



Forestry Department

Food and Agriculture Organization of the United Nations

NATIONAL FOREST INVENTORY

FIELD MANUAL TEMPLATE

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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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Abbreviations

cc	canopy cover	GPS	Global Positioning System
Dbh	diameter at breast height	LUS	land use/forest type section
Dsh	diameter at stump height	NGO	Non Governmental Organization
FAO	Food and Agricultural Organization	NWFP	non wood forest product
FRA	Forest Resources Assessment programme	P/S	products and services
		RRA	rapid rural appraisal

1. Introduction

This field manual contains definitions and procedures used to plan and perform a national forest inventory and assessment following the approach developed by the Forest Resources Assessment programme (FRA) of the FAO. The methodology, based on nation-wide field sampling, has already been tested and implemented in several countries since year 2000 (Costa Rica, Guatemala, Philippines, Cameroon and Lebanon).

The purpose of the national forest inventory (NFI) is to assess forest resources and tree resources outside forest and to provide new qualitative and quantitative information on the state, use, management and trends of these resources. The assessment covers a large range of biophysical and socio-economic variables and thus, provides a broad and holistic view of land use for the country as a whole. In particular, the information will be used to plan, design and implement national and international policies and strategies for sustainable use and conservation of forestry ecosystems, and to understand the relationship between resources and users of the forest and tree resources.

The first part of the manual describes the adopted sampling design and the distribution and configuration of the tracts where measurements are carried out. The second part deals with the forest type/land use classification adopted to carry out the inventory. Recommendations to undertake data collection in the field are presented in the third part. In part four the field forms are described in detail.

The Appendices provide some tools and methods for measuring the variables such as diameter, height, horizontal distance, a guide for the use of Global Positioning System receivers (GPS) as well as techniques and recommendations to carry out interviews and group discussions.

2. Sampling design

2.1 Tract selection and distribution

The sampling design adopted for the national forest resources assessment is systematic. Tracts are selected at least at the intersection of every degree of the latitude/longitude grid.

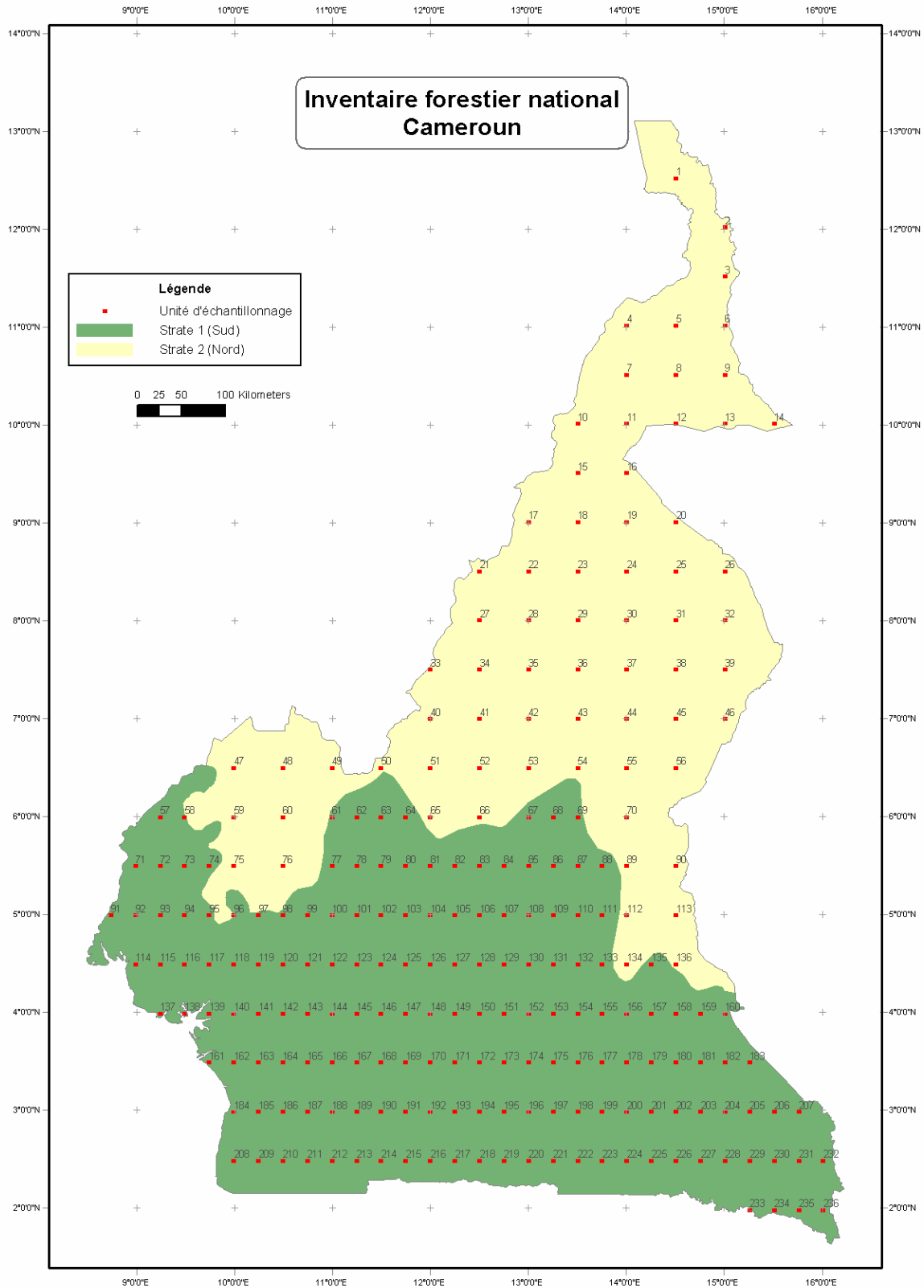
Depending on country's situations and information needs, higher sampling intensity may be applied. Stratification may be adopted in situations where stable strata such as ecological zones are deemed to improve the design.

