot No ☐	4c. Sub-Plot No ☐
70a. Aspect ☐ °	70b. Aspect ☐ °	70c. Aspect ☐ °
71a. Slope ☐ %	71b. Slope ☐ %	71c. Slope ☐ %
72a. Relief ☐ C	72b. Relief ☐ C	72c. Relief ☐ C
73a. Soil texture ☐ C	73b. Soil texture ☐ C	73c. Soil texture ☐ C
74a. Soil drainage ☐ C	74b. Soil drainage ☐ C	74c. Soil drainage ☐ C

B. NESTED PLOTS LEVEL 2 – Tree measurements (0cm < Dbh < 10cm)

6. L2 No (1-3)	4. Sup-plot N	76. Area (≤50m^2) (m^2)	77. Species		78a. Counts	78b. Total number
			77a. **Common name**	77b. **Scientific name**		

79. *Note*s:

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OTHER MINOR FOREST PRODUCTS
(For 3.99m-radius Nested Plot, L2)

1. NFI Philippines

2. **Tract No** .... 3. **Plot No** ☐

- F4b -
PLOT

Stem N°/Clump N°	Species		Average Stem Diameter	Total N° of stems/clump	Average Stem Diameter	Total N° of stems/clump	Average Stem Diameter	Total N° of stems/clump
	56bb. Listed Species	56ab. Not Listed Species	(cm)		(cm)		(cm)	

Notes:..
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1. NFI Philippines — **- F5 -**
2. **Tract No** ....   3. **Plot No** ☐   **SUB-PLOT**
4. **Sub-plot No** ☐

A. General

80. Land use ☐ C

84. *Environmental problems*	
0	Not Applicable (urban areas…)
1	Not existing
2	Loss of water levels in rivers and other sources
3	Drought
4	Inundation
5	Poor water quality
6	Pests
7	Erosion
10	Landslide
11	Windthrow
90	Not known
99	Other ………………………………………

85. Fire occurrence ☐ C

86. Fire area ☐ m^2

88. Lianas ☐
89. Epiphytes ☐

81a. Width ☐ m
81b. Length ☐ m

82. Designation/ Protection status ☐ C

83. Land tenure C

B. Forest management and structure

90. Stand origin* | N | P | C | n |

91. Stand structure ☐ C
92. Canopy coverage ☐ C
93. Management plan ☐ C

95. *Timber exploitation*	
0	No felling
1	Clearing
2	Selective felling
3	Group felling
4	Strip felling
99	Other

96. *Silviculture*	
0	No practice
1	Improvement
2	Release of desirable superior tree
3	Release of lianas and tropical plants
4	Enrichment
5	Sanitary cutting

97. *Technology used*	
0	Not Applicable
1	Manual
2	Chainsaw
3	Mechanised (tractors etc.)
90	Not known
99	Other (oxen etc.)

* N=Natural regeneration; P=Plantation; C=Coppice; nk= not known

98. *Notes*: ………

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4. **Sub-plot No** ☐

A. General

80. Land use ☐ C

84. *Environmental problems*	
0	Not Applicable (urban areas…)
1	Not existing
2	Loss of water levels in rivers and other sources
3	Drought
4	Inundation
5	Poor water quality
6	Pests
7	Erosion
10	Landslide
11	Windthrow
90	Not known
99	Other

85. Fire occurrence ☐ C

86. Fire area ☐ m^2

Future trees:
88. Expected ☐ C
89. Desired ☐ C

81a. Width ☐ m
81b. Length ☐ m

82. Designation/ Protection status ☐ C

83. Land tenure C

B. Forest management and structure

90. Stand origin* | N | P | C | n |

91. Stand structure ☐ C
92. Canopy coverage ☐ C
93. Management plan ☐ C

95. *Timber exploitation*	
0	No felling
1	Clearing
2	Selective felling
3	Group felling
4	Strip felling
99	Other

96. *Silviculture*	
0	o practice
1	Improvement
2	Release of desirable superior tree
3	Release of lianas and tropical plants
4	Enrichment
5	Sanitary cutting

97. *Technology used*	
0	Not Applicable
1	Manual
2	Chainsaw
3	Mechanised (tractors etc.)
90	Not known
99	Other (oxen etc.)

* N=Natural regeneration; P=Plantation; C=Coppice; nk= not known

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- F6 -
SUB-PLOT

1. NFI Philippines
2. Tract No ......   3. **Plot No** ☐   4. **Sup-plot No** ☐

D. Products / Services

99. Product/Service (C)	100. Rank	101. End use*	102. Harvester**	103. User right (C)	104. User conflicts (C)	105. Demand Trend (C)	106. Supply Trend (C)	*Harvesting/Activity* 107. Season activity (C)	108. Last activity (C)	109. Trend (C)	110. Change reason (C)	111. Species**
		d / c / nk	Children / Women / Men / Local organisations & comp. / National companies / International companies / Other									

* Multiple choice: d = domestic use; c = commercial use; nk = destination not known
** Multiple choice

112. *Notes:*
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28

5.3   Tract/plots Coordinates

FAO-FORM provided FMB with the list of tract/plots coordinates. The list of coordinates was reproduced by the staffs of FRA-NCO and distributed to the crew leaders. Further, FRA-NCO prepared the list of tracts by region to determine the number of tracts to be established in each region. Said list specified the location of the respective tracts by province and municipality. A copy of the list was provided to the crew leaders, for reference purposes.

5.4   Equipment

In collaboration with the FAO-FORM backstopping forestry officer, the staffs of FRA-NCO identified the surveying/measurement instruments, supplies and materials needed by the field crews in collecting field data. The staffs of FRA-NCO then contacted identified dealers who submitted the lowest price quotations and made arrangement for the order and purchase of said instruments, supplies and materials. The instruments, supplies and materials were later issued to the respective crew leaders. (Please see the list of equipment in the preceding paragraph).

FAO-FORM donated to FMB 6 sets of surveying instruments. A set consists of a GPS receiver (Garmin), box compass (Suunto), Haga altimeter, calliper, meter tape, diameter tape, flagging tapes, and back-pack. These were issued to the staffs of FRA-NCO.

5.5   Maps

Map provides data on the spatial attributes of the area. The topographic map charts the physical features on the ground (e.g. roads, rivers, etc) and the elevation of the area. A topographic map is usually available at a scale of 1:50,000.

The project purchased from NAMRIA sets of topographic maps (1:50,000) as well as regional and provincial maps and distributed these to the crew leaders for reference purposes. The crew leaders prepared their respective regional map showing the location of the tracts by province and municipality, based on the list of tract/plots coordinates. Some crew leaders generated their respective regional map with the help of the GIS unit in the regional office.

Further, the crew leaders delineated the tract and plots borders on the appropriate topographic map sheet to help them identify possible routes that could expedite their access to the tract/first plot.

5.6   Regional Field Inventory Teams (RFIT)

Seventeen (17) *regional field inventory teams* (RFIT) were created nationwide to carry out data collection in the field. Each regional office has one RFIT, composed of 2 professional foresters (1 team leader and 1 assistant team leader) and 3 locally hired laborers.

In May 2002, FMB requested all DENR regional offices to submit to FMB the names of 2 professional foresters, preferably with background in forest inventory, who shall act as team leader and assistant team leader of the field crew. In June 2002, FMB drafted the DENR Special Order creating the crew leaders of the RFIT. In August 2002, the DENR Secretary approved said Order.

In October 2002, FMB organized and conducted a one-week training course to familiarize the crew leaders with the technique and methodology of the NFA approach and improve their individual skills.

6. Project Management

The activities of the project were implemented through the *Letter of Agreement* (LOA) signed between the representatives of FAO and FMB. The LOA stipulated, among others, the financial contribution of FAO to FMB, the activities for which the funds were to be used, general conditions of the Agreement, reporting system, terms of payment, and settlement of disputes.

Two LOAs were signed for the project; each LOA had a duration of 6 months. The 1st LOA entered into force in August 2002; in this agreement FAO made a financial contribution in the amount of US$96,000. The 2nd LOA entered into force in May 2003; in this agreement FAO made a financial contribution in the amount of US$98,000.

The project was implemented in the field by the DENR operating units. To support the budgetary requirements of the regional teams in the conduct of field survey, FMB had to transfer funds to the RFIT. In this connection, the crew leaders had to open a bank account in the name of the project to facilitate fund transfer. The team leader and the assistant team leader were the signatories. FMB periodically transferred the budget of the field crews to said bank account.

FMB and in collaboration with the crew leaders had periodically prepared the Regional Work and Financial Plan (WFP) which were then approved by the concerned REDs. The approved WFP served as basis for FRA-NCO in facilitating funds to the bank account of the regional teams. The approved WFP also provided FRA-NCO with a tool to monitor the teams' progress towards achieving the specified work goals.

During project implementation, FMB periodically visited the RFIT to assist and supervise them in data collection, and ensure that field data were collected in accordance with the prescribed procedures in the NFI Field Manual. The field visits also allowed the crew leaders to clarify uncertainties associated with data gathering. Inasmuch as the FRA approach is new, it was not expected that every team could carry out the work right from the start.

To ensure that the field crews' concerns regarding project implementation are appropriately addressed, the 17 regions were divided into 3 groups, based on geographic location. A desk officer was assigned and/or designated for each group. The desk officer, aside from his inherent responsibilities in FRA-NCO, was directly

responsible for the review and correction of submitted field reports and editing of electronically stored data for his regions.

The crew leaders prepared and submitted field report to FMB on a monthly basis. The concerned *Regional Executive Director* (RED) or *Regional Technical Director* (RTD) for Forestry endorsed said report. The desk officers reviewed the submitted field report and corrected identified deficiencies prior to data entry.

Data entry and data processing was undertaken at FMB (FRA-NCO). The project contracted the services of a database expert to handle the project's database concerns. Data entry progressed as field reports were submitted to FMB. To fast-track data encoding, the project hired the services of a data encoder and a GIS expert to assist the database expert in data entry. The staffs of FRA-NCO and in consultation with the FAO-FORM backstopping forestry officer were responsible for data processing and analysis as well as in reporting the results to FAO-FORM.

IEC Campaign

In order to create awareness to the people about the operations of the FRA Project, the project contracted the services of a Communications Consultant for the production of posters and leaflets promoting the project. The information materials were prepared in English and translated into the major vernaculars used as medium of communication in the country. Said leaflets and posters were distributed to the crew leaders for further distribution to concerned government offices and communities involved during the field survey.

7. Methodology

7.1 Sampling Design

The sampling design adopted was systematic and without stratification. The design was developed by FAO-FORM and adopted by the FMB. The selection of the sample sites population has been done on the basis of the latitude/longitude grid. A grid of tracts measuring 1 km x 1 km was established at each 15 minutes latitude and 15' longitude. The coordinates of the Southwest corner of the tracts correspond to the intersection of the lat/long lines.

The inventory component of the project was based on relatively low intensity sampling (sampling intensity is 0.0026%). Three hundred and ninety five (395) tracts were initially selected in the national grid. Each tract composed of a cluster of 4 rectangular sample plots where data collection was carried out. The sample plots measuring 20 m x 250 m were in perpendicular orientation following the 4 cardinal directions and were 250 m apart from each other. (Please see item 5 under Form F2).

The sample plot would be further subdivided into land use sections (LUS), with variable sizes and shapes, representing homogenous land use and forest type units along the plot. Most of the data related to forest characteristics, management and resource uses were collected in the LUS. In LUS that was classified as forest, only trees with dbh ≥20 cm were measured and recorded. However, in LUS that was not

classified as forest (OWL, OL, and IW), all trees with dbh ≥10 cm were measured and recorded.

Each sample plot included "nested plots" (NP) when the land use was forest. There could be up to 3 locations of NP in the sample plot. The 1st location was centered at 5 m, the 2nd at 125 m, and the 3rd at 245 m from the plot starting point, respectively. The NPs consisted of two levels. The 1st level NP comprised a sample area of 200 m^2 (20 m x 10 m) for measurement of trees with dbh ≥10 cm but <20 cm dbh. The 2nd level comprised a sample area of 50 m^2 for recording tree regenerations, soil information and topography.

 If the land use at the location of the NP was not classified as forest, the nested plot was not established.

7.2 Land Use/Land Cover Classification

The FAO global land use classes were used as a standard for developing the country's national classification system. The FAO global land use classes were applied as the first level of the national land use classification system.

The FAO global land use classes are the following:

- Forest
- Other Wooded Land
- Other Lands
- Inland water

A second level classification subdivided the FAO global land use classes into more detailed classes to fulfil country specific needs. The national land uses classes were the following:

- Forest
  - Closed broad-leaved forest (FBC)
  - Open broad-leaved forest (FBO)
  - Closed coniferous forest (FCC)
  - Open coniferous forest (FCO)
  - Closed mixed forest (FMC)
  - Open mixed forest (FMO)
  - Closed broad-leaved plantation (PBC)
  - Open broad-leaved plantation (PBO)
  - Closed coniferous plantation (PCC)
  - Open coniferous plantation (PCO)
  - Closed bamboo/boho formation (BBC)
  - Open bamboo/boho formation (BBO)
  - Closed mangrove forest (MgC)
  - Open mangrove forest (MgO)
- Other Wooded Lands
  - Shrubs (Sh)
  - Fallow (Fa)
  - Wooded grassland (WGL)

- Other Lands
  - Barren land (Bl)
  - Lahar (Lahar)
  - Grassland (Gl)
  - Marshland (Ml)
  - Annual crop (AC)
  - Perennial crop (PCr)
  - Pastures (Pa)
  - Built-up area (BUA)
  - Primary paved road (Rd1)
  - Primary unpaved road (Rd2)
- Inland Water
  - Inland water pond (Iwp)
  - Fishpond (FpW)

7.3   Variables

Three groups of variables were defined to cover the social, economic as well as environmental aspects. These provided description of the forest and trees outside forest resources in the country. The extent of variables was defined taking into account the need to produce different outputs in the predefined forest and tree attributes such as land use/land cover area, volume, biomass and carbon, resources management and protection status, biodiversity, and uses of resources. The variables were chosen to provide the necessary information for decision making at national level as well as for international reporting. The set of variables consisted of a core of internationally harmonised variables and a group of country specific variables that together permitted monitoring and reporting to satisfy both the national and international information requirements.

Attributes	Variables
Land use/ land cover	Land use class, area, land tenure/ownership status, designation/protection status, management system, ecological zone*
Volume	Land use class, area, tree species, diameter at breast height/above buttress, total tree height, commercial height, timber quality, management system, land tenure/ownership status, designation/protection status, ecological zone*
Biomass & Carbon Stock	Land use class, area, tree species, diameter at breast height/above buttress, total tree height, management system, land tenure/ownership status, designation/protection status, ecological zone*
Management	Land use class, area, management system, land tenure/ownership status, designation/protection status, stand origin, timber exploitation, silvicultural treatments, technology used, disturbances, ecological zone*
Forest health	Land use, area, management system, land tenure/ownership status, health state, causing elements, fire occurrence
Biodiversity	Land use, area, tree species
Uses of resources	Products and services, users, user rights, supply and demand trend, harvesting activity, season and frequency of extraction, tree species, accessibility to sample sites, distance to infrastructures

* Ecological Zone – large ecological areas characterized by similar vegetation and climate and all the living organisms in it (e.g. Tropical rain forest and Tropical Mountain Systems).

7.4   Training of Field Crews

In preparation for the NFA Training, the staff of FRA-NCO developed a design for the NFA Training program. The list of official participants, budget estimate and course content were prepared. Potential resource persons who are experienced in the specified field of discipline and with good academic background were identified and considered.   Further, the necessary letters-of-invitation to concerned DENR executives and selected resource persons were prepared.   Likewise, the instructional materials were prepared. Moreover, the training venue was identified.

After the training program was designed, the staffs of FRA-NCO drafted in July 2002 the DENR Special Order requiring the field crew leaders and selected FMB technical personnel to attend and participate in the NFA training scheduled from October 1-8, 2002. In August 2002, the DENR Secretary approved said Order.

In September 2002, a week prior to the NFA training, the FAO-FORM backstopping forestry officer and the staffs of FRA-NCO conducted 2 days field-testing of the inventory sampling design and data collection methodology of the NFA approach. The group also selected 2 sites to be used in the field practicum. The sites contained a mixture of forests, shrubs, perennial crops and annual crops that are typical in the country to familiarize the participants with the different land use classifications prescribed in the NFI Field Manual.

The NFA training was organized and conducted by the staffs of FRA-NCO, in collaboration with DENR-HRDS personnel, FAO-FORM backstopping forestry officer, and local experts. The training was held in Los Baños, Laguna.

The NFA training involved lectures and field practicum. The training included, but was not limited to, the following:

- Forest inventory design and data collection methodology
- Dendrology/tree identification
- Tree measurement standards
- Soil analysis
- Training to operate the GPS receiver

The ultimate aim of the training was to develop the skills and improve the participants' performance. To ensure that the participants' had a higher level of acquisition and application of the skills discussed in the lectures, field practicum was conducted.

7.5   Measurement of Biophysical Variables

    7.5.1 Diameter

    Tree diameter was measured over bark. It was expressed as diameter at breast height (dbh) or diameter above buttress (dab). The dbh was measured at 1.3 m above the ground, while dab was at 0.3 m above the highest flange or buttress. If the tree was located on a slope, the dbh/dab measurement was made on the uphill side of the tree.

When abnormalities occurred at dbh/dab, such as bulge or depression, the dbh/dab was measured at the point just above the abnormality. A forked tree was considered as one tree when the fork occurred above the 1.3 m, and two trees when the fork was situated below the 1.3 m. The dbh of the latter was measured above the fork.

The dbh/dab was recorded to the nearest centimeter. In order to avoid overestimation of volume and to compensate for measurement errors, dbh/dab was measured in cm and rounded off to the immediate lower whole centimeter. DBH/dab was measured with the aid of diameter tape.

7.5.2 Tree Height

The total height of a tree is the linear distance along the axis of the bole from the base of the tree to the tip of the crown. The total height of a tree was measured with the aid of the Haga altimeter and recorded to the nearest meter.

7.5.3 Commercial Height

The commercial height of a tree is the linear distance along the axis of the bole from the stump height (50 cm above the ground or end of buttress) to the first main branch; however, it could be extended beyond the first main branch if there is a clear length of 3 meters up to the succeeding branch or at top end diameter of 30 cm.

The commercial height of a tree was measured with the use of the Haga altimeter and recorded to the nearest meter.

7.5.4 Distance

Ground distance was measured with the use of the meter tape. It was recorded in the horizontal. In sloping terrain, the horizontal distance was determined by break-chaining.

7.5.5 Elevation

The elevation was determined from the topographic map.

7.5.6 Slope

Slope was determined with the use of the Haga altimeter or clinometer. In the absence of these instruments, the slope is computed using the Rise/Run formula.

7.6   Interviews

Field interviews were an essential element of the NFA approach. It was conducted to collect reliable and valid information by asking questions from local forest users and external key informants face-to-face. The interview produced observations in the form of narrations or responses stated in the respondent's own words which are then interpreted. The interview provided information on the social aspects of the use of the forests and tree resources and also provided very valuable additional information to the direct observations and measurements.

The RFIT normally conducted the interview after measurement of the biophysical variables in the plot. Most of the data on forest products and services were collected from the interviews. Majority of the respondents were the local folks that accompanied the team. The team leader usually did the interview. The interview was semi-structured.   The questions answered by the respondents were not formulated prior to interview.

It was observed that some respondents did not have the necessary information needed to answer some of the questions.   There were also matters that the respondents were reluctant to disclose, particularly when it related to timber poaching. At times, the field crews found difficulties in locating respondents from whom to elicit the required information.

The first requisite for successful interview was to create a congenial atmosphere and to put the respondent at his ease so that he will talk freely and fully. The interviewer casually and briefly introduced the project with a pleasant and confident approach. His manner was friendly, courteous, and conversational. He had to create a situation wherein the respondent's answers will be reliable and valid.

The interview began by asking questions that started off easily. From then on, the interview proceeded by asking questions that were able to collect valid and useful data that are responsive to the interview's objectives. When the reply was inadequate, the question was simply repeated, with proper emphasis, to get a response in satisfactory terms. The interviewer took all opinions in stride and never showed surprise or disapproval of a respondent's answer. The interviewer also answered any legitimate questions the respondent asked. Throughout, the interviewer was extremely careful not to suggest a possible reply.

7.7   Reporting

The crew leaders submitted field reports to FMB on a monthly basis. Said reports were collated and compiled at FRA-NCO. Likewise, the staffs of FRA-NCO prepared and submitted to FAO-FORM the project's Accomplishment Reports, pursuant to the provisions of the Letter of Agreement.   The reports included physical accomplishment and Statement of Expenditures covering specific periods.

8.   Fieldwork and Coordination

8.1   Coordination

When conducting fieldwork, it is an office protocol to pay courtesy call to the concerned heads of different government agencies with administrative jurisdiction over the area to be visited. This is to inform the concerned authorities of the presence of the team in the area as well as the nature of the activity to be undertaken. This enabled the team to be apprised of the situation in the area.

In August 2002, prior to the start of the project implementation, the staffs of FRA-NCO drafted a letter for the Secretary of *Interior and Local Government* (DILG) requesting that heads of local government units (province, municipality, and barangay) be informed of the implementation of the FRA Project - taking into consideration that some tracts fell in alienable and disposable lands/private lands - to help facilitate field coordination with concerned local government officials. A copy of the letter-response from DILG, informing that DENR shall directly coordinate with the concerned LGUs, was provided to the crew leaders as documentary evidence that shows proper coordination has been carried out at the national level.

Before proceeding to the tract, the crew leaders paid courtesy call to the concerned Provincial Environment and Natural Resources Officer (PENRO) and Community Environment and Natural Resources Officer (CENRO) and subsequently to the head of local government unit (LGU) to ask information about the situation in the area and about local people who can be hired as guides and laborers. In areas with peace and order problem, the crew leaders coordinated with the commanding officer of the concerned military unit and sought for his clearance before visiting the area.

8.2   Fieldwork

Primary data gathering was done during the fieldwork. Fieldwork was physically demanding, particularly in forestland. It usually required walking several kilometers over varied terrain.

8.2.1 Access to the First Plot

With the aid of the topographic map and through the help of the local guides/laborers, the field crew first located the best route that could expedite the team's access to the nearest plot. Then the field crew proceeded to the nearest plot, with the aid of the GPS receiver and box compass. When leaving the nearest road, the crew leader identified the coordinates and time, and recorded these in Form F1. The field crew also identified and recorded the coordinates of natural features on the ground used as reference points in accessing the nearest plot. The coordinates were determined with the GPS receiver.

8.2.2 Plot Marking

Permanent sample plots were established on the ground generally at the exact location specified for each plot. The plot starting point was located on

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the ground with the aid of the GPS receiver. A tolerance of 5 m radius, which is the maximum estimated position error (EPE) of the GPS, was allowed.

When arriving at the starting point of the 1st plot, a marker (galvanized iron pipe measuring 0.5 m in length x 5 cm in diameter) was inserted on the ground. The marker was placed exactly on the starting point of the plot. However, if an obstacle hampered the operation, the marker was placed as close as possible to the plot starting point. The distance and direction of the plot starting point from the marker were measured and recorded. Further, at least three reference points surrounding the marker were also identified and recorded. Said data were recorded in Form F2.

8.2.3 <u>Data Collection</u>

During data collection, the team leader acted as the operator of the GPS receiver, compass man, and recorder. The assistant team leader led the laborers in the measurement of biophysical variables. The laborers also acted as brushers and tapemen/chainmen. They also helped in the identification of local tree species.

Data collection started from the plot starting point and progressed towards the plot end following the appropriate direction of the plot axis. The date and time when the operation started and ended were recorded in Form F2.

Measurement was carried out on each side of the plot axis, on a 10 m wide extension. Different variables were collected according to data unit level.

▪ <u>The Plot</u>

Measurement of large diameter trees was carried out in the plot. In LUS classified as forest, trees with dbh ≥ 20 cm were measured, whereas trees with dbh ≥ 10 cm were measured in land use section outside the forest. The data collected included tree species, dbh/dab, total height, commercial height, health, and stem quality. Said data were recorded in Form F3.

All details observed in the plot such as boundaries of the LUS, rivers, roads, and other features inherent to the plot were reflected in the Plot Plan (Form F2). Natural features adjacent to the plot that can help in locating the plot during revisits were also sketched in the Plot Plan.

▪ <u>Rectangular Subplot (Nested Plot Level 1)</u>

Trees with dbh ≥10 cm but <20 cm were measured in the rectangular subplot. Likewise, non-wood forest products such as bamboo, rattan, and erect palms were measured. Trees with dbh ≥10 cm but <20 cm were recorded in Form

F3a and NWFP were recorded in Form F3b. The rectangular subplot shall be established only when the land use is forest.

- Circular Subplot (Nested Plot Level 2)

Data on regeneration and small diameter trees (saplings ≥1.3 m height and trees < 10 cm dbh) were collected in the circular subplot. These were counted by species. Edaphic variables such as aspect, slope, relief, soil texture, soil drainage, and thickness of organic matter were also measured. Said data were recorded in Form F4a. Further, data on other non-wood forest products (other than bamboo, rattan and erect palms) were also measured. Said data were recorded in Form F4b. The circular subplot shall be established only when the land use is forest.

- Land Use Section (LUS)

A land use section is an area that has homogenous land use class. Different LUS varied in size and shape. The whole plot was considered as one LUS when it has a homogeneous land use; however, it was subdivided into different LUS when some portions of the plot have varying land uses.

Most of the data related to forest characteristics, management and resource uses were collected in the LUS. In order to facilitate the area calculation for each LUS, the width of the LUS was fixed at 20 meters.

In forest, trees with dbh ≥ 20 cm were measured and recorded whereas in TOF, trees with dbh ≥ 10 cm were measured and recorded.

In the field survey, the field crews recorded tree species either in their official common name or local name in the region. As a consequence a tree species may have been assigned at least one local name.

Table 1m shows the status of physical accomplishment by region.

Table 1m: Status of accomplishment by Region

Region	Goal	Accomplished	Accomplishment (%)
NCR	2	2	100
CAR	24	22	92
1	17	17	100
2	36	36	100
3	25	25	100
4A	24	20	83
4B	35	33	94
5	24	23	96
6	28	28	100
7	21	21	100
8	27	27	100
9	19	18	95
10	22	18	82
11	22	19	86
12	26	26	100
13	26	24	92
ARMM	17	8	47
Total	395	367	93

Of the 367 tracts visited, 6 tracts fell in sea water (non-inland water), 4 tracts partially fell in the sea, 5 tracts fell in inland water, and 1 tract fell in a ravine.

9.   Database Design, Data Entry and Data Processing, Data Analysis and Data Interpretation

9.1   Database Design

The purpose of the database system is to store the data in a manner that allows the extraction of information through queries. Data is a collection of facts while information is that data organized or presented in such a way as to be useful for decision making.

The NFI-Philippines database application was developed by FAO-FORM and FMB.

9.2   Data Entry and Data Processing

Data entry and data processing was centralized. The field data collected by the field crews were submitted to- and aggregated at FMB (FRA-NCO). Submitted field data were then electronically stored using both the NFI-Philippines database application (MS Access 2000) developed by FAO together with FMB. The data were then organized and transformed into information so that it can be viewed in a useful form.

9.2.1   Data Entry

Data were entered into form. FAO-FORM developed tailor-made forms for the data entry. The forms were structured to look like the original data registration forms (Field Forms).

Before data entry, the staffs of FRA-NCO reviewed the field data to screen incorrect or missing values. However, considering that said staffs at first were not quite familiar with the NFA approach, not all errors were corrected in many of the early reports. As such, some field data have missing or incorrect values.

Data entry started in the 1st quarter of CY 2003 when field reports started to come in at FMB (FRA-NCO) and ended in August 2004. Out of the 367 tract reports submitted to FMB, the reports in 10 tracts were not encoded for the following reasons: 8 tract reports (Region 12) were submitted during data processing, 1 tract report (ARMM) was collected about 2 km away from its supposed location because the field crew was denied entry by the landowner, and 1 tract report (ARMM) was neglected by the data encoder.

The electronically encoded data were later reviewed and edited by the staffs of FRA-NCO to correct any observed disparities.

In January 2005, the FAO-FORM backstopping forestry officer further recommended some refinements to the Data Registration Forms to address

observed data gaps. As a consequence, re-editing of the encoded field data was conducted. Re-editing of encoded data was completed in April 2005.

The project employed a database expert to help the staffs of FRA-NCO in managing the data generated by the project. To expedite data entry, the project also contracted the services of a data encoder to assist the database expert in the data entry.

9.2.2 Data Processing

The FAO-FORM backstopping forestry officer travelled to the Philippines in February and October 2004 to introduce the statistical functions for the data processing and also to demonstrate to the staffs of FRA-NCO the basic applications of the NFI-Philippines database processing system.

In the NFI-Philippines database application, all data was stored in tables or two-dimensional grids. The columns of the grid are called fields and the rows are called records. The rows contain the data corresponding to the fields. Fields or columns define the type of data, while rows or records give specific values to fields. Each record in the table has a primary key to positively identify it. The *primary key value* for a record is unique to that record in each table.

The data within the database was broken into small, but logically consistent, parts. Each of these parts had its own table. Each table has logically consistent contents.

The data were then assembled from the various tables by linking those tables by fields containing identical data. By making a query with the tables, information was extracted from the data contained in the tables. A query using the tables in the dataset was designed; the query then assembled the linked data. The database manager associated and put together the data from the said tables.

The data in the NFI-Philippines database was then exported to Microsoft Excel for statistical calculations. Worksheet macros were built to automate the calculations.

9.3   Data Analysis and Data Interpretation

After the field data were collected, electronically stored and processed, the staff of FRA-NCO and in collaboration with the FAO-FORM backstopping forestry officer conducted data analysis and interpretation. The purpose of data analysis is to summarize the completed observations in such a manner that they yield answers to any question at hand; while the purpose of data interpretation is to search for the broader meaning of these answers by linking them to other available knowledge.

10.   Results

Based on the numerical descriptions extracted from the processed data, the following results are drawn:

10.1   Area

In the calculation of area, those land use sections where physical measurement of trees was not carried out, but the field crews were able to visually identify the land use classification, were included. An example is a plot with a land use of forest that fell in a ravine.

In the calculation of land use area distribution in the country, a total of 351 sample units (tracts) with an aggregate area of 695.768 ha were statistically analyzed. This excludes the tracts and/or land use sections that fell in the sea (non-inland water). A tract could have one or more land use classes. Table 2.a shows the distribution of the sample units per land use class.

Table 2a: Sample units distribution by land use

Land Use Class	No. of sample units (tract)	Area (ha)
Forest	169	166.116
Other Wooded Land	136	83.752
Other Land	299	427.286
Inland Water	110	18.614
Total		695.768

Likewise, in the calculation of area by forest type in the country, even those LUS where tree measurement was not carried out were included. A total of 169 sample units (tracts) with an aggregate area of 166.116 ha contain land use sections classified as forest. A sample unit (tract) could have one or more forest types. Table 2.b shows the sample unit distribution by forest type.

Table 2b: Sample units distribution by forest type

Forest Type	No. of sample units (tract)	Area (ha)
Closed broad-leaved forest (FBC)	90	99.418
Open broad-leaved forest (FBO)	66	40.4
Closed coniferous forest (FCC)	2	1.03
Open coniferous forest (FCO)	4	3.874
Closed mixed forest (FMC)	1	1.5
Open mixed forest (FMO)	1	0.42
Closed broad-leaved plantation (PBC)	17	6.456
Open broad-leaved plantation (PBO)	28	7.846
Closed coniferous plantation (PCC)	1	0.2
Open coniferous plantation (PCO)	1	0.044
Closed bamboo/boho formation (BBC)	8	2.602
Open bamboo/boho formation (BBO)	7	1.384
Closed mangrove forest (MgC)	1	0.72
Open mangrove forest (MgO)	2	0.222
Total		166.116

10.1.1 Area by Land Use Class

Statistical analysis shows that the area distribution in the Philippines based on global land use classes, in decreasing order of area coverage, is as follows: Other Land (OL): 18,423,641 ha; Forest: 7,162,560 ha; Other Wooded Land (OWL): 3,611,204 ha; and Inland Water (IW): 802,595 ha.

Table 2c: Area by land use class

	Forest	OWL	OL	IW
Land use area in country (ha)	7,162,560	3,611,204	18,423,641	802,595
Percent	23.9%	12.0%	61.4%	2.7%
Sampling Error %	7.92%	10.21%	3.38%	20.72%
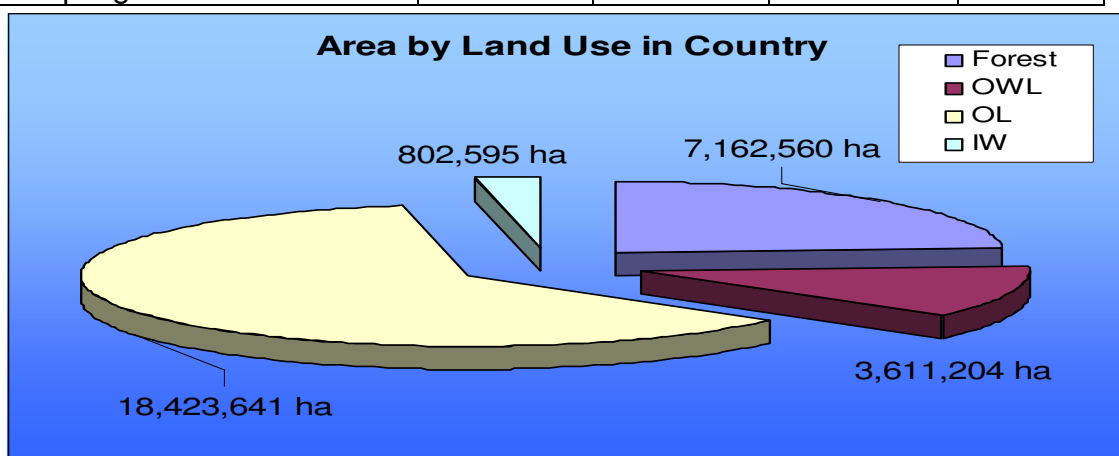
10.1.2 Area by Forest Type

Statistical analysis shows that the country's forest cover is about 7,162,560 ha (about 23.9% of the total area of the country). Out of this, about 6,087,029 ha or 85% is in legally classified forestland or owned by the state; 4,826,007 ha or 67.4% is closed canopy forest; 6,535,368 ha or 91.2% is natural forest; 6,645,319 ha or 92.8% is broad-leaved forest; 5,462,510 ha or 76.3% is for production purposes; and about 5,059,618 ha or 70.6% is not covered by a formal management system.

The succeeding discussions will provide details on the status of the forest situation in the country.

10.1.2.1 Forest area by category

Based on forest category, about 6,645,319 ha or 92.8% is broad-leaved forest; 221,970 ha or 3.1% is coniferous forest; 82,876 ha or 1.2% is mixed forest, 171,868 ha or 2.4% is bamboo/boho formation, and 40,617 ha or 0.6% is mangrove forest.

In bamboo/boho formation, the dominant species is boho. The area is most often sparsely interspersed with small diameter naturally-growing trees. Bamboo is mostly found in alienable and disposable lands.

Table2d: Forest area by category

	Broad-leaved Forest	Coniferous Forest	Mixed Forest	Bamboo/boho Formation	Mangrove
Area (ha)	6,645,319	221,970	82,786	171,868	40,617
Percent	92.8%	3.1%	1.2%	2.4%	0.6%

Forest Area by Category
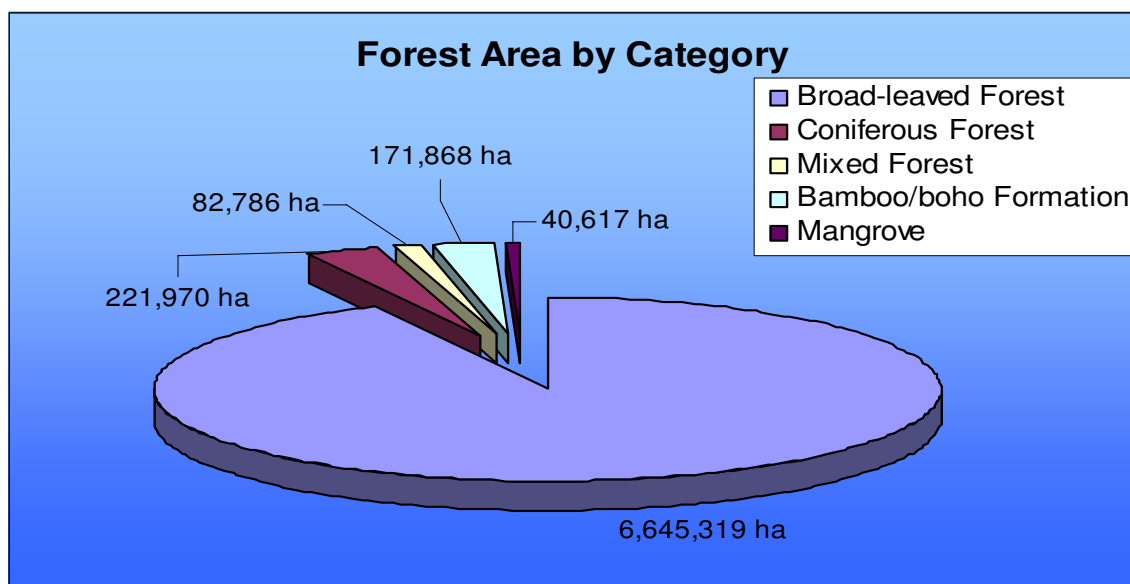
10.1.2.2 Area by major forest type

Based on canopy coverage, forest is classified into closed canopy forest and open canopy forest. Out of the forest area, about 4,826,007 ha or 67.4% is closed canopy forest and 2,336,553 ha or 32.6% is open canopy forest.

Table 2e: Area by major forest type

	Forest	Closed Canopy	Open Canopy
Area (ha)	7,162,560	4,826,007	2,336,553
Percent	100%	67.4%	32.6%

Area by Major Forest Type
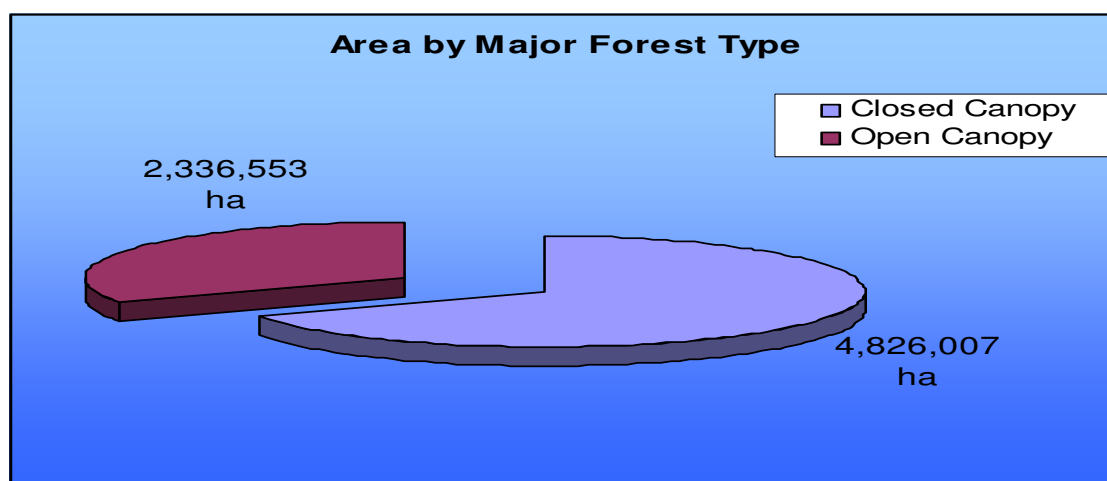
10.1.2.3 Area by main forest type

Forest is further sub-classified into natural forest and plantation forest. Natural forest covers about 6,535,368 ha or 91.2% and plantation forest covers 627,192 ha or 8.8%.

Table 2f: Area by main forest type

	Total	Natural Forest	Plantation forest
Area (ha)	7,162,560	6,535,368	627,192
Percent	100%	91.2%	8.8%

10.1.2.3.1 Natural forest area

In the natural forest, about 4,286,688 ha is closed broad-leaved forest (FBC); 1,741,960 ha is open broad-leaved forest 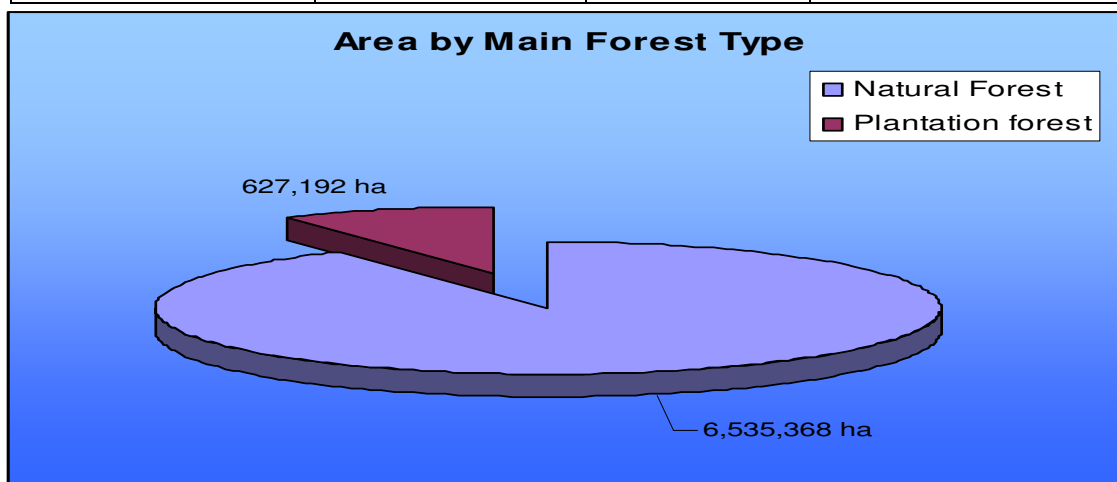(FBO); 44,411 ha is closed coniferous forest (FCC); 167,038 ha is open coniferous forest (FCO); 64,677 ha is closed mixed forest (FMC); 18,109 ha is open mixed forest (FMO); 112,193 ha is closed bamboo/boho formation (BBC); 59,675 ha is open bamboo/boho formation (BBO); 31,045 ha is closed mangrove forest (MgC); and 9,572 ha is open mangrove forest (MgO).