The example of Cameroon is shown in Table 1 and Figure 1 below. The systematic and stratified sampling design applied (30 minutes latitude by 15 minutes longitude in stratum 1 and 30 minutes latitude by 30 minutes longitude in stratum 2) resulted in the selection of 236 tracts nation-wide.

Table 1. Tract density per stratum in Cameroon

Stratum	Tract number	Distance between tracts	
		(minutes)	(km)
1	167	lat 30' x lon 15'	km 50 N X 25 km E
2	69	lat 30' x lon 30'	km 50 N X 50 km E
TOTAL	236		

Figure 1. Distribution of tracts for the national forest inventory of Cameroon



2.2 Tract description

Forest and tree inventory data is exclusively collected within the limits of the **tract**. Data is collected through observations, measurements and interviews at different levels: within the tracts, which represents the highest level, then in smaller sub-units (plots and subplots) demarcated within the tracts.

A **tract** is a square of 1 km x 1 km (see figure 2). The co-ordinates of the south-west corner of the tracts correspond to those of the points selected in the systematic sampling frame. Each tract contains four field plots.

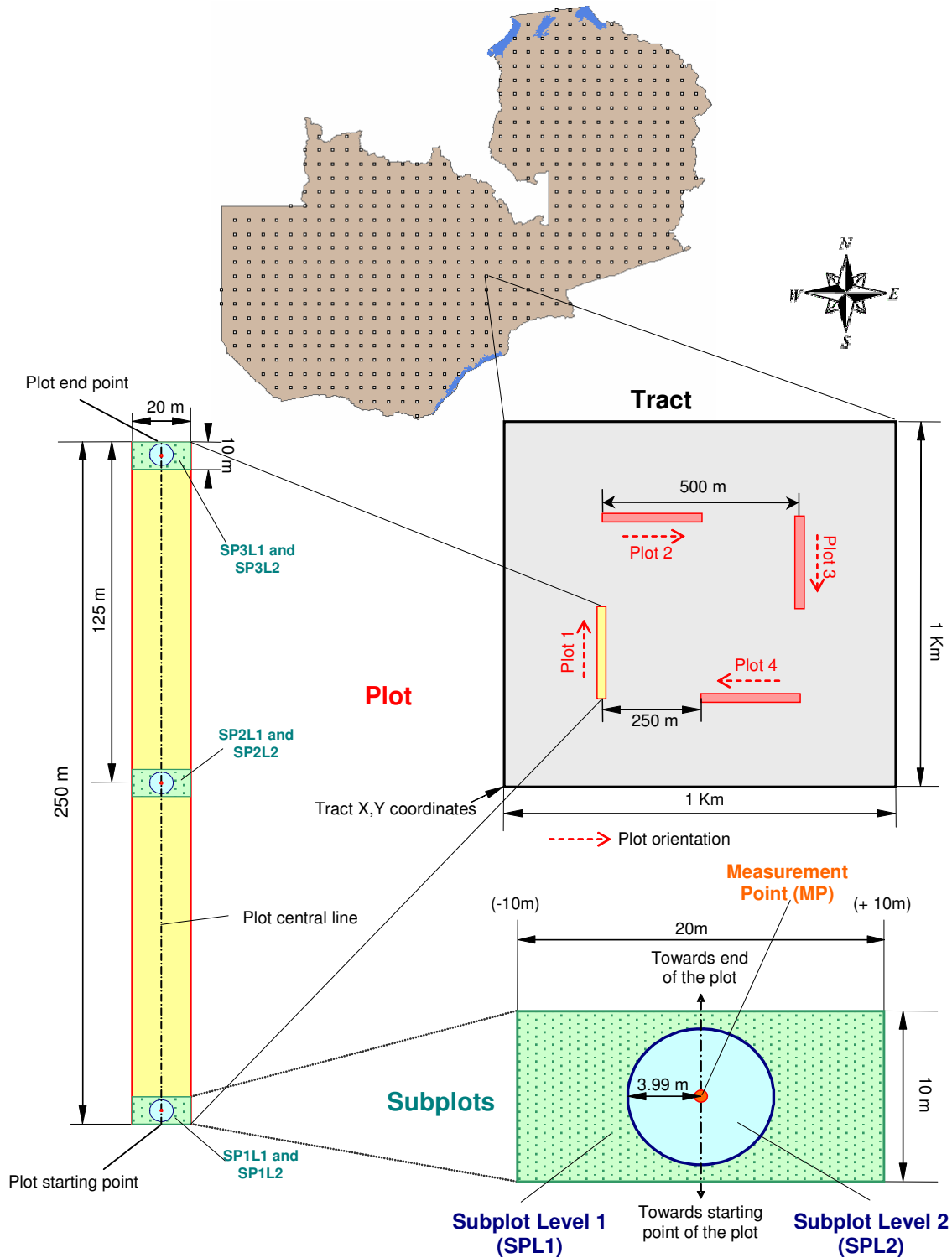
The **plots** are rectangles measuring 20 m wide and 250 m long. They start at each corner of an inner 500 m square (same centre as tract's) and are numbered clockwise from 1 to 4 as shown in figure 2. The location and orientation of the 4 plots are given in Table 2.