Table 2g: Natural forest area

Main Forest Type	Area (ha)	Percent
Closed broad-leaved forest	4,286,688	65.6%
Open broad-leaved forest	1,741,960	26.6%
Closed coniferous forest	44,411	0.7%
Open coniferous forest	167,038	2.6%
Closed mixed forest	64,677	1.0%
Open mixed forest	18,109	0.3%
Closed bamboo/boho formation	112,193	1.7%
Open bamboo/boho formation	59,675	0.9%
Closed mangrove forest	31,045	0.5%
Open mangrove forest	9,572	0.1%
Total	6,535,368	100.0%

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Area In Natural Forest
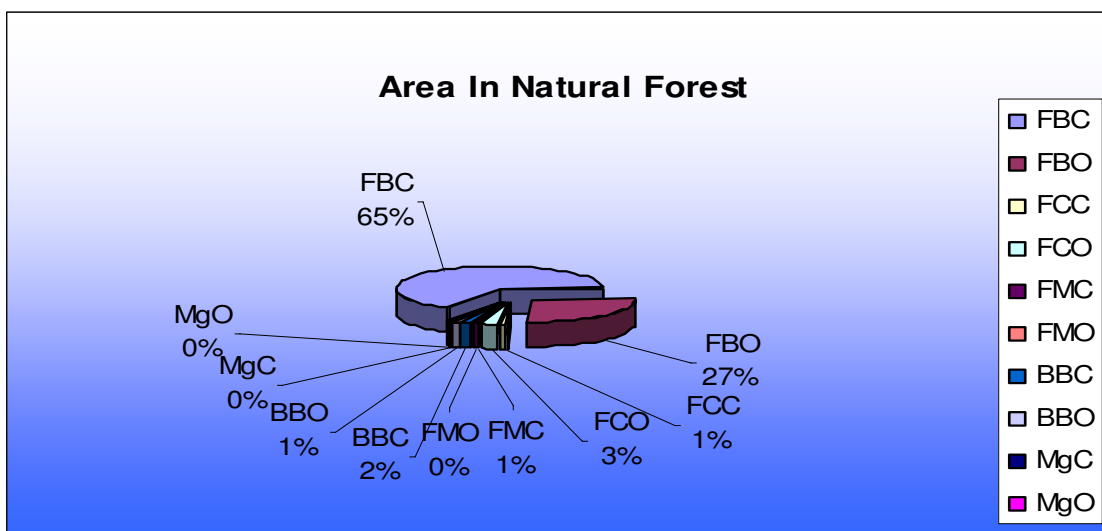
10.1.2.3.2 Plantation forest

In the plantation forest, about 616,671 ha or 98.3% is broad-leaved plantation and 10,521 ha or 1.7% is coniferous plantation. Broad-leaved plantation is broken down as follows: about 278,369 ha is closed broad-leaved plantation (PBC); and 338,302 ha is open broad-leaved plantation (PBO). On the other hand, coniferous plantation is broken down as follows: 8,624 ha is closed coniferous plantation (PCC); and 1,897 ha is open coniferous plantation (PCO).

Table 2h: Area by forest plantation type

	Total	Broadleaved Plantation		Coniferous Plantation	
Area (ha)	627,192	616,671		10,521	
Percent	100.0%	98.3%		1.7%	
		Closed	Open	Closed	Open
Area (ha)	627,192	278,369	338,302	8,624	1,897
Percent	100.0%	44.4%	53.9%	1.4%	0.3%

Forest Area by Plantation Type

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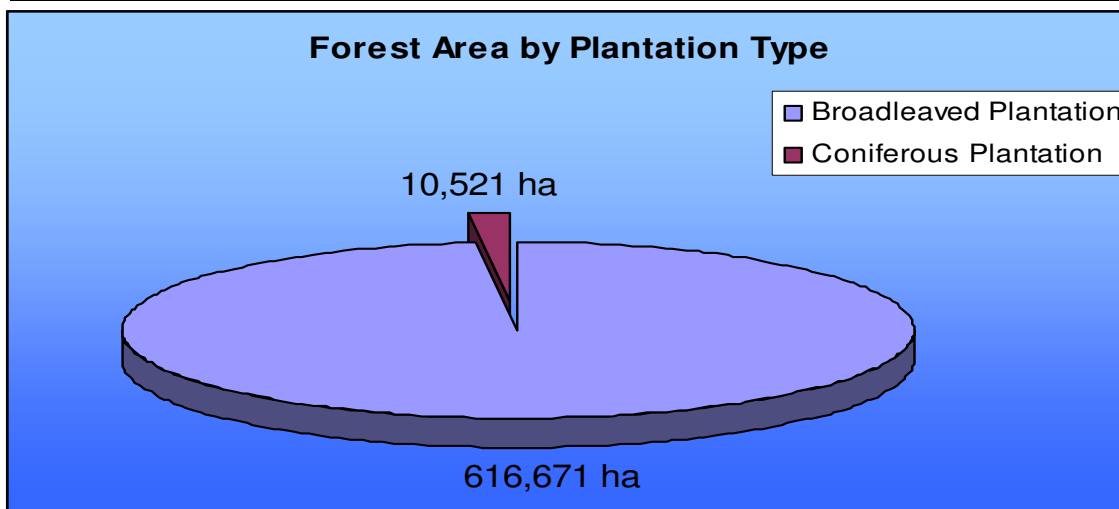
10.1.3 Forest Area by Ecological Zone

Based on the global ecological zone classification, the country lies under the Tropical Rain Forest (TAR) and Tropical Mountain Systems (TM). Data shows that out of the 7,162,560 ha of forest, about 6,959,216 ha or 97.1% falls in TAR while 203,344 ha or 2.9% falls in TM.

Table 2i: Forest area by ecological zone

	Total	TAR	TM
Area (ha)	7,162,560	6,959,216	203,344
Percent	100%	97.1%	2.9%
Sampling error %		1.7%	59.4%
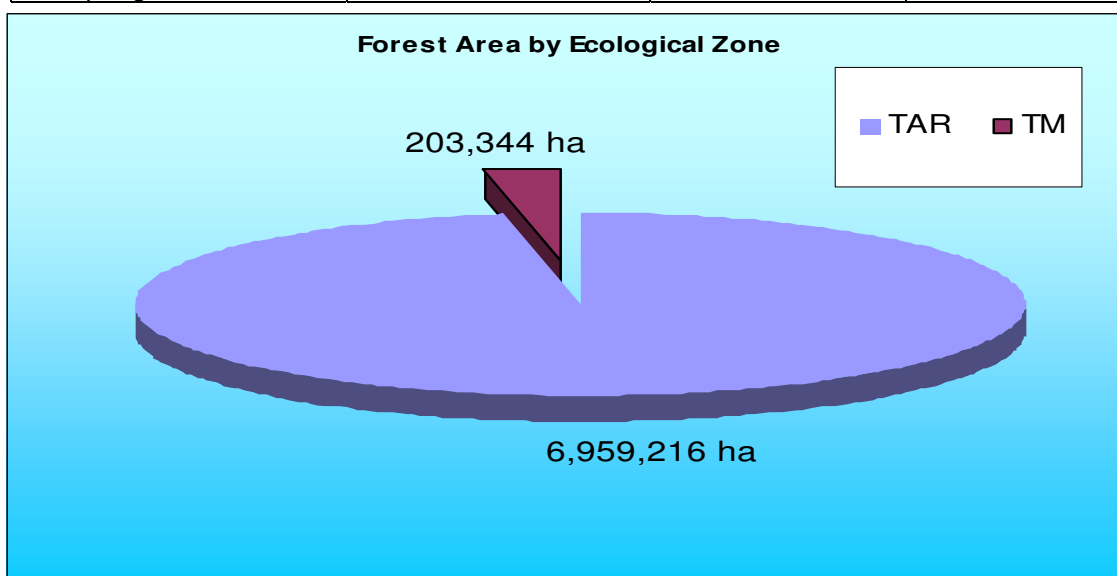
10.1.4 Forest Area by Management System

Data shows that about 2,102,942 ha or 29.4% is under formal management system (with Forest Management Plan) and 5,059,618 ha or 70.6% is not covered by any management system.

Table 2j: Forest area by management system

	Total	Formal management	No known management
Area (ha)	7,162,560	2,102,942	5,059,618
Percent	100%	29.4%	70.6%
Sampling error %		15.5%	6.4%
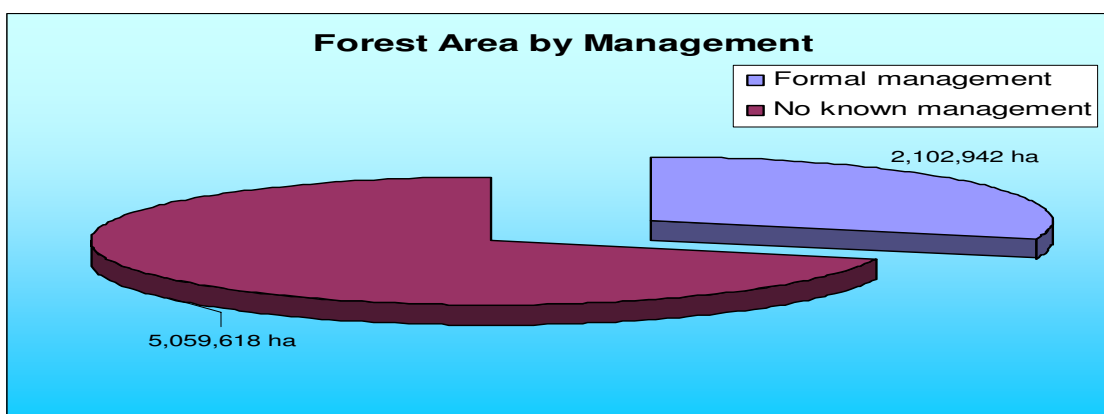
10.1.5 Forest Area by Designation/Protection Status

Data shows that about 5,462,510 ha or 76% of the country's forest is designated for production purposes and the remaining 24% is for protection purposes. Protection forest is broken down as follows: natural reserve: 537,593 ha; national park: 258,707; and managed protected area: 903,750 ha.

Table 2k: Forest area by designation/protection status

	Total	Production	Natural Reserve	National Park	National Monument	Managed protected area
Area (ha)	7,162,560	5,462,510	537,593	258,707	0	903,750
Percent	100%	76.3%	7.5%	3.6%	0%	12.6%
Sampling error %		5.8%	123.7%	511.7%	0%	77.3%
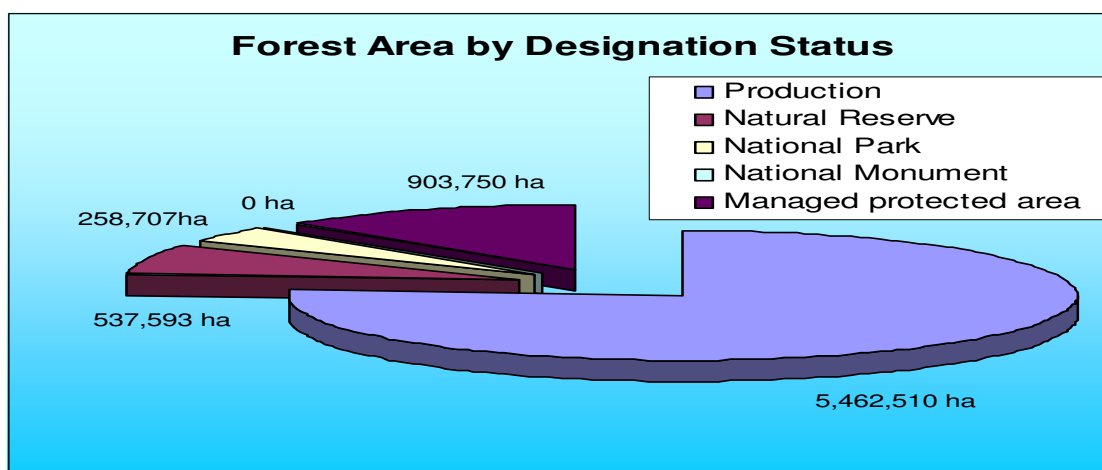
10.1.6 Forest Area by Ownership

As of 2002, about 15.86 million hectares or 53% of total area of the Philippines is legally classified as forestlands while 14.14 million hectares or 47% is alienable and disposable lands.

Legally classified forestlands are those lands that belong to the public domain and are classified for forestry purposes regardless of the present state of the forest cover. Forestlands include the public forest, the permanent forest or forest reserves, and forest reservations.

Alienable and disposable lands refer to those lands of the public domain which have been the subject of the present system of classification and declared as not needed for forest purposes. No land of the public domain 18% in slope or over shall be classified as alienable and disposable land.

Out of the 7,162,560 ha of forest in the country, about 6,087,029 ha or 85% is owned by the state; 1,044,486 ha or 14.6% is privately owned; 9,486 ha or 0.1% is municipality owned and 21,559 ha or 0.3% is owned by the community. Those areas owned by the communities are covered by Certificate of Ancestral Domain Title (CADT).

Table 2l: Forest area by ownership

	Total	State	Private	Municipality	Community
Area (ha)	7,162,560	6,087,029	1,044,486	9,486	21,559
Percent	100%	85%	14.6%	0.1%	0.3%
Sampling error		3%	17.7%	100.5%	99.5%

Forest Area by Ownership

- State
- Private
- Municipality
- Community

9,486 ha

1,044,486 ha

21,559 ha

6,087,029 ha
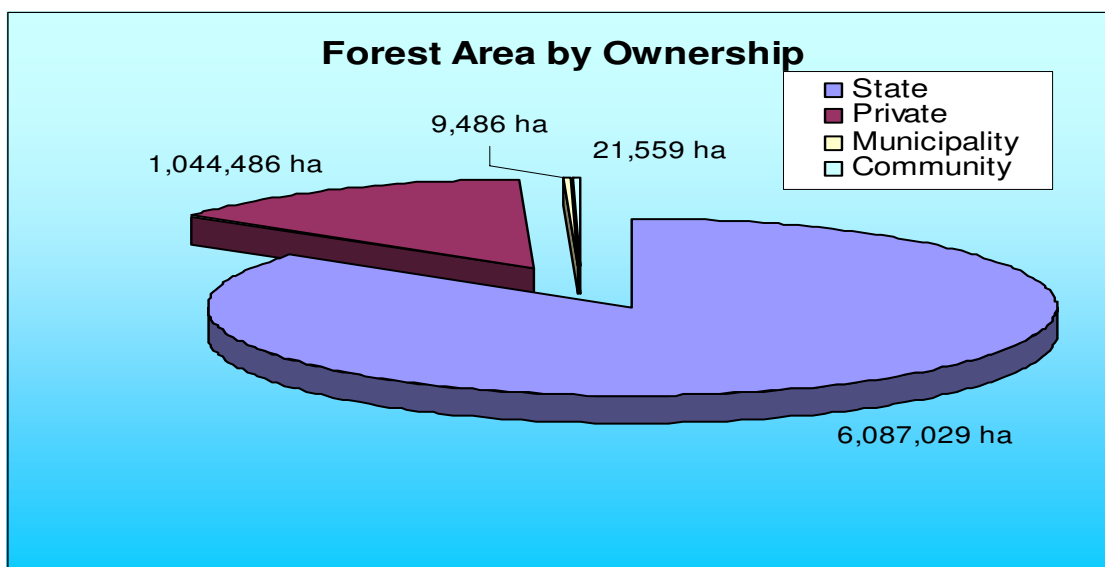
10.1.7 Precision of Area Estimates

Precision is measured through the sampling error of an estimate – the smaller the sampling error, the more precise is the estimate.

10.1.7.1 Precision of Area Estimates by Land Use

Based on 351 sample units, Other Land has a sampling error of ±3.38%. At the same time, Forest has a sampling error of ±7.92%.

Table 2m: Precision of area estimates by land use

Land Use	Sampling Unit	Area (ha)	Sampling Error
Forest	169	166.116	7.92%
Other Wooded Land	136	83.752	10.21%
Other Land	299	427.286	3.38%
Inland Water	110	18.614	20.72%

10.1.7.2 Precision of Area Estimates by Forest Type

When Forest was subdivided into different forest types, the sampling error is high. Based on 169 sample units, closed broad-leaved forest, with the largest number of sample plots, has a sampling error of ±6.81%. At the same time, closed mixed forest, open mixed forest, closed coniferous plantation, open coniferous plantation, and closed mangrove forest, with the lowest no. of sample units, have more >100% sampling error.

10.1.8 Table 2n: Precision of area estimates by forest type

Forest Type	Sampling Unit	Area (ha)	Sampling Error
Closed broadleaved forest	90	99.418	6.81
Open broadleaved forest	66	40.4	14.12
Closed coniferous forest	2	1.03	70.41
Open coniferous forest	4	3.874	63.0
Closed mixed forest	1	0.42	100.5
Open mixed forest	1	1.5	99.54
Closed broadleaved plantation	17	6.456	33.81
Open broadleaved plantation	28	7.846	31.98
Closed coniferous plantation	1	0.2	100.29
Open coniferous plantation	1	0.044	99.6
Closed bamboo/boho formation	8	2.602	46.26
Open bamboo/boho formation	7	1.384	47.18
Closed mangrove forest	1	0.72	100.28
Open mangrove forest	2	0.222	75.419

Table 2m shows that precision for area estimates in Forest is very high in the aggregated results. However, when it is subdivided into forest types (Table 2n) the sampling error increased. It can be deduced from the above information that the number of sample units is critical in ensuring the precision of the results; that the larger the number of sample plots the lesser the sampling error.

10.2 Volume

In this report, two types of volume were calculated: the gross volume and the commercial volume.

The gross volume is calculated using the following formula: Gross Volume = $(dbh)^2$ x form factor x total height of the tree. The form factor differs between dipterocarp species and non-dipterocarp species. Likewise, the form factor differs in each climatic region. (Please see the attached Regional Volume Equations). In the calculation of gross volume, all trees with dbh ≥10 cm that have healthy and slightly damaged health state are included. Those trees whose health state are strongly affected, lying and/or standing dead were excluded.

At the same time, the commercial volume is calculated using the following formula: Commercial Volume = $(dbh)^2$ x form factor x commercial height of the tree. The form factor differs between dipterocarp species and non-dipterocarp species as well as in each climatic region. In the calculation of the commercial volume, only trees with dbh ≥50 cm that have healthy and slightly damaged health state are included.

The above-mentioned formulae were applied to all types of land use, including mangrove forest.

In the calculation of volume, only those land use sections where physical measurement of trees was carried out were included to avoid underestimation of volume. In this connection, the number of sample units used in the calculation of volume is lesser than the number of sample units used in the calculation of area.

A total of 164 sample units (tracts) with an aggregate area of 141.856 ha contain LUS classified as Forest. A sample unit (tract) could have one or more forest types. Table 3.a shows the distribution of sample units (tracts) by forest type.

Table 3a: Sample unit distribution by Forest Type

Forest Type	No. of sample unit	Area of sample unit (ha)
Closed broad-leaved forest (FBC)	86	85.792
Open broad-leaved forest (FBO)	64	33.89
Closed coniferous forest (FCC)	2	0.91
Open coniferous forest (FCO)	3	1.37
Closed mixed forest (FMC)	0	0.0
Open mixed forest (FMO)	1	0.42
Closed broad-leaved plantation (PBC)	17	6.456
Open broad-leaved plantation (PBO)	26	7.846
Closed coniferous plantation (PCC)	1	0.2
Open coniferous plantation (PCO)	1	0.044
Closed bamboo/boho formation (BBC)	8	2.602
Open bamboo/boho formation (BBO)	7	1.384
Closed mangrove forest (MgC)	1	0.72
Open mangrove forest (MgO)	2	0.222
Total		141.856

Table 3.a shows that closed canopy broad-leaved forest has the largest number of sampling units (86 tracts), and followed by open canopy broad-leaved forest (64 tracts).

10. 2.1: Volume in Forest

In Forest, the gross volume of all trees with dbh ≥10 cm is about 1,247,858,946 m^3 or an average gross volume per ha of 174.22 m^3. At the same time, the commercial volume of all trees with dbh ≥ 50 cm is 386,956,668.6 m^3 or an average commercial volume per ha of 54.02 m^3.
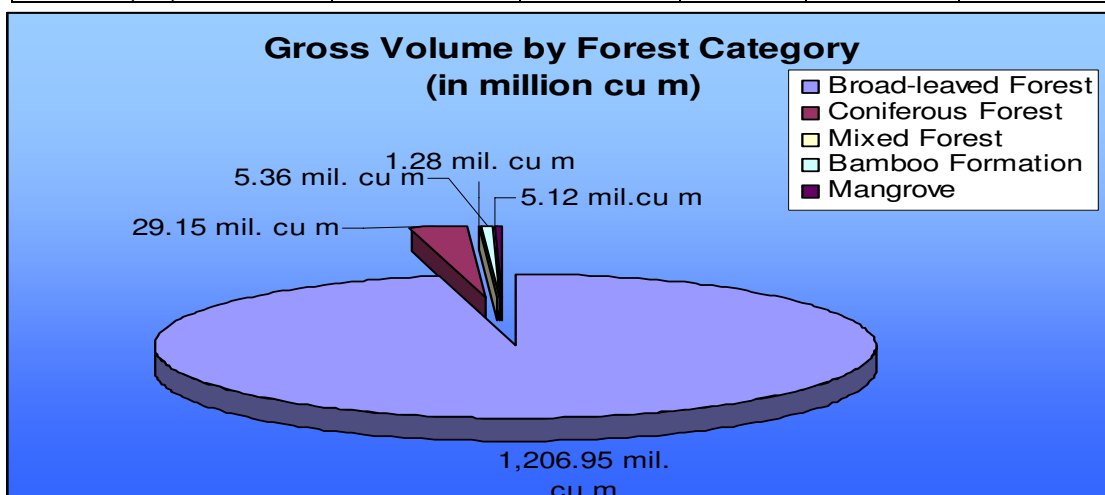
10.2.1.1: Gross Volume in Forest

In the calculation of gross volume, the volume of all trees with dbh ≥20 cm was computed first. Then a separate calculation was carried out for the volume of trees with dbh ≥10 cm but <20 cm (trees recorded in the rectangular subplots). The calculated volume of trees with dbh ≥10 cm but <20 cm was later added to the volume of trees with dbh ≥20 cm to come up with the gross volume of all trees with dbh ≥10 cm.

10.2.1.1.1: Gross volume by forest category

Forest is categorized into broad-leaved forest, coniferous forest, mixed forest, bamboo/boho formation, and mangrove forest. These have aggregate gross volume of 1,247,858,946 m^3. Out of this, about 1,206.95 million m^3 or 96.7% is in broad-leaved forest; 29.15 million m^3 or 2.3% is in coniferous forest; 1.28 million m^3 or 0.1% is in mixed forest; 5.36 million m^3 or 0.4% is in bamboo/boho formation; and 5.12 million m^3 or 0.4% is in mangrove forest.

Table 3b: Gross volume by forest category

	Broad-leaved Forest	Coniferous Forest	Mixed Forest	Bamboo Formation	Mangrove
Gross Vol. (million m^3)	1,206.95	29.15	1.28	5.36	5.12
Percent	96.7%	2.3%	0.1%	0.4%	0.4%
Vol./ha (m^3)	178.41	228.71	15.42	31.21	126.08

Gross Volume by Forest Category (in million cu m)

- Broad-leaved Forest
- Coniferous Forest
- Mixed Forest
- Bamboo Formation
- Mangrove

1.28 mil. cu m
5.36 mil. cu m
29.15 mil. cu m
5.12 mil.cu m
1,206.95 mil. cu m

10.2.1.1.2: Gross volume by major forest type

Forest is further classified into closed canopy forest and open canopy forest. Out of the gross volume of 1,247.86 million m^3, about 999.91 million m^3 or 80.1% is in closed canopy forest and 247.95 million m^3 or 19.9% is in open canopy forest.

Table 3c: Gross volume by major forest type

		Major Forest Type	
	Total	Closed Canopy	Open Canopy
Gross Volume (million m^3)	1,247.86	999.91	247.95
Percent	100.0%	80.1%	19.9%
Vol./ha (m^3)	174.22	204.83	99.94

Gross Volume by Major Forest Type

- Closed Canopy
- Open Canopy
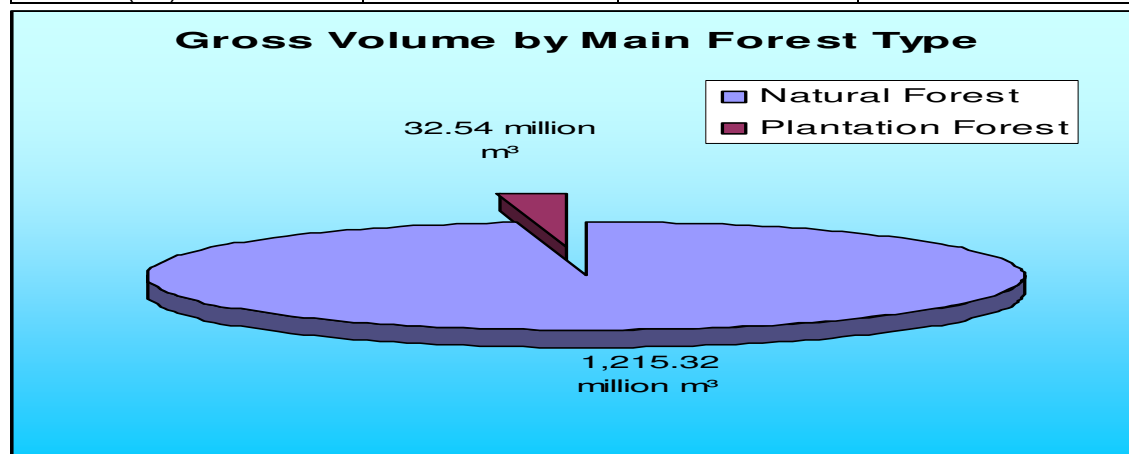
247.95 million m³
999.91 million m³
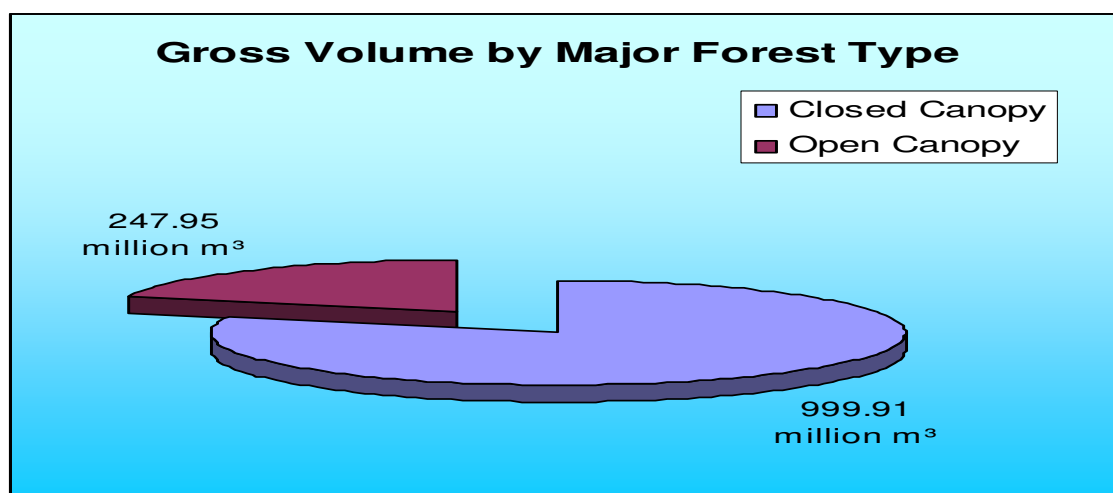
10.2.1.1.3: Gross volume by main forest type

Forest is further sub-classified into natural forest and plantation forest. Out of the gross volume of 1,247.86 million m^3, about 1,215.32 million m^3 or 97.4% is in natural forest and 32.54 million m^3 or 2.6% is in plantation forest.

Table 3d: Gross volume by main forest type

	Total	Natural Forest	Plantation Forest
Volume (in million m^3)	1,247.86	1,215.32	32.54
Percent	100.0%	97.4%	2.6%
Vol./ha (m^3)	174.22	186.0	52.0

Gross Volume by Main Forest Type
- Natural Forest
- Plantation Forest
32.54 million m^3
1,215.32 million m^3

10.2.1.1.3.1: Gross volume in natural forest

The gross volume distribution in natural forest is as follows: closed broad-leaved forest (FBC): 959.29 million m^3; open broad-leaved forest (FBO): 216.35 million m^3; closed coniferous forest (FCC): 12.48 million m^3; open coniferous forest (FCO): 15.44 million m^3; closed mixed forest (FMC) 0 m^3; open mixed forest (FMO): 1.28 million m^3; closed bamboo/boho formation (BBC): 4.96 million m^3; open bamboo/boho formation (BBO): 0.40 million m^3; closed mangrove (MgC): 4.49 million m^3; and open mangrove (MgO): 0.63 million m^3.

Note: The gross volume indicated under bamboo/boho formation is the **gross volume of trees within the area** and not the volume of bamboo or boho.

Table 3e: Gross volume in natural forest

Main Forest Type	Gross Volume (in million m^3)	Vol./ha (m^3)
Closed broad-leaved forest	959.29	221.45
Open broad-leaved forest	216.35	126.44
Closed coniferous forest	12.48	271.59
Open coniferous forest	15.44	223.20
Closed mixed forest	0.0	0.0
Open mixed forest	1.28	60.20
Closed bamboo/boho formation	4.96	37.77
Open bamboo/boho formation	0.4	5.74
Closed mangrove forest	4.49	123.60
Open mangrove forest	0.63	55.98
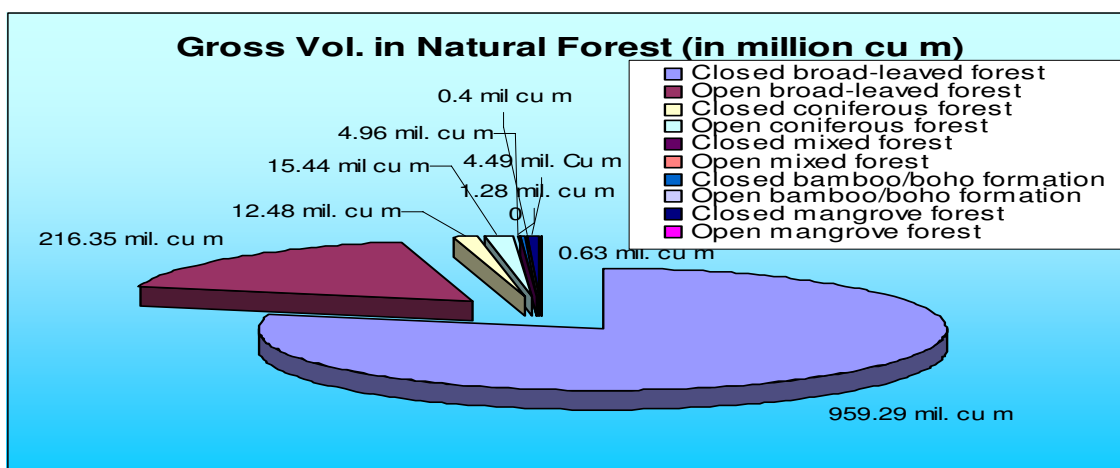
In Table 3e, natural coniferous forest has a higher gross volume/ha than natural broad-leaved forest. This may be attributed to the smallness of sample unit as well as the relatively higher total height of the trees in the coniferous forest, as observed in the tract reports.

10.2.1.1.3.1.1 Gross volume of most abundant tree species in natural forest

Table 3f shows the top 20 most abundant tree species in the natural forest. The most dominant species are *Shorea contorta* and *Shorea polysperma* with average volume/ha of 19.78 m^3 and 19.33 m^3, respectively.

In the calculation of average gross volume/ha per tree species, the land use area in mangrove forest was included. In case the area of mangrove forest be excluded, the average gross volume/ha per tree species would be higher.

Table 3f: Gross volume/ha of most abundant tree species in natural forest

Scientific Name	Species	Gross Vol./ha (m^3)
Shorea contorta	white lauan	19.78
Shorea polysperma	Tangile	19.33
Shorea negrosensis	red lauan	16.28
Shorea squamata	Mayapis	14.76
Dipterocarpus grandiflorus	Apitong	10.76
Parashorea plicata	Bagtikan	7.59
Shorea astylosa	Yakal	4.97
Shorea almon	Almon	3.69
Lithocarpus llanosii	Ulayan	3.40
Shorea guiso	Guijo	3.01
Pterocarpus indicus	Narra	2.83
Palaquium luzoniense	Nato	2.11
Combretodendron quadrialatum	Toog	1.82
Tristania decorticata	Malabayabas	1.35
Terminalia foetidissima	talisai-gubat	1.26
Koordersiodendron pinnatum	Amugis	1.16
Anisoptera thurifera	Palosapis	1.10
Hopea foxwothyi	Dalingdingan	1.11
Mangifera altissima	Pahutan	1.07
Euphoria didyma	Alupag	0.95

10.2.1.1.3.2: Gross volume in plantation forest

The gross volume distribution in plantation forest is as follows: Broad-leaved plantation is 31.31 million m^3 and coniferous plantation is 1.23 million m^3. This is broken down as follows: closed broad-leaved plantation (PBC): 17.45 million m^3, open broad-leaved plantation (PBO) 13.86 million m^3, and closed coniferous plantation (PCC): 1.23 million m^3.

Table 3g: Gross volume in plantation forest

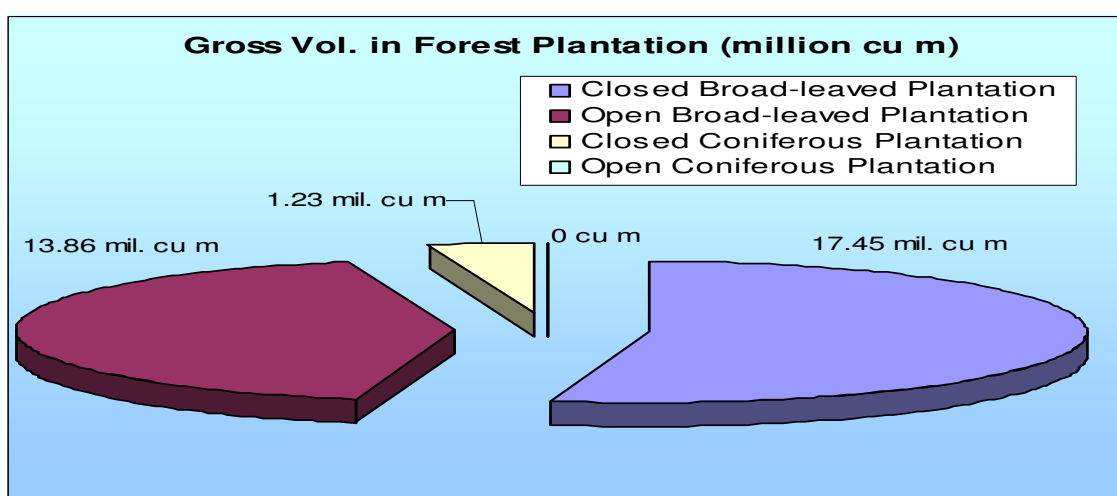|	Broad-leaved Plantation		Coniferous Plantation	
Gross Vol. (m^3)	31,308,464.76		1,228,301.06	
Percent	96.2%		3.8%	
	Closed Canopy	Open Canopy	Closed Canopy	Open Canopy
Gross Vol. (m^3)	17,452,442.43	13,856,022.32	1,228,301.06	0
Vol./ha (m^3)	53.54	23.24	121.64	0.0

10.2.1.1.3.2.1 Gross volume per ha of the top 20 most abundant tree species in plantation forest

Table 3h shows the top 20 most abundant tree species in plantation forests. Some tree species that were not used as planting materials are among the dominant species like *Ficus elastica, Araucaria bidwilli, Musanga cecropioides, Syzygium gigantifolium, Mallotus philippinenses, Hevea brasiliensis, Albizia procera, Ceiba pentandra,* and *Macaranga tanarius.* This may infer that natural succession is taking place in the area.

Table 3h: Gross volume of most abundant tree species in plantation forest

Scientific Name	Species	Gross Volume/ha
Gmelina arborea	Yemane	15.56
Ficus elastica	India rubber	4.55
Leucaena leucocephala	ipil-ipil	6.34
Paraserianthes falcataria	Moluccan sau	3.61
Cocos nucifera	Coconut	1.99
Acacia mangium	mangium	1.52
Araucaria bidwilli	bunya pine	1.45
Mangifera indica	mangga	0.87
Samanea saman	raintree	0.80
Pterocarpus indicus	narra	0.72
Swietenia macrophylla	broad-leaved mahogany	2.83
Musanga cecropioides	umbrella tree	0.78
Syzygium gigantifolium	malatalisai	0.44
Mallotus philippinenses	banato	0.39
Hevea brasiliensis	para rubber	1.39
Albizia procera	akleng-parang	0.37
Ceiba pentandra	kapok	0.29
Artocarpus blancoi	antipolo	0.53
Shorea contorta	white lauan	0.21
Macaranga tanarius	binunga	0.18
Vitex parviflora	molave	0.87

10.2.1.2: Commercial Volume in Forest

In the calculation of commercial volume, only the volume of trees with dbh ≥ 50 cm is included. At the same time, only the land use sections where tree measurement was carried out were taken into consideration.

10.2.1.2.1 Commercial volume by forest category

Forest is categorized into broad-leaved forest, coniferous forest, mixed forest, bamboo/boho formation, and mangrove forest. The afore-mentioned forest categories have aggregate commercial volume of 386,956,668.6 m^3. Out of this, about 369.98 million m^3 or 95.6% is in broad-leaved forest; 15.29 million m^3 or 4% is in coniferous forest; 0.05 million m^3 or 0.01% is in mixed forest; 1.63 million m^3 or 0.4% is in bamboo/boho formation; and 0 m^3 is in mangrove forest.

Mangrove forest has a 0 m^3 commercial volume because no mangrove species with dbh of ≥ 50 cm was recorded during the field survey. At the same time, this may be attributed to the smallness of the sample unit (0.942 ha). In the calculation of commercial volume, probably the diameter limit for mangrove species may be lower than the prescribed diameter limit for other tree species. Consequently, the NFA result on the commercial volume for mangrove forest may change.

Table 3i: Commercial volume by forest category

|	Broad-leaved Forest	Coniferous Forest	Mixed Forest	Bamboo Formation	Mangrove Forest
Comm. Vol. (million m^3)	369.94	15.29	0.05	1.63	0.0
Percent	95.6%	4.0%	0.01%	0.4%	0.0%
Vol./ha (m^3)	54.69	119.99	2.47	8.09	0.0
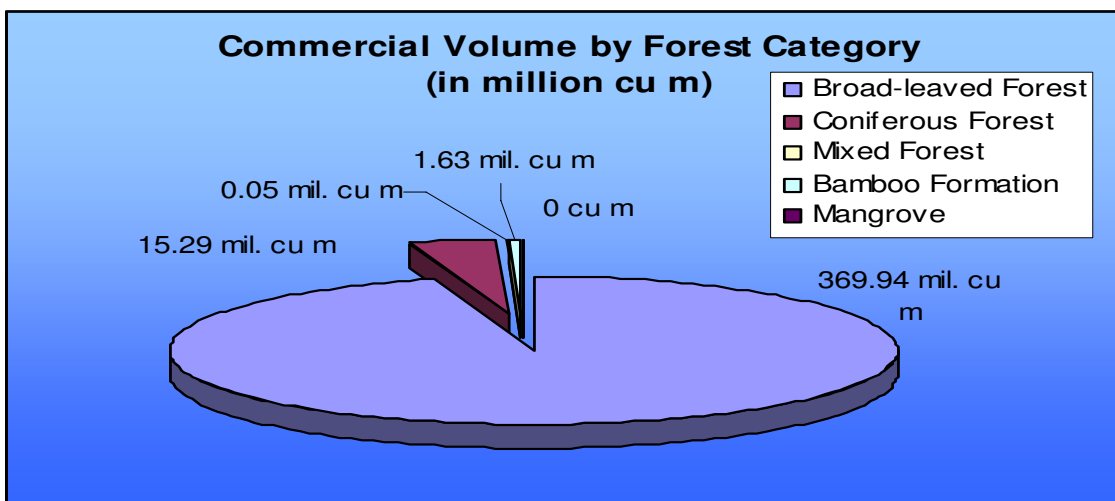
It can be observed in Table 3.i that coniferous forest has a higher commercial volume per ha (119.99 m^3) than broad-leaved forest (54.59 m^3). This may be attributed to the small number of sample size in coniferous forest (0.244 ha) as compared to broad-leaved forest (119.682 ha).