Table 2. Plot location and orientation

Plot	Location of the starting point of the plot, within the 500 m inner square	Orientation	Bearing
Plot 1	South-West corner	South-North	0 / 360 degrees
Plot 2	North-West corner	West-East	90 degrees
Plot 3	North-East corner	North-South	180 degrees
Plot 4	South-East corner	East-West	270 degrees

Three pairs of **subplots** are delimited within each plot. They correspond to two different data collection levels: 3 rectangular subplots (SPL1) measuring 20m x 10m, corresponding to level 1, and 3 circular subplots (SPL2) with a radius of 3.99 m, corresponding to level 2, located in the centre of the rectangular subplots. Both subplots categories are numbered from 1 to 3, starting at the starting point of the plot. The subplots serve to measure tree regeneration ($Dbh < 10$ cm) and small diameter trees ($10 \leq Dbh < 20$ cm) in forest. An edaphic and topographic measurement point is established at the centre of each subplot. **When the location of the subplots falls in land use classes other than forest, they must not be demarcated.**

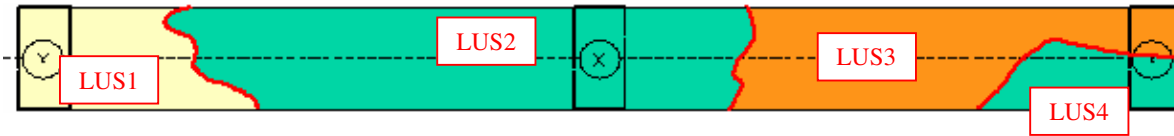
Figure 2. Tract, plot and subplot design



Each plot is divided into **land use/forest type sections (LUS)** representing homogenous land use or forest type units, with variable size and shape that have been identified in the field. The classification system adopted to identify the different land use classes and forest types is described

in chapter 3. Most of the data related to forest characteristics, management and resources use and users are collected within the LUS.

Figure 3. Example of land use sections (LUS) distribution within a plot



There are 4 land use sections in this plot. The red lines indicate the limits between them. LUS2 and LUS4 belong to the same Land Use class.

The specifications of the different units are summarized in Table 3. All the distances indicated are horizontal.

Table 3. Inventory unit specifications

Unit	Shape	Size * (area)	Number
Tract	Square	1000 m x 1000 m (1km ²)	1
Plot	Rectangle	250 m x 20 m (5000 m ²)	4/tract
Subplot level 1	Rectangle	20 m x 10 m (200 m ²)	3/plot
Subplot level 2	Circular	Radius r = 3,99 m (50 m ²)	3/plot
Land use/forest type section (LUS)	Variable	Variable	Variable

Notes: All distances indicated are horizontal distances.