10.2.1.2.2 Commercial volume by major forest type

Out of the commercial volume of 386.96 million m^3, about 323.49 million m^3 or 83.6% is in closed canopy forest and 63.47 million m^3 or 16.4% is in open canopy forest. Closed canopy forest has a higher average commercial volume per ha (66.27 m^3) than open canopy forest (25.58 m^3).

Table 3j: Commercial volume by major forest type

|	Total	Closed Canopy	Open Canopy
Comm. Vol. (in million m^3)	386.96	323.47	63.47
Percent	100.0%	83.6%	16.4%
Vol./ha (m^3)	54.02	66.27	25.58
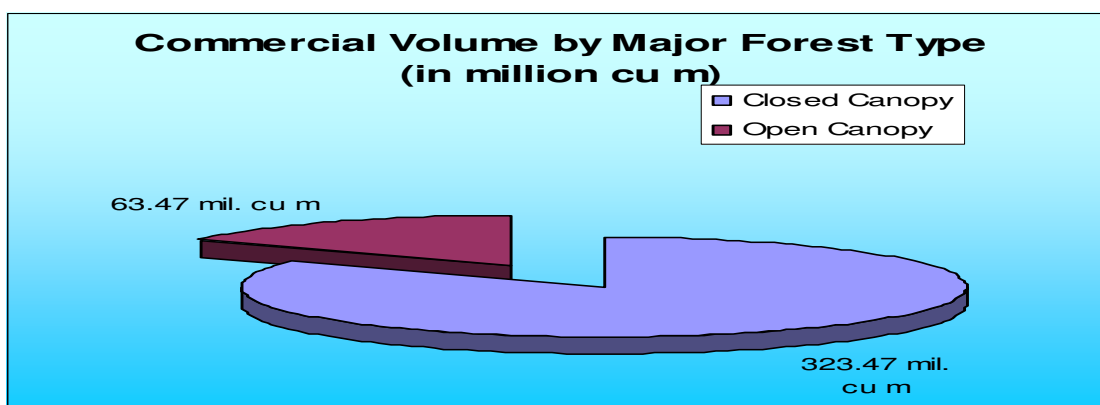
10.2.1.2.3   Commercial volume by main forest type

Forest is further sub-classified into natural forest and plantation forest. Out of the commercial volume of 386.96 million m^3, about 385.5 million m^3 or 99.6% is in natural forest and 1.4 million m^3 or 0.4% is in plantation forest.

Table 3k: Commercial volume by main forest type

	Total	Natural Forest	Plantation Forest
Comm. Volume (in million m^3)	386.96	385.5	1.4
Percent	100.0%	99.6%	0.4%
Vol./ha (m^3)	54.02	59.0	2.0
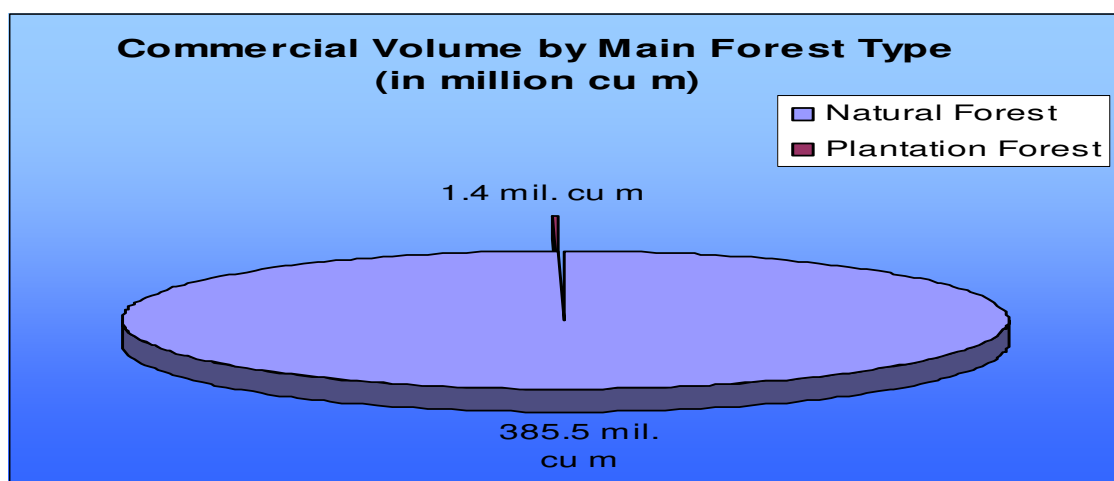
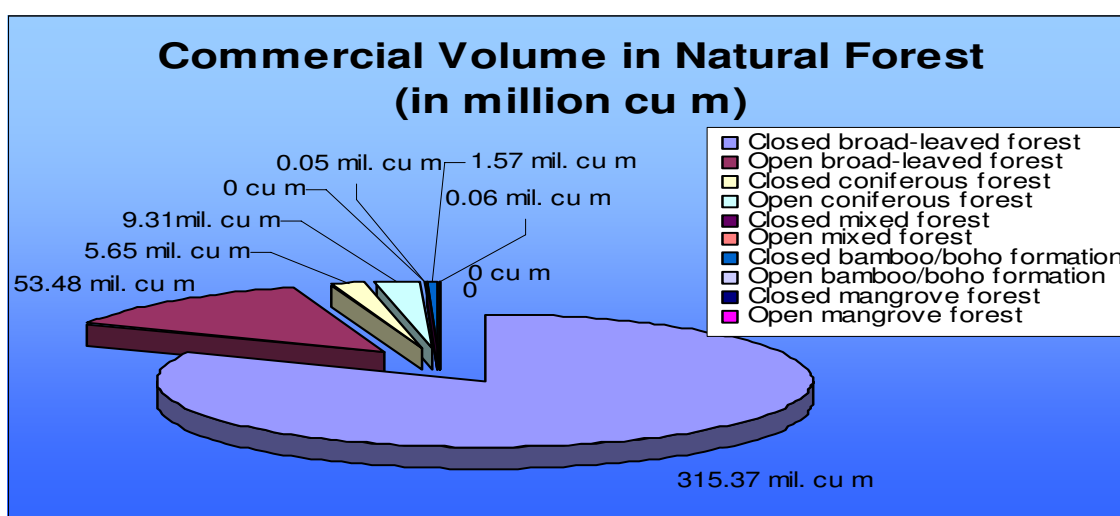10.2.1.2.3.1   Commercial volume in natural forest

Table 3.i shows the commercial volume in natural forest. This is distributed as follows: closed broad-leaved forest (FBC): 315.37 million m^3, open broad-leaved forest (FBO): 53.48 million m^3, closed coniferous forest (FCC): 5.65 million m^3, open coniferous forest (FCO): 9.31 million m^3, closed mixed forest (FMC): 0 m^3, open mixed forest (FMO): 0.05 million m^3, closed bamboo/boho formation (BBC): 1.57 million m^3, open bamboo/boho formation (BBO): 0.06 million m^3, and open mangrove forest (MgO): 0 m^3.

It can be observed that natural coniferous forest has a higher commercial volume/ha than natural broad-leaved forest. Further, open canopy natural coniferous forest has a higher average commercial volume/ha (134.65 m^3) than closed canopy natural coniferous forest (123 m^3). These abnormalities may be attributed, among others, to the size of the sample units. In closed canopy coniferous forest, there were only 2 sample units with a total area of 0.91 ha as compared to open canopy forest with 3 sample units with aggregate area of 1.37 ha.

Note: The commercial volume indicated under bamboo/boho formation is the **commercial volume of trees within the area** and not the volume of bamboo or boho.

Table 3l: Commercial volume in natural forest

Main Forest Type	Comm. Vol. (million m^3)	Vol./ha (m^3)
Closed broad-leaved forest	315.37	72.80
Open broad-leaved forest	53.48	31.25
Closed coniferous forest	5.65	123.00
Open coniferous forest	9.31	134.65
Closed mixed forest	0.0	0.0
Open mixed forest	0.05	2.48
Closed bamboo/boho formation	1.57	11.94
Open bamboo/boho formation	0.06	0.86
Closed mangrove forest	0.0	0.0
Open mangrove forest	0.0	0.0

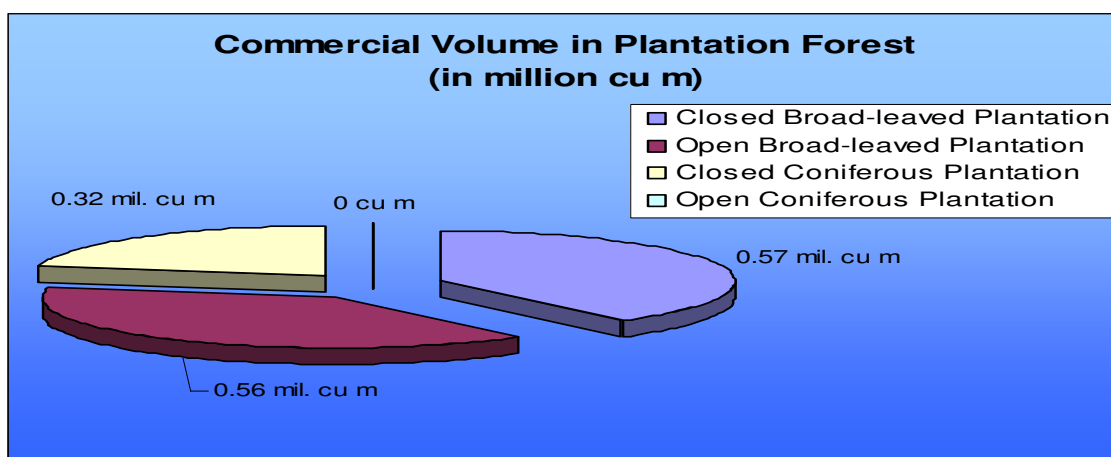10.2.1.2.3.2 <u>Commercial volume in plantation forest</u>

Plantation forest complements the natural forest as source of a sustained supply of wood raw materials for the various forest-based industries.

Plantation forest has a total commercial volume of 1,453,694 m^3. Out of this, broad-leaved plantation has a commercial volume of about 1,128,558.43 m^3 or 77.6% and coniferous plantation has 325,135.57 m^3 or 22.4%. Commercial volume in broad-leaved plantation is broken down as follows: closed broad-leaved plantation (PBC): 0.57 million m^3; open broad-leaved plantation (PBO): 0.56 million m^3. At the same time, the commercial volume in closed coniferous plantation (PCC) is estimated at 0.32 million m^3. Open coniferous plantation has no commercial volume.

Table 3m shows that coniferous plantation has a higher average commercial volume per ha than broad-leaved plantation. This may be attributed, among others, to the size of the sample units. In coniferous plantation, there were only 2 sample units (0.244 ha) whereas broad-leaved plantation has 43 sample units (14.302 ha).

Table 3m: Commercial volume in plantation forest

	Broad-leaved Plantation		Coniferous Plantation	
Comm. Vol. (m^3)	1,128,558.43		325,135.57	
Percent	77.6%		22.4%	
Vol./ha (m^3)	1.56		26.39	
	Closed	Open	Closed	Open
Comm. Vol.(in million m^3)	0.57	0.56	0.32	0.0
Percent	39.0%	38.6%	22.4%	0.0%
Vol./ha (m^3)	1.74	1.42	32.20	0.0

Commercial Volume in Plantation Forest (in million cu m)

Closed Broad-leaved Plantation
Open Broad-leaved Plantation
Closed Coniferous Plantation
Open Coniferous Plantation

0.32 mil. cu m   0 cu m   0.57 mil. cu m   0.56 mil. cu m

10.2.1.3 Commercial volume of most abundant tree species in natural forest

In forest, there are about 541 tree species recorded. The most abundant tree species belong to the Family Dipterocarpaceae. Out of the top 20 dominant tree species that register the highest commercial volume per ha, 11 tree species belong to the Family Dipterocarpaceae. Table 3n shows the average commercial volume per ha for the top 20 most abundant tree species in forest.

Table 3n: Commercial volume of most abundant tree species in natural forest

Scientific Name	Common Name	Comm. Vol. /ha (m^3)
Shorea polysperma	tangile	8.36
Shorea contorta	white lauan	7.85
Shorea squamata	mayapis	6.89
Shorea negrosensis	red lauan	6.29
Parashorea plicata	bagtikan	3.33
Dipterocarpus grandiflorus	apitong	3.24
Shorea almon	almon	1.44
Combretodendron quadrialatum	toog	1.17
Shorea astylosa	yakal	1.14
Shorea guiso	guijo	1.06
Palaquium luzoniense	nato	0.79

Scientific Name	Common Name	Comm. Vol. /ha (m^3)
Pterocarpus indicus	narra	0.65
Lithocarpus llanosii	ulayan	0.61
Koordersiodendron pinnatum	amugis	0.49
Hopea foxwothii	dalingdingan	0.45
Terminalia foetidissima	talisai-gubat	0.43
Mangifera altissima	pahutan	0.38
Tristania decorticata	malabayabas	0.33
Anisoptera thurifera	palosapis	0.30
Euphoria didyma	alupag	0.23

10.2.2.4 <u>Commercial volume of most abundant tree species in plantation forest</u>

Table 3o shows the commercial volume of most abundant tree species in plantation forest. The results show that the most common species is *Gmelina arborea* followed by *Aurucaria bidwilli* and *Paraserianthhes falcataria*.

Table 3o: Commercial volume of most abundant tree species in plantation forest

Scientific Name	Species Name	Comm. Vol./ha (m^3)
Gmelina arborea	yemane	0.54
Araucaria bidwilli	bunya pine	0.44
Paraserianthes falcataria	Moluccan sau	0.29
Mangifera indica	mangga	0.23
Pterocarpus indicus	narra	0.14
Samanea saman	raintree	0.10
Swietenia macrophylla	broad-leaved mahogany	0.07
Ceiba pentandra	kapok	0.07
Tamarindus indica	sampalok	0.04
Mallotus philippinenses	banato	0.03
Leucaena leucocephala	ipil-ipil	0.03

10.2.2: <u>Volume in Trees Outside Forests (TOF)</u>

Trees outside forest (TOF) are defined by default, as all trees excluded from the definition of forest and other wooded lands. However, in order to provide information on the volume of trees in OWL and IW, data on OWL and IW are included under TOF.

In the calculation of volume, only LUS where physical measurement of trees was carried out were included to avoid underestimation of volume. In this connection, the number of sample units used in the calculation of volume is lesser than the number of sample units used in the calculation of area.

 A total of 317 sample units (tracts) with an aggregate area of 519.878 ha contain LUS classified as outside forest (TOF). A sample unit (tract) could have one or more land use types. Table 3.p shows the distribution of sample units (tracts) in TOF.

Table 3p: Sample units distribution in TOF

Land Use	No. of sample units (tract)	Area (ha)
Other Wooded Land (OWL)	136	82.202
Other Land (OL)	299	423.062
Inland Water (IW)	109	16.614

10.2.2.1 Gross volume in TOF

In TOF, the gross volume of all trees with dbh ≥ 10 cm is estimated at 444,666,003.5 m^3, broken down as follows: about 76,059,664.46 m^3 or 17.1% is in OWL; 365,030,730.4 m^3 or 82.1% is in OL; and 3,575,608.63 m^3 or 0.8% is in IW. IW has volume because trees found on the side-slope of rivers and creeks were recorded. Further, in some instances trees were also found on the riverbeds.

Table 3q: Gross Volume in TOF

| Land Use	Gross Vol. (in million m^3)	Vol./ha (m^3)
Other Wooded Land (OWL)	76.06	21.99
Other Land (OL)	364.58	20.14
Inland Water (IW)	3.58	4.99
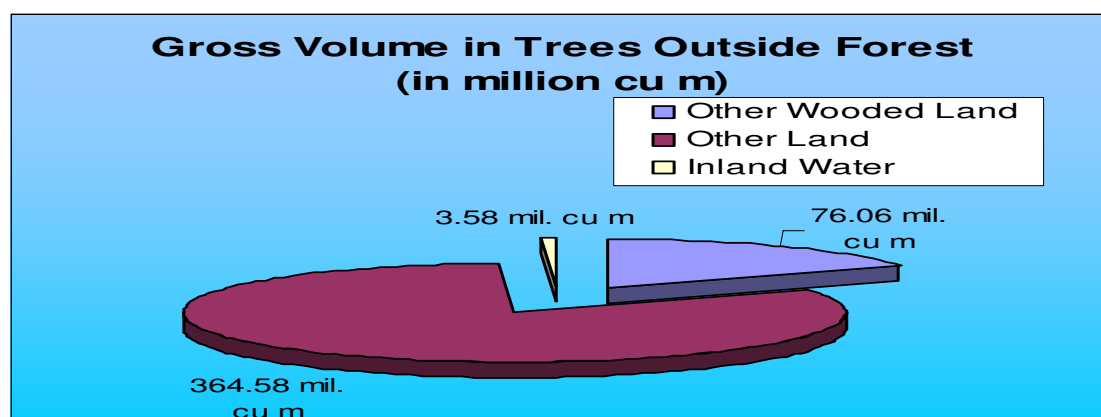
10.2.2.2: Commercial volume in TOF

In TOF, the commercial volume of all trees with dbh ≥ 10 cm is 38,104,529.82 m^3. Out of this, about 13,351,271.42 m^3 or 35.04% is in OWL; 24,080,987.47 m^3 or 63.2% is in OL; and 672,270.93 m^3 or 1.76% is in IW.

Table 3r: Commercial volume in TOF

Land Use	Comm. Vol. (in million m^3)	Vol/ha (m^3)
Other Wooded Land	13.35	3.86
Other Land	24.08	1.32
Inland Water	0.67	0.94

Commercial Vol. in Trees Outside Forest
(in million cu m)
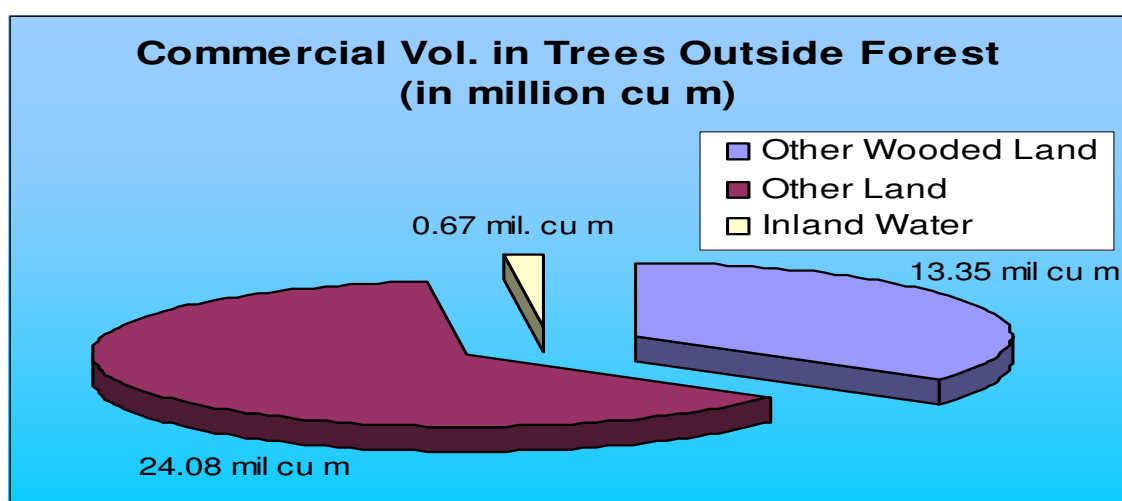
10.2.3: Gross and Commercial Volume per Ecological Zone

A total of 164 sample units (tracts) with an aggregate area of 141.856 ha contain LUS classified as forest. Out of this, 161 sample units fell in TAR and only 3 sample units fell in TM. Table 3.s shows the distribution of sample units in forest by ecological zone.

Table 3s: Sample unit distribution in forest by ecological zone

GEZ	No. of sample units (tract)	Area (ha)
TAR	161	139.26
TM	3	2.596
Total		141.856

On the other hand, a total of 317 sample units (tracts) with an aggregate area of 519.878 ha contain LUS classified as outside forest (TOF). Out of this, 314 sample units fell in TAR and only 3 sample units fell in TM. The following table shows the distribution of sample units in TOF by ecological zone.

Table 3t: Sample unit distribution in TOF by ecological zone

Land Use	TAR		TM	
	No. of sample units	Area (ha)	No. of sample units	Area (ha)
OWL	136	80.202	0	0
OL	296	419.778	3	3.284
IW	109	16.614	0	0
Total		516.594		3.284

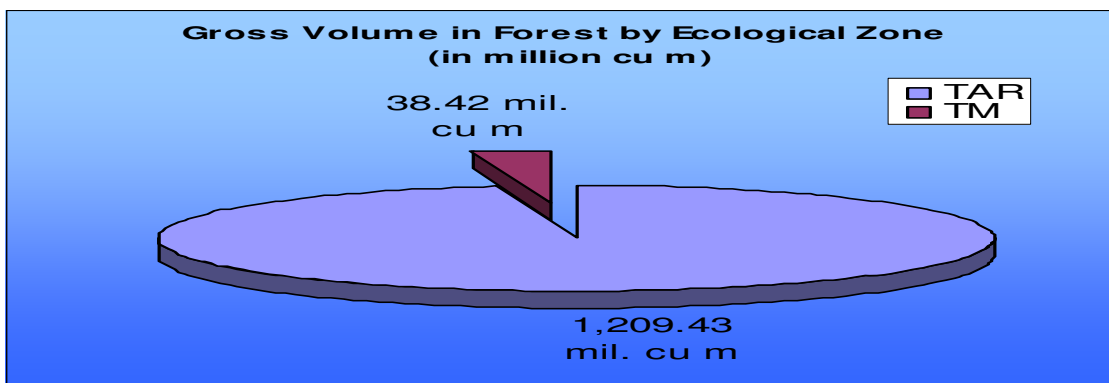10.2.3.1 Gross and commercial volume in Forest per ecological zone

In terms of area, about 97% of the country's forests lies in the tropical rainforest (TAR) and only 3% lies in tropical mountain system (TM). In terms of gross volume, 97% is in TAR and 3% is in TM. At the same time, in terms of commercial volume, 98% is in TAR and 2% is in TM.

10.2.3.1.1 Gross volume in Forest per ecological zone

In TAR, forest has a gross volume of 1,209,433,265 m^3 or an average volume per ha of 172.00 m^3 while in TM the gross volume is 38,425,681.24 m^3 or an average volume per ha of 293.15 m^3.

Table 3u: Gross volume in forest by ecological zone

| GEZ	Gross Vol. (in million m^3)	Vol./ha (m^3)
TAR	1,209.43	172.00
TM	38.42	293.15

10.2.3.1.2 Commercial volume in forest per ecological zone

In TAR, forest has a commercial volume of 378,258,107.6 m^3 or an average commercial volume per ha of 53.79 m^3 while in TM the commercial volume is 8,698,560.95 m^3 or an average commercial volume per ha of 66.36 m^3.

Table 3v: Commercial volume in forest by ecological zone

GEZ	Comm. Vol. (in million m^3)	Vol./ha (m^3)
TAR	378.26	53.79
TM	8.70	66.36
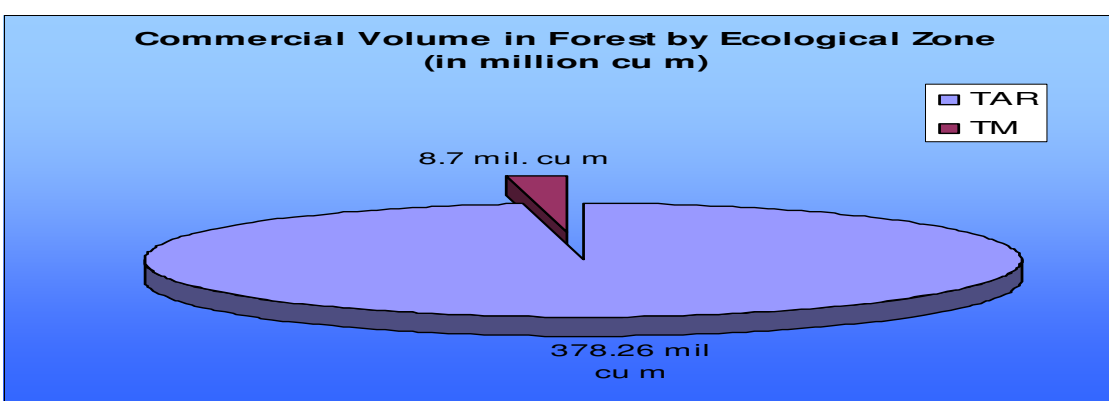
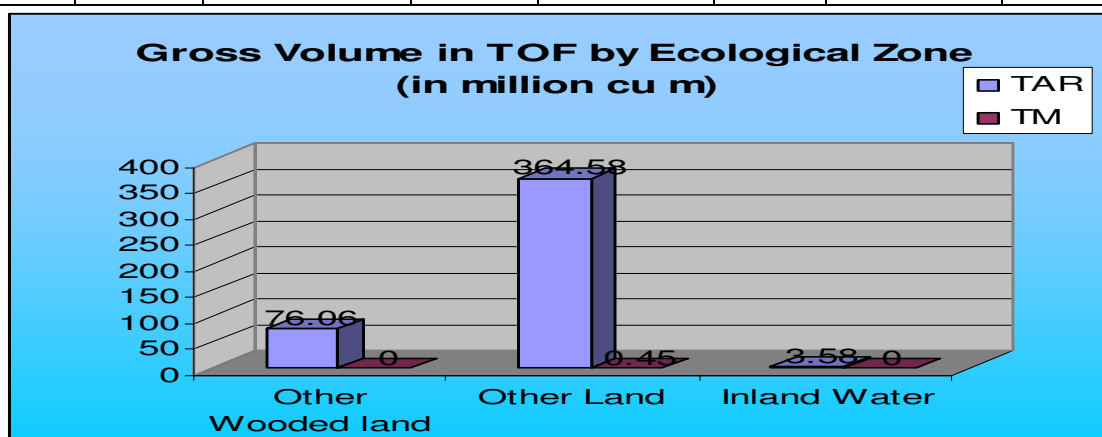10.2.3.2 Gross and commercial volume in TOF per ecological zone

In terms of area, about 99% of all land use outside forest (TOF) lie in TAR and only 1% lies in TM. With regard to gross volume, about 99.9% is in TAR and only 0.1% is in TM. In terms of commercial volume, all is in TAR.

10.2.3.2.1 Gross volume in TOF per ecological zone

In TOF, the gross vol. of trees with dbh ≥ 10 cm is 444,666,003.5 m^3. In TAR, the gross vol. is 444,219,085.7 m^3 or an average vol. per ha of 19.84 m^3 and in TM the gross vol. is 446,917.81 m^3 or an average vol. per ha of 3.16 m^3.

Table 3w: Gross volume in TOF by ecological zone

| GEZ	Total (million m^3)	Other Wooded Land		Other Land		Inland Water	
		Gross Vol. (million m^3)	Vol./ha (m^3)	Gross Vol. (million m^3)	Vol./ha (m^3)	Gross Vol. (million m^3)	Vol./ha (m^3)
TAR	444.67	76.06	21.99	365.03	20.01	3.58	4.99
TM	0.45	0.0	0.0	0.45	3.16	0.0	0.0

Commercial volume in TOF per ecological zone

In TOF, the commercial volume of trees with dbh ≥ 50 cm is 38,104,529.82 m^3 or an average volume per ha of 1.7 m^3. Said volume is found only in TAR. No commercial volume was recorded in TM.

Table 3x: Commercial volume in TOF by ecological zone

GEZ	Total (million m^3)	Other Wooded land		Other Land		Inland Water	
		Comm. Vol. (million m^3)	Vol./ha (m^3)	Comm. Vol. (million m^3)	Vol./ha (m^3)	Comm. Vol. (million m^3)	Vol./ha (m^3)
TAR	38.10	13.35	3.86	24.08	1.33	0.67	0.94
TM	0.0	0.0	0.0	0.0	0.0	0.0	0.0
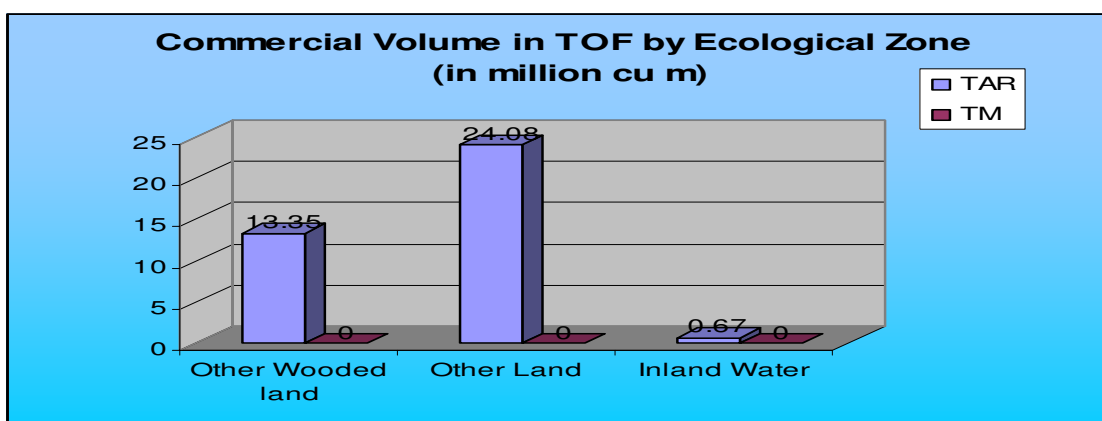
10.2.7. Precision of Volume Estimates

10.2.7.1 Precision of Volume Estimates by Land Use

Based on Table 3y, we can deduce that the precision of volume estimates is dependent on the quantity of trees found in the sample unit more than on the size of the sample unit (land use area), as observed between the volume in Forest and Other Land. Although Other Land has a larger sample size than Forest, the quantity of trees found in Other Land is lesser than in Forest. Corollary to this the sampling error in Other Land is higher than in Forest. This inference is also supported by the precision level between gross volume and commercial volume whereby gross volume has a higher precision level than commercial volume. In the calculation of gross volume, trees with dbh ≥ 10 cm were included; however, in the calculation of commercial volume, only those trees with dbh ≥ 50 cm were included. As such, more trees were involved in the calculation of gross volume than in the calculation of commercial volume.

Table 3y: Precision of Volume Estimates by Land Use

Land Use	Sampling Unit	Land Use Area (ha)	Gross Vol. (m^3)	SeR (%)	Comm. Vol. (m^3)	SeR (%)
Forest	164	141.856	24714.107	8.78	7663.757	17.80
Other Wooded Land	136	83.752	1763.996	12.05	309.646	21.89
Other Land	299	427.286	8465.89	9.04	558.492	15.84
Inland Water	110	18.614	82.926	40.72	15.591	60.61

10.2.7.2 Precision of Volume Estimates by Forest Type

The precision of volume estimate in Forest is generally at acceptable level (8.78%) when taken collectively (by land use). However, when this is subdivided into forest types the sampling error increased to above 10% (Table 3z).

Table 3z: Precision of Volume Estimates by Forest Type

Forest Type	Sampling Unit	Area (ha)	Gross Vol. (m^3)	SeR (%)	Comm. Vol. (m^3)	SeR (%)
Closed broad-leaved forest	86	85.792	18998.959	9.69	6246.059	20.21
Open broad-leaved forest	64	33.89	4284.886	11.43	1059.196	21.09
Closed coniferous forest	2	0.91	247.148	13.80	111.931	20.67
Open coniferous forest	3	1.37	305.788	36.66	184.475	48.20
Closed mixed forest	-	-	-	-	-	-
Open mixed forest	1	0.42	25.283	-	1.04	-
Closed broad-leaved plantation	17	6.456	345.649	14.77	11.22	239.34
Open broad-leaved plantation	28	7.846	274.421	26.89	11.127	-
Closed coniferous plantation	1	0.2	24.326	-	6.439	-
Open coniferous plantation	1	0.044	-	-	.044	-
Closed bamboo/ boho formation	8	2.602	98.283	52.69	31.07	86.08
Open bamboo/boho formation	7	1.384	7.939	39.01	1.191	105.72
Closed mangrove forest	1	0.72	88.994	-	-	-
Open mangrove forest	2	0.222	12.426	42.84	-	-

10.3 Biomass

Given the volume over bark (VOB) data, the above-ground biomass density can be computed using the following allometric equations (Brown, 1997):

Above-ground biomass density (Mg/ha) = VOB x WD x BEF

Where:

WD = volume-weighted average wood density (t of oven dry biomass per m^2 green volume)

BEF= biomass expansion factor (ratio of aboveground oven-dry biomass of trees to oven-dry biomass of inventoried volume)

Ideally the wood density should be weighted based on all the species found in the stand. However, in the absence of species names and wood density values, the "default" value for tropical trees in Asia is o.57 t/m^3 (range: 0.40-0.69).

The BEF for broadleaf forests can be computed using the following formula:

BEF = Exp. {3.213-0.506 Ln (BV)} for BV < 190

1.74 for BV ≥ 190 t/ha
(sample size = 56, adjusted r^2 = 0.76)

where:

BV = biomass of inventoried volume in t/ha. Calculated as the product of VOB/ha (m^3 / ha) and wood density (t/ m^3)

10.3.1 Above-Ground Woody Biomass per Hectare

In forest, the average above-ground woody biomass is 240.93 tons/ha. In TOF the average above-ground woody biomass is 82.36 tons/ha. Out of this about 86.67 t/ha is in OWL; 82.72 t/ha is in OL; and 41.66 t/ha is in IW.

Table 4a: Above-ground woody biomass by Land Use (tons/ha)

| Land Use	VOB/ha (m^3)	AGB (t/ha)
Forest	174.22	240.93
Other Wooded Land	21.99	86.67
Other Land	20.01	82.72
Inland Water	4.99	41.66

Above Ground Woody Biomass (tons/ha)
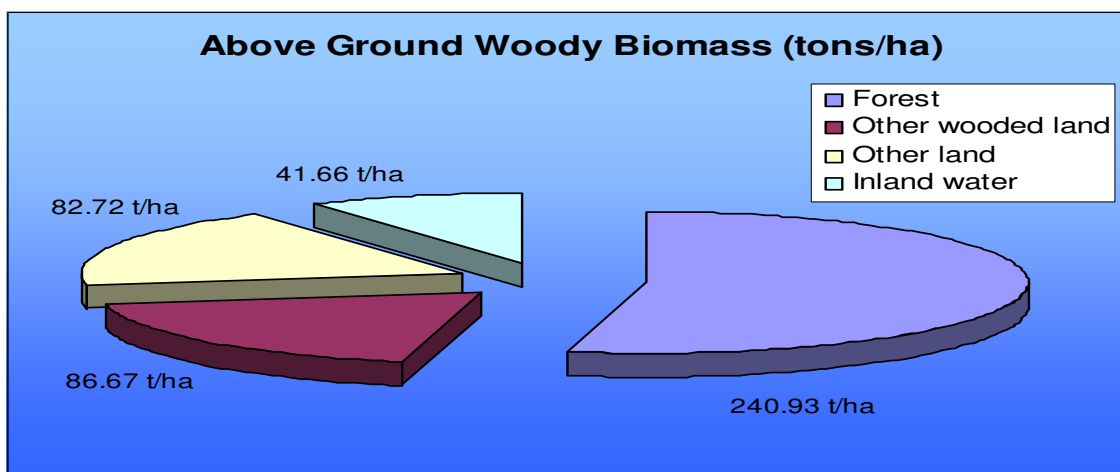
10.3.2. Total Above-Ground Woody Biomass

In forest the total above-ground woody biomass is 1,725,681,529 tons. In TOF the aggregate total above-ground woody biomass is 1,846,297,029 tons, distributed as follows: about OWL: 299,733,041 tons; OL: 1,508,960,507 tons; and IW: 29,842,915 tons.

Table 4b: Total above-ground woody biomass by land use

Land Use	AGB (t)
Forest	1,725,681,529
Other wooded land	299,733,041
Other land	1,508,960,507
Inland water	29,842,915

Total Above Ground Woody Biomass by Land Use (tons)
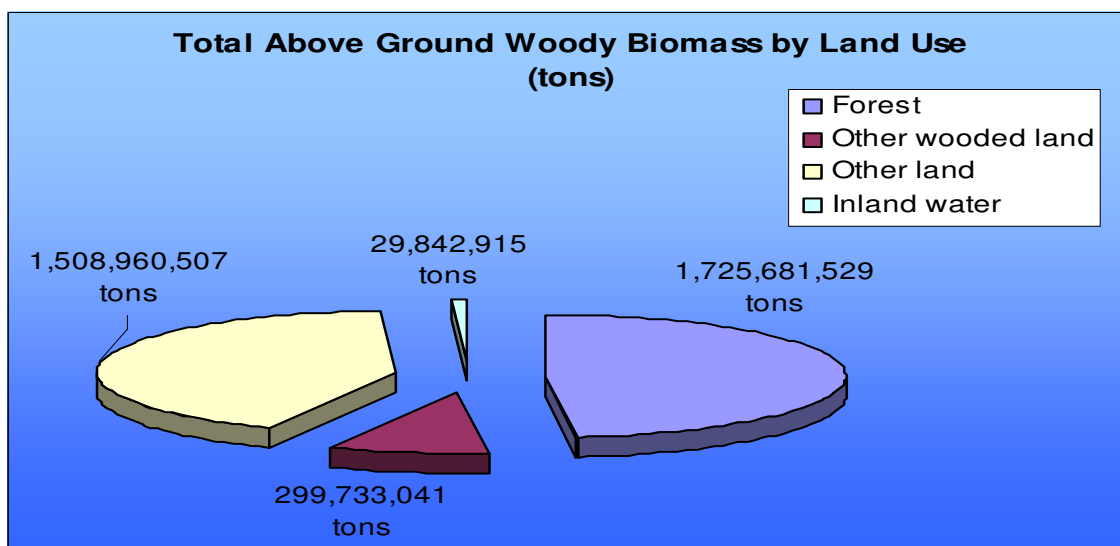
10.4   DBH distribution

The trees were grouped into diameter classes at interval of 10 cm (DBH Class 15, DBH Class 25, DBH Class 35, etc). DBH Class 15 ranges from 10 cm to 19.99 cm, DBH Class 25 ranges from 20 cm to 29.99 cm; DBH Class 35, ranges from 30 cm to 39.99 cm, and so on.
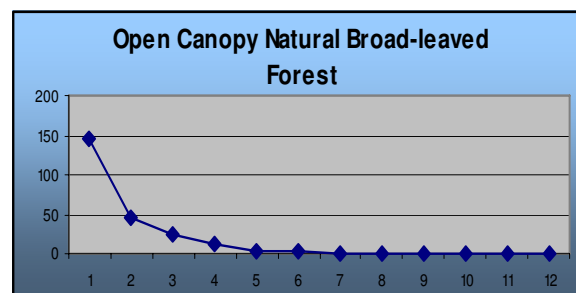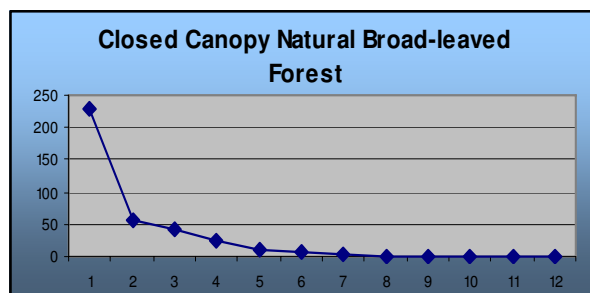
10.4.1 DBH Distribution by Forest Type

In normal condition, tree distribution by DBH class follows the inverted "J" graph, whereby small diameter trees are always greater in number than big diameter trees.

Based on the NFA results, the DBH distribution in the different forest types is shown in Table 5.