3. Land use/forest type classification

The classification system used to define land use/forest type classes is based on a dichotomous approach and includes two levels:

- The first level is composed by the global classes designed for the assessment of forest and tree resources at the global level;
- The second level is country specific, and includes additional classes integrated in order to take into account national and sub-national information needs.

The global classes were developed within the framework of the Global Forest Resources Assessment of FAO. The terms and definitions used in national assessments are chosen to harmonize national with global level forest assessments. The global classes include:

- Forests;
- Other wooded land;
- Other land;
- Inland water.

The global classes ensure harmonisation of the classifications between countries for regional or global assessments. The second level of classification is designed to meet specific country needs for information.

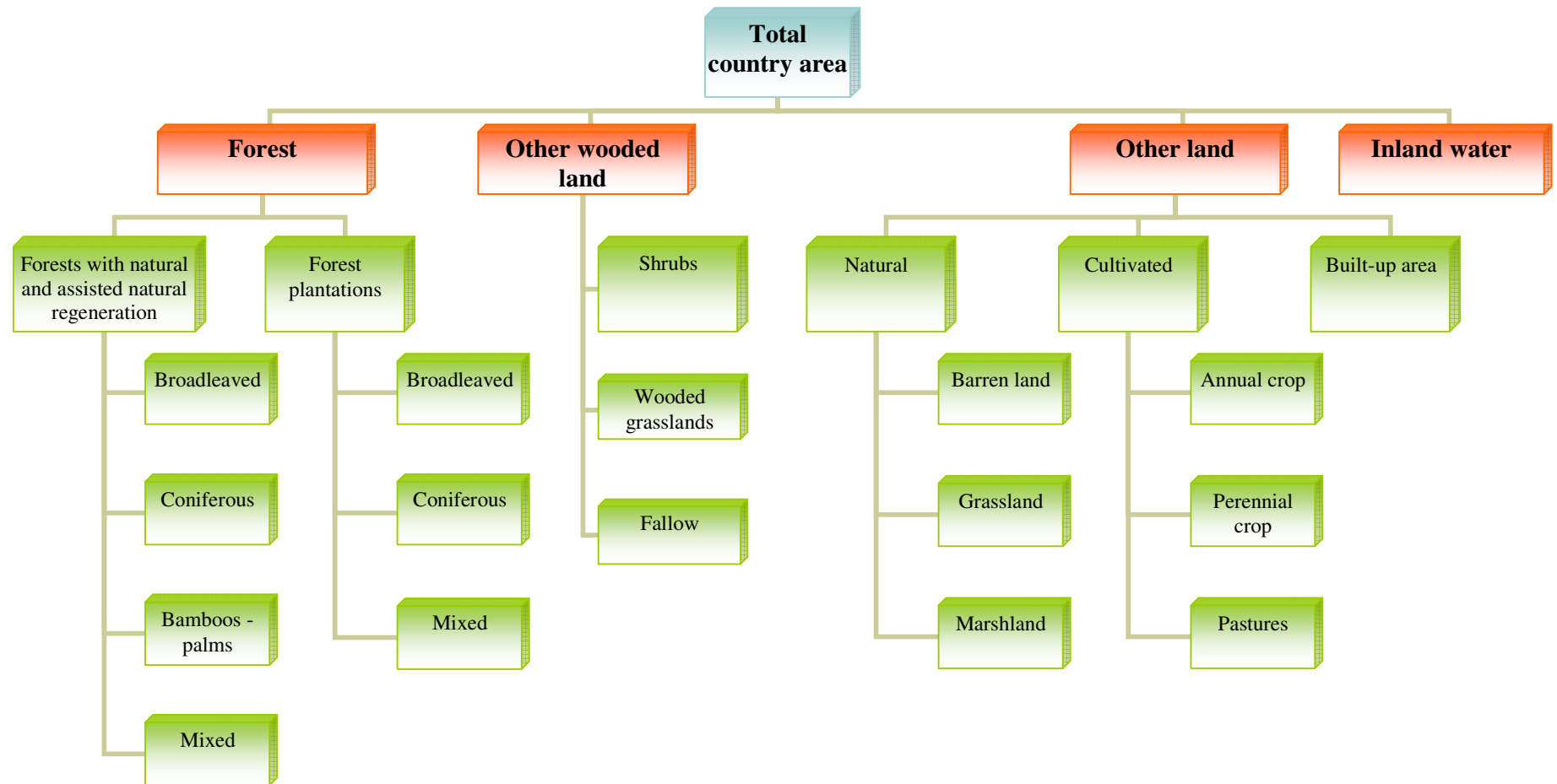
A code with 2 to 4 characters has been assigned to each class in order to facilitate data collection and input.