Table 5: DBH Class distribution by forest type

Forest Type	DBH Class (trees/ha)											
	DBH 15	DBH 25	DBH 35	DBH 45	DBH 55	DBH 65	DBH 75	DBH 85	DBH 95	DBH 105	DBH 115	DBH ≥125
FBC	227.38	55.69	41.04	24.77	10.14	5.68	2.28	1.48	0.72	0.15	0.15	0.21
FBO	144.54	44.64	24.79	13.6	4.19	2.77	1.06	0.83	0.71	0.21	0.12	0.12
FCC	0	0	15.38	18.68	31.87	18.68	20.88	6.59	0	0	0	0
FCO	56.25	61.31	11.68	10.95	10.95	8.76	8.76	2.19	1.46	0.73	0	0
FMC	0	0	0	0	0	0	0	0	0	0	0	0
FMO	0	30.95	26.19	7.14	2.38	0	0	0	0	0	0	0
PBC	250.00	64.59	20.29	2.79	1.08	0.15	0	0.15	0	0	0	0
PBO	88.24	51.36	10.58	1.66	1.02	0.13	0	0.25	0	0	0	0
PCC	0	40.00	5.00	40.00	15.00	10.00	0	0	0	0	0	0
PCO	0	0	0	0	0	0	0	0	0	0	0	0
BBC	22.73	8.46	7.69	3.07	0.77	0	0	0.77	0	0	0	0.38
BBO	0	4.34	2.89	1.45	0.72	0	0	0	0	0	0	0
MgC	200.00	54.17	56.94	20.83	0	0	0	0	0	0	0	0
MgO	150.00	76.58	4.50	4.50	0	0	0	0	0	0	0	0

Closed Canopy Natural Broad-leaved Forest

Open Canopy Natural Broad-leaved Forest

Closed Canopy Natural Coniferous Forest

Open Canopy Natural Coniferous Forest

Closed Canopy Mixed Forest
(No trees measured)

Open Canopy Mixed Forest

Closed canopy Broad-leaved Plantation

Open Canopy Broad-leaved Plantation

Closed Canopy Coniferous Plantation

Open Canopy Coniferous Forest
(No trees measured)

Closed Canopy Bamboo/Boho Formation

Open Canopy Bamboo/Boho Formation

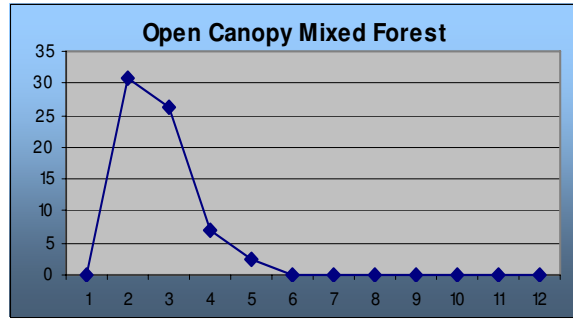## Closed Canopy Mangrove Forest
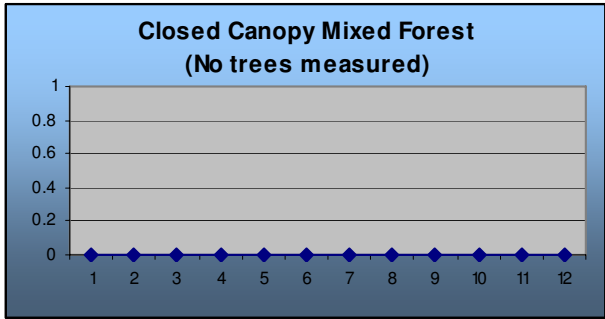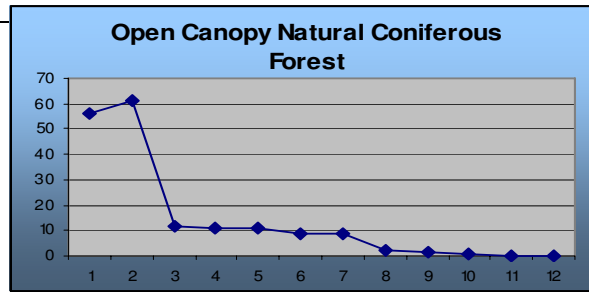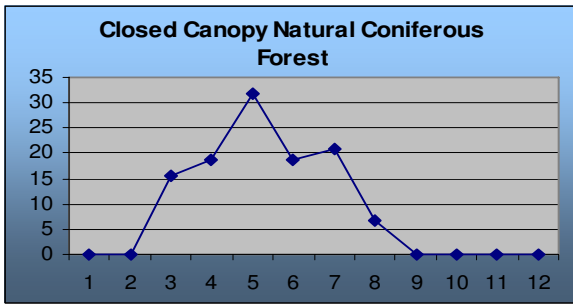
Open Canopy Mangrove Forest

70

Table 5 shows that the distribution of trees by DBH Class in the different forest type is erratic, except in broad-leaved forest (both natural and plantation). This may be attributed to the size of the sample units. In forest type with large sample units, such as natural broad-leaved forest, the tree distribution by DBH Class follows the inverted "J" graph; however, in forest type with small sample units, such as natural coniferous forest, the tree distribution by DBH Class is erratic.

10.5   Biodiversity

Forest is the home of the majority of living species. In the Philippines, there are over three thousand species of trees that can reach dbh of 30 cm or more. However, forest biodiversity is being lost due to deforestation, fragmentation and degradation of all forest types. The most important factors associated with forest and biological diversity decline are human-induced causes that include: agricultural development, overgrazing, unmitigated shifting cultivation, unsustainable forest management, infrastructure development, mining, forest fires and pollution and climate change.

10.5.1 List and Frequency of Tree Species in Natural Forest

In the natural forest, there were about 541 tree species recorded. The most dominant tree species recorded are of the Family Dipterocarpaceae, such as: *Shorea contorta, Shorea polysperma, Shorea negrosensis, Shorea squamata, Dipterocarpus grandiflorus, Dipterocarpus grandiflorus, Shorea astylosa, Shorea almon,* and *Shorea guiso.*

Table 6a: Top 20 most abundant tree species in natural forest

Order	Scientific Name	Species	Trees/ha	%
1	*Shorea contorta*	white lauan	11.22	8.01%
2	*Shorea polysperma*	Tangile	8.83	6.31%
3		miscellaneous spp.	8.71	6.21%
4	*Shorea negrosensis*	red lauan	8.57	6.12%
5	*Shorea squamata*	Mayapis	7.22	5.15%
6	*Dipterocarpus grandiflorus*	Apitong	6.16	4.40%
7	*Parashorea plicata*	Bagtikan	3.79	2.71%
8	*Shorea astylosa*	Yakal	3.67	2.62%
9	*Lithocarpus llanosii*	Ulayan	3.49	2.49%
10	*Gmelina arborea*	Yemane	2.98	2.13%
11	*Shorea almon*	Almon	2.51	1.79%
12	*Pterocarpus indicus*	Narra	2.24	1.60%
13	*Syzygium brevistylum*	Sagimsim	1.74	1.24%
14	*Pinus kesiya*	Benguet pine	1.70	1.21%
15	*Shorea guiso*	Guijo	1.68	1.20%
16	*Ficus elastica*	India rubber	1.67	1.19%
17	*Ficus nota*	Tibig	1.64	1.17%
18	*Palaquium luzoniense*	Nato	1.39	0.99%
19	*Alangium javanicum var. jaheri*	Putian	1.36	0.97%
20	*Macaranga tanarius*	Binunga	1.28	0.92%

10.5.2 List and Frequency of Tree Species in TOF

In TOF, there were 426 tree species recorded. The most dominant tree species are *Cocos nucifera, Gmelina arborea, Mangifera indica, Leucaena leucocephala, Artocarpus blancoi, Macaranga tanarius, Sandoricum koetjape, Artocarpus heterophylla, Swietenia macrophylla, Ficus nota, Syzygium cumini, Pterocarpus indicus, Polyscias nodosa,* and *Trema orientalis*. About 77.1% of these tree species are found in Other Land while 68.3% are in Other Wooded Land (OWL).

Table 6b: Top 20 tree species in TOF

Scientific Name	Default Common name	TOF (trees/ha)	OWL (trees/ha)	OL (trees/ha)	IW (trees/ha)
Cocos nucifera	Coconut	17.88	2.10	21.66	2.04
Gmelina arborea	yemane	1.60	2.28	1.54	0.16
	Miscellaneous spp	1.44	5.42	0.71	0.32
Mangifera indica	mangga	1.01	0.20	1.20	0.21
Leucaena leucocephala	ipil-ipil	0.81	0.90	0.81	0.27
Artocarpus blancoi	antipolo	0.49	0.92	0.43	0.05
Macaranga tanarius	binunga	0.42	1.25	0.28	0.05
Sandoricum koetjape	santol	0.39	0.14	0.45	0.00
Pterocarpus indicus	narra	0.34	0.55	0.32	0.00
Ficus nota	tibig	0.33	0.78	0.23	0.64
Polyscias nodosa	malapapaya	0.32	0.97	0.21	0.00
Artocarpus heterophylla	nangka	0.32	0.23	0.35	0.11
Syzygium cumini	duhat	0.30	0.87	0.20	0.00
Trema orientalis	anabiong	0.29	0.80	0.21	0.00
Swietenia macrophylla	broad-leaved mahogany	0.29	0.57	0.24	0.11
Alstonia macrophylla	batino	0.26	0.20	0.26	0.59
Gliricida sepium	madre-cacao	0.25	0.74	0.17	0.00
Samanea saman	raintree	0.24	0.36	0.22	0.11
Chrsophyllum cainito	starapple	0.21	0.11	0.24	0.05
Theobroma cacao	cacao	0.21	0.00	0.26	0.00

10.5.3 Forest Area per Stand Structure

Out of the 7,162,560 ha of forest, about 2,150,976 ha or 30% has 2 layer canopy structure; 2,071,725 ha or 28.9% has more than 3 layer canopy structure; 1,951,340 ha or 27.2% has 3 layer canopy structure; and 988,519 ha or 13.8% has 1 layer canopy structure.

Table 7a: Forest area per stand structure

|	1 Layer	2 Layer	3 Layer	>3 Layer
Area	988,519	2,150,976	1,951,340	2,071,725
Percent	13.8%	30%	27.2%	28.9%
Sampling error %	30.6%	18.6%	27.2%	32.8%
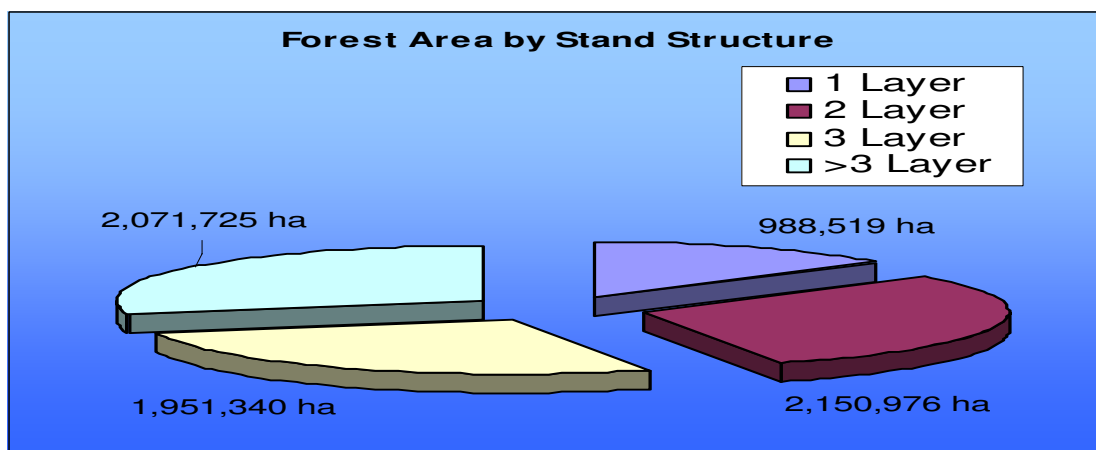
10.5.4 Forest Area per Human Induced Disturbance Level

Forest disturbance is mostly anthropogenic in nature resulting from the increasing pressure of expanding population. NFA data shows that out of the total forest in the country, only about 44,029 ha or 0.6% is heavily disturbed. Table 7b shows the status of forest disturbance in the country.

Table 7b: Status of forest disturbance

Status of disturbance	Area (ha)	Percent
Not Disturbed	2,056,732	28.7%
Slightly Disturbed	2,989,012	41.7%
Moderately Disturbed	2,072,788	28.9%
Heavily Disturbed	44,029	0.6%
Total	7,162,560	99.99%
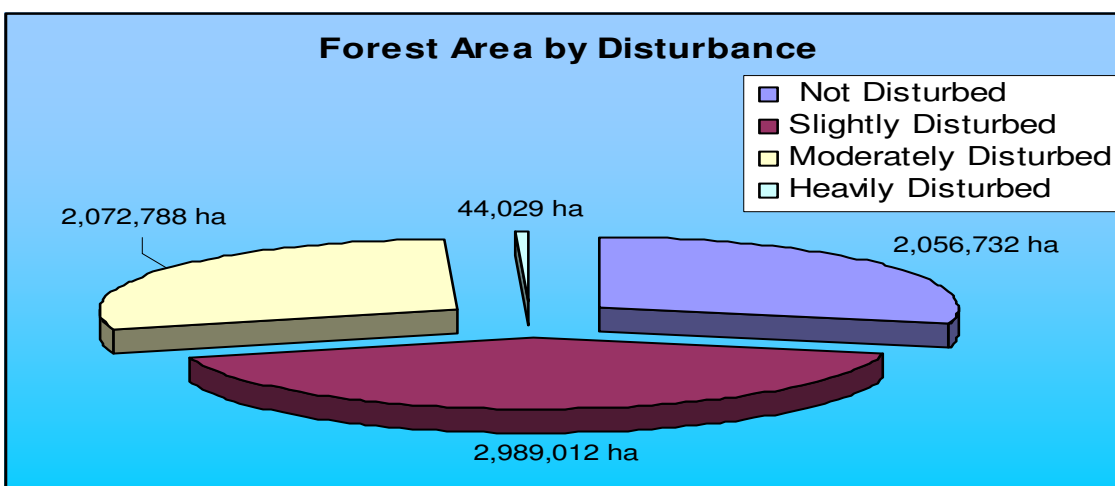
10.5.5 Forest Area Burned

The forest controls the rise of carbon dioxide concentration in the air. Frequent forest fires, therefore, reduce the carbon stored in vegetation and trees, increasing carbon dioxide emissions, and contributes to forest degradation.

Out of the 166 sample units with LUS classified as forest, 4 sample units have incidence of forest fire. Table 7c shows the statistics on the extent of forest fire in the country.

Table 7c: Forest area burned

	Forest Area	Area Burned		
		Total	Recent Fire	Old Fire
Area	7,162,560	28,427	5,352	23,075
Percent		0.4%	0.1%	0.3%

10.6   Use of Resources

Forest provides a wide array of goods and services, from timber and some non-timber forest resources to playing an important role in mitigating climate change as carbon sinks. At the same time, forest provides livelihood and jobs to millions of people.

In the calculation of area for the production of goods and services in Forest, only those land use sections where measurement was carried out were included.

10.6.1 Wood and Non-wood Products Provided by the Forest and Trees Outside Forest

10.6.1.1 Wood and Non-wood Products Provided by the Forest

Based on the perception of the people interviewed, timber and fuel-wood remain the highest-value products provided by the forest.

Statistics shows that out of the total forest area of 7,162,560 ha, about 4,730,372 ha or 66.0% is the source of wood. The 2003 Philippine Forestry Statistics shows that about 505,703 m^3 round logs were produced, excluding data from the Autonomous Region in Muslim Mindanao (ARMM). Out of this about 177,566 m^3 were produced from the natural forest and 328,137 m^3 were produced from the plantation forest.

Table 8a shows the extent of the area covered in the extraction of the different wood and non-wood products. It can be observed that "Bush meat" has zero value. This is probably attributed to the opinion that "bush meat" is the end-product of hunting.

Table 8a: Wood and non-wood products provided by the Forest.

Product Type	Area (ha)	Percent
Wood	4,730,372	66.0%
Fuel wood	3,340,636	46.6%
Food	874,113	12.2%
Fodder	103,609	1.4%
Medicines	100,883	1.4%
Essential oils	30,295	0.4%
Tannins	39,989	0.6%
Spices, herbs	151,475	2.1%
Exudates	275,887	3.9%
Utensils, handicrafts	725,870	10.1%
Construction materials	483,206	6.7%
Ornamentals	100,984	1.4%
Seeds	13,128	0.2%
Bio fertilizers, insecticides etc.	0	0.0%
Other non wooded plant products	479,672	6.7%
Living animals	241,856	3.4%
Bush meat	0	0.0%
Honey, beeswax	353,947	4.9%

10.6.1.2 Wood and Non-wood Products Provided by Trees Outside Forest

Table 8b shows that food, fuel-wood, and wood are the highest-value products derived from TOF. Food products are not limited to those provided by the trees but include agricultural products such as rice, vegetables, etc.

Table 8b: Wood and non-wood products provided by TOF

Product Type	Area (ha)	Percent
Wood	3273549	14.3%
Fuel wood	6012840	26.3%
Food	12609489	55.2%
Fodder	1128522	4.9%
Medicines	361619	1.6%
Essential oils	1253630	5.5%
Tannins	0	0.0%
Spices, herbs	0	0.0%
Exudates	69758	0.3%
Utensils, handicrafts	193022	0.8%
Construction materials	2482837	10.9%
Ornamentals	118958	0.5%
Seeds	0	0.0%
Bio fertilizers, insecticides etc.	56404	0.2%
Other non wooded plant products	706457	3.1%
Living animals	182655	0.8%
Bush meat	74678	0.3%
Honey, beeswax	13618	0.1%

10.6.2   Social, Economic and Environmental Services Provided by the Forest and Trees Outside Forest

10.6.2.1 Social, economic and environmental services provided by the Forest

Water and soil conservation is perceived to be the highest value services provided by the forest. Statistics shows that about 3,959,160 ha or 55.3% of the country's forest is intended for soil and water conservation.   This is followed by hunting that covers about 1,307,939 ha or 18.3%.

Table 8c: Social, economic and environmental services provided by the Forest

Service Type	Area (ha)	Percent
Employment (salary)	453,315	6.3%
Hunting	1,307,939	18.3%
Grazing	32,719	0.5%
Exploration of natural resources	30,093	0.4%
Conservation	418,072	5.8%
Agricultural functions	174,197	2.4%
Water and soil conservation	3,959,160	55.3%
Recreation	353,442	4.9%
Religious/spiritual	0	0.0%

10.6.2.2 Social, economic and environmental services provided by the Trees Outside Forest

Based on the perception of the respondents, grazing is the highest value service provided by TOF at 12.6% (Table 8d). This is followed by water and soil conservation, agricultural functions, employment, and hunting.

Table 8d: Social, economic and environmental services provided by TOF

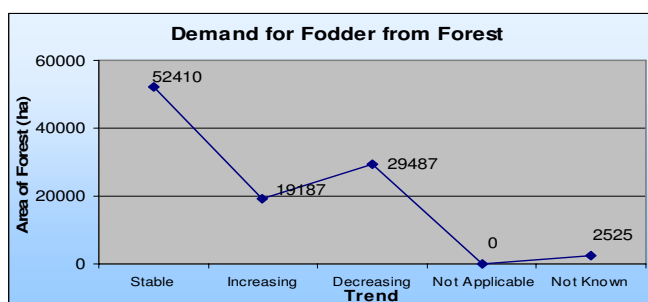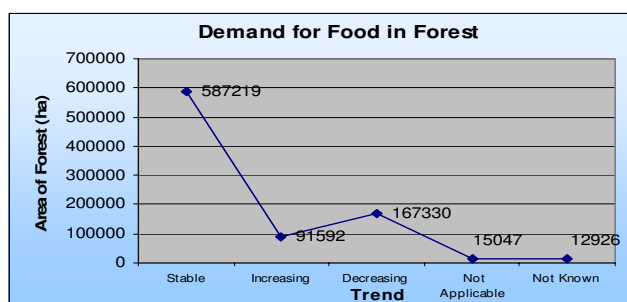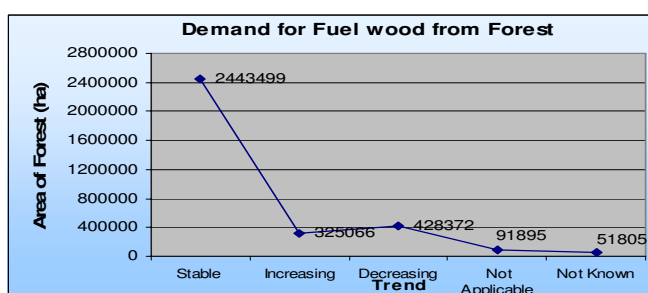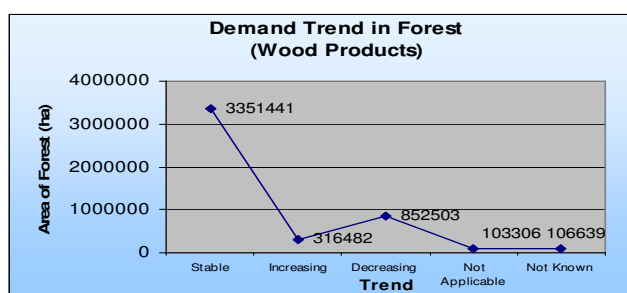| Service Type	Area (ha)	Percent
Employment (salary)	1,848,334	8.1%
Hunting	471,352	2.1%
Grazing	2,882,234	12.6%
Exploration of natural resources	82,761	0.4%
Conservation	13,618	0.1%
Agricultural functions	1,935,927	8.5%
Water and soil conservation	2,250,016	9.9%
Recreation	91,371	0.4%
Religious/spiritual	44,895	0.2%

10.6.3   Demand Trend for Wood and Non-wood Products Provided by Forest and Trees Outside Forest
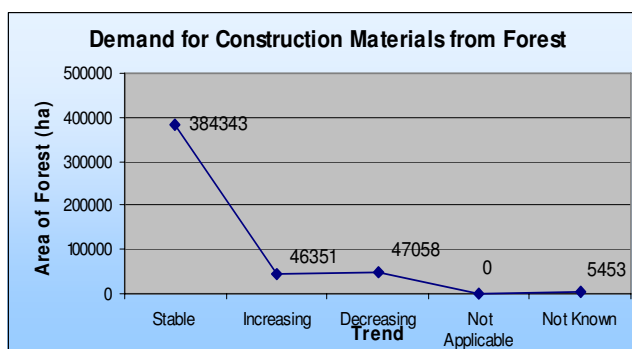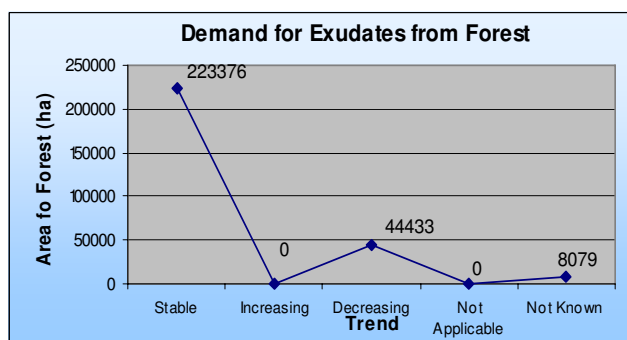
10.6.3.1 Demand trend for wood and non-wood products provided by Forest

Table 8e shows that the demand for wood, fuel-wood, food, fodder, tannins, exudates, construction materials, ornamental plants, living animals, and honey & beeswax is stable.   At the same, demand for medicinal plants and materials for utensil and handicraft making is decreasing.

Table 8e: Demand trend for wood and non-wood products provided by the Forest

Products	Demand Trend (Area in ha)						Percent in Forest
	Stable	Increasing	Decreasing	Not Applicable	Not Known	Total	
Wood	3351441	316482	852503	103306	106639	4730372	66.0%
Fuel wood	2443499	325066	428372	91895	51805	3340636	46.6%
Food	587219	91592	167330	15047	12926	874113	12.2%
Fodder	52410	19187	29487	0	2525	103609	1.4%
Medicines	22721	37364	40797	0	0	100883	1.4%
Essential oils	0	0	30295	0	0	30295	0.4%
Tannins	39989	0	0	0	0	39989	0.6%
Spices, herbs	126229	0	25246	0	0	151475	2.1%
Exudates	223376	0	44433	0	8079	275887	3.9%
Utensils, handicrafts	298911	82403	344556	0	0	725870	10.1%
Construction materials	384343	46351	47058	0	5453	483206	6.7%
Ornamentals	100984	0	0	0	0	100984	1.4%
Seeds	0	0	13128	0	0	13128	0.2%
Bio fertilizers, insecticides	0	0	0	0	0	0	0.0%
Living animals	180256	0	61600	0	0	241856	3.4%
Bush meat	0	0	0	0	0	0	0.0%
Honey, beeswax	292347	25246	36354	0	0	353947	4.9%

Demand Trend in Forest (Wood Products)

Demand for Fuel wood from Forest

Demand for Food in Forest

Demand for Fodder from Forest

Demand for Exudates from Forest

**Demand for Construction Materials from Forest**

10.6.3.2 Demand trend for wood and non-wood products Provided by TOF

Table 8f shows that most of the wood and non-wood products provided by TOF have stable demand, except medicinal plants that have decreasing demand.

 About 1,598,243 ha or 55.2% of the TOF area serves as sources for food while 3,073,674 ha or 26.3% serves as source for fuel wood.

Table 8f: Demand trend for wood and non-wood products provided by TOF

| Products | Demand Trend (Area in ha) | | | | | | Percent in TOF |
	Stable	Increasing	Decreasing	Not Applicable	Not Known	Total	
Wood	1703546	243012	1001569	27411	298011	3273549	14.3%
Fuel wood	3073674	628880	1694672	184236	419429	6000891	26.3%
Food	8723138	612187	2966752	108503	187662	12598243	55.2%
Fodder	563163	10806	349934	6853	197766	1128522	4.9%
Medicines	40853	19944	244594	21964	34264	361619	1.6%
Essential oils	777709	106219	314791	0	54911	1253630	5.5%
Tannins	0	0	0	0	0	0	0.0%
Spices, herbs	0	0	0	0	0	0	0.0%
Exudates	57986	4393	2987	4393	0	69758	0.3%
Utensils, handicrafts	104550	2636	85836	0	0	193022	0.8%
Construction materials	1252576	499642	528723	96730	105165	2482837	10.9%
Ornamentals	70901	5271	21964	6765	0	104901	0.5%
Seeds	0	0	0	0	0	0	0.0%
Bio fertilizers, insecticides	56404	0	0	0	0	56404	0.2%
Living animals	529865	879	174660	0	1054	706457	3.1%
Bush meat	136178	12124	21964	0	12388	182655	0.8%
Honey, beeswax	52714	0	21964	0	0	74678	0.3%

Demand Trend for Wood from TOF

Demand for Fuel wood in TOF

78
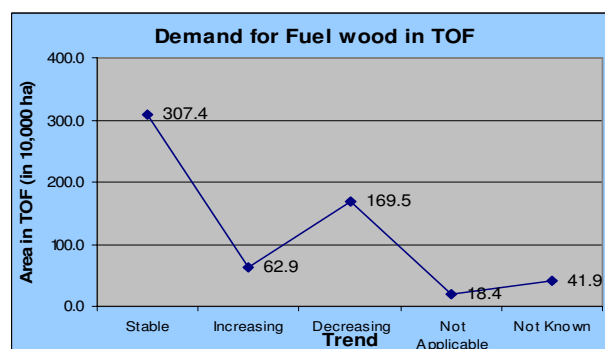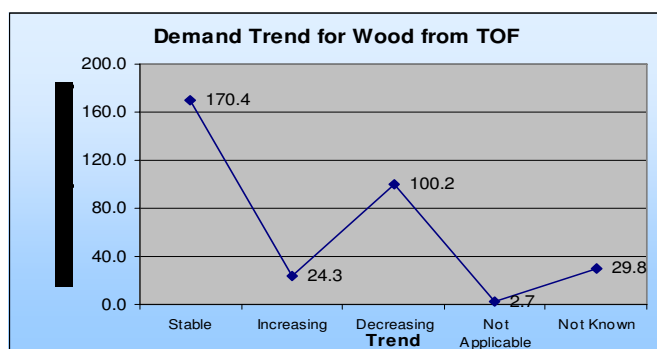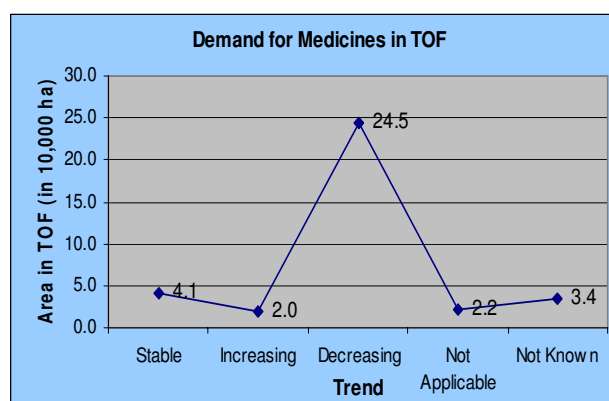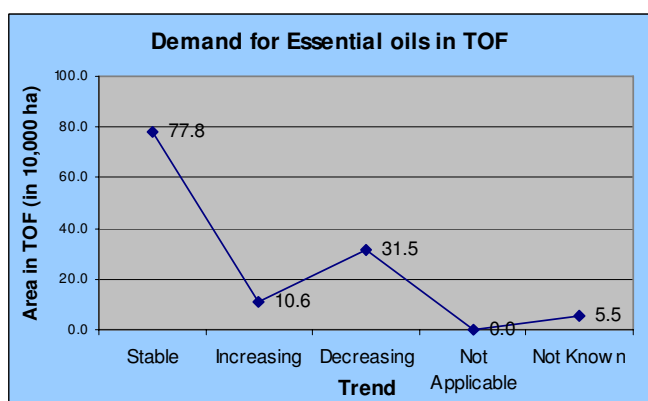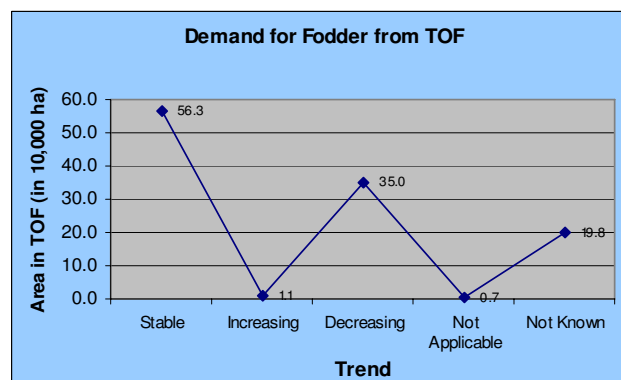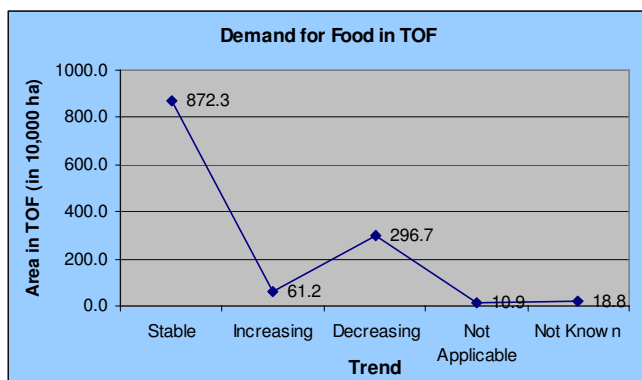
10.6.4 Demand Trend for Social, Economic and Environmental Services Provided by the Forest and Trees Outside Forest

10.6.4.1 Demand trend for social, economic and environmental services provided by the Forest

Table 8g shows that the demand trend for most of the social, economic and environmental services provided by the Forest is stable. Water & soil conservation, hunting and employment cover the largest area.

Table 8g: Demand trend for social, economic and environmental services provided by the Forest

Service	Demand Trend (Forest Area Covered in ha)						Percent in Forest
	Stable	Increasing	Decreasing	Not Applicable	Not Known	Total	
Employment (salary)	453315	0	0	0	0	453315	6.3%
Hunting	1154141	24842	128956	0	0	1307939	18.3%
Grazing	22721	0	0	0	9997	32719	0.5%
Exploration of natural resources	0	0	0	30093	0	30093	0.4%
Conservation	165613	0	50492	100984	100984	418072	5.8%
Agricultural functions	134510	0	6362	20702	12623	174197	2.4%
Water and soil conservation	3502614	3938	82907	266698	103003	3959160	55.3%
Recreation	227213	0	0	25246	100984	353442	4.9%
Religious/spiritual	0	0	0	0	0	0	0.0%

Water and Soil Conservation

Hunting

Employment

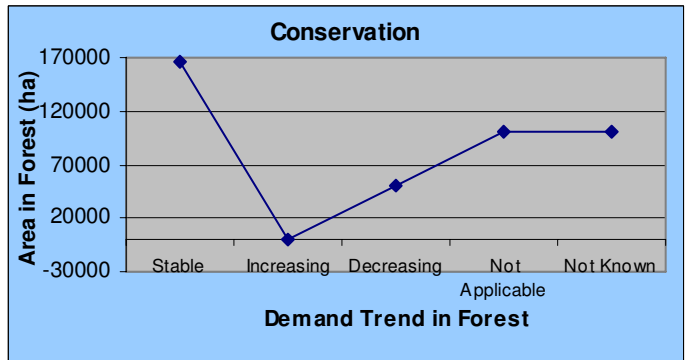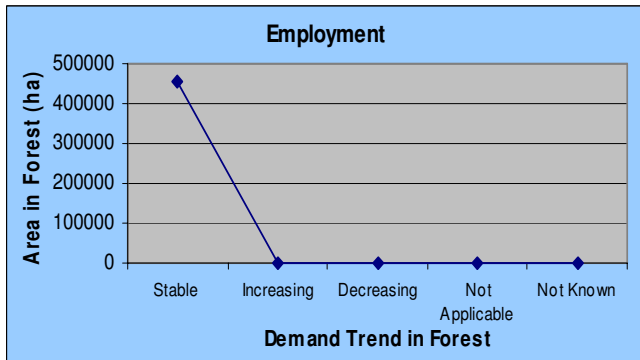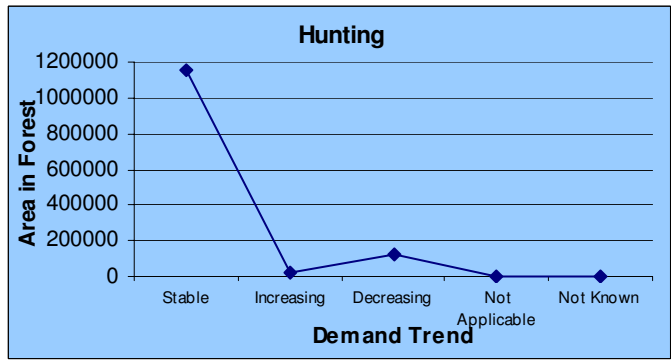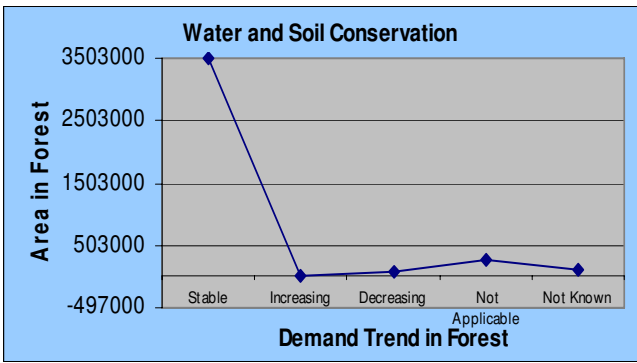Conservation

Recreation

Agricultural Functions
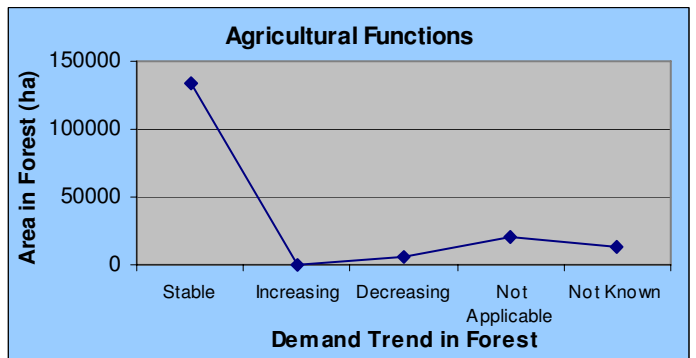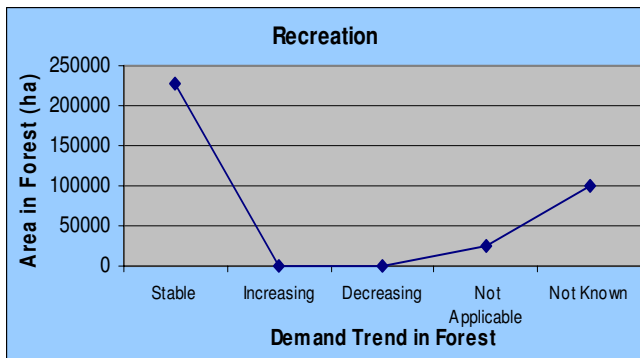
10.6.4.2 <u>Demand trend for social, economic and environmental services provided by Trees Outside Forest</u>

Table 8h shows that grazing, water and soil conservation, agricultural functions, and employment are the most dominant services provided by TOF. The demand trend for these services is stable except for grazing. Grazing, which covers the largest area, has a slightly decreasing demand.

Table 8h: Demand trend for social, economic and environmental services provided by TOF

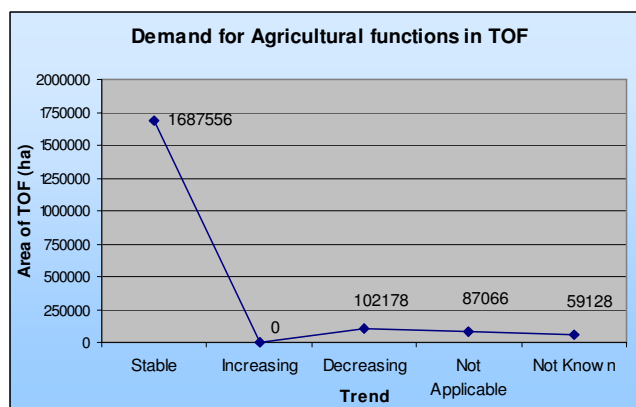| Service	Demand Trend (Area in ha)						Percent in TOF
	Stable	Increasing	Decreasing	Not Applicable	Not Known	Total	
Employment (salary)	1308541	106043	371810	61939	0	1848334	8.1%
Hunting	406514	33210	21964	0	9664	471352	2.1%
Grazing	1083803	281581	1127995	82673	306181	2882234	12.6%
Exploration of natural res.	0	0	0	0	82761	82761	0.4%
Conservation	13618	0	0	0	0	13618	0.1%
Agricultural functions	1687556	0	102178	87066	59128	1935927	8.5%
Water and soil conservation	1925736	0	32243	292036	0	2250016	9.9%
Recreation	72570	0	0	10367	8434	91371	0.4%
Religious/spiritual	21964	0	0	22931	0	44895	0.2%

Demand for Employment (salary) in TOF

Demand for Hunting in TOF

Demand for Grazing in TOF

Demand for Agricultural functions in TOF

Demand for Water and Soil Conservation in TOF

Demand for Recreation in TOF
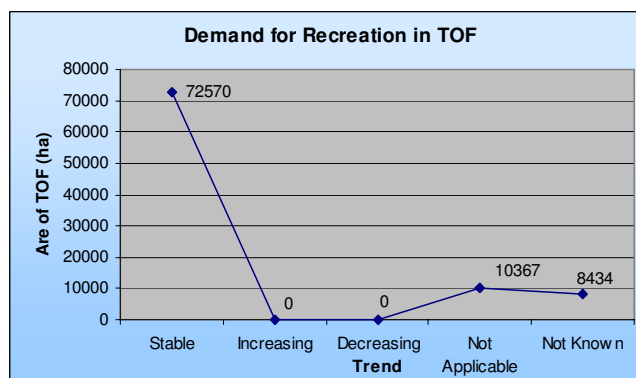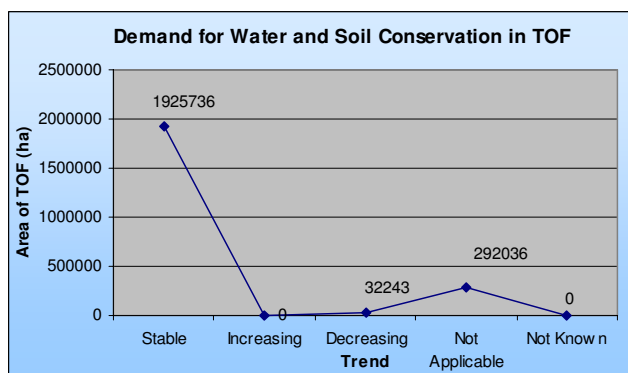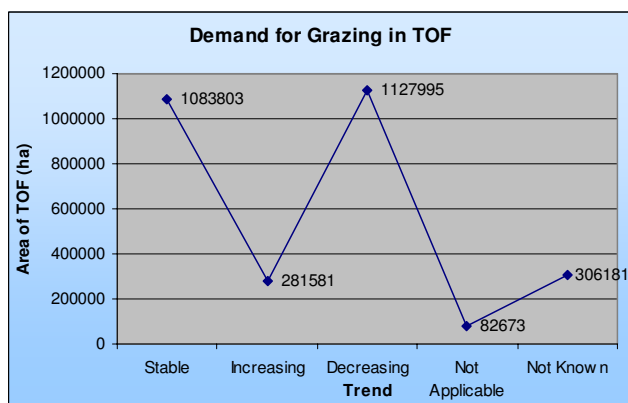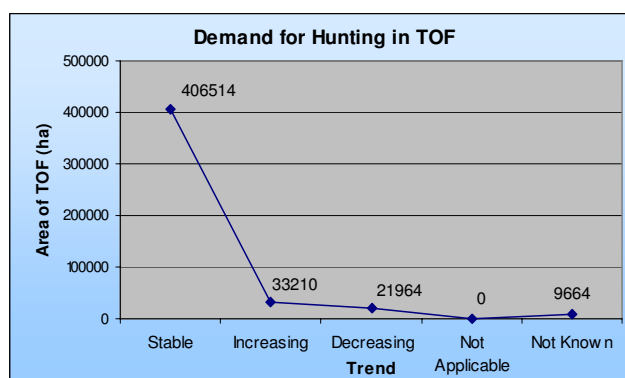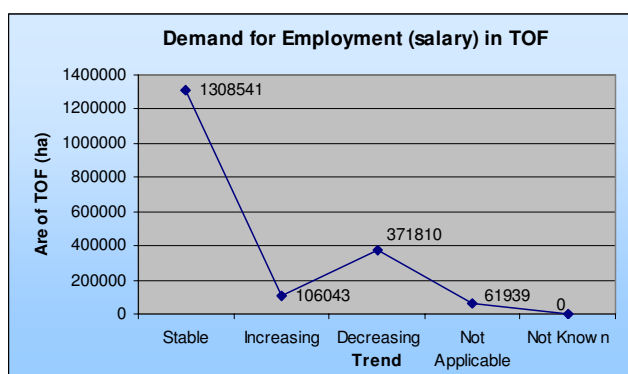
10.6.5 <u>Supply Trend for Wood and Non-wood Products Provided by Forest and Trees Outside Forest</u>

10.6.5.1 <u>Supply trend for wood and non-wood products provided by the Forest</u>

Table 8i shows that there is an increasing supply of wood, fuel-wood, utensils & handicraft materials, construction materials, and living animals. At the same time, the supply of food, fodder, and medicinal plants is decreasing.
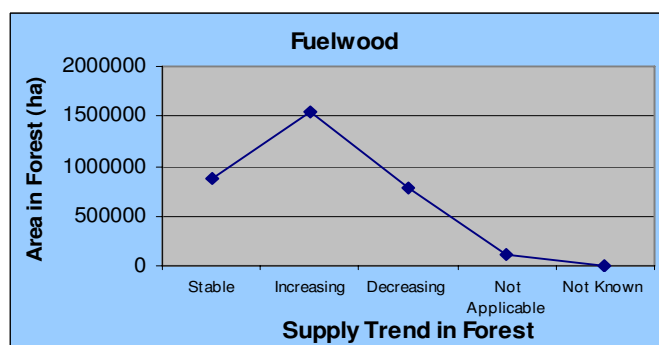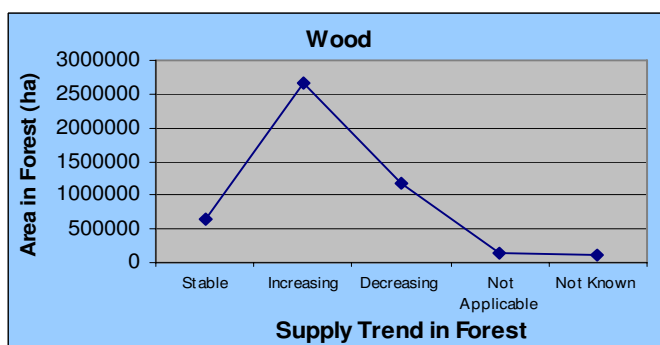
Table 8i: Supply trend for wood and non-wood products provided by the Forest

Products	Supply Trend (Area in ha)						Percent in Forest
	Stable	Increasing	Decreasing	Not Applicable	Not Known	Total	
Wood	636,297	2,671,519	1,169,591	149759	103205	4730372	66.0%
Fuel wood	878,557	1,549,289	786,056	118151	8584	3340636	46.6%
Food	124,109	306,485	415,547	15047	12926	874113	12.2%
Fodder	6,059	2,929	92,097	0	2525	103609	1.4%
Medicines	0	0	100,883	0	0	100883	1.4%
Essential oils	0	0	30,295	0	0	30295	0.4%
Tannins	28,881	0	0	11108	0	39989	0.6%
Spices, herbs	0	126,229	25,246	0	0	151475	2.1%
Exudates	198,130	25,246	44,433	0	8079	275887	3.9%
Utensils, handicrafts	30,093	352,332	343,445	0	0	725870	10.1%
Construction materials	66,245	301,436	94,925	0	5453	483206	6.7%
Ornamentals	0	75,738	25,246	0	0	100984	1.4%
Seeds	0	0	13,128	0	0	13128	0.2%
Bio fertilizers, insecticides	0	0	,0	0	0	0	0.0%
Living animals	39,687	165,815	36,354	0	0	241856	3.4%
Bush meat	0	0	0	0	0	0	0.0%
Honey, beeswax	191,061	101,286	61,600	0	0	353947	4.9%
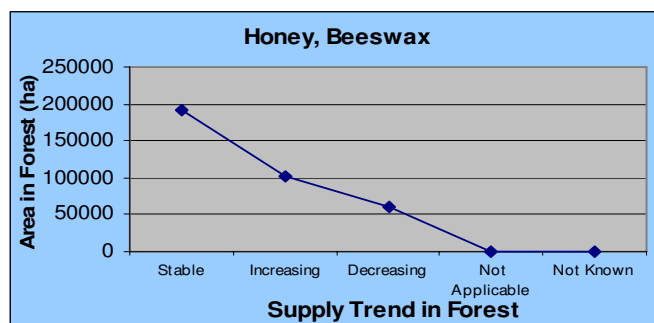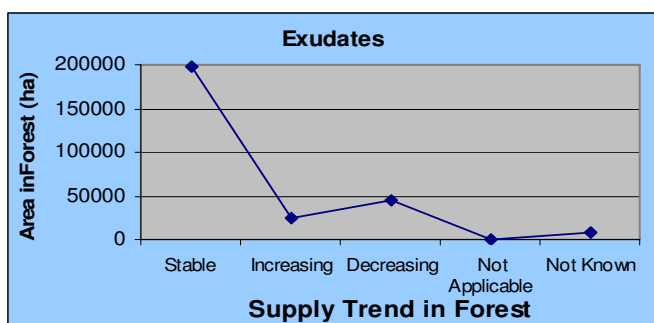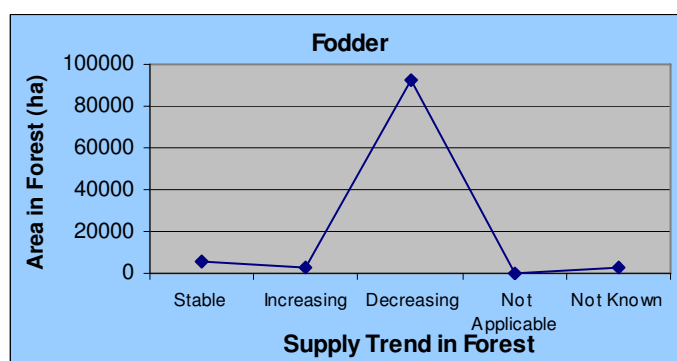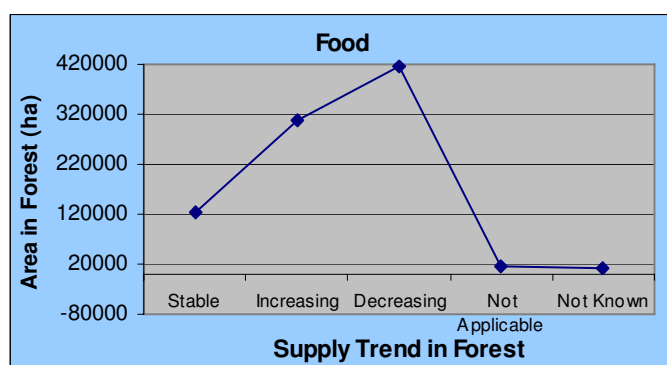
10.6.5.2 Supply trend for wood and non-wood products provided by TOF

Among the wood and non-wood products provided by the Forest with stable supply are food, essential oils, exudates, ornamental plants, bio-fertilizer & insecticide materials, living animals, and honey/beeswax. Those products with increasing supply are fuel-wood and construction materials. At the same time, those products with decreasing supply are fodder, medicinal plants, utensils and handicraft materials, and bush meat.

In TOF, about 12.6 million ha or 55.2% is the source for food and 6.0 million ha or 26.2% is the source for fuel-wood. There is no record for tannin, spices/herbs, and seed source.

Table 8j: Supply trend for wood and non-wood products provided by TOF

Products	Supply Trend (Area in ha)						Percent in TOF
	Stable	Increasing	Decreasing	Not Applicable	Not Known	Total	
Wood	529,689	1,347,725	1,099,705	43665	252764	3273549	14.3%
Fuel wood	1,367,142	1,814,070	2,183,157	317691	296869	5978927	26.2%
Food	5,073,122	2,325,573	4,807,443	170442	224299	12600879	55.2%
Fodder	106,746	404,405	412,752	63521	141098	1128522	4.9%
Medicines	21,964	32,595	273,674	21964	11421	361619	1.6%
Essential oils	476,712	353,624	368,384	0	54911	1253630	5.5%
Tannins	0	0	0	0	0	0	0.0%
Spices, herbs	0	0	0	0	0	0	0.0%
Exudates	62,378	0	2,987	4393	0	69758	0.3%
Utensils, handicrafts	29,783	38,657	103,232	21349	0	193022	0.8%
Construction materials	807,317	878,833	603,577	96730	96379	2482837	10.9%
Ornamentals	53,593	5,271	33,825	12212	0	104901	0.5%
Seeds	0	0	0	0	0	0	0.0%
Bio fertilizers, insecticides	56,404	0	0	0	0	56404	0.2%
Living animals	502,190	47,091	156,122	0	1054	706457	3.1%
Bush meat	82,410	12,388	87,857	0	0	182655	0.8%
Honey, beeswax	43,928	0	30,750	0	0	74678	0.3%

Food
Area in TOF (ha) vs Supply Trend in TOF

Other Non-wood Plant Products
Area in TOF (ha) vs Supply Trend in TOF

Construction Materials
Area in TOF (ha) vs Supply Trend in TOF

Wood
Area in TOF (ha) vs Supply Trend in TOF

Fuelwood
Area in TOF (ha) vs Supply Trend in TOF

Fodder
Area in TOF (ha) vs Supply Trend in TOF
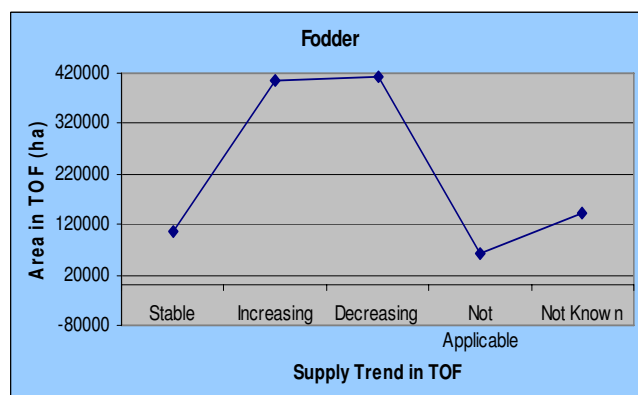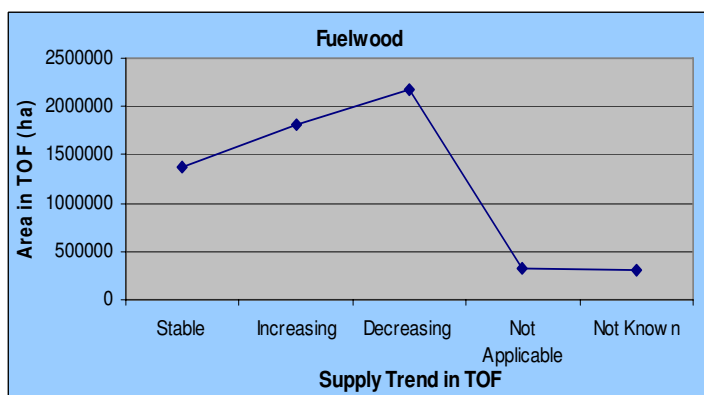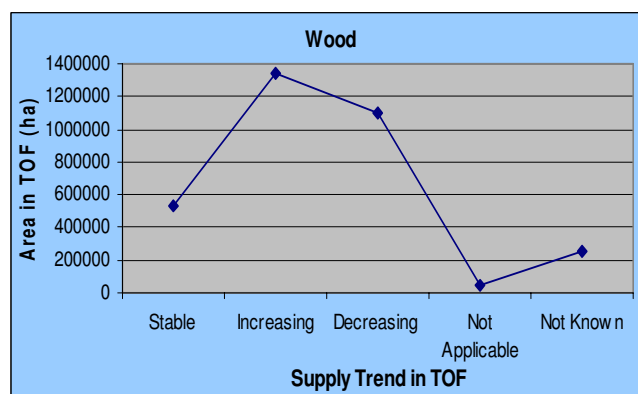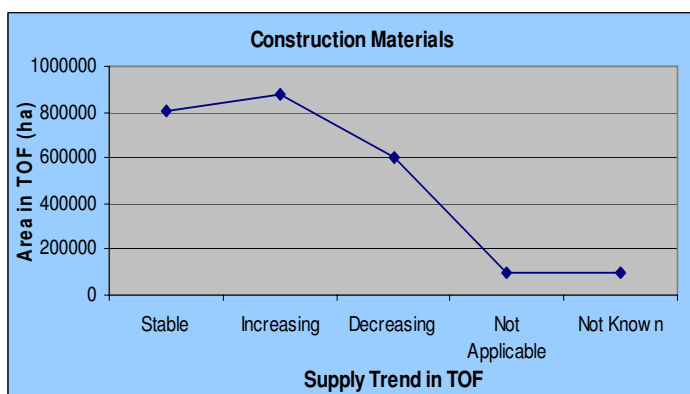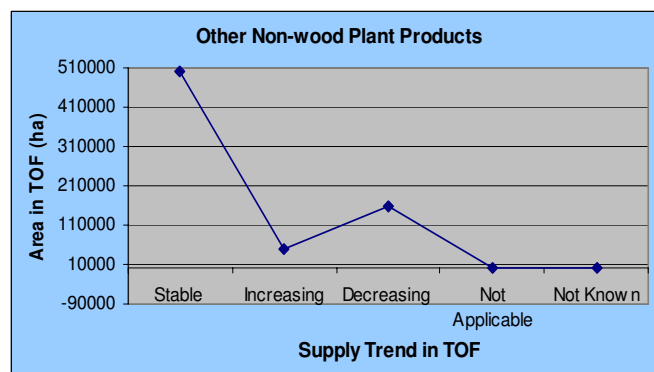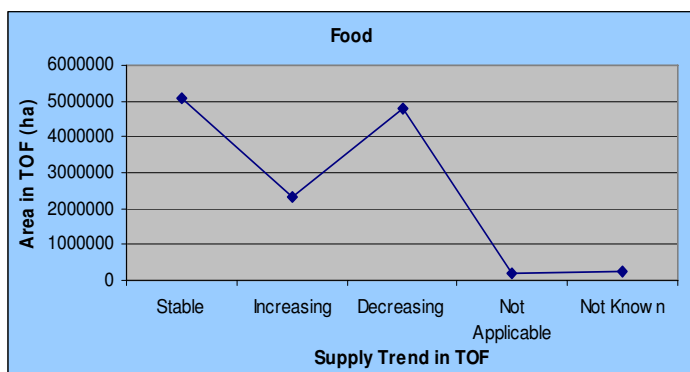
10.6.6 Supply Trend for Social, Economic and Environmental Services Provided by the Forest and Trees Outside Forest

10.6.6.1 Supply Trend for Social, Economic and Environmental Services Provided by the Forest

In Forest, the services/activities with increasing supply trend are hunting, grazing and employment. The remaining services have no clear supply trend.

Table 8k: Supply trend for social, economic and environmental services provided by the Forest

Services	Supply Trend (Area in ha)						Percent in Forest
	Stable	Increasing	Decreasing	Not Applicable	Not Known	Total	
Employment (salary)	25,246	426,151	0	0	1919	453315	6.3%
Hunting	50,492	1,027,507	229,940	0	0	1307939	18.3%
Grazing	9,997	22,721	0	0	0	32719	0.5%
Exploration of natural res.	0	0	0	30,093	0	30093	0.4%
Conservation	0	0	75,738	342,334	0	418072	5.8%
Agricultural functions	3,635	0	30,093	127,845	12623	174197	2.4%
Water & soil conservation	22,620	57,157	45,039	3,832,325	2020	3959160	55.3%
Recreation	25,246	25,246	100,984	201,967	0	353442	4.9%
Religious/spiritual	0	0	0	0	0	0	0.0%
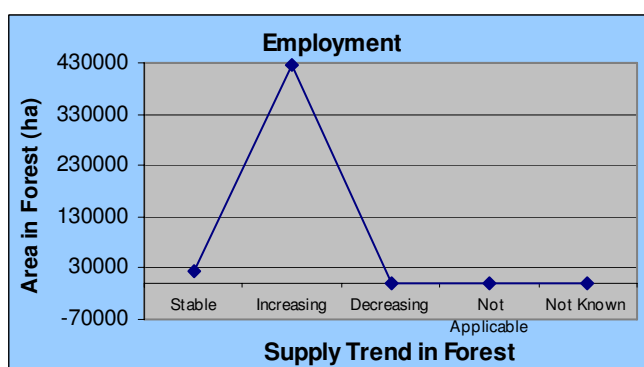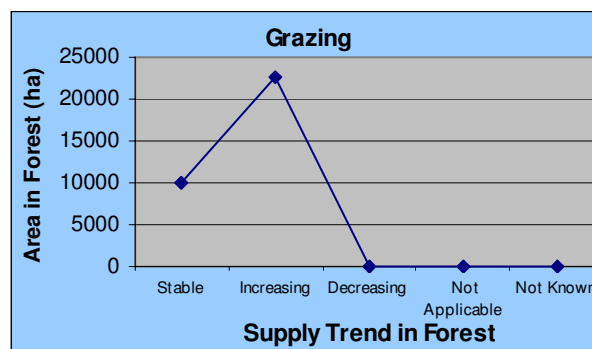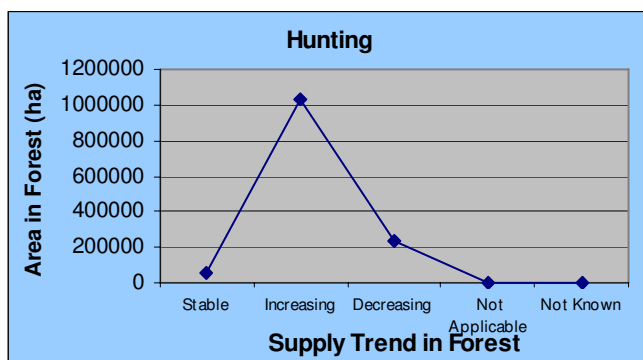
10.6.6.2 Supply Trend for Social, Economic and Environmental Services Provided by Trees Outside Forest

In TOF, grazing and water & soil conservation are the services that provide the highest percentage of area coverage at 12.6% and 9.9%, respectively. Grazing has a decreasing supply trend; however, water & soil conservation has no clear supply trend. Employment and recreation, which cover 8.1% and 0.4%, respectively are the only services that have stable supply trend in TOF.

Table 8l: Supply trend for social, economic and environmental services provided by TOF

Services	Supply Trend (Area in ha)						Percent in TOF
	Stable	Increasing	Decreasing	Not Applicable	Not Known	Total	
Employment (salary)	717,967	376,730	613,066	74678	65893	1848334	8.1%
Hunting	106,131	333,593	21,964	0	9664	471352	2.1%
Grazing	215,249	856,517	1,410,104	82673	317691	2882234	12.6%
Exploration of natural res.	0	0	0	0	82761	82761	0.4%
Conservation	0	0	0	13618	0	13618	0.1%
Agricultural functions	186,520	33,122	103,408	1556385	56492	1935927	8.5%
Water & soil conservation	23,721	2,636	1,054	2222604	0	2250016	9.9%
Recreation	50,606	21,964	0	10367	8434	91371	0.4%
Religious/spiritual	21,964	0	0	22931	0	44895	0.2%
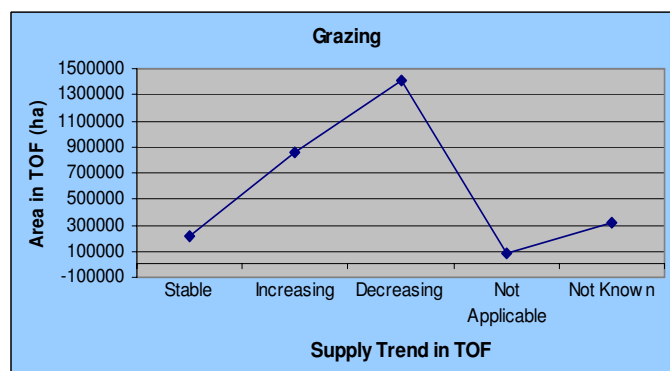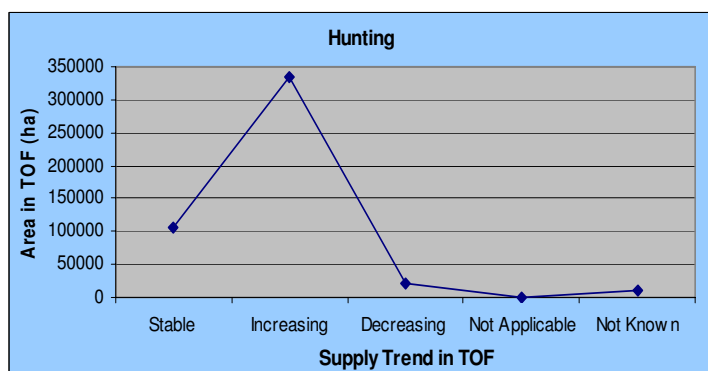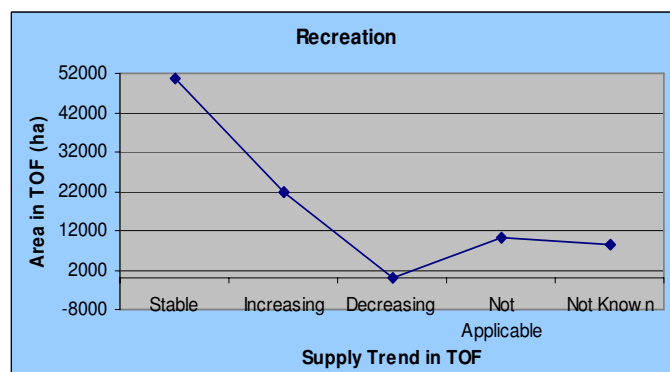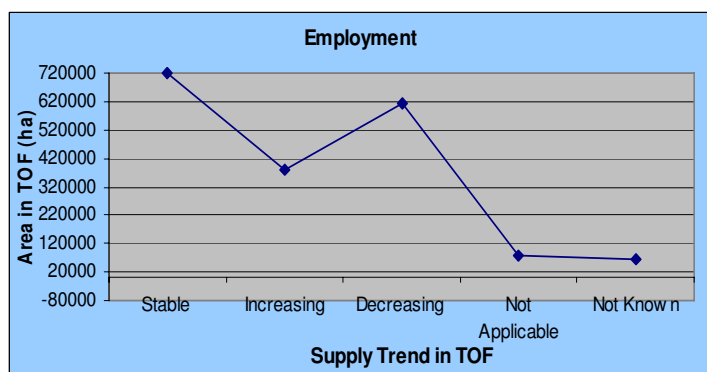
10.6.7 Activity Trend for Wood and Non-wood Products in Forest and Trees Outside Forest

10.6.7.1 Activity Trend for Wood and Non-Wood Products in Forest

NFA results show that timber extraction is decreasing in Forest. This may be attributed to the reduction in the number of logging companies due to the DENR policy on non-renewal of expired timber license agreements (TLA) as well as in the implementation of selective logging ban in the country. At the

same time, the extraction of fuel wood decreased resulting from its substitution by other oil products such as the liquefied petroleum gas (LPG).

Table 8m: Activity trend for wood and non-wood products provided by Forest

Product/Service	Activity Trend (Area in ha)						Percent in Forest
	Stable	Increasing	Decreasing	Not Applicable	Not Known	Total	
Timber	1,001,757	1,083,351	1,580,594	627,209	437461	4730372	66.0%
Firewood	818,472	1,083,856	1,126,269	119,766	192273	3340636	46.6%
Food	445,741	322,844	77,555	0	27972	874113	12.2%
Fodder	51,603	49,482	0	2,525	0	103609	1.4%
Medical products	86,341	0	14,542	0	0	100883	1.4%
Oils, soap, cosmetics	22,721	0	0	0	7574	30295	0.4%
Tannins	0	28,881	0	11,108	0	39989	0.6%
Herbs and spices	25,246	126,229	0	0	0	151475	2.1%
Resin	148,143	119,665	0	0	8079	275887	3.9%
Handicraft	363,642	174,702	162,281	25,246	0	725870	10.1%
Non-wood constructions	105,730	225,395	146,628	0	5453	483206	6.7%
Ornamentals	0	100,984	0	0	0	100984	1.4%
Seeds	13,128	0	0	0	0	13128	0.2%
Fertilizers, biological pesticides	0	0	0	0	0	0	0.0%
Other Non-wood forest products	25,246	151,475	302,951	0	0	479672	6.7%
Wild animals	61,600	166,926	13,330	0	0	241856	3.4%
Bush meat	0	0	0	0	0	0	0.0%
Honey, beeswax	61,600	260,033	32,315	0	0	353947	4.9%

Honey, Beeswax

Non-wood Construction Materials

Wood/Timber
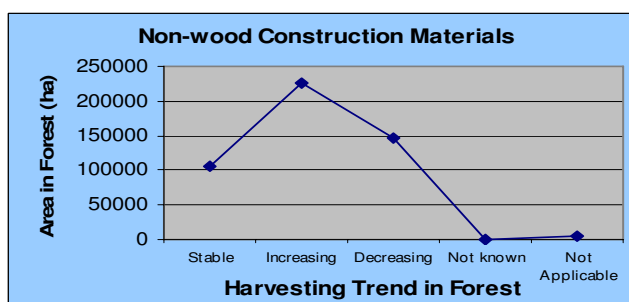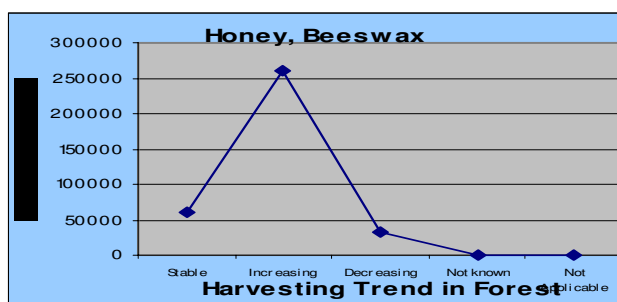
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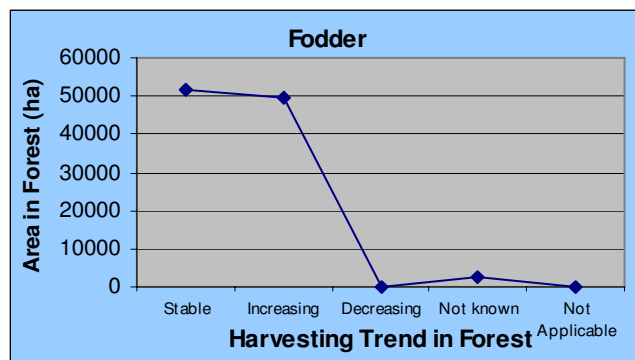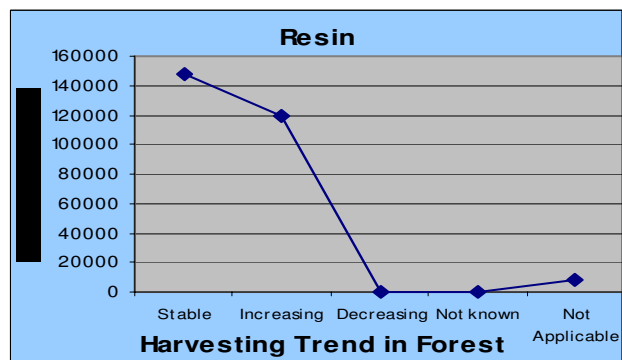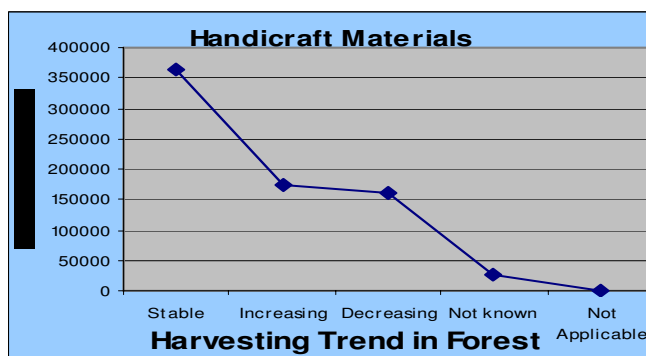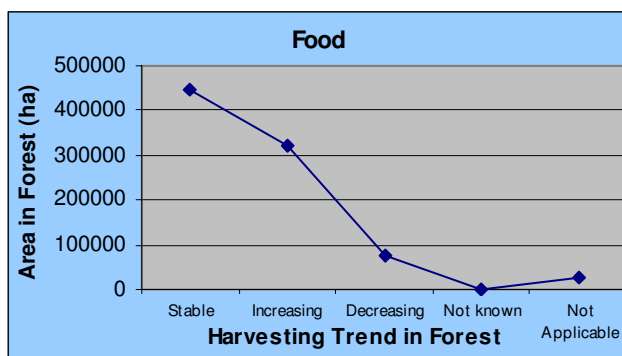
10.6.7.2 Activity trend for wood and non-wood products provided by TOF
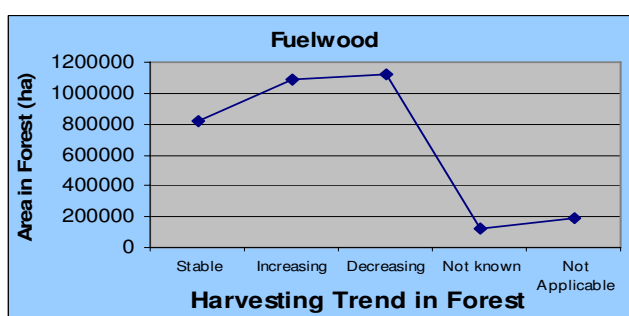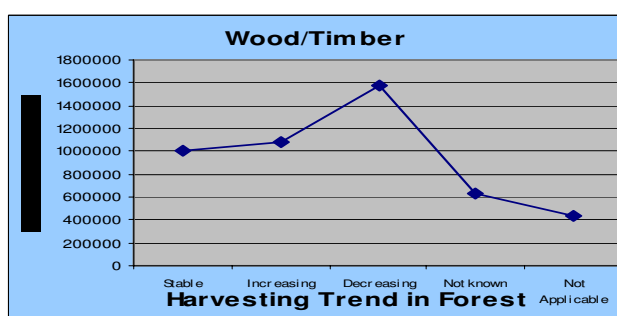
In TOF, the harvesting trend for wood/timber; fuel-wood; food; oil, soap, & cosmetics materials; handicraft materials; medicinal plants; and collection of wild animals is stable. At the same time, other non-wood forest products and bush meat have increasing trend. For fodder and non-wood construction materials, the trend is decreasing.

Table 8n: Activity trend for wood and non-wood products provided by TOF

Products	Activity Trend (Area in ha)						Percent in TOF
	Stable	Increasing	Decreasing	Not Applicable	Not Known	Total	
Wood/Timber	1,131,421	542,780	483,916	503,244	612187	3,273,549	14.3%
Firewood	3,016,392	1,123,075	1,112,796	237,653	510976	6,000,891	26.3%
Food	6,656,919	3,687,179	1,702,579	193,022	361180	12,600,879	55.2%
Fodder	306,621	123,439	402,560	86,715	209187	1,128,522	4.9%
Medical products	288,698	0	25,479	21,964	25479	361,619	1.6%
Oils, soap, cosmetics	665,516	287,907	243,100	0	57107	1,253,630	5.5%
Tannins	0	0	0	0	0	0	0.0%
Herbs and spices	0	0	0	0	0	0	0.0%
Resin	60,973	4,393	0	4,393	0	69,758	0.3%
Handicraft	104,725	29,783	22,843	21,349	14321	193,022	0.8%
Non-wood construction	540,144	693,894	1,018,613	103,056	127129	2,482,837	10.9%
Ornamentals	39,096	19,329	5,271	41,205	0	104,901	0.5%
Seeds	0	0	0	0	0	,0	0.0%
Fertilizers, biological pesticides	27,148	7,292	21,964	0	0	56,404	0.2%
Other non-wood forest products	235,808	420,044	39,623	0	10982	706,457	3.1%
Wild animals	136,178	46,476	0	0	0	182,655	0.8%
Bush meat	21,964	52,714	0	0	0	74,678	0.3%
Honey, beeswax	7,468	0	0	0	6150	13,618	0.1%

Food

Fuelwood

Wood/Timber

Handicraft Materials

Other Non-wood Forest Products

Bush Meat

Fodder

Non-wood Construction Materials
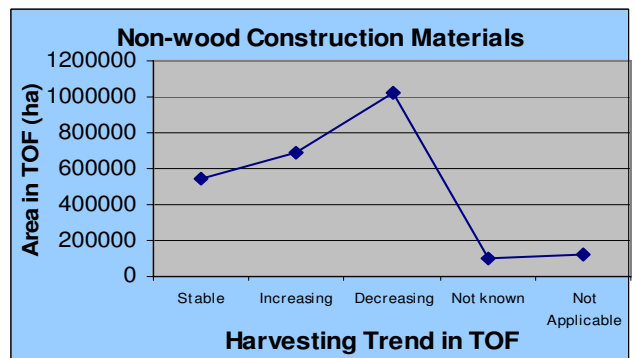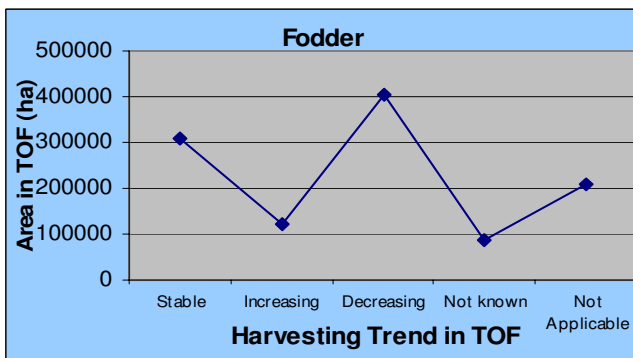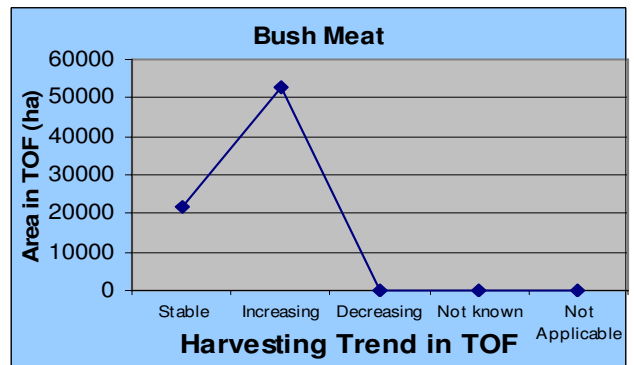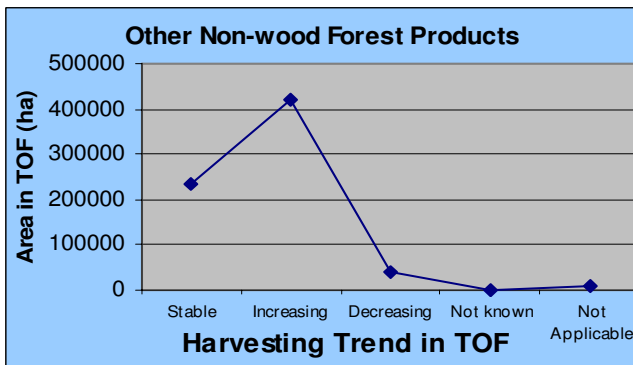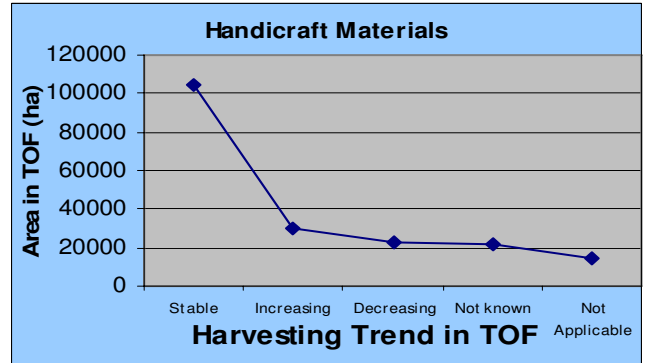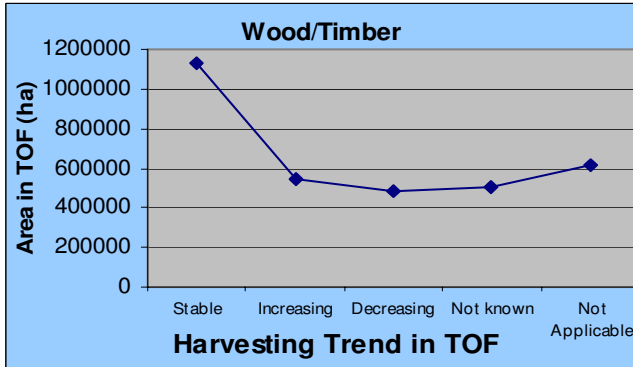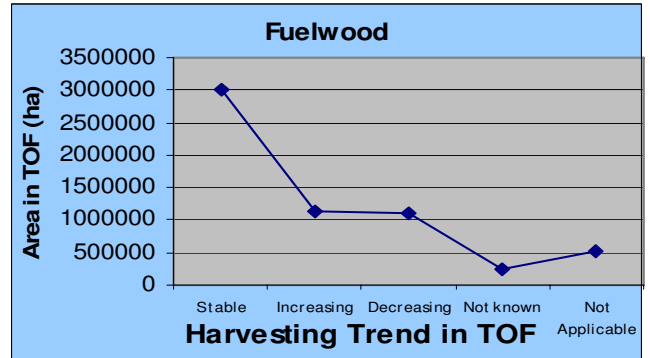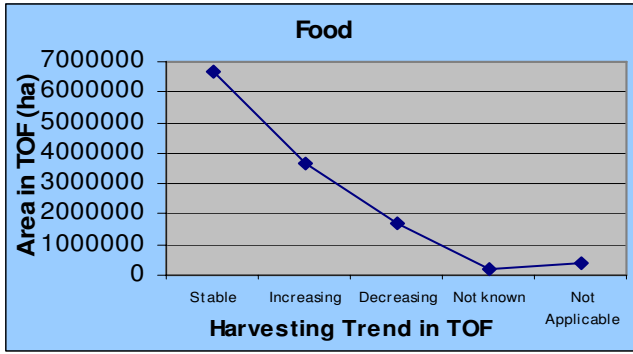
10.6.8. <u>Activity Trend for Social, Economic and Environmental Services Provided by the Forest and Trees Outside Forest</u>

10.6.8.1. <u>Activity trend for social, economic and environmental services provided by the Forest</u>

Table 8o shows that employment generation in forest and forestry-related activities has a decreasing trend. Statistics show that only about 453,000 ha of the forest have provided employment during the period of data collection. Hunting activities also have decreasing trend. This maybe attributed to the dwindling wildlife faunal resources resulting from the disturbance of their natural habitat.