The classes and related codes used in the inventory are shown in Table 4. The diagram on Figure 4 shows the dichotomous approach and the class subdivision. Classes are further defined in the Annexes (section 6.1).

Table 4. Land use/forest type classification

Classes	Code
Forest	
Forest with natural or natural assisted regeneration	
Broadleaved forest	FB
Coniferous forest	FC
Bamboo or palm forest	FB
Mixed forest	FM
Forest plantations	
Broadleaved forest plantation	PB
Coniferous forest plantations	PC
Mixed forest plantations	PM
Other wooded lands	
Shrubs	Sh
Fallow	Fa
Wooded grassland	WGL
Other land	
Natural and semi natural land	
Barren land	Bl
Grassland	Gl
Marshland	Ml
Cultivated and managed land	
Annual crop	AC
Perennial crop	PC
Pastures	Pa
Built up area (urban or rural)	BUA
Inland water	IW

Figure 4. Forest type/land use classification



4. Fieldwork

This part includes recommendations to prepare and carry out fieldwork activities. The fieldwork, together with recommendations on the data collection techniques, is described step by step for a tract.

4.1 Overview of data collection process

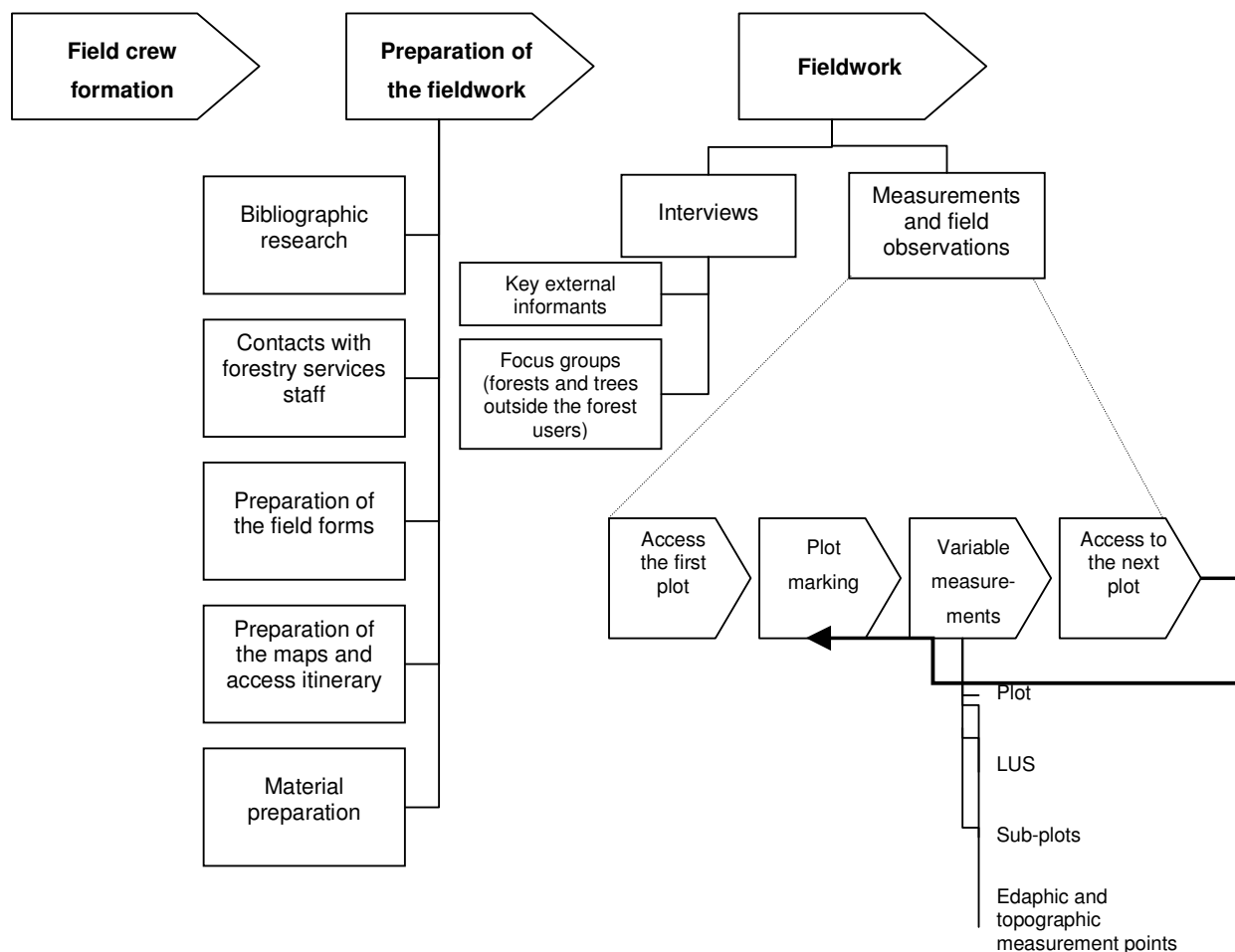
Data are collected by the field crews for tracts, plots, subplots and LUS. The two main information sources for the inventory are:

- Field measurements and observations;
- Interviews with local people, land owners or users, key external informants such as foresters responsible for the area where the tract is located.