Table 8o: Activity trend for social, economic and environmental services provided by the Forest

Product/Service	Activity Trend (Area in ha)						Percent in Forest
	Stable	Increasing	Decreasing	Not Applicable	Not Known	Total	
Source for employment	90,885	0	360,511	0	1,919	453,315	6.3%
Hunting (sport)	154,202	387,777	765,960	0	0	1,307,939	18.3%
Grazing	0	9,997	22,721	0	0	32,719	0.5%
Scientific studies	0	0	0	30,093	0	30,093	0.4%
Conservation	50,492	0	0	367,580	0	418,072	5.8%
Recreation and tourism	100,984	0	0	201,967	50,492	353,442	4.9%
Religious, spiritual	0	0	0	0	0	0	0.0%
Soil & water conservation	52,612	9,089	36,455	3,819,298	41,706	3,959,160	55.3%
Wind-breaking curtains	32,416	1,313	0	130,370	10,098	174,197	2.4%
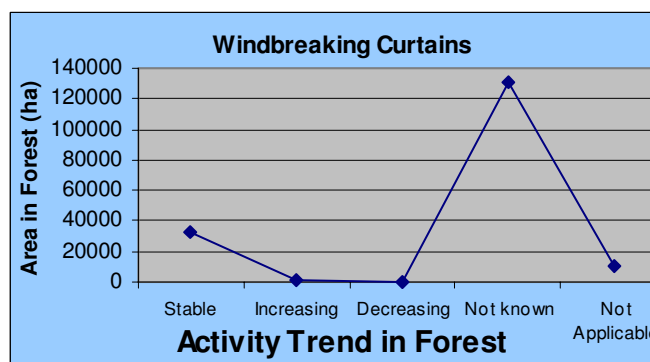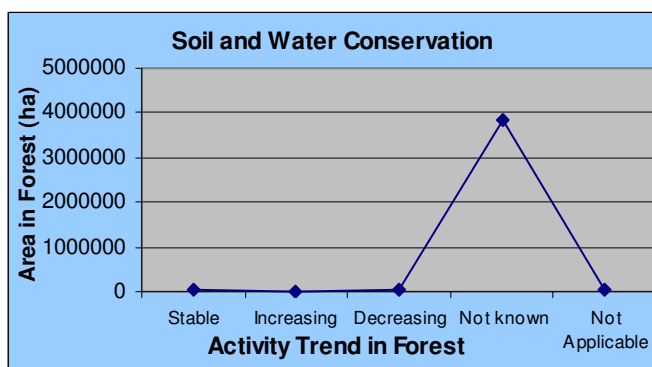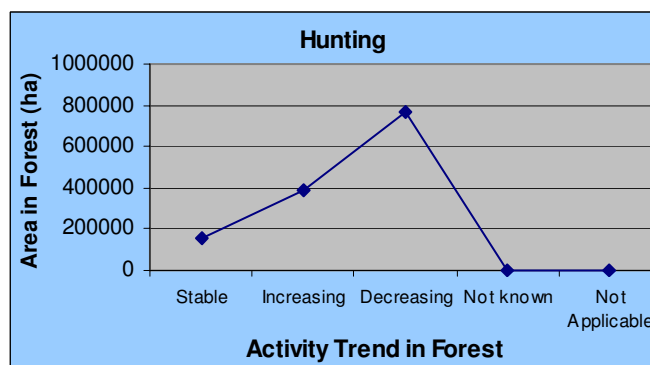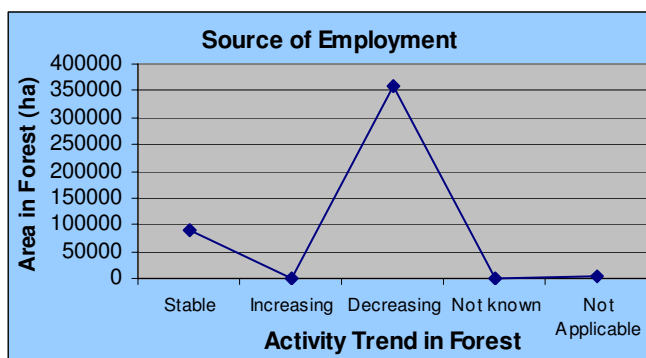
10.6.8.2 <u>Activity trend for social, economic and environmental services provided by Trees Outside Forest</u>

In TOF, grazing and employment have stable activity trend. Hunting activity, on the other hand, is decreasing. The remaining services have no clear activity trend.

Table 8p: Activity trend for social, economic and environmental services provided by the Forest

Services	Activity Trend (Area in ha)						Percent in TOF
	Stable	Increasing	Decreasing	Not Applicable	Not Known	Total	
Source for employment	784,650	536,806	379,805	81,180	65893	1848334	8.1%
Hunting (sport)	21,964	189,771	237,829	12,124	9664	471352	2.1%
Grazing	1,254,773	435,331	686,163	106,395	399573	2882234	12.6%
Scientific studies	0	0	0	61,676	21086	82761	0.4%
Conservation	0	0	0	13,618	0	13618	0.1%
Recreation and tourism	0	966	0	56,492	33913	91371	0.4%
Religious, spiritual	0	21,964	0	22,931	0	44895	0.2%
Soil & water conservation	23,019	18,011	0	2,193,524	15463	2250016	9.9%
Wind-breaking curtains	161,042	84,079	26,796	1,607,518	56492	1935927	8.5%

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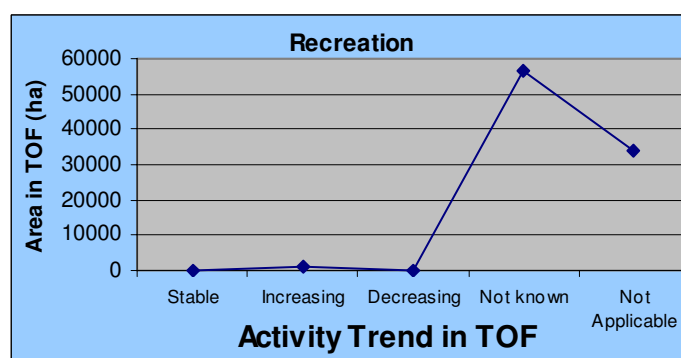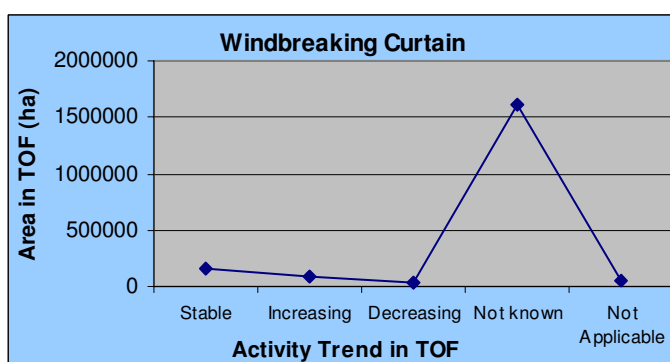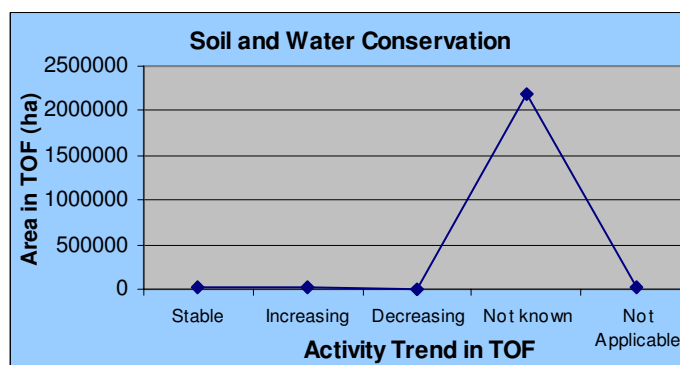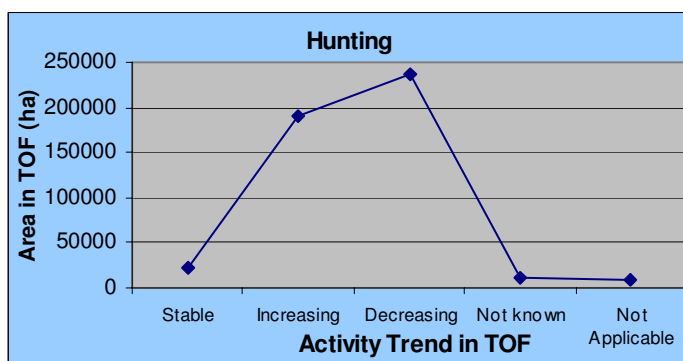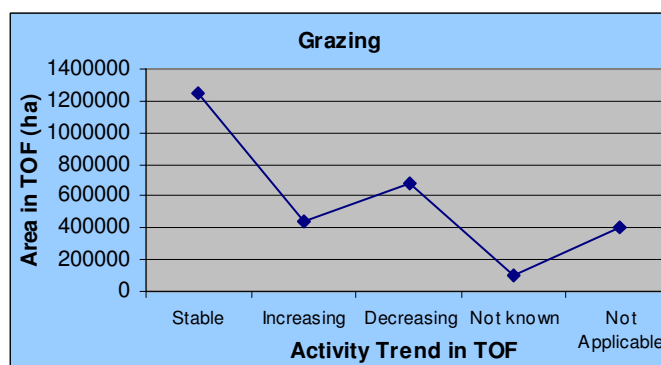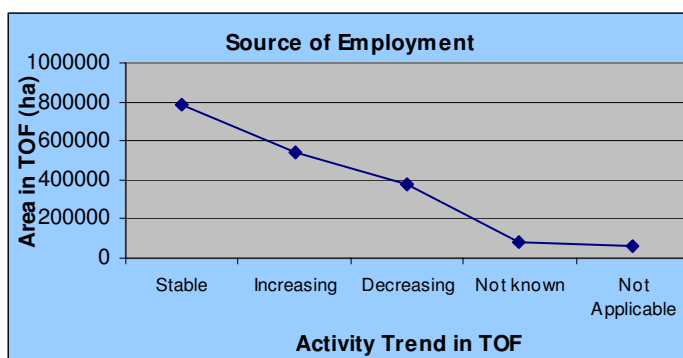
10.6.9 <u>Season extraction of wood and non-wood products and services in Forest</u>

10.6.9.1 <u>Season extraction of wood and non-wood products in Forest</u>

In Forest, timber, fuelwood, and construction materials are generally collected during the dry season. Although timber and fuelwood are also collected during the rainy season, it is only on occasional basis. Food and resin, on the other hand, are collected whole year round.

Table 8q: Season extraction of products in Forests

Product	Dry Season	Rainy season	All the year	Not applicable
Timber	48.2%	1.3%	35.7%	9.0%
Fuelwood	47.8%	1.9%	38.8%	10.4%
Food	8.9%	4.8%	63.6%	0.0%
Resin	14.0%	0.0%	81.6%	0.0%
Non-wood constructions	53.8%	0.0%	46.2%	0.0%
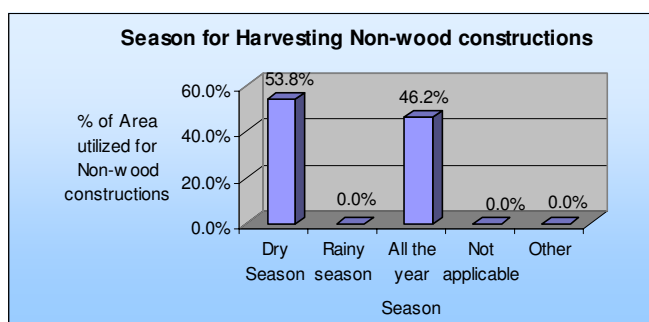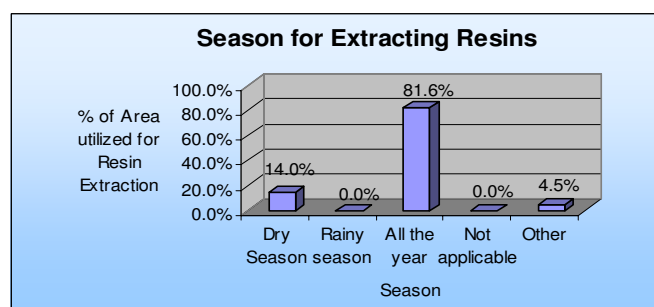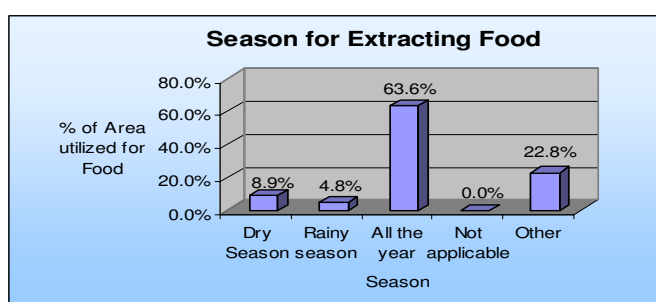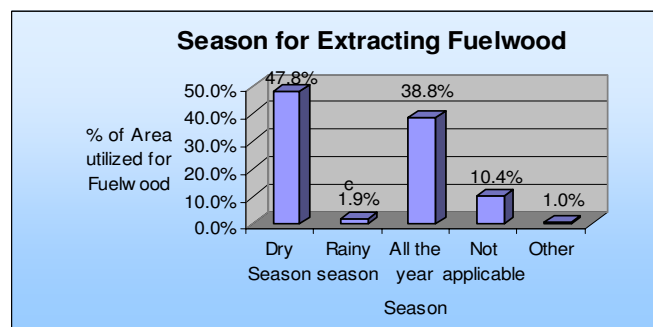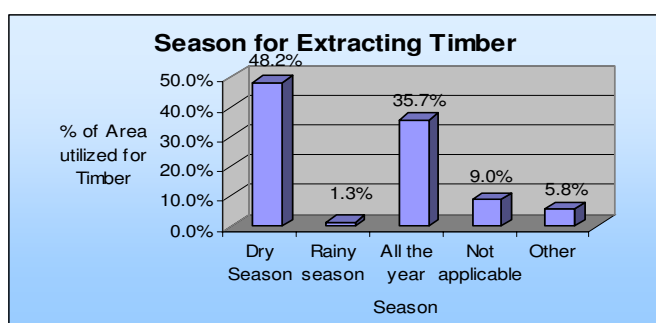
10.6.9.2 Season extraction of services in Forest

Grazing is generally carried out during the dry season while hunting and soil & water conservation give beneficial services all through out the year.

Table 8r: Season extraction of services in Forest

Services	Dry Season	Rainy season	All the year	Not applicable
Hunting (sport)	0.0%	0.0%	100.0%	0.0%
Grazing	69.4%	0.0%	30.6%	0.0%
Scientific studies	0.0%	0.0%	0.0%	100.0%
Soil and water conservation	0.0%	2.2%	4.7%	93.0%
Wind-breaking curtains	23.5%	0.0%	0.0%	76.5%
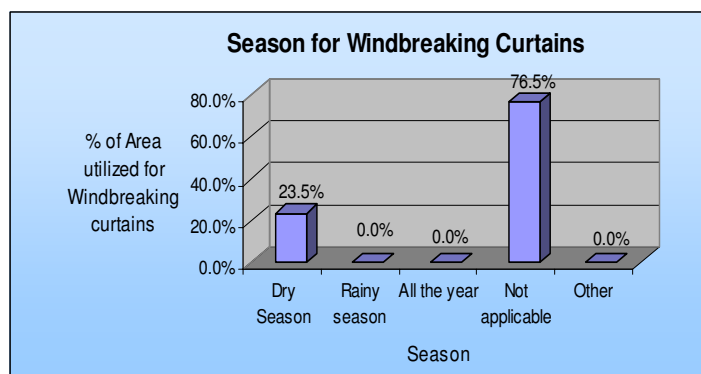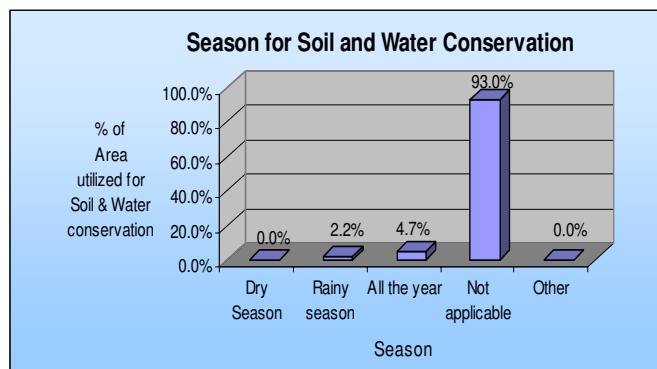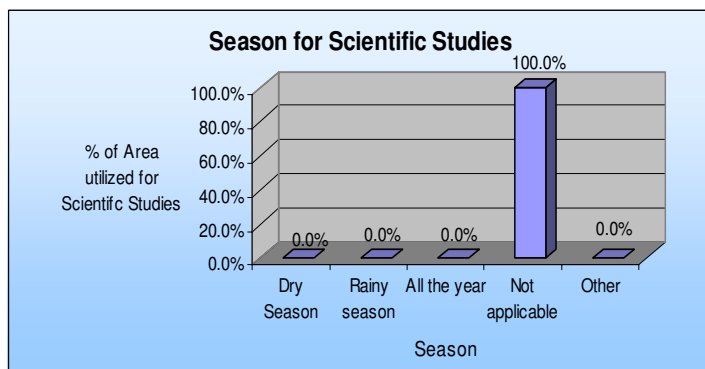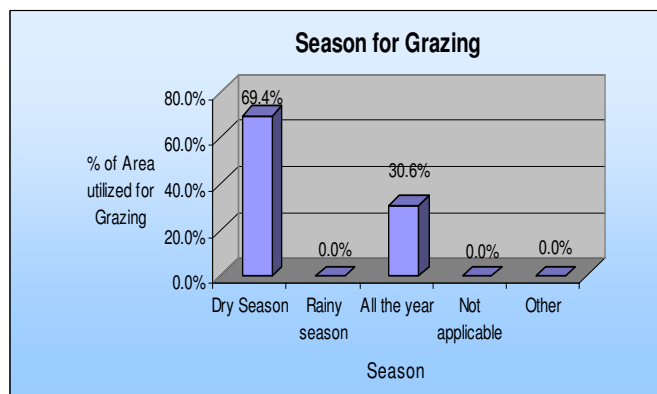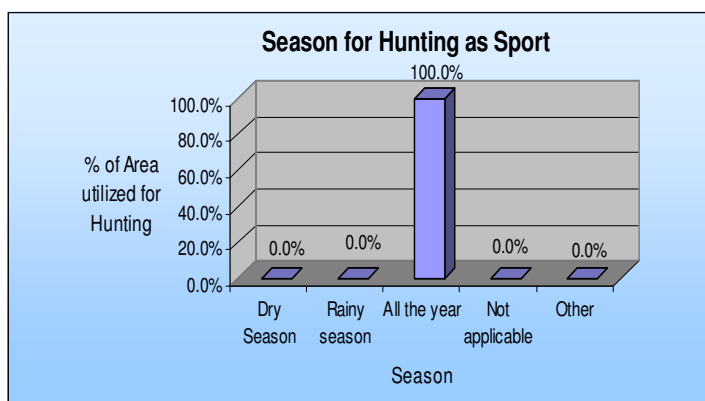
10.6.10 Season extraction of wood and non-wood products and services in Trees Outside Forest

10.6.10.1 Season extraction of wood and non-wood products in TOF

In TOF, all products provided by the forest are generally collected all through out the year except for non-wood construction materials which is collected most of the time during the dry season.

Table 8s: Season extraction of wood and non-wood products in TOF

Products	Dry Season	Rainy season	All the year	Not applicable	Other
Food	30.9%	5.7%	58.9%	1.6%	2.8%
Fuelwood	39.5%	0.0%	50.0%	6.3%	4.2%
Timber	33.4%	0.0%	55.3%	10.5%	0.8%
Oils, soap, cosmetics	18.2%	0.0%	81.8%	0.0%	0.0%
Non-wood constructions	60.9%	2.9%	34.4%	1.8%	0.0%
Other Non-wood forest products	14.5%	1.5%	82.8%	1.1%	0.0%
Fodder	35.7%	0.0%	25.4%	38.9%	0.0%
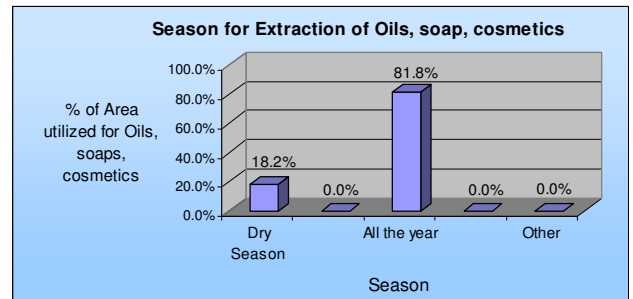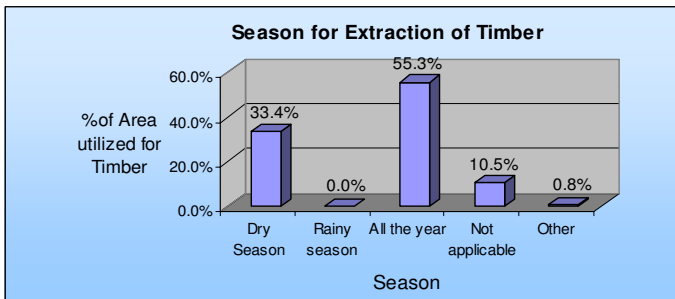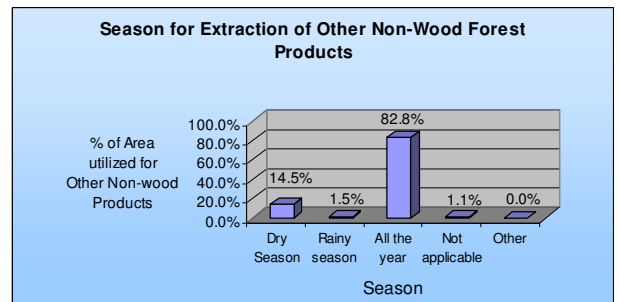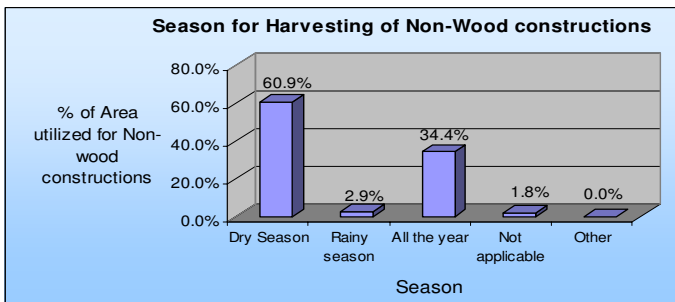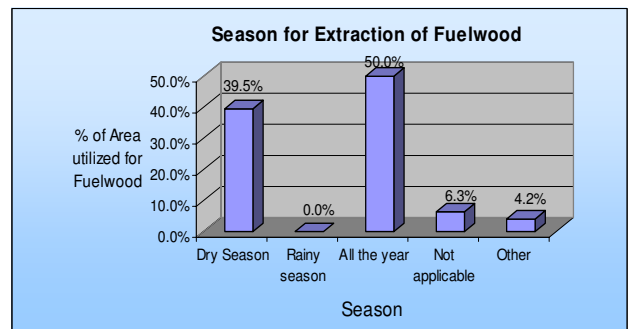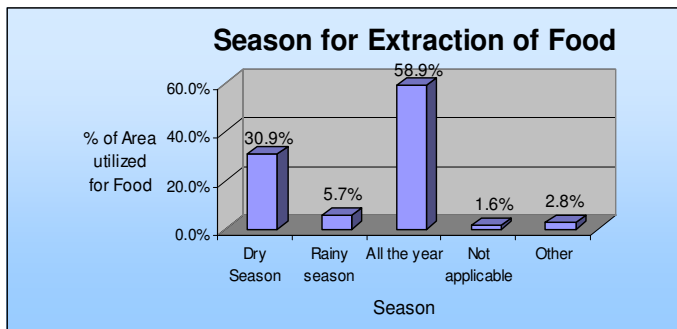
10.6.10.2 <u>Season extraction of services in TOF</u>

The services provided by trees outside forest are generally beneficial all through out the year except for soil and water conservation which has no clear extraction pattern.

Table 8.t: Season extraction of services in TOF

Services	Dry Season	Rainy season	All the year	Not applicable	Other
Grazing	5.1%	3.8%	88.4%	1.8%	1.0%
Soil and water conservation	0.0%	0.0%	3.2%	96.8%	0.0%
Wind-breaking curtains	2.4%	7.8%	31.5%	58.3%	0.0%
Source for employment (paid)	0.0%	0.0%	74.0%	26.0%	0.0%
Recreation & Tourism	0.0%	0.0%	72.0%	28.0%	0.0%
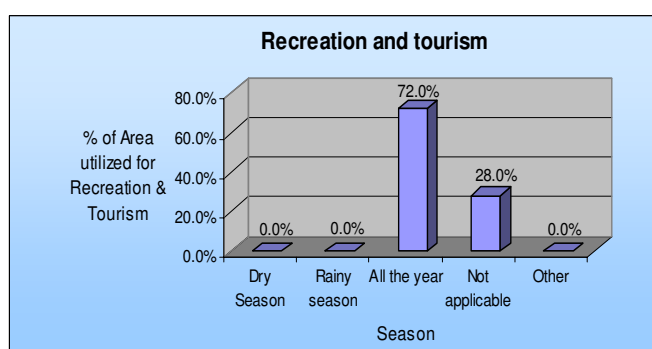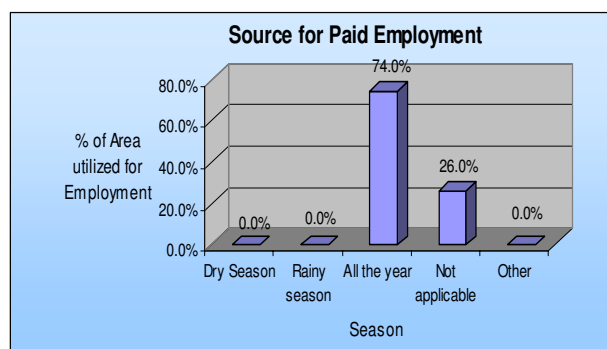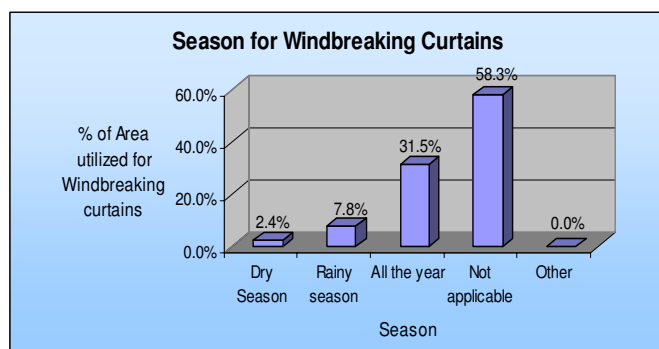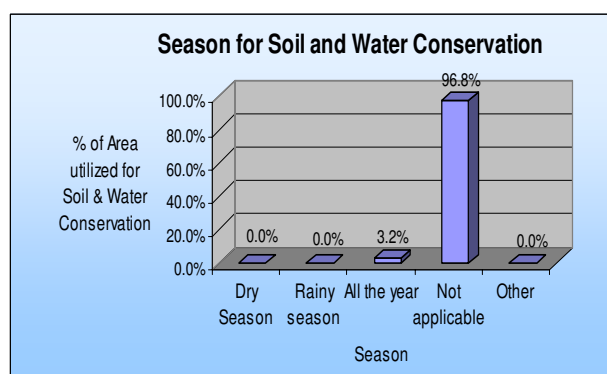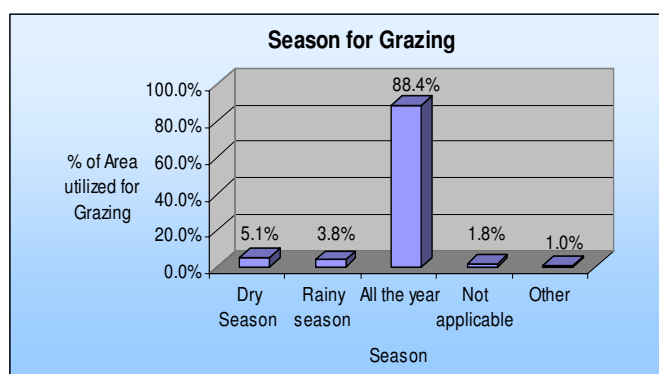
10.6.11 Last extraction of wood and non-wood products and service in Forest

Data shows that in most of the areas visited, timber extraction was carried out more than a year ago whereas food and fuelwood extraction were done mostly in the previous month.

10.6.11.1 Last extraction of wood and non-wood products in Forest

Table 8u: Last extraction of wood and non-wood products in Forest

Products	Yesterday	Last week	Last month	Last year	More than a year ago	Not known	Not applicable	Other
Timber	0.0%	3.9%	15.7%	6.6%	44.1%	13.8%	15.9%	0.0%
Firewood	3.0%	7.9%	34.0%	15.9%	1.2%	23.5%	14.5%	0.0%
Food	0.0%	19.9%	30.1%	19.0%	0.0%	8.1%	0.0%	22.8%
Resin	0.0%	0.0%	0.0%	85.2%	10.3%	4.5%	0.0%	0.0%
Non-wood constructions	0.0%	22.7%	4.2%	9.4%	7.4%	56.2%	0.0%	0.0%

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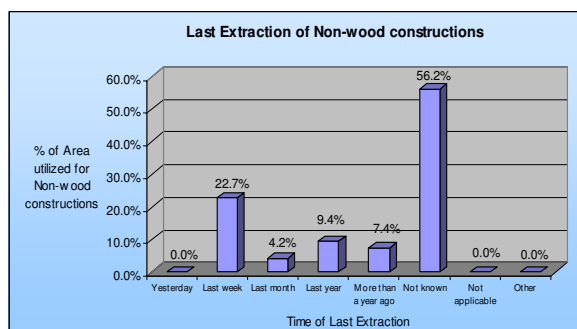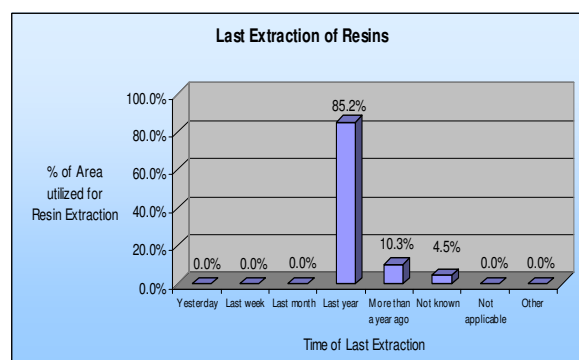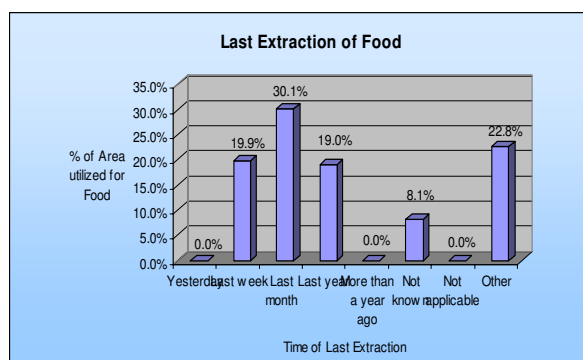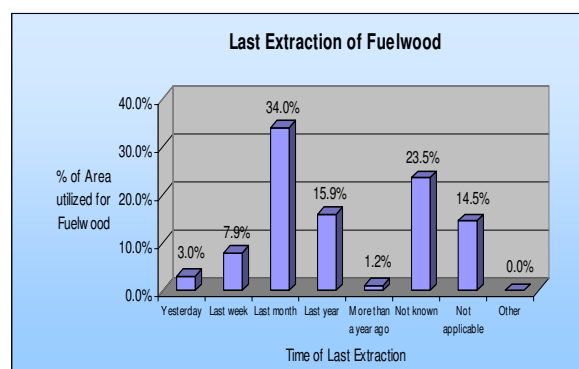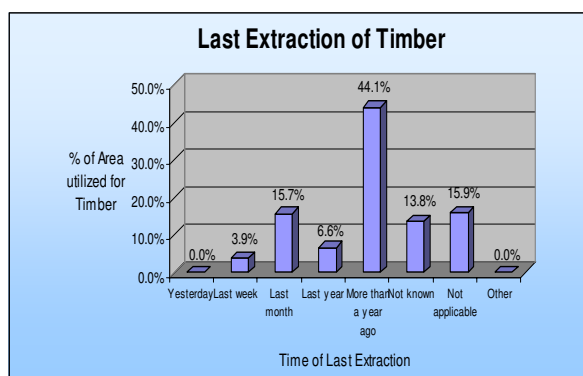
10.6.11.2   Last extraction of services provided by the Forests

Temporal information on the last extraction of most of the services provided by the forest is difficult to capture as most of these services are intangible and cannot be quantified, except for grazing which was mostly carried out in the previous month.

Table 8.v: Last extraction of services provided by the Forest

Services	Yesterday	Last week	Last month	Last year	More than a year ago	Not known	Not applicable
Soil and water conservation	1.5%	0.0%	5.1%	0.0%	0.0%	0.4%	93.0%
Grazing	0.0%	0.0%	69.4%	0.0%	0.0%	30.6%	0.0%
Wind breaking curtains	0.0%	0.0%	0.0%	0.0%	23.5%	0.0%	76.5%

Windbreaking Curtains
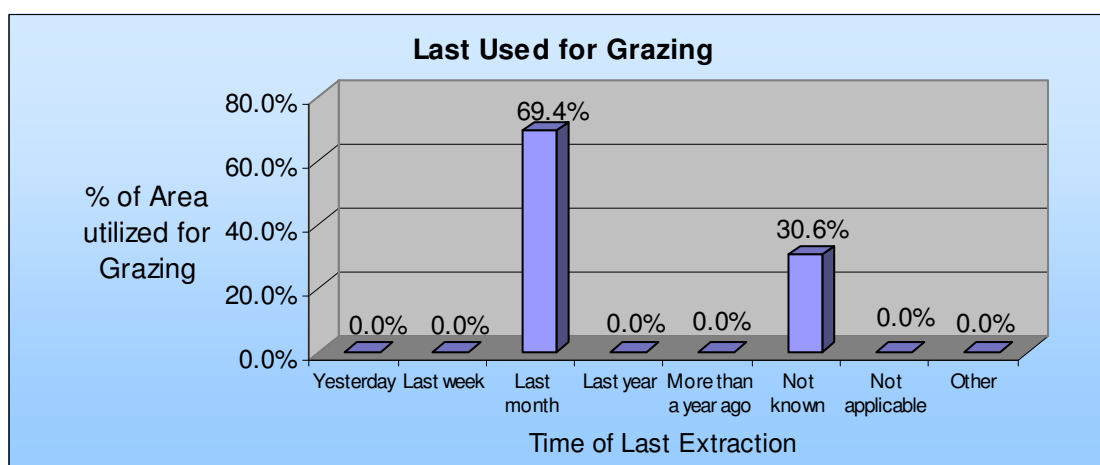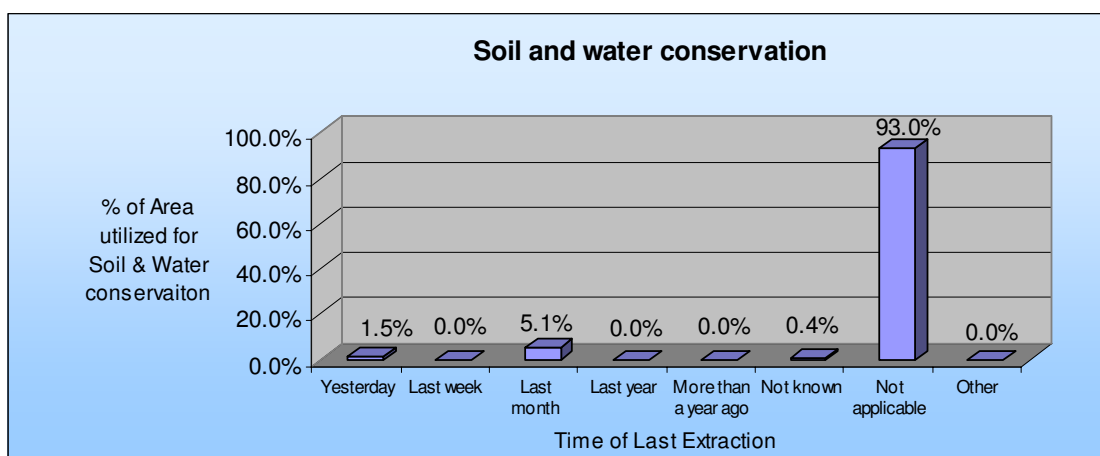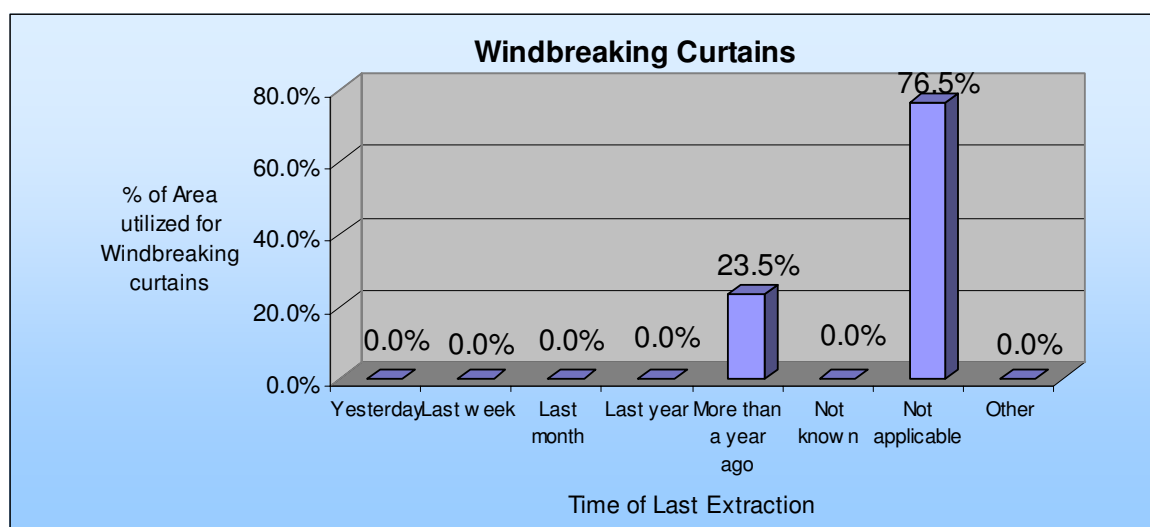
10.6.12   Last extraction of wood and non-wood products and services in TOF

10.6.12.1 Last extraction of wood and non-wood products provided by TOF

In most of the areas visited food, firewood, other non-wood forest products, fodder, and resin were mostly extracted in the previous month. On the other hand, most of the respondents have no concrete information when was the last extraction of timber, non-wood construction and handicraft materials.