These two sources of information imply the use of different methods and approaches that complement each other. One them will be used as the main source, according to the type of information and field conditions. As much as possible, field observations should be applied to confirm the information obtained from interviews.

The process for data collection is summarized in figure 5.

Figure 5. Data collection procedures



4.2 Fieldwork organisation

4.2.1 Organisation structure

The organisation structure of National Forest Assessment (NFA) in the country may be as follows:

- A **National Technical Team** will coordinate and monitor the NFA at National level. This will be done by:
 - Analysis and adaptation, if needed, of sampling design, inventoried variables and definitions;
 - Setting up field crews;
 - Conducting training for field crews;

- Organising and planning fieldwork, in particular mobilisation and preparation of necessary resources and equipment, such as vehicles, and allocation of tracts by field crews;
 - Monitoring and backstopping fieldwork, including technical and logistic support to field crews, in order to ensure data quality and homogeneity among field crews;
 - Controlling and validating field forms;
 - Controlling data and evaluating its quality;
 - Compiling databases; and
 - Reporting and disseminating results.
- **Field Crews** will be responsible for collection of data in the field.

4.2.2 Field crew composition

A forest inventory field crew, taking into account the amount of information to be collected and the tasks of each individual, is composed by at least four members. Additional persons may be included to improve performance of the field crews when conditions require greater resources. It is desirable that some in the field crews are hired locally and act as guides in the field. The crew leader and/or his/her assistant should be experienced in participatory interview techniques to collect socio-economic data from local people. One of the crew members must be experienced in tree species identification. It is preferable that the field crews include both men and women to facilitate the interviews and it is also advised to include forestry students for capacity building.

The responsibilities of each crew member must be clearly defined and their tasks are proposed as follows:

- The **crew leader** is responsible for organizing all the phases of the fieldwork, from the preparation to the data collection. He/she has the responsibility of contacting and maintaining good relationships with the community and the informants and has a good overview of the progress achieved in the fieldwork. He/she will specifically:
 - prepare the fieldwork by carrying out bibliographic research, preparing field forms and maps;
 - plan the work for the crew;
 - contact local forestry officers, authorities and the community. Introduce the survey objectives and the work plan to the local forestry service staff and authorities, and request their assistance to contact the local people, identify informants, guides and workers;
 - administer the location of tracts and plots;
 - take care of logistics of the crew by organizing and obtaining information on accommodation facilities, recruiting local workers, organizing access to the tracts;
 - interview external informants and local people;
 - ensure that field forms are properly filled in and that collected data are reliable;

- organize meetings after fieldwork in order to sum up daily activities;
- organize the fieldworks safety.
- **The assistant of the crew leader** will:
 - help the crew leader to carry out his/her tasks ;
 - take necessary measurements and observations;
 - make sure that the equipment of the crew is always complete and operational;
 - supervise and orient the workers.
- **The workers** are assigned the following tasks, according to their skills and knowledge of local species, language and practices:
 - help to measure distances ;
 - open ways to facilitate access and visibility to technicians;
 - provide the common/local name of forest species;
 - inform about access to the tract;
 - provide information about the forest uses and management;
 - carry the equipment.

Training of the crews on the survey methodology should be undertaken at the beginning of the fieldwork in theoretical and practical sessions where techniques of different forest and tree measurements, tally of data and techniques of interviews will be explained and practised.

The names and addresses of the crew members must be written down in field form F1 part B.

4.3 Preparation for the fieldwork

4.3.1 Bibliographic research

In forest inventories auxiliary information is necessary to prepare the field survey and carry out the interviews. Existing reports on forest inventory, national policy and forestry community issues, local people, etc. have to be studied to enable the crew members to understand and to build better knowledge on the local realities.

4.3.2 Contacts

Each field crew, through its leader, should start its work by contacting staff of the local forestry services in charge of the area where the tracts are located. The local staff may help contacting the authorities, community leaders and land owners in order to introduce the field crew and its programme of work in the area. The local forestry staff may also provide information about access conditions to the site and about the people who can be locally recruited as guides or workers. They may also inform the local people about the project.

Depending on the social context in the country/region, the forest owners may be requested to provide the crews with a written authorization to access the property where the tract is located.

A recommendation letter, written by the Forestry Department and asking for support and assistance to the field crew members, should be issued to facilitate the work.

The data related to the land owners and informants must be reported in **form F1, part B**.

4.3.3 Preparation of the field forms

The Technical Unit of the project will prepare and print, for each crew, the necessary field forms to cover the tracts assigned to it. Six field forms, of one or more pages, are needed for each tract. The forms are described in the following section (section 5).

Some information will be filled-in before going out in field: sections for **identification of the tract** and plots (header of each page), general information related to tract location (**form F1, section A**), coordinates of the starting point of the plot (**form F2, section A**).

The use of secondary data sources, particularly maps, is necessary to determine information such as names of administrative centres (administrative maps) and ecological zones (FAO/FRA 2000 global ecological zones map). Some sections in the form may be filled-in during the preparation phase and be verified, in the field, later on: population data (**form F1, part C**), information on distances to infrastructure (**form F1, part D**).

The crew leader must ensure that enough forms are available to carry out the planned field data collection.

4.3.4 Preparation of maps

Maps covering the study area should be prepared to help the orientation in the field. These may be enlarged and reproduced, if necessary.

Prior to the field visit, each crew must plan the itinerary to access the tract, which should be the easiest and least time consuming. Advices of local informants (local forestry staff, for example) are usually valuable and help saving time in searching the best option to access the tract.

The tract and plot limits will be delineated on topographic maps and possibly on aerial photographs/satellite images, if available. The spots that correspond to the starting point of the plot in the tract are to be indicated, together with their respective coordinates, in the map projection system as well as in decimal degrees (latitude and longitude). The first system is more precise and easier to apply when using the maps, and will be used in GPS.

An enlarged section of the map corresponding to the area surrounding the tract will be prepared (photocopy or printed copy) and used to draw the access itinerary to the first plot.

The plot order for data collection will vary according to conditions of accessibility. It is determined during the preparation phase.

Reference objects (roads, rivers, houses) that contribute to the better orientation of the crew in the field are identified during the planning phase.

The starting point coordinates of the plots are entered into the GPS receiver according to following: (Tract number) + "P"(=Plot) + (Plot number) + "S"(=Starting point), e.g. for tract 13, plot 3: 013P3S.

4.3.5 Field equipment per crew

The equipment needed to carry out the inventory is composed of:

- Compass (360°);
- GPS receiver (Geographic Positioning System) and extra batteries;
- 2 self rolling measuring tapes 10-30 m (metric);
- 2 diameter tapes or calliper (metric);
- Tree height and land slope measuring equipment: clinometers;
- 50 m measuring tape or 50 meter metal rope, marked at every 5 meters;
- Coloured flagging;
- 50 cm (length) galvanized steel bars for plot marking;
- Waterproof bags to protect measurement instruments and forms;
- Binoculars(optional);
- Range finder (recommended);
- Radio /mobile phone(optional);
- Camera and films (or digital camera);
- Waterproof boots and outfits;
- Machetes;
- Emergency kit;
- Topographic maps;
- Supporting board to take notes;
- Data collection forms;
- Field manual;
- Permanent markers and pens;
- Flora and species list (common and scientific names);
- Flipchart;
- Flashlight.

4.4 Data collection in the field

4.4.1 Introduction of the project to the local people

If the tract area is inhabited, the crew must establish contacts with local people and on arrival to the site, meet with contacted persons and others such as village representative, closest forestry service in place, owners and/or people living in the tract area. In many cases, it will

be necessary to contact the local population before visiting the area in order to inform them about the visit and request permission to access the property. An introductory meeting may also be organized.

The crew must briefly introduce and explain the aim of the visit and study. A map or an aerial photograph, showing the limits of the tract, may be very useful to facilitate the discussion. It is important to ensure that both local people and the inventory crew understand which area will be studied. The aim of the forest inventory must also be clearly introduced to avoid misunderstandings or raise false expectations. Cooperation and support from local people are essential to carry out the fieldwork. It is easier to achieve this support if the first impression is good. Nevertheless, it must be stressed that the fieldwork consists only in data collection and not local development project.

Some key points about the project introduction are mentioned in Box 1.