Table 8.w: Last extraction of wood and non-wood products provided by TOF

| Products	Yesterday	Last week	Last month	Last year	More than a year ago	Not known	Not applicable	Other
Food	3.8%	10.1%	38.1%	36.1%	3.9%	6.0%	1.6%	0.3%
Firewood	9.1%	19.8%	35.6%	7.9%	1.6%	24.9%	1.0%	0.0%
Timber	1.2%	3.7%	26.7%	6.9%	14.3%	29.1%	16.3%	1.7%
Oils, soap, cosmetics	0.0%	2.0%	21.7%	57.4%	4.0%	5.9%	0.0%	9.0%
Non-wood constructions	0.0%	22.7%	17.5%	25.3%	0.5%	23.5%	10.5%	0.0%
Other Non-wood forest products	0.0%	14.8%	59.1%	23.5%	1.2%	1.4%	0.0%	0.0%
Fodder	9.5%	14.4%	28.5%	1.8%	0.0%	18.4%	27.3%	0.0%
Medical products	37.6%	21.6%	29.1%	11.6%	0.0%	0.0%	0.0%	0.0%
Handicraft	0.0%	0.0%	12.2%	15.0%	27.3%	22.7%	0.0%	22.7%
Resin	0.0%	0.0%	83.6%	0.0%	0.0%	0.0%	16.4%	0.0%

Last Harvest for Food

Last Extraction of Fuelwood

Last Extraction of Resin

Last Extraction of Timber

Last Extraction of Other Non-Wood Forest Products

Last Extraction of Oils, soap, cosmetics

Last Extraction of Fodder

Last Extraction for Non-Wood Constructions

Last Harvest for Handicraft Materials
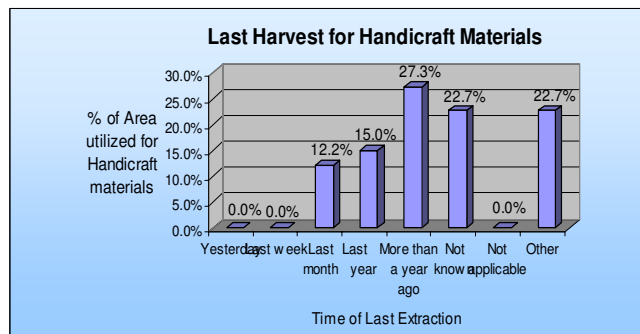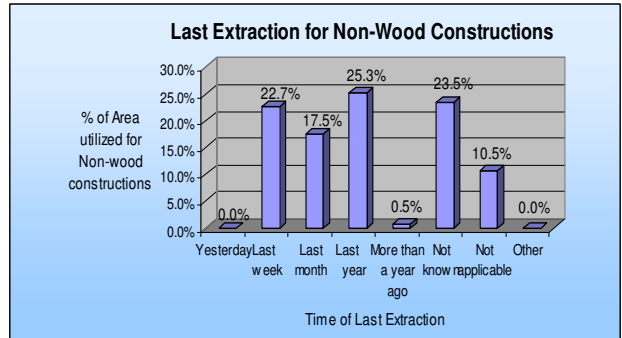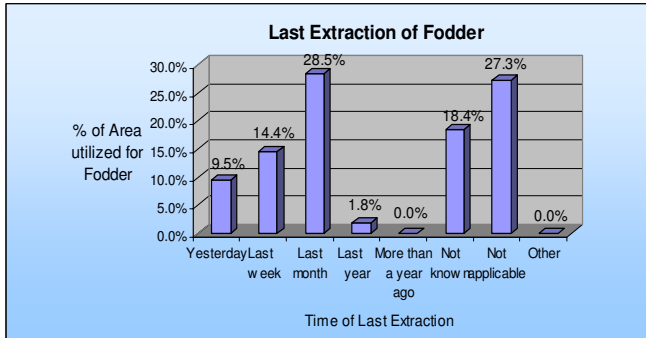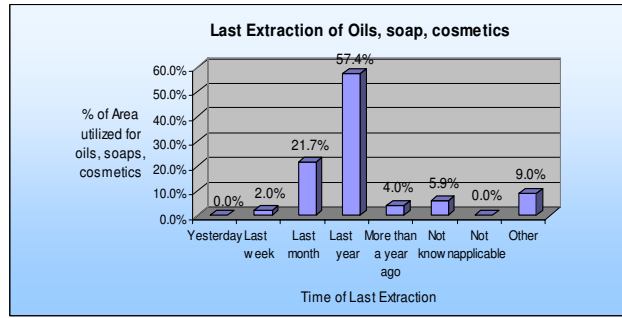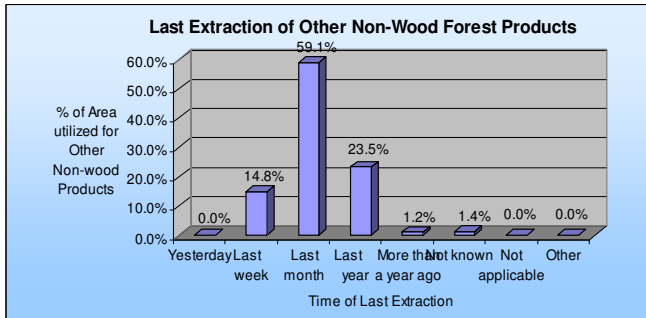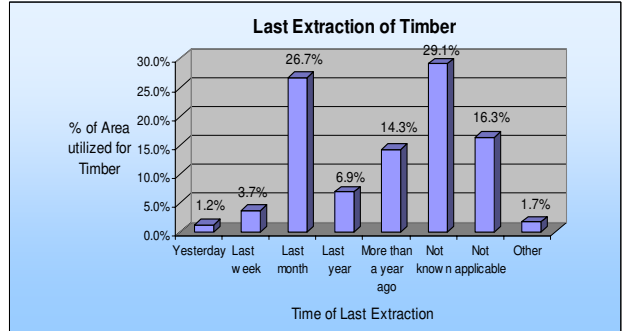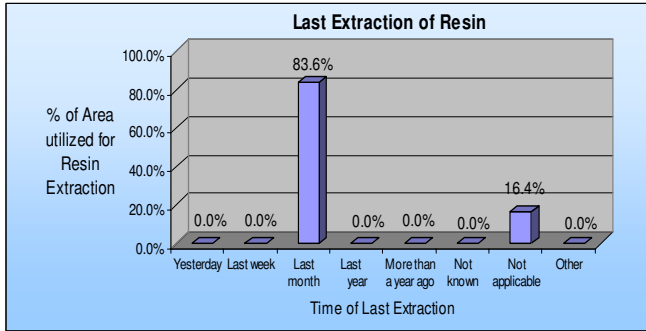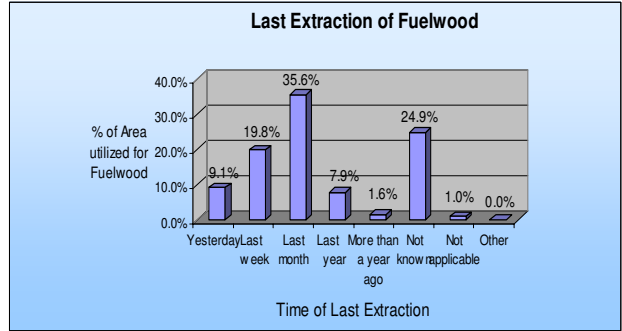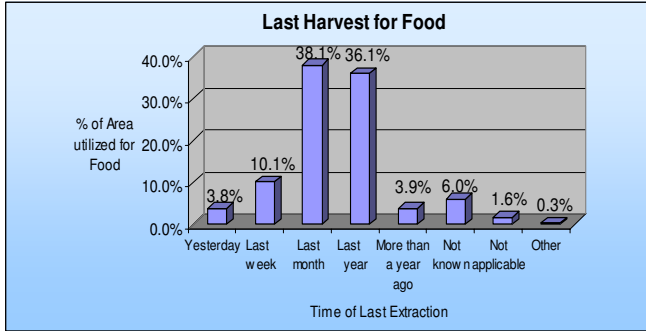
11.   Conclusions

The sampling design, although it was based on relatively low sampling intensity, has generated fundamental data that reflects the true picture of the current forest and trees resources situation at the macro-level.

The comprehensive statistical data generated on land classification and land use, including data on forest cover, forest ownership and management status, stand and volume density, biomass and carbon stock, socio-economic and other pertinent information related to forest and trees outside forest provide adequate databases and baseline information necessary in decision making and in the formulation of national forest policies, plans and programmes as well as in programme evaluation.

12.   Recommendations

12.1   Monitoring of the resources

The provision of timely, reliable and accurate information is essential for sound environmental policy formulation and resource management.   Access to reliable information could enable policy makers and resource planning managers to render sound decisions on how forest resources should be effectively managed.

The regular implementation of national forest assessment could help ensure the availability of recent and reliable data and information that are essential to policy makers and resource planning managers.

National forest assessment therefore should be institutionalized in the DENR department in order to have a consistent basis of information necessary for informed decision-making. This can also provide up-to-date information that would support other present requirements and future needs to report trends in the country's forest and trees resources.

In this regard, it is recommended that FAO-FORM should continually provide support and collaborate with countries that have implemented the NFA approach particularly when revisiting the tracts in order to provide guidance on how to further build the capacity of the implementing organization and update them of recent developments related to the NFA approach. It is also requested that FAO-FORM should financially support the immediate conduct of a complementary forest inventory in the legally classified forestland that would increase the sampling intensity and provide a better picture of forest situation in the area.

12.2   Additional information needs and data collection with more intensive sampling

In the Philippines, one of the major potentials of the forestry sector that would contribute to the development of the country both economically and ecologically, as identified in the Philippine Master Plan for Forestry Development (PMPFD), is the expansion of forest through plantation establishment, enrichment planting and assisted natural regeneration. Various modes of plantation development have been adopted to encourage greater public participation and accelerate the plantation development efforts in the country.

Applicable tenurial instruments have been issued to qualified individuals, associations/organizations and corporations including government agencies and government-controlled corporations in order to accelerate the implementation of the program. At present, about 7.5 million hectares of legally forestlands are covered by various tenurial instruments.   There are 195 Integrated Forest Management Agreements (IFMA) issued covering a total area of 704,328 hectares and a total of 126,822 hectares planted so far with forest and fruit trees.   There are 1,643 Socialized IFMAs (SIFMA) with a total area of 4,269.29 hectares planted so far. A total of 5,322 Community-based Forest Management (CBFM) project sites covering a total project area of 3.43 million hectares have been granted to at least 591,360 families.   Of these, about 1.7 million hectares are covered by 1,577 CBFM Agreements granted to organized local communities.

The information generated by the NFA project shows that the country has approximately 620,000 ha of established plantation. The sampling error, however, is quite high. This may be attributed to the relatively low sampling intensity (0.0026%) whereby a tract measuring 1 km x 1 km represents about 38,000 ha.

In this regard, it is recommended that an inventory of established plantation at a higher sampling intensity (5%) should be implemented in collaboration with FAO-FORM in order to increase the level of precision and reflect the actual situation in the field.

12.3   Actions for Resources Development

The Philippine Forestry Statistics until 1997 had been using the results of the 2nd national forest inventory carried out from 1969 to 1987 as base data in projecting, based on experts' opinion, the country's land use/land cover information. The level of precision of the projected data, therefore, is dependent on the reliability of the projection model used.

Although the NFA approach is based on relatively low sampling intensity, the information generated is highly reliable. It can serve as basis for the FMB to update its statistics.

The NFA results could also serve as basis in revisiting existing environmental laws, policies and regulations so that they match with existing resources and capabilities to help improve the performance of the agency in the management of the countries forest resources.

Data on commercial volume could help rationalize the establishment/maintenance of wood processing plants in proportion to wood supply.

Data on plantation will provide information on the extent of established plantation and harvestable volume that would replace wood supply coming from natural forest, in case logging ban will be totally banned in the natural forest. Based from this information, FMB could initiate a plantation investment program and incentives portfolio to be made available to any and all interested parties with a demonstrated commitment to implement plantation establishment.

12.4   International Reporting

The Philippines is a signatory to different forestry-related international processes and instruments like the Convention on Biological Diversity (CBD), United Nations Framework Convention on Climate Change (UNFCCC), International Tropical Timber Agreement (ITTA), United Nations Convention to Combat Desertification (CCD), ASEAN Agreement on Trans-boundary Haze Pollution, etc. As a consequence, the country has an obligation to regularly report to these international bodies.

The forestry terms and definitions adopted by the NFA approach are in harmony with the terms and definitions adopted by most of these international processes. Further, the NFA approach includes variables that generate some of the data and information requirements by these international processes.

13.   Comparison and Contrast between the NFA Approach and the Second National Forest Inventory (RP-German FRI Project), and NFA Land Use/Forest Cover Data vs.   NAMRIA Land Use/Forest Cover Data

13.1   Second Forest Resources Inventory (RP-German Project)

The second national forest inventory was conducted from 1979 to 1988. It was a bilateral project between the Government of the Philippines (GOP) and the federal Republic of Germany.   The project was assisted by the Deutsche Forstinventur-Service (DFS) under commission of the Deutsche Gesellschaft für Technische Zusammenrbeit (GTZ) GmbH.

13.1.1 Inventory Design

The RP-German FRI Project adopted a two-stage inventory design using aerial photographs or satellite imagery for obtaining an area frame, and clusters of angle-count samples together with concentric circles for collecting stand and stock data of the most important forest strata. In the first stage, all natural forest areas in the Philippines were mapped using aerial photographs. In the second stage, all economically relevant forest types (dipterocarp and pine forests) were sampled in the field using a stratified restricted random sampling design.

Depending on the forest type to be inventoried, two different field sampling units have been adopted: 6-point clusters in dipterocarp forests and 3-point clusters in pine forest.

The 6-point cluster consisted of a triangular arrangement of 6 record units. One corner of the equivalent triangle pointed towards the south. The sides of the triangle measured 100m in length.   The record units were evenly distributed along the perimeter of the triangle and consequently numbered from 1 to 6 starting with the southern corner. All record units comprised an angle-count sample (ACS) using a basal area factor (BAF) of 9 m^2/ha where all trees with a dbh of ≥15 cm were included. In addition to the ACS, record

units 1, 3 and 5 encompassed each 2 concentric circular plots of 2 m and 5 m radius, respectively. Within the 2m radius circular plot, the regeneration of trees with dbh of < 5cm and with a total height of at least 1.3 m, as well as bamboo and erect palms were enumerated. Regeneration of trees with dbh from 5 cm to 15 cm and rattan were surveyed within the 5 m radius circular plot.

The 3-point cluster consisted of a triangular arrangement of 3 record units. One corner of the equilateral triangle points toward the south. The sides of the triangle measured 75 m in length. The record units were located at the corners of the triangle and consequently numbered from 1 to 3 starting with the southern corner. All record units comprised an ACS using a BAF of 4 m^2/ha where all trees with dbh of ≥15 cm were included. In addition to the ACS, all record units encompassed each 2 concentric circular plots of 2 m and 5 m, respectively where tree regeneration and eventual rattan and bamboo occurrence were inventoried following the same principles described for the 6-point cluster.

Two thousand six hundred and twenty-seven (2,627) sample clusters were measured during the project, including 726 strip samples in Region 10 and 11 following the FAO design (systematic sampling at 8 km x 8 km).

13.1.2 Data Processing and Data Analysis

Area calculation and timber volume estimation were done not only at the national level but also at the sub-regional level (per region and per province).

- Forest area

  The area calculation was based on approximately 300,000 dot counts, keeping the measurement error way below the ±1% for most forest strata. Both classified forest land and certified A&D land have been stratified and mapped.

- Timber volume

  Based on 1,901 angle-count sampling units, the total gross volume inside bark had been estimated with a standard error of ±0.7% (simple) or ±1.5% at 95% probability.

13.2 Comparison of Results (NFA-Philippines Project vs. RP-German Project)

13.2.1 Land Use and Forest Types

Land use/forest type cannot be compared between the NFA-Philippines Project and the RP-German Project because the two projects adopted different land use classification system.

Table 9a: Land use/ forest cover classification system (NFA Project & RP-German Project)

Land Use/ Land Cover Classification	
NFA Project	RP-German Project
Forest	
Closed broad-leaved forest	Dipterocarp forest, old growth
Open broad-leaved forest	Dipterocarp forest, residual forest
Closed coniferous forest	Pine forest, closed
Open coniferous forest	Pine forest, open
Closed mixed forest	Mossy forest
Open mixed forest	Submarginal forest
Closed broad-leaved plantation	Forest plantations
Open broad-leaved plantation	
Closed coniferous plantation	
Open coniferous plantation	
Closed bamboo/boho formation	
Open bamboo/boho formation	
Closed mangrove forest	Mangrove, old growth
Open mangrove forest	Mangrove, reproduction
Other Wooded Land	Brushland
Shrubs	
Fallow	
Wooded grassland	
Other Land	Other land use
Barren land	
Lahar	
Grassland	
Marshland	
Annual crop	
Perennial crop	
Pastures	
Built-up area	
Primary paved road	
Primary unpaved road	
Inland Water	
Inland water pond	
Fishpond	

13.2.2 Forest Area

Prior to the NFA project, *FOREST* was defined as areas of one hectare or more which are at least 10 percent stocked with forest trees (including seedlings and saplings), wild palm, bamboo, or brush. Narrow strips of land bearing forest must be at least 60 meters wide and one hectare in size to qualify as forest. Industrial tree plantations and tree farms one hectare or more in size are also included. (Source: 1978 Philippine Forestry Statistics)

Inasmuch as the two projects adopted different land use/land cover classification system, it is not possible to make comparison by forest type; however, it is possible in total area of forest. Based on the RP-German Project (1988), the country's forest cover was 6.46 million hectares or 21.5%. On the other hand, the NFA Project (2004) shows that the country's forest is about 7.16 million hectares or 23.9%. This shows an increase of about 0.7 million hectares.

Table 9b: Forest area (NFA Project vs RP-German Project)

Forest Area (ha)		
NFA Project	RP-German Project	Difference
7,162,560	6,460,600	+701,960

Table 9.b shows that between 1988 and 2004, for a period of 16 years, the country's forest cover increased by about 702,000 ha or an average increase per year of 43,872 ha. The increase in forest cover could be attributed to the citizenry's increased awareness in plantation establishment and the decrease in the number of existing timber license agreements (TLA) from 120 TLAs covering 4.74 million ha in 1988 to16 TLAs covering 0.66 million ha in 2003, resulting to the significant reduction in forest loss.

13.2.3 <u>Timber Volume in Forest</u>

13.2.3.1 <u>Gross/Bole Volume</u>

Data on gross volume between the NFA Project and the RP-German Project are not comparable because they used different diameter limit in the calculation of gross/bole volume. In the NFA Project, the diameter limit is ≥10 cm whereas in the RP-German Project, it was ≥15 cm. Further, in the NFA Project all forest types were included in the calculation of gross volume whereas in the RP-German Project, it was confined only to the productive forests (dipterocarp and pine).

Table 9c: Data on gross volume (NFA Project vs. RP-German Project)

Gross/Bole Volume (in million m^3)	
NFA Project (≥10 cm)	RP-German Project (≥15 cm)
1,247.86	744.07

13.2.3.2 <u>Commercial Volume</u>

At the same time, data on commercial volume between the NFA Project and the RP-German Project are not comparable because they also used different diameter limit in the calculation of commercial volume. In the NFA Project, the diameter limit is ≥50 cm whereas in the RP-German Project, it was ≥55 cm.

Table 9d: Data on commercial volume (NFA Project vs. RP-German Project)

Commercial Volume (in million m^3)	
NFA Project (≥50 cm)	RP-German Project (≥55 cm)
386.96	253.55

13.2.4 Timber Volume in TOF

The RP-German Project has no data on timber volume in trees outside forest.

13.3 Comparison of Land Use/Forest Cover Data (NFA Project vs. NAMRIA)

In 2003, NAMRIA, through its Remote Sensing and Resource Data Analysis Department (RSRDAD) came up with the Land Use/Forest Cover data through the interpretation of 2002 Landsat imageries. In the interpretation, NAMRIA adopted the land use classification system used in the NFA Project. Comparison of data between NAMRIA and the NFA Project is shown in Table 9.e.

Table 9e: Land use/forest cover data (NFA Project vs. NAMRIA)

Land Use	Area (ha)		
	NFA Project	NAMRIA	Variance
Forest	7,162,560	7,168,400	5,840
Other Wooded Land	3,611,204	7,589,260	3,978,056
Other Land	18,423,641	14,943,856	3,181,301
Inland Water	802,595	298,484	504,111
Total	30,000,000	30,000,000	

It can be observed in Table 9e that in land use classified as Forest, the NFA data and NAMRIA data have a difference of only about 5,840 ha. However, in the other land use classes, the variance is quite high.

The significant variance in the other land use classes may be attributed to the resolution of the Landsat. A picture element (pixel) covers an area of 900 m^2 (30m x 30); therefore, small land use sections were not captured in the imagery. In inland water, the variance may be attributed to the fact that NAMRIA considered only major rivers and lakes whereas in the NFA Project even those river systems with a width ≥ 5 meters were classified as inland water.

In April 2004, the NFA Project forwarded to NAMRIA the results of its land use classification in 87 tracts, for comparison with the NAMRIA interpretation. The results of the comparison showed that NAMRIA achieved a 91% accuracy rate.

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Annex 1: Volume equations used in Philippine forestry

Volume Equation Code	Region	Dipterocarp Species (Volume = …)	Non-Dipterocarp Species (Volume = …)
A	CAR, 1, 2, 3	0.00005203 (D^2H)	0.00005109 (D^2H)
B	4 & 5, except Palawan	0.00005171 (D^2H)	0.00005204 (D^2H)
C	8 and Bohol	0.00005231 (D^2H)	0.00004874 (D^2H)
D	6,7 and Palawan	0.00004649 (D^2H)	0.00004874 (D^2H)
E	Eastern Mindanao (Portion of Agusan east of Agusan River, Davao & Surigao)	0.00005087 (D^2H)	0.00004961 (D^2H)
F	Central Mindanao (Bukidnon, Cotabato, Lanao, Misamis, & Portion of Agusan west of Agusan River)	0.00005019 (D^2H)	0.00005039 (D^2H)
G	Western Mindanao (Basilan, Sulu & Zamboanga)	0.00004668 (D^2H)	0.00004840 (D^2H)

*Note: D is measured in cm, H is measured in m

Annex 2: Sampling error in land use area calculation

Land use area	No. of samples	Area of Samples (ha)	Sampling error (%)
A. Area			
1. Area by land use			
Forest	169	166.116	7.92
Other wooded Land	136	83.752	10.21
Other Land	299	427.286	3.38
Inland Water	110	18.614	20.72
2. Area by forest type			
Closed broadleaved forest	90	99.418	6.81
Open broadleaved forest	66	40.4	14.12
Closed coniferous forest	2	1.03	70.41
Open coniferous forest	4	3.874	63.0
Closed mixed forest	1	0.42	100.5
Open mixed forest	1	1.5	99.54
Closed broadleaved plantation	17	6.456	33.81
Open broadleaved plantation	28	7.846	31.98
Closed coniferous plantation	1	0.2	100.29
Open coniferous plantation	1	0.044	99.6
Closed bamboo/boho formation	8	2.602	46.26
Open bamboo/boho formation	7	1.384	47.18
Closed mangrove forest	1	0.72	100.28
Open mangrove forest	2	0.222	75.419
3.Area of Forest by Ecological Zone			
Forest in Tropical Rain Forest	165	161.4	1.74
Forest in Tropical Mountain System	4	4.716	59.41
4.Area of Forest by Management System			
Formal	30	48.772	15.52
Not Known	143	117.344	6.45
5.Area of Forest by Ownership			
State owned	128	141.172	3.04
Privately owned	57	24.224	17.7
6.Area of Forest by Protection/Designation Status			
Production	143	126.688	5.85
Natural Reserve	12	12.468	123.70
National Park	3	6	511.71
National Monument	-	-	-
Managed Protected Area	17	20.96	77.33
7.Area of forest by Stand Structure			
1-layer	63	22.926	30.6
2-layer	76	49.886	18.57
3-layer	49	45.256	27.17
>3-layer	38	48.048	32.84

Annex 3: Sampling error in gross volume calculation by land use area

	Area	Gross Volume	SeR %	Comm Volume	SeR %
1. Volume by Land Use					
Forest	141.856	24714.107	8.78	7663.757	17.80
Other wooded Land	80.202	1763.996	12.05	309.646	21.89
Other Land	423.062	8465.89	9.04	558.492	15.84
Inland Water	16.614	82.926	40.72	15.591	60.61
2. Volume by Forest Type					
Closed broadleaved forest	85.792	18998.959	9.69	6246.059	20.21
Open broadleaved forest	33.89	4284.886	11.43	1059.196	21.09
Closed coniferous forest	0.91	247.148	13.80	111.931	20.67
Open coniferous forest	1.37	305.788	36.66	184.475	48.20
Closed mixed forest	0	0	0	0	0
Open mixed forest	0.42	25.283	0	1.04	0
Closed broadleaved plantation	6.456	345.649	14.77	11.22	239.34
Open broadleaved plantation	7.846	274.421	26.89	11.127	0
Closed coniferous plantation	0.2	24.326	0	6.439	0
Open coniferous plantation	0.044	0	0	0.044	0
Closed bamboo/boho formation	2.602	98.283	52.69	31.07	86.08
Open bamboo/boho formation	1.384	7.939	39.01	1.191	105.72
Closed mangrove forest	0.72	88.994	0	0	0
Open mangrove forest	0.222	12.426	42.84	0	0
3. Volume by Ecological Zone					
Tropical Rain Forest	138.26	23953.08	8.99	7491.481	18.22
Tropical Mountain System	2.596	761.029	14.81	172.277	15.46
4. Volume by Forest Management System					
Formal	44.752	11473.528	14.2	4234.489	28.16
Not Known	97.104	13240.58	9.2	3429.269	15.52
5. Volume by Ownership					
State owned	22.244	2288.346	21.96	723.30	42.15
Privately owned	119.252	22388.364	9.26	6939.933	18.99
Municipality owned	0.22	23.171	0	0.525	0
Community owned	0.14	14.227	0	0	0
6. Volume by Protection/Designation Status					
Production	106.762	15715.853	7.49	4399.729	13.09
Natural Reserve	12.468	3166.392	20.43	812.322	37.35
National Park	6.0	3196.101	39.63	1840.248	52.61
National Monument	-	-	-	-	-
Managed Protected Area	16.626	2635.761	17.07	611.458	30.61

7. Volume by Stand Structure					
1-layer	18.692	1120.52	17.51	191.178	45.7
2-layer	41.48	5719.297	12.64	1818.982	24.05
3-layer	35.636	6228.061	11.99	1597.747	19.84
>3-layer	46.048	11646.229	13.79	4055.851	28.91

Annex 4: Trees species outside forests

Order	Scientific name	Common name	Number	%
1	Cocos nucifera	Coconut	9458	50.1%
2	Gmelina arborea	yemane	1078	5.7%
3	Mangifera indica	mangga	537	2.8%
4	Leucaena leucocephala	ipil-ipil	448	2.4%
5	Artocarpus blancoi	antipolo	269	1.4%
6	Macaranga tanarius	binunga	237	1.3%
7	Sandoricum koetjape	santol	229	1.2%
8	Artocarpus heterophylla	nangka	215	1.1%
9	Swietenia macrophylla	big-leafed mahogany	204	1.1%
10	Ficus nota	tibig	200	1.1%
11	Syzygium cumini	duhat	188	1.0%
12	Pterocarpus indicus	narra	185	1.0%
13	Polyscias nodosa	bongliw	170	0.9%
14	Trema orientalis	anabiong	148	0.8%
15	Samanea saman	raintree	143	0.8%
16	Alstonia macrophylla	batino	133	0.7%
17	Gliricida sepium	madre-cacao	131	0.7%
18	Persea americana	avocado	126	0.7%
19	Albizia procera	akleng-parang	123	0.7%
20	Chrsophyllum cainito	starapple	120	0.6%
21	Theobroma cacao	cacao	112	0.6%
22	Shorea contorta	white lauan	96	0.5%
23	Tamarindus indica	sampalok	91	0.5%
24	Pterocymbium tinctorium	taluto	82	0.4%
25	Bauhinia monandra	fringon	81	0.4%
26	Vitex parviflora	molave	81	0.4%
27	Melanolepis multiglandulosus	alim	80	0.4%
28	Anacardium occidentale	kasui	80	0.4%
29	Erythrina orientalis	dap-dap	77	0.4%
30	Artocarpus communis	rimas	76	0.4%
31	Antidesma ghaesembilla	binayuyu	75	0.4%
32	Artocarpus odoratissimus	marang	68	0.4%
33	Lagerstroemia speciosa	banaba	67	0.4%
34	Kleinhovia hospita	bitan-ag	67	0.4%
35	Ficus variegata	tangisang bayawak	64	0.3%
36	Ceiba pentandra	kapok	62	0.3%
37	Nauclea orientalis	bangkal	60	0.3%
38	Canarium asperum	pagsahingin	60	0.3%
39	Leucaena		59	0.3%
40	Paraserianthes falcataria	Moluccan sau	57	0.3%
41	Ficus minahassae	hagimit	55	0.3%
42	Alstonia scholaris	dita	53	0.3%
43	Antidesma bunius	bignai	51	0.3%
44	Ficus septica	hauili	50	0.3%
45	Buchanania arborescens	balinghasai	46	0.2%
46	Macaranga grandifolia	bingabing	46	0.2%
47	Streblus asper	kalios	46	0.2%
48	Wrightia laniti	lanete	45	0.2%
49	Litsea perrottetii	bakan	44	0.2%

50	Pithecellobium dulce	kamachile	44	0.2%
51	Artocarpus ovata	anubing	43	0.2%
52	Cananga odorata	ilang-ilang	42	0.2%
53	Colona serrafolia	anilau	40	0.2%
54	Piliostigma malabaricum	alibangbang	36	0.2%
55	Leucosyke capitellata	alagasi	35	0.2%
56	Myristica philippinensis	duguan	35	0.2%
57	Psidium guajava	bayabas	34	0.2%
58	Cordia dichotoma	anonang	33	0.2%
59	Lansium domesticum	lansones	33	0.2%
60	Spondias purpurea	sineguelas	33	0.2%
61	Dipterocarpus grandiflorus	apitong	32	0.2%
62	Securinega flexuosa	anislag	31	0.2%
63	Koordersiodendron pinnatum	amugis	29	0.2%
64	Ficus balete	balete	29	0.2%
65	Annona muricata	guyabano	29	0.2%
66	Intsia bijuga	ipil	29	0.2%
67	Lithocarpus llanosii	ulayan	29	0.2%
68	Combretodendron quadrialatum	toog	28	0.1%
69	Parashorea plicata	bagtikan	27	0.1%
70	Citrus grandis	lukban	27	0.1%
71	Shorea squamata	mayapis	27	0.1%
72	Hevea brasiliensis	para rubber	26	0.1%
73	Melia dubia	bagalunga	24	0.1%
74	Syzygium nitidum	makaasim	24	0.1%
75	Canarium ovatum	pili	24	0.1%
76	Radermachera pinnata	banai-banai	23	0.1%
77	Macaranga bicolor	hamindang	23	0.1%
78	Palaquium luzoniense	nato	23	0.1%
79	Coffea arabica	kafe	22	0.1%
80	Toona calantas	kalantas	22	0.1%
81	Artocarpus odortissima	marang-banguhan	22	0.1%
82	Teijsmanniodendron ahernianum	sasalit	22	0.1%
83	Octomeles sumatrana	binuang	21	0.1%
84	Averrhoa bilimbi	kamias	21	0.1%
85	Parinari corymbosa	liusin	21	0.1%
86	Terminalia catappa	talisai	21	0.1%
87	Ficus ruficaulis	tabgun	20	0.1%
88	Ardisia squamulosa	tagpo	20	0.1%
89	Terminalia foetidissima	talisai-gubat	19	0.1%
90	Artocarpus		19	0.1%
91	Firmiana simplex	bitnong	18	0.1%
92	Albizia lebbekoides	kariskis	18	0.1%
93	Pittospermum pentandrum	mamalis	18	0.1%
94	Shorea polysperma	tangile	18	0.1%
95	Avicennia officinalis	api-api	17	0.1%
96	Diospyros philosanthera	bolong-eta	17	0.1%
97	Aglaia llanosiana	bayanti	16	0.1%
98	Mallotus multiglandulosus v. pendulus	alim-bitin	15	0.1%
99	Sapium luzonicum	balakat-gubat	15	0.1%
100	Pinus kesiya	Benguet pine	15	0.1%
101	Nephelium philippinense	bulala	15	0.1%

102	Dracontomelon dao	dao	15	0.1%
103	Anthocephalus cadamba	Kaatoan bangkal	15	0.1%
104	Duabanga moluccana	loktob	15	0.1%
105	Tristania decorticata	malabayabas	15	0.1%
106	Anisoptera thurifera	palosapis	15	0.1%
107	Bischofia javanica	tuai	15	0.1%
108	Shorea negrosensis	kaliyaan	14	0.1%
109	Celtis luzonica	magabuyo	14	0.1%
110	Guettarda speciosa	tabug	14	0.1%
111	Syzygium aqueum	tambis	14	0.1%
112	Pouteria campechiana	tiesa	14	0.1%
113	Shorea astylosa	yakal	14	0.1%
114	Shorea almon	almon	13	0.1%
115	Allaeanthus luzonicus	himbaba-o	13	0.1%
116	Sonneratia alba	pagatpat	13	0.1%
117	Cratoxylum celebicum	paguringon	13	0.1%
118	Calophyllum blancoi	bitanghol	12	0.1%
119	Durio zibethinus	durian	12	0.1%
120	Cratoxylum blancoi v. apiculatum	kansilai	12	0.1%
121	Dillenia philippinensis	katmon	12	0.1%
122	Premna adorata	alagau	11	0.1%
123	Antidesma ilocanum	arosip	11	0.1%
124	Morinda citrifolia	bangkoro	11	0.1%
125	Garuga floribunda	bogo	11	0.1%
126	Artocarpus nitida	kubi	11	0.1%
127	Spondias pinnata	libas	11	0.1%
128	Semecarpus cuneiformis	ligas	11	0.1%
129	Celtis philippinensis	malaikmo	11	0.1%
130	Broussonetia paprifera	paper-mulberry	11	0.1%
131	Afzelia rhomboidea	balayong	10	0.1%
132	Barringtonia asiatica	botong	10	0.1%
133	Pometia pinnata	eba	10	0.1%
134	Neonauclea formicaria	hambabalud	10	0.1%
135	Ficus ulmifolia	is-is	10	0.1%
136	Diospyros philippensis	kamagong	10	0.1%
137	Ziziphus mauritiana	manzanitas	10	0.1%
138	Mangifera altissima	pahutan	10	0.1%
139	Symplocos villarii	agosip	9	0.0%
140	Semecarpus elmeri	anagas	9	0.0%
141	Annona reticulata	anonas	9	0.0%
142	Ficus botryocarpa	basikong	9	0.0%
143	Myrica javanica	hindang	9	0.0%
144	Terminalia microcarpa	kalumpit	9	0.0%
145	Clethra lancifolia	kamog	9	0.0%
146	Randia racemosa	kapi-kapi	9	0.0%
147	Hibiscus tiliaceus	malubago	9	0.0%
148	Cinnamomum mindanaense	Mindanao cinnamon	9	0.0%
149	Canthium monstrosum	tadiang-anuang	9	0.0%
150	Acacia auriculiformis	Tan Wattle	9	0.0%
151	Mallotus paniculatus	anaplan	8	0.0%
152	Endospermum peltatum	gubas	8	0.0%
153	Pterospermum obliquum	kulatingan	8	0.0%
154	Neanauclea bartlingii	lisak	8	0.0%

155	Syzygium samarangense	makopa	8	0.0%
156	Garcinia vidalii	piris	8	0.0%
157	Alangium javanicum var. jaheri	putian	8	0.0%
158	Nephelium lappaceum	rambutan	8	0.0%
159	Tectona grandis	teak	8	0.0%
160	Eucalyptus deglupta	bagras	7	0.0%
161	Mallotus philippinenses	banato	7	0.0%
162	Drypetes microphylla	butong-manuk	7	0.0%
163	Parasponia parviflora	hanagdong	7	0.0%
164	Shorea polita	malaanonang	7	0.0%
165	Vatica mangachapoi	narig	7	0.0%
166	Dillenia marsupialis	palali	7	0.0%
167	Ficus casidyana	uuangan	7	0.0%
168	Saurauia elegans	uyok	7	0.0%
169	Diplodiscus paniculatus	balobo	6	0.0%
170	Mussaenda philippica	boyon	6	0.0%
171	Muntingia calabura	datiles	6	0.0%
172	Camptostemon philippinense	gapas-gapas	6	0.0%
173	Podocarpus philippinensis	malakauayan	6	0.0%
174	Acacia mangium	mangium	6	0.0%
175	Ptychopyxis philippina	panglangkaen	6	0.0%
176	Trichospermum eriopodum	sayapo	6	0.0%
177	Ficus ribes	adagei	5	0.0%
178	Premna subglabra	adgau	5	0.0%
179	Spathodea campanulata	African tulip	5	0.0%
180	Ficus irisana	aplas	5	0.0%
181	Homalanthus populneus	balanti	5	0.0%
182	Averrhoa carambola	balimbing	5	0.0%
183	Lagerstroemia piriformis	batitinan	5	0.0%
184	Iteadaphne philippinensis	boga	5	0.0%
185	Semecarpus philippinensis	kamiring	5	0.0%
186	Parkia roxburghii	kupang	5	0.0%
187	Canthium dicoccum	malakape	5	0.0%
188	Mangifera monandra	malapaho	5	0.0%
189	Moringa oleifera	malunggai	5	0.0%
190	Maesopsis eminii	Musizi	5	0.0%
191	Cynometra luzoniensis	oringon	5	0.0%
192	Pangium edule	pangi	5	0.0%
193	Syzygium brevistylum	sagimsim	5	0.0%
194	Musanga cecropioides	umbrella tree	5	0.0%
195	Pouteria macrantha	White nato	5	0.0%
196	Aglaia cuminguiana	alauihau	4	0.0%
197	Acacia farnesiana	aroma	4	0.0%
198	Cynometra ramiflora	balitbitan	4	0.0%
199	Ochroma pyramidale	balsa	4	0.0%
200	Delonix regia	firetree	4	0.0%
201	Antidesma impressinerve	inyam	4	0.0%
202	Colona lanceolata	kadiin	4	0.0%
203	Citrus microcarpa	kalamunding	4	0.0%
204	Albizia retusa	kasai	4	0.0%
205	Sesbania grandiflora_	katurai	4	0.0%
206	Laportea luzonensis	lipa	4	0.0%
207	Aleurites moluccana	lumbang	4	0.0%

208	Aglaia diffusa	malasaging	4	0.0%
209	Syzygium gigantifolium	malatalisai	4	0.0%
210	Aglaia elaeagnoidea	mata-mata	4	0.0%
211	Breynia rhamnoides	matang-hipon	4	0.0%
212	Canarium hirsutum	milipili	4	0.0%
213	Ficus odorata	pakiling	4	0.0%
214	Ilex pulogensis	papatak	4	0.0%
215	Actinodaphne dolichophylla	pipi	4	0.0%
216	Xylocarpus granatum	tabigi	4	0.0%
217	Diospyros copelandii	talang-gubat	4	0.0%
218	Neonauclea media	uisak	4	0.0%
219	Sterculia glabrifolia	uos	4	0.0%
220	Agathis philippinensis	almaciga	3	0.0%
221	Trema cannabina	anagdung	3	0.0%
222	Glochidion traindrum	bagna	3	0.0%
223	Syzygium rizalense	bangkalauan	3	0.0%
224	Sterculia philippinensis	banilad	3	0.0%
225	Wallaceodendron celebicum	banuyo	3	0.0%
226	Alstonia parvifolia	batinong-liitan	3	0.0%
227	Xantophyllum excelsum	bok-bok	3	0.0%
228	Engelhardia rigida	buntan	3	0.0%
229	Excoecaria agallocha	buta-buta	3	0.0%
230	Palaquium merrillii	dulitan	3	0.0%
231	Vaccinium barandanum	dusong	3	0.0%
232	Dipterocarpus warburgii	hagakhak	3	0.0%
233	Syzygium escritorii	igot	3	0.0%
234	Cinnamomum mercadoi	kalingag	3	0.0%
235	Taxotrophis macrophylla	kuyos-kuyos	3	0.0%
236	Homalanthus megaphyllus	labulti	3	0.0%
237	Dracontomelon edule	lamio	3	0.0%
238	Planchonia spectabilis	lamog	3	0.0%
239	Mitrephora lanotan *****	lanutan	3	0.0%
240	Litchi chinensis	licheas	3	0.0%
241	Laportea brunnea	lingaton	3	0.0%
242	Vitex turczaninowii	lingo-lingo	3	0.0%
243	Sterculia oblongata	malabuho	3	0.0%
244	Sandoricum vidalii	malasantol	3	0.0%
245	Hopea acuminata	manggachapui	3	0.0%
246	Palaquium tenuipetiolatum	maniknik	3	0.0%
247	Melicope triphylla	matang-arau	3	0.0%
248	Ficus pseudopalma	niog-niogan	3	0.0%
249	Calophyllum pseudowallichianum	pameklaten	3	0.0%
250	Pterocarpus vidalianus	prickly narra	3	0.0%
251	Codiaeum luzonicum	putak	3	0.0%
252	Trigonachras cuspidata	salab	3	0.0%
253	Albizia saponaria	salingkugi	3	0.0%
254	Cassia siamea	Thailand shower	3	0.0%
255	Hopea malibato	yakal-kaliot	3	0.0%
256	Bixa orellana	achuete	2	0.0%
257	Casuarina equisetifolia	agoho	2	0.0%
258	Guioa koelreuteria	alahan	2	0.0%
259	Aphanthe philippinensis	alasiis	2	0.0%

260	Hymenodictyon excelsum	aligango	2	0.0%
261	Euphoria didyma	alupag	2	0.0%
262	Abarema scutifera	anagap	2	0.0%
263	Glochidion psidioides	anam	2	0.0%
264	Diospyros elmeri	balingagta	2	0.0%
265	Baccaurea philippinensis	baloiboi	2	0.0%
266	Diploknema ramiflora	baniti	2	0.0%
267	Voacanga globosa	bayag-usa	2	0.0%
268	Pterospermum diversifolium	bayok	2	0.0%
269	Macaranga sinensis	binungang-pula	2	0.0%
270	Syzygium curranii	Curran lipote	2	0.0%
271	Ficus virgata v. philippinensis	diakit	2	0.0%
272	Heritiera littoralis	dungon-late	2	0.0%
273	Hopea philippinensis	gisok-gisok	2	0.0%
274	Shorea guiso	guijo	2	0.0%
275	Cratoxylum blancoi	guyong-guyong	2	0.0%
276	Michelia platyphylla	hangilo	2	0.0%
277	Cicca acida	iba	2	0.0%
278	Diospyros longiciliata	itom-itom	2	0.0%
279	Phoebe sterculioides	kaburo	2	0.0%
280	Saurauia latibractea	kolalabang	2	0.0%
281	Syzygium claviflorum	kurasam	2	0.0%
282	Laportea meyeniana	lipang-kalabau	2	0.0%
283	Salmalia malabarica	malabulak	2	0.0%
284	Vernonia arborea	malasambong-gubat	2	0.0%
285	Syzygium hutchinsonii	malatambis	2	0.0%
286	Ficus congesta	malatibig	2	0.0%
287	Premna nauseosa	malauin-aso	2	0.0%
288	Mitragyna rotundifolia	mambog	2	0.0%
289	Koompassia excelsa	manggis	2	0.0%
290	Garcinia mangostana	mangosteen	2	0.0%
291	Breynia cernua	matang-katang	2	0.0%
292	Syzygium costulatum	paitan	2	0.0%
293	Guioa acuminata	pasi	2	0.0%
294	Canarium luzonicum	piling-liitan	2	0.0%
295	Cassia nodosa	pinkshower	2	0.0%
296	Litsea glutinosa	sablot	2	0.0%
297	Aegiceras corniculatum	saging-saging	2	0.0%
298	Cratoxylum formosum	salinggogon	2	0.0%
299	Ficus variegata v. garciae	tablot-ot	2	0.0%
300	Ficus benguetensis	tabul	2	0.0%
301	Palaquium pinnatinervium	tagkan	2	0.0%
302	Pterospermum cumingii	talinuanga	2	0.0%
303	Shorea polysperma f. tiaong	tiaong	2	0.0%
304	Crypteronia paniculata	tiaui	2	0.0%
305	Alphitonia philippinensis	tulo	2	0.0%
306	Ficus ampelas	upling-gubat	2	0.0%
307	Syzygium malaccense	yambu	2	0.0%
308	Aglaia		2	0.0%
309	Diospyros		2	0.0%
310	Radermachera		2	0.0%
311	Serialbizia acle	akle	1	0.0%
312	Pittosporum ramosii	albon	1	0.0%

313	Abroma augusta	anabo	1	0.0%
314	Diospyros pyrrhocarpa	anang	1	0.0%
315	Cassia javanica	antsoan	1	0.0%
316	Clethra luzonica	apiit	1	0.0%
317	Homalium foetidum	aranga	1	0.0%
318	Litsea hutchinsonii	asasala	1	0.0%
319	Diospyros mindanaensis	ata-ata	1	0.0%
320	Annona squamosa	ates	1	0.0%
321	Gnetum gnemon v. gnemon	bago	1	0.0%
322	Ormosia calavensis	bahai	1	0.0%
323	Euphorbia plumerioides	bait	1	0.0%
324	Rhizophora mucronata	bakauan-babae	1	0.0%
325	Mangifera caesia	baluno	1	0.0%
326	Pongamia pinnata	bani	1	0.0%
327	Cleistanthus pilosus	banitlong	1	0.0%
328	Grewia eriocarpa	bariuan	1	0.0%
329	Tarenna stenantha	basa	1	0.0%
330	Garcinia brevirostris	basan	1	0.0%
331	Garcinia busuangaensis	batuhan	1	0.0%
332	Pterospermum niveum	bayok-bayokan	1	0.0%
333	Phytolacca dioica	bella-sombra	1	0.0%
334	Antidesma pentadrum	bignai-pogo	1	0.0%
335	Leucosyke elmeri	bilan-bilan	1	0.0%
336	Syzygium subfoetidum	bintang	1	0.0%
337	Spiraeopis celebica	bognag	1	0.0%
338	Adenanthera intermedia	bolong kadyos	1	0.0%
339	Dillenia bolsteri	Bolster katmon	1	0.0%
340	Glochidion camiguinense	bonot-bonot	1	0.0%
341	Araucaria bidwilli	bunya pine	1	0.0%
342	Canthium gynochthodes	butlig-babui	1	0.0%
343	Manilkara sapota	chico	1	0.0%
344	Garcinia binukau	Choisy binukau	1	0.0%
345	Macaranga caudatifolia	daha	1	0.0%
346	Cyathocalyx globosus	dalinas	1	0.0%
347	Pipturus arborescens	dalunot	1	0.0%
348	Calophyllum obliquinervium	dangkalan	1	0.0%
349	Pseuduvaria grandiflora	dangloi-iloko	1	0.0%
350	Erythrina variegata	dapdap	1	0.0%
351	Ficus pedunculosa v. imberbis	dularog	1	0.0%
352	Canarium hirsutum f. multipinnatum	dulit	1	0.0%
353	Ficus pedunculosa	gambit-gambit	1	0.0%
354	Garcinia venulosa	gatasan	1	0.0%
355	Canarium vrieseanum	gisau	1	0.0%
356	Pavetta indica	gusokan	1	0.0%
357	Goniothalamus gitingensis	guyog	1	0.0%
358	Weinmannia hutchinsonii	Hutchinson kalilan	1	0.0%
359	Alectryon excisus	ibu	1	0.0%
360	Viburnum odoratissimum	idog	1	0.0%
361	Macaranga ovatifolia	indang	1	0.0%
362	Garcinia ituman	ituman	1	0.0%
363	Commersonia bartramia	kakaag	1	0.0%
364	Plumeria acuminata	kalachuche	1	0.0%

365	Neonauclea calycina	kalamansanai	1	0.0%
366	Garcinia lateriflora	kandis	1	0.0%
367	Linociera ramiflora	karaksan	1	0.0%
368	Chisocheton pentandrus	katong-matsing	1	0.0%
369	Itea macrophylla	kodai	1	0.0%
370	Psychotria versicolor	kotipo	1	0.0%
371	Memecylon ovatum	kulis	1	0.0%
372	Melochia umbellata	labayo	1	0.0%
373	Wendlandia glabrata	lanipa	1	0.0%
374	Toona philippinensis	lanipga	1	0.0%
375	Gonystylus macrophyllus	lanutan-bagyo	1	0.0%
376	Sterculia multistipularis	lapnit	1	0.0%
377	Vaccinium tenuipes Merr.	likop	1	0.0%
378	Syzygium polycephaloides	lipote	1	0.0%
379	Glochidion mindorense	litok	1	0.0%
380	Flacourtia jangomas	Madagascar plum	1	0.0%
381	Dalbergia mimosella	makapil	1	0.0%
382	Dillenia luzoniensis	malakatmon	1	0.0%
383	Palaquium philippinense	malak-malak	1	0.0%
384	Cleistocalyx operculatus	malaruhat	1	0.0%
385	Stemonurus hallieri	malatadu	1	0.0%
386	Palaquium cuprifolium	malatagkan	1	0.0%
387	Neonauclea reticulata	malauisak	1	0.0%
388	Colona blancoi	mamaued	1	0.0%
389	Azadirachta indica	Margosa	1	0.0%
390	Colona macgregorii	McGregor anilau	1	0.0%
391	Orophea elliphantoides	pagaion	1	0.0%
392	Triplaris cumingiana	palo-santo	1	0.0%
393	Lithocarpus bennettii	pangnan	1	0.0%
394	Decaspermum blancoi	patalsik-pula	1	0.0%
395	Neolitsea vidalii	puso-puso	1	0.0%
396	Barringtonia racemosa	putat	1	0.0%
397	Erythrina subumbrans	rarang	1	0.0%
398	Liquidambar styraciflua	redgum	1	0.0%
399	Sloanea sigun	sala	1	0.0%
400	Wikstroemia meyeniana	salagong-laparan	1	0.0%
401	Zanthoxylum integrifoliolum	salai	1	0.0%
402	Pistacia chinensis	sangilo	1	0.0%
403	Caesalpinia sappan	sibukau	1	0.0%
404	Ctenolophon philippinense	sudiang	1	0.0%
405	Parinari glaberrima	tabon-tabon	1	0.0%
406	Croton leiophyllus	tagoang-uak	1	0.0%
407	Strombosia philippinensis	tamayuan	1	0.0%
408	Xylopia densifolia	tangisang-bagyo	1	0.0%
409	Neonauclea vidalii	tikim	1	0.0%
410	Canthium ramosii	topas	1	0.0%
411	Cecropia peltata	trumpet tree	1	0.0%
412	Pometia tomentosa	tugaui	1	0.0%
413	Micromelum inodorum	tulibas-mabolo	1	0.0%
414	Horsfieldia megacarpa	yabnob	1	0.0%
415	Hopea plagata	yakal-saplungan	1	0.0%
416	Bridelia		1	0.0%
417	Cratoxylum		1	0.0%

418	Dysoxylum		1	0.0%
419	Lagerstroemia		1	0.0%
420	Mallotus		1	0.0%
421	Mearnsia		1	0.0%
422	Mimusops		1	0.0%
423	Palmae		1	0.0%
424	Rubiaceae		1	0.0%
425	Vitex		1	0.0%
426	Unidentified		912	4.8%

Annex 5: Tree species in forests

Order	Scientific Name	Common name	Number	%
1	Shorea contorta	white lauan	1592	7.7%
2	Shorea polysperma	tangile	1259	6.1%
3	Shorea negrosensis	red lauan	1219	5.9%
4	Shorea squamata	mayapis	1011	4.9%
5	Dipterocarpus grandiflorus	apitong	887	4.3%
6	Parashorea plicata	bagtikan	539	2.6%
7	Gmelina arborea	yemane	517	2.5%
8	Lithocarpus llanosii	ulayan	502	2.4%
9	Shorea astylosa	yakal	480	2.3%
10	Shorea almon	almon	358	1.7%
11	Pterocarpus indicus	narra	323	1.6%
12	Palaquium luzoniense	nato	264	1.3%
13	Ficus nota	tibig	250	1.2%
14	Syzygium brevistylum	sagimsim	250	1.2%
15	Pinus kesiya	Benguet pine	247	1.2%
16	Shorea guiso	guijo	242	1.2%
17	Ficus elastica	India rubber	237	1.1%
18	Alangium javanicum var. jaheri	putian	203	1.0%
19	Macaranga tanarius	binunga	199	1.0%
20	Leucaena leucocephala	ipil-ipil	187	0.9%
21	Syzygium simile	panglongboien	178	0.9%
22	Myristica philippinensis	duguan	169	0.8%
23	Endospermum peltatum	gubas	156	0.7%
24	Vatica mangachapoi	narig	155	0.7%
25	Cocos nucifera	Coconut	153	0.7%
26	Dillenia philippinensis	katmon	152	0.7%
27	Trema orientalis	anabiong	150	0.7%
28	Ficus variegata	tangisang bayawak	149	0.7%
29	Paraserianthes falcataria	Moluccan sau	144	0.7%
30	Tristania decorticata	malabayabas	143	0.7%
31	Vitex parviflora	molave	143	0.7%
32	Mitrephora lanotan *****	lanutan	142	0.7%
33	Canarium asperum	pagsahingin	137	0.7%
34	Agathis philippinensis	almaciga	127	0.6%
35	Pterocymbium tinctorium	taluto	120	0.6%
36	Hopea foxwothyi	dalingdingan	102	0.5%
37	Anisoptera thurifera	palosapis	100	0.5%
38	Artocarpus blancoi	antipolo	99	0.5%
39	Diospyros philosanthera	bolong-eta	98	0.5%
40	Rhizophora mucronata	bakauan-babae	98	0.5%
41	Euphoria didyma	alupag	97	0.5%
42	Mangifera altissima	pahutan	93	0.4%
43	Teijsmanniodendron ahernianum	sasalit	92	0.4%
44	Toona calantas	kalantas	91	0.4%
45	Artocarpus ovata	anubing	90	0.4%
46	Alstonia macrophylla	batino	89	0.4%
47	Polyscias nodosa	bongliw	84	0.4%

48	Hopea philippinensis	gisok-gisok	83	0.4%
49	Ficus minahassae	hagimit	79	0.4%
50	Sandoricum vidalii	malasantol	79	0.4%
51	Combretodendron quadrialatum	toog	76	0.4%
52	Litsea perrottetii	bakan	75	0.4%
53	Swietenia macrophylla	big-leafed mahogany	74	0.4%
54	Hevea brasiliensis	para rubber	72	0.3%
55	Casuarina		70	0.3%
56	Pometia pinnata	eba	68	0.3%
57	Cananga odorata	ilang-ilang	66	0.3%
58	Canarium ovatum	pili	66	0.3%
59	Terminalia foetidissima	talisai-gubat	66	0.3%
60	Calophyllum blancoi	bitanghol	65	0.3%
61	Antidesma ghaesembilla	binayuyu	64	0.3%
62	Diplodiscus paniculatus	balobo	64	0.3%
63	Ficus balete	balete	59	0.3%
64	Terminalia nitens	sakat	59	0.3%
65	Casuarina equisetifolia	agoho	57	0.3%
66	Garcinia venulosa	gatasan	57	0.3%
67	Kleinhovia hospita	bitan-ag	56	0.3%
68	Diospyros philippensis	kamagong	55	0.3%
69	Koordersiodendron pinnatum	amugis	54	0.3%
70	Alstonia scholaris	dita	52	0.2%
71	Celtis luzonica	magabuyo	52	0.2%
72	Acacia mangium	mangium	51	0.2%
73	Melanolepis multiglandulosus	alim	51	0.2%
74	Pterospermum diversifolium	bayok	48	0.2%
75	Macaranga grandifolia	bingabing	47	0.2%
76	Erythrina orientalis	dap-dap	46	0.2%
77	Saurauia latibractea	kolalabang	46	0.2%
78	Afzelia rhomboidea	balayong	43	0.2%
79	Artocarpus odortissima	marang-banguhan	43	0.2%
80	Macaranga bicolor	hamindang	43	0.2%
81	Octomeles sumatrana	binuang	43	0.2%
82	Wrightia laniti	lanete	42	0.2%
83	Aglaia banahaensis	Banahao malasaging	41	0.2%
84	Duabanga moluccana	loktob	41	0.2%
85	Xanthostemon verdugonianus	mangkono	41	0.2%
86	Symplocos salix	maksa	39	0.2%
87	Barringtonia racemosa	putat	38	0.2%
88	Intsia bijuga	ipil	38	0.2%
89	Xylocarpus granatum	tabigi	36	0.2%
90	Bischofia javanica	tuai	35	0.2%
91	Samanea saman	raintree	34	0.2%
92	Ficus septica	hauili	33	0.2%
93	Mangifera indica	mangga	33	0.2%
94	Neotrewia cumingii	apanang	33	0.2%
95	Nauclea orientalis	bangkal	32	0.2%
96	Allaeanthus luzonicus	himbaba-o	31	0.1%
97	Neonauclea formicaria	hambabalud	31	0.1%
98	Leucaena pulverulenta	giant ipil-ipil	30	0.1%
99	Neonauclea calycina	kalamansanai	30	0.1%

100	Ctenolophon philippinense	sudiang	29	0.1%
101	Parasponia parviflora	hanagdong	29	0.1%
102	Syzygium cumini	duhat	29	0.1%
103	Lagerstroemia speciosa	banaba	28	0.1%
104	Sapium luzonicum	balakat-gubat	28	0.1%
105	Garcinia ituman	ituman	27	0.1%
106	Tristania micrantha	tiga	27	0.1%
107	Calophyllum inophyllum	bitaog	26	0.1%
108	Hopea acuminata	manggachapui	26	0.1%
109	Pittospermum pentandrum	mamalis	26	0.1%
110	Syzygium nitidum	makaasim	26	0.1%
111	Bauhinia monandra	fringon	25	0.1%
112	Canarium vrieseanum	gisau	25	0.1%
113	Cratoxylum celebicum	paguringon	25	0.1%
114	Garcinia brevirostris	basan	25	0.1%
115	Syzygium gigantifolium	malatalisai	25	0.1%
116	Viburnum odoratissimum	idog	25	0.1%
117	Pisonia umbillefera	anuling	24	0.1%
118	Celtis philippinensis	malaikmo	22	0.1%
119	Lumnitzera racemosa	kulasi	22	0.1%
120	Nephelium philippinense	bulala	22	0.1%
121	Psychotria luzoniensis	katagpo	22	0.1%
122	Shorea philippinensis	manggasinoro	22	0.1%
123	Syzygium hutchinsonii	malatambis	22	0.1%
124	Albizia procera	akleng-parang	21	0.1%
125	Drypetes littoralis	bato-bato	21	0.1%
126	Podocarpus imbricatus	igem	21	0.1%
127	Dracontomelon dao	dao	20	0.1%
128	Dysoxylum	sagimsiman	20	0.1%
129	Dysoxylum laxum	tauing	20	0.1%
130	Tarrietia sylvatica	dungon	20	0.1%
131	Wallaceodendron celebicum	banuyo	20	0.1%
132	Astronia megalantha	bagaubau	19	0.1%
133	Ficus ampelas	upling-gubat	19	0.1%
134	Ficus botryocarpa	basikong	19	0.1%
135	Neonauclea media	wisak	19	0.1%
136	Palaquium pinnatinervium	tagkan	19	0.1%
137	Pandanus spp	ulango	19	0.1%
138	Claoxylon arboreum	banata	18	0.1%
139	Diospyros elmeri	balingagta	18	0.1%
140	Mallotus philippinenses	banato	18	0.1%
141	Vitex quinata	kulipapa	18	0.1%
142	Musanga cecropioides	umbrella tree	17	0.1%
143	Nephelium lappaceum	rambutan	17	0.1%
144	Ormosia calavensis	bahai	17	0.1%
145	Piliostigma malabaricum	alibangbang	17	0.1%
146	Xantophyllum excelsum	bok-bok	17	0.1%
147	Ficus benguetensis	tabul	16	0.1%
148	Lithocarpus soleriana	manaring	16	0.1%
149	Myrica javanica	hindang	16	0.1%
150	Parinari corymbosa	liusin	16	0.1%
151	Shorea polysperma f. tiaong	tiaong	16	0.1%

152	Syzygium leytense	bagotambis	16	0.1%
153	Aglaia diffusa	malasaging	15	0.1%
154	Aglaia llanosiana	bayanti	15	0.1%
155	Buchanania arborescens	balinghasai	15	0.1%
156	Ficus ruficaulis	tabgun	15	0.1%
157	Parkia roxburghii	kupang	15	0.1%
158	Radermachera pinnata	banai-banai	15	0.1%
159	Securinega flexuosa	anislag	15	0.1%
160	Actinodaphne dolichophylla	pipi	14	0.1%
161	Alphitonia philippinensis	tulo	14	0.1%
162	Araucaria bidwilli	bunya pine	14	0.1%
163	Homalanthus populneus	balanti	14	0.1%
164	Sandoricum koetjape	santol	14	0.1%
165	Saurauia leytensis	tagibokbok	14	0.1%
166	Antidesma cumingii	bignai-kalau	13	0.1%
167	Dipterocarpus warburgii	hagakhak	13	0.1%
168	Dolichandrone spathacea	tui	13	0.1%
169	Ervatamia cumingiana	salibukbuk	13	0.1%
170	Garuga floribunda	bogo	13	0.1%
171	Grewia eriocarpa	bariuan	13	0.1%
172	Leucosyke capitellata	alagasi	13	0.1%
173	Shorea kalunti	kalunti	13	0.1%
174	Alchornea rugosa	aguioi	12	0.1%
175	Dracontomelon edule	lamio	12	0.1%
176	Gliricida sepium	madre-cacao	12	0.1%
177	Homonoia javanse	mala-mala	12	0.1%
178	Palaquium tenuipetiolatum	maniknik	12	0.1%
179	Pterospermum obliquum	kulatingan	12	0.1%
180	Rapanea apoensis	tongog	12	0.1%
181	Vaccinium barandanum	dusong	12	0.1%
182	Avicennia officinalis	api-api	11	0.1%
183	Castanopsis javanica	gasa	11	0.1%
184	Cecropia peltata	trumpet tree	11	0.1%
185	Colona serrafolia	anilau	11	0.1%
186	Cryptocarya oligocarpa	malaigot	11	0.1%
187	Eucalyptus deglupta	bagras	11	0.1%
188	Evodia bintoco	bintoko	11	0.1%
189	Ilex pulogensis	papatak	11	0.1%
190	Macaranga caudatifolia	daha	11	0.1%
191	Meliosma macrophylla	balilang-uak	11	0.1%
192	Semecarpus philippinensis	kamiring	11	0.1%
193	Canarium hirsutum	milipili	10	0.0%
194	Canthium dicoccum	malakape	10	0.0%
195	Chisocheton cumingianus	balukanag	10	0.0%
196	Elaeocarpus parvilimbus	lapitling	10	0.0%
197	Lithocarpus bennettii	pangnan	10	0.0%
198	Michelia platyphylla	hangilo	10	0.0%
199	Pinus merkusii	Mindoro pine	10	0.0%
200	Pterocarpus vidalianus	prickly narra	10	0.0%
201	Aglaia elaeagnoidea	mata-mata	9	0.0%
202	Castanopsis		9	0.0%
203	Chisocheton pentandrus	katong-matsing	9	0.0%

204	Cinnamomum mercadoi	kalingag	9	0.0%
205	Homalium foetidum	aranga	9	0.0%
206	Iteadaphne philippinensis	boga	9	0.0%
207	Morinda citrifolia	bangkoro	9	0.0%
208	Neolitsea lanceolata	lanat	9	0.0%
209	Radermachera biternata	agtap	9	0.0%
210	Shorea		9	0.0%
211	Terminalia microcarpa	kalumpit	9	0.0%
212	Albizia lebbekoides	kariskis	8	0.0%
213	Anthocephalus cadamba	Kaatoan bangkal	8	0.0%
214	Artocarpus heterophylla	nangka	8	0.0%
215	Barringtonia asiatica	botong	8	0.0%
216	Bridelia glauca	balitahan	8	0.0%
217	Canarium luzonicum	piling-liitan	8	0.0%
218	Engelhardia rigida	buntan	8	0.0%
219	Koompassia excelsa	manggis	8	0.0%
220	Mallotus auriculatus	kamanian	8	0.0%
221	Prunus junghuhnianus	Palawan cherry	8	0.0%
222	Sterculia cuneata	malabunot	8	0.0%
223	Strombosia philippinensis	tamayuan	8	0.0%
224	Syzygium roseomarginatum	pamaayasen	8	0.0%
225	Tectona grandis	teak	8	0.0%
226	Terminalia samoensis	luno-luno	8	0.0%
227	Cassia javanica	antsoan	7	0.0%
228	Clethra pulgarensis	tagobahi	7	0.0%
229	Colona philippinensis	anitai	7	0.0%
230	Cordia dichotoma	anonang	7	0.0%
231	Dillenia luzoniensis	malakatmon	7	0.0%
232	Evodia confusa	mangkau	7	0.0%
233	Glochidion camiguinense	bonot-bonot	7	0.0%
234	Litchi philippinensis	alupag-amo	7	0.0%
235	Litsea glutinosa	sablot	7	0.0%
236	Palaquium merrillii	dulitan	7	0.0%
237	Planchonia spectabilis	lamog	7	0.0%
238	Pouteria macrantha	White nato	7	0.0%
239	Pouteria velutina	uakatan	7	0.0%
240	Spathodea campanulata	African tulip	7	0.0%
241	Streblus asper	kalios	7	0.0%
242	Trema cannabina	anagdung	7	0.0%
243	Trichospermum eriopodum	sayapo	7	0.0%
244	Artocarpus nitida	kubi	6	0.0%
245	Avicennia marina	bungalon	6	0.0%
246	Crypteronia paniculata	tiaui	6	0.0%
247	Cynometra luzoniensis	oringon	6	0.0%
248	Dillenia bolsteri	Bolster katmon	6	0.0%
249	Diospyros curranii	malagaitmon	6	0.0%
250	Diospyros mindanaensis	ata-ata	6	0.0%
251	Ficus irisana	aplas	6	0.0%
252	Ficus saxophila	balitarhan	6	0.0%
253	Ficus variegata v. garciae	tablot-ot	6	0.0%
254	Lansium domesticum	lansones	6	0.0%
255	Laportea meyeniana	lipang-kalabau	6	0.0%

256	Litsea garciae	bangulo	6	0.0%
257	Palaquium philippinense	malak-malak	6	0.0%
258	Persea americana	avocado	6	0.0%
259	Pipturus arborescens	dalunot	6	0.0%
260	Podocarpus philippinensis	malakauayan	6	0.0%
261	Syzygium polycephaloides	lipote	6	0.0%
262	Tamarindus indica	sampalok	6	0.0%
263	Terminalia citrina	binggas	6	0.0%
264	Timonius lanceolatus	sibau	6	0.0%
265	Abarema clypearia f. clypearia	tiagkot	5	0.0%
266	Abarema scutifera	anagap	5	0.0%
267	Antidesma pentadrum	bignai-pogo	5	0.0%
268	Artocarpus		5	0.0%
269	Baccaurea philippinensis	baloiboi	5	0.0%
270	Calliacarpa		5	0.0%
271	Camptostemon philippinense	gapas-gapas	5	0.0%
272	Chrsophyllum cainito	starapple	5	0.0%
273	Decaspermum blancoi	patalsik-pula	5	0.0%
274	Derris cumingii	tubling-kahoi	5	0.0%
275	Dipterocarpus caudatus	leaf-tailed panau	5	0.0%
276	Dipterocarpus gracilis	panau	5	0.0%
277	Garcinia rubra	kamandiis	5	0.0%
278	Guioa mindorensis	alahan-mangyan	5	0.0%
279	Hopea malibato	yakal-kaliot	5	0.0%
280	Leptospermum		5	0.0%
281	Mimusops		5	0.0%
282	Nephelium mutabile	kapulasan	5	0.0%
283	Pistacia chinensis	sangilo	5	0.0%
284	Pygeum vulgare	lago	5	0.0%
285	Randia racemosa	kapi-kapi	5	0.0%
286	Shorea falciferoides	yakal-yamban	5	0.0%
287	Sterculia		5	0.0%
288	Syzygium albayense	sambulauan	5	0.0%
289	Terminalia catappa	talisai	5	0.0%
290	Theobroma cacao	cacao	5	0.0%
291	Triplaris cumingiana	palo-santo	5	0.0%
292	Aglaia luzoniensis	kuling-manuk	4	0.0%
293	Carallia branchiata	bakauan-gubat	4	0.0%
294	Clethra lancifolia	kamog	4	0.0%
295	Cryptocarya foxworthyi	baniakau	4	0.0%
296	Endospermum ovatum	malagubas	4	0.0%
297	Ficus congesta	malatibig	4	0.0%
298	Flacourtia rukam	bitongol	4	0.0%
299	Garcinia nervosa	buradgis	4	0.0%
300	Glyptopetalum euphlebium	butingi	4	0.0%
301	Gyrocarpus americanus	Gyrocarpus	4	0.0%
302	Kopsia fruticosa	lipata	4	0.0%
303	Mangifera monandra	malapaho	4	0.0%
304	Mangifera philippinensis	paho	4	0.0%
305	Melia dubia	bagalunga	4	0.0%
306	Neanauclea bartlingii	lisak	4	0.0%
307	Olea europaea	common olive	4	0.0%

308	Palaquium foxworthyi	tagatoi	4	0.0%
309	Palaquium gigantifolia	alakaak	4	0.0%
310	Pavetta indica	gusokan	4	0.0%
311	Phoebe sterculioides	kaburo	4	0.0%
312	Polyalthia oblongifolia	lapnisan	4	0.0%
313	Saurauia trunciflora	pulak	4	0.0%
314	Spondias pinnata	libas	4	0.0%
315	Sterculia foetida	kalumpang	4	0.0%
316	Syzygium calubcob	kalubkub	4	0.0%
317	Terminalia		4	0.0%
318	Terminalia pellucida	dalinsi	4	0.0%
319	Vaccinium perrigidum	balau	4	0.0%
320	Vernonia vidalii	malasambong	4	0.0%
321	Vitex turczaninowii	lingo-lingo	4	0.0%
322	Voacanga megacarpa	bayag-aso	4	0.0%
323	Weinmannia hutchinsonii	Hutchinson kalilan	4	0.0%
324	Xylopia		4	0.0%
325	Aegiceras corniculatum	saging-saging	3	0.0%
326	Albizia saponaria	salingkugi	3	0.0%
327	Alectryon excisus	ibu	3	0.0%
328	Aleurites moluccana	lumbang	3	0.0%
329	Artocarpus communis	rimas	3	0.0%
330	Averrhoa bilimbi	kamias	3	0.0%
331	Breynia rhamnoides	matang-hipon	3	0.0%
332	Calophyllum pentapetalum	pamitoyen	3	0.0%
333	Canthium gynochthodes	butlig-babui	3	0.0%
334	Ceiba pentandra	kapok	3	0.0%
335	Cratoxylum blancoi	guyong-guyong	3	0.0%
336	Dasymaschalon clusiflorum	malaates	3	0.0%
337	Delonix regia	firetree	3	0.0%
338	Drypetes bordenii	balikbikan	3	0.0%
339	Ficus ulmifolia	is-is	3	0.0%
340	Firmiana simplex	bitnong	3	0.0%
341	Garcinia busuangaensis	batuhan	3	0.0%
342	Harpullia arborea	uas	3	0.0%
343	Hibiscus tiliaceus	malubago	3	0.0%
344	Hopea cagayanensis	narek	3	0.0%
345	Knema stenocarpa	libago	3	0.0%
346	Litsea leytensis	batikuling	3	0.0%
347	Litsea macgregorii	balanganan	3	0.0%
348	Madhuca betis	betis	3	0.0%
349	Melochia umbellata	labayo	3	0.0%
350	Murraya paniculata	kamuning	3	0.0%
351	Mussaenda philippica	boyon	3	0.0%
352	Pangium edule	pangi	3	0.0%
353	Parartocarpus		3	0.0%
354	Parinari glaberrima	tabon-tabon	3	0.0%
355	Pemphis acidula	bantigi	3	0.0%
356	Radermachera		3	0.0%
357	Schizolobium excelsum	Brazilian firetree	3	0.0%
358	Semecarpus cuneiformis	ligas	3	0.0%
359	Shorea polita	malaanonang	3	0.0%

360	Solenospermum paucinervium	malabuab	3	0.0%
361	Sophora tomentosa	sandalaitan	3	0.0%
362	Swintonia foxworthyi	lomarau	3	0.0%
363	Symplocos acuminatissima	mangkunai	3	0.0%
364	Symplocos villarii	agosip	3	0.0%
365	Syzygium glaucicalyx	mariig	3	0.0%
366	Thevetia peruviana	Peruvian bell	3	0.0%
367	Vavaea amicorum	nangka-nangka	3	0.0%
368	Vernonia arborea v. celebica	bogig	3	0.0%
369	Ziziphus talanai	balakat	3	0.0%
370	Aglaia cuminguiana	alauihau	2	0.0%
371	Ailanthus triphysa	malakamias	2	0.0%
372	Anacardium occidentale	kasui	2	0.0%
373	Anisoptera aurea	dagang	2	0.0%
374	Antidesma bunius	bignai	2	0.0%
375	Antidesma impressinerve	inyam	2	0.0%
376	Astronia		2	0.0%
377	Astronia bicolor	kalingai	2	0.0%
378	Astronia purpuriflora	kaningag	2	0.0%
379	Buchanania nitida	balitantan	2	0.0%
380	Caesalpinia sappan	sibukau	2	0.0%
381	Canarium hirsutum f. multipinnatum	dulit	2	0.0%
382	Casuarina sumatrana	maribuhok	2	0.0%
383	Citrus hystrix	kabuyau-kitid	2	0.0%
384	Elaeocarpus		2	0.0%
385	Euphorbia		2	0.0%
386	Ficus		2	0.0%
387	Ficus benjamina	salisi	2	0.0%
388	Glochidion lancifolium	kalian	2	0.0%
389	Graptophyllum hortense	atai-atai	2	0.0%
390	Guioa acuminata	pasi	2	0.0%
391	Hopea		2	0.0%
392	Horsfieldia megacarpa	yabnob	2	0.0%
393	Kopsia arborea	anatau	2	0.0%
394	Laportea brunnea	lingaton	2	0.0%
395	Lepisanthes		2	0.0%
396	Litchi chinensis	licheas	2	0.0%
397	Lithocarpus apoensis	Apo oak	2	0.0%
398	Lithocarpus jordanae	katiluk	2	0.0%
399	Litsea vanoverberghii	baaken	2	0.0%
400	Madhuca amindanaensis	silanangsang	2	0.0%
401	Mallotus multiglandulosus v. pendulus	alim-bitin	2	0.0%
402	Matthaea sancta v. venulosa	balit	2	0.0%
403	Melicope triphylla	matang-arau	2	0.0%
404	Myristica guatteriaefolia	duguan-mabolo	2	0.0%
405	Neolitsea vidalii	puso-puso	2	0.0%
406	Osbornia octodonta	taualis	2	0.0%
407	Palaquium lanceolatum	palak-palak	2	0.0%
408	Pouteria campechiana	tiesa	2	0.0%
409	Premna adenosticta	kalangiauan	2	0.0%
410	Psidium guajava	bayabas	2	0.0%

411	Rauvolfia membranaceae	andarayan	2	0.0%
412	Sesbania grandiflora_	katurai	2	0.0%
413	Stemonurus hallieri	malatadu	2	0.0%
414	Sterculia glabrifolia	uos	2	0.0%
415	Syzygium vidalianum	bagilumboi	2	0.0%
416	Tarrietia javanica	lumbayau	2	0.0%
417	Tectona philippinensis	Philippine teak	2	0.0%
418	Thespesia populnea	banalo	2	0.0%
419	Trichadenia philippinensis	malapinggan	2	0.0%
420	Vitex glabrata	bongoog	2	0.0%
421	Voacanga globosa	bayag-usa	2	0.0%
422	Wendlandia glabrata	lanipa	2	0.0%
423	Acalypha		1	0.0%
424	Acmena acuminatissima	binoloan	1	0.0%
425	Aegiceras floridum	tinduk-tindukan	1	0.0%
426	Aglaia laevigata	gisihan	1	0.0%
427	Albizia magallanensis	unaki	1	0.0%
428	Alstonia macrophylla v. mollis	batinong-mabolo	1	0.0%
429	Alstonia parvifolia	batinong-liitan	1	0.0%
430	Antidesma		1	0.0%
431	Antidesma nitidum	bignai-kintab	1	0.0%
432	Aphanamixis perrottetiana	kangko	1	0.0%
433	Ardisia sibuyanensis	lolumboi	1	0.0%
434	Ardisia soligna	dapui	1	0.0%
435	Ardisia squamulosa	tagpo	1	0.0%
436	Azadirachta excelsa	maranggo	1	0.0%
437	Beilschmiedia		1	0.0%
438	Bixa orellana	achuete	1	0.0%
439	Broussonetia paprifera	paper-mulberry	1	0.0%
440	Buddleja asiatica	taliknono	1	0.0%
441	Calophyllum cucullatum	palumut	1	0.0%
442	Calophyllum mindanaense	Mindanao bitanghol	1	0.0%
443	Calophyllum obliquinervium	dangkalan	1	0.0%
444	Chisocheton clementis	dagau	1	0.0%
445	Cinnamomum microphyllum	kalingag-liitan	1	0.0%
446	Citrus macroptera v. southwickii	limau	1	0.0%
447	Colona mollis	keddeng	1	0.0%
448	Commersonia bartramia	kakaag	1	0.0%
449	Cordia cumingiana	anonang-lalaki	1	0.0%
450	Croton heterocarpus	tuba-tuba	1	0.0%
451	Cryptocarya ampla	bagarilau	1	0.0%
452	Cryptocarya lauriflora	lamot	1	0.0%
453	Cubilia cubili (Blanco) Adelb.	kubili	1	0.0%
454	Decaspermum fruticosum	patalsik	1	0.0%
455	Dillenia reifferscheidtia	katmon-kalabau	1	0.0%
456	Diospyros bulusanensis	baganito	1	0.0%
457	Diospyros longiciliata	itom-itom	1	0.0%
458	Diospyros montana	kamagong-bundok	1	0.0%
459	Diplodiscus		1	0.0%
460	Dipterocarpus		1	0.0%
461	Durio zibethinus	durian	1	0.0%
462	Elmerrillia		1	0.0%

463	Ervatamia cordata	sakang-manuk	1	0.0%
464	Euphorbia plumerioides	bait	1	0.0%
465	Evodia		1	0.0%
466	Evodia crassifolia	balasbas	1	0.0%
467	Excoecaria philippinensis	dakau	1	0.0%
468	Ficus cumingii	isis-ibon	1	0.0%
469	Garcinia mangostana	mangosteen	1	0.0%
470	Gardenia megalocarpa	kalapi	1	0.0%
471	Geunsia cumingiana	danasi	1	0.0%
472	Gironniera celtidifolia	magaubau	1	0.0%
473	Glochidion merrillii	pud-pud	1	0.0%
474	Glochidion traindrum	bagna	1	0.0%
475	Gnetum gnemon v. gnemon	bago	1	0.0%
476	Goniothalamus lancifolius	monat	1	0.0%
477	Grewia inflexa	banglad	1	0.0%
478	Grewia setacea	alinau	1	0.0%
479	Guioa koelreuteria	alahan	1	0.0%
480	Heritiera littoralis	dungon-late	1	0.0%
481	Homalanthus alpinus	buta	1	0.0%
482	Homalium panayanum	ampupuyot	1	0.0%
483	Hopea mindanensis	yakal-magasusu	1	0.0%
484	Hydnocarpus		1	0.0%
485	Itea macrophylla	kodai	1	0.0%
486	Ixora macrophylla	asas	1	0.0%
487	Jossinia aherniana	kamania	1	0.0%
488	Lagerstroemia piriformis	batitinan	1	0.0%
489	Leea aculeata	amamali	1	0.0%
490	Lepisanthes macrocarpa	balungai	1	0.0%
491	Linociera ramiflora	karaksan	1	0.0%
492	Lithocarpus buddii	Camus-babaisakan	1	0.0%
493	Litsea baractanensis	sablot-linis	1	0.0%
494	Litsea euphlebia	matang-usa	1	0.0%
495	Litsea luzonica	dungoi	1	0.0%
496	Litsea urdanetensis	dilak-manuk	1	0.0%
497	Lunasia amara	lunas	1	0.0%
498	Macaranga cumingii	anitap	1	0.0%
499	Mangifera caesia	baluno	1	0.0%
500	Mangifera longipes	apali	1	0.0%
501	Memecylon venosum	gikayan	1	0.0%
502	Nauclea multicephala	kabak	1	0.0%
503	Neonauclea		1	0.0%
504	Neonauclea reticulata	malauisak	1	0.0%
505	Ochna foxworthyi	bansilai	1	0.0%
506	Parartocarpus venenosus subsp. Papuanus	malanangka	1	0.0%
507	Parinari		1	0.0%
508	Pometia tomentosa	tugaui	1	0.0%
509	Premna integrifolia	alagau-dagat	1	0.0%
510	Premna membranifolia	agbau	1	0.0%
511	Pterospermum cumingii	talinuanga	1	0.0%
512	Rhizophora stylosa	bangkau	1	0.0%
513	Saurauia elegans	uyok	2	0.0%
514	Securinega		1	0.0%

515	Semecarpus gigantifolia	manalu	1	0.0%
516	Serialbizia acle	akle	1	0.0%
517	Shorea malibato	yakal-malibato	1	0.0%
518	Shorea seminis	malayakal	1	0.0%
519	Spiraeopis celebica	bognag	1	0.0%
520	Spondias purpurea	sineguelas	1	0.0%
521	Sterculia graciliflora	bolat	1	0.0%
522	Sterculia oblongata	malabuho	1	0.0%
523	Sterculia philippinensis	banilad	1	0.0%
524	Symplocos bulusanensis	magoting	1	0.0%
525	Syzygium aqueum	tambis	1	0.0%
526	Syzygium costulatum	paitan	1	0.0%
527	Syzygium mananquil	manangkil	1	0.0%
528	Syzygium martelinoi	bagohangin	1	0.0%
529	Syzygium samarangense	makopa	1	0.0%
530	Syzygium subsessiliflorum	malagulagan	1	0.0%
531	Syzygium tula	tula	1	0.0%
532	Teijsmanniodendron pteropodum	tikoko	1	0.0%
533	Terminalia calamansanai	malakalumpit	1	0.0%
534	Timonius arboreus	mabalod	1	0.0%
535	Trigonachras cuspidata	salab	1	0.0%
536	Tristania littoralis	taba	1	0.0%
537	Villebrunea rebescens	alipasio	1	0.0%
538	Ziziphus		1	0.0%
539	Ziziphus trinervia	duklap	1	0.0%
540		***various unidentified species (or species with local names)	1206	5.8%

Annex 6: Summary DBH Class by Forest Type

Forest Type	Area	Tree Count /ha	Trees/ha by diameter class												
			DBH 15 (10-19)	DBH 25 (20-29)	DBH 35 (30-39)	DBH 45 (40-49)	DBH 55 (50-59)	DBH 65 (60-69)	DBH 75 (70-79)	DBH 85 (80-89)	DBH 95 (90-99)	DBH 105 (100-109)	DBH 115 (110-119)	DBH 125 (120-129)	DBH 135 & up (130 up)
FB - Closed	4316601	463	327	53	39	24	10	5	2	1	1	0	0	0	0
FB- Open	1716627	216	127	43	23	13	4	3	1	1	1	0	0	0	0
FC - Close	22836	226	0	42	42	42	26	42	32	0	0	0	0	0	0
FC - Open	189750	127	75	18	7	10	7	6	4	1	1	0	0	0	0
FM - Close	64629	no measurement was conducted													
FM - Open	18096	67	0	31	26	7	2	2	0	0	0	0	0	0	0
PB - Close	263944	93	61	24	7	1	0	0	0	0	0	0	0	0	0
PB - Open	345462	120	55	50	11	2	1	0	0	0	0	0	0	0	0
PC - Close	8617	110	0	40	5	40	15	10	0	0	0	0	0	0	0
PC - Open	1896	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB - Close	96943	17	10	2	4	1	0	0	0	0	0	0	0	0	0
BB- Open	59631	9	0	4	3	0	1	0	0	0	0	1	0	0	0
Mg - Close	31022	570	475	39	41	15	0	0	0	0	0	0	0	0	0
Mg - Open	9565	80	71	9	1	1	1	0	0	0	0	0	0	0	0
Total	7145619														

Legend:

FB – Close: Natural Broadleaved Forest Close
FB – Open: Natural Broadleaved Forest Open
FC – Close: Natural Coniferous Forest Close
FC – Open: Natural Coniferous Forest Open
FM – Close: Mixed Forest Close
FM – Open: Mixed Forest Open
PB – Close: Broadleaved Plantation Close
PB – Open: BroadleavedPlantation Open
PC – Close: Coniferous Plantation Close
PC – Open: Coniferous Plantation Open
BB – Close: Bamboo/Boho Formation Close
BB- Open: Bamboo/Boho Formation Open
Mg – Close: Mangrove Forest Close
Mg – Open: Mangrove Forest Open