Box 1. Key points to be stressed during the presentation of the project to the local people

- This project is part of a programme for tree and forest data collection over the whole world.
- An objective of this study is to support national training in forests inventories and data collection on forest use by interacting with the local forest users.
- The data are collected from two sources: (1) Measurements of the forests and trees outside the forests; and (2) Interviews with forest users and other people who are knowledgeable of the area. Measurement examples to be mentioned may be: tree diameter and height, as well as forest species composition. The field crew should be equally interested in the local people's perception on forest changes, the main forest products, forest related problems, and will therefore interview forest users.
- The outside world has little information about the local use of forests and about the problems that might exist at the local level. The collected forest and tree information will be used by the country and the international community. The objective is to generate reliable information for improved forest policies that takes into account people's reality and needs. Hopefully, this can lead to forest and tree resources being managed in a sound and sustainable way.
- The tracts where the survey will be carried out are distributed systematically throughout the country.
- The results from the study will be shared with the local community.
- Some or all of the tracts surveyed in the country will be monitored in the future, with the aim of assessing forest and tree changes.

Besides the presentation of the project, this initial meeting aims at resolving logistic matters. After the general introduction, access to the forest, interview schedule as well as food and accommodation issues will be discussed. This meeting should also give the opportunity to start the interviews to collect socio-economical information. The number of people included in the field crew must then be reduced to avoid giving the impression that the interviewers dominate the group. Historical information related to the changes in the area (see participatory exercise using aerial photographs in annex, section 6.5.3 page 77) is a good starting point for the discussions.

The field inventory schedule to be carried out in the next days must be explained. This meeting is one of the opportunities to identify key informants and focus groups for interviews. It is recommended to schedule the interviews so that they fit with the daily work-schedule of the people.

All the persons interviewed and providing information on the tract must be mentioned in the list of persons involved in the inventory (**form F1, section B**).

4.4.2 Access to plot

The plots will be located with the help of the topographic maps (and aerial photographs/satellite images, if available), where the plots have been delineated. Some reference points that facilitate the orientation in the field will also be identified on the maps. A local guide will be useful to access the plots more easily. Orientation in the field will be assured with the help of a GPS where the starting points of each plot have been registered as waypoints. To get to a well defined starting point, an average position should be taken with the GPS when its reading indicates that the starting point is within a few meters (less than 10m). Then, the compass and measuring tape might be used for the last few meters instead of the GPS.

The order of the plots for data collection, decided during the preparatory phase, should be followed and the plot code and orientation must be respected (the collection task must start at the plot starting point).

While accessing the first plot, form **F1, section E** must be filled in. The coordinates of the departure location on foot towards the first plot must be read on GPS (or on the map, if the GPS does not capture a signal). A sketch representing the covered itinerary will be drawn on the site map (to be attached to the field form), with indications of the reference objects that will facilitate the relocation of the plot. The coordinates of each reference point are read on the GPS and a reference photograph may also be taken. Then, the film and photograph codes will be reported in the form. The flagging coloured tape can be placed along the access path, on trees visible enough to facilitate the return out of the tract.

4.4.3 Establishment of permanent plot

When arriving to the starting point of the first plot, a permanent marker (galvanized metal tube) is placed into the ground. The marker must be placed exactly on the position of the starting point of the plot. In cases where obstacles obstruct such exact location (tree, rock, river etc.), the permanent marker should be placed as close as possible to the starting point of the plot.

Marker location data must be collected together with a starting point description of the plot in order to enable relocation in the future:

- the coordinates of plot marker position are determined, with the help of GPS, as average position. An identification code will be assigned to name each one of the points identified by the GPS, according to following: (Tract number) + "P" (= Plot) + (Plot number) + "M" ("Marker"), e.g. for tract 13, plot 3: 013P3M;

- the distance and direction (compass bearing in degrees, 360°) of the plot's starting point, measured from the marker location, must be measured in case that these two positions do not coincide ;
- three prominent reference objects (rock, largest tree, houses etc.) must be identified and the direction (compass bearing in degrees starting from the marker location) and distance from the marker measured.

These indications are recorded on **section A** of **form F2** and are reported on a sketch where the reference points and the starting point of the plot are indicated. A brief description of the reference points will also be provided in a table (the columns containing the bearing and the distance from the marker position may be filled-in according to the sketch indications after the field work).

Markers should be positioned at the starting point of all the plots.

4.4.4 Data collection in the plot

The data collection starts at the plot starting point and continues in predefined direction (see prepared maps and Figure 2). The progress along the central line will be made with the help of the compass and 50 m rope (or metal string), to get a well defined central line. In order to facilitate the bearing, flagging coloured tape may be stretched along the central line and attached to trees as the field crew advances.

Measurements involve both sides, from the central line on a 10 m wide extension. Flagging coloured tape may also be placed on the corners and limits of the plot (at 10 m from the central line) as the crew advances, in order to easily identify the trees within the plot.

Different variables are collected according to the data collection level dealt with:

- **Plot:** measurements of large trees and stumps ($Dbh \geq 20$ cm, or ≥ 10 cm for the trees outside forest). These data are to be recorded in form **F3a or b** (one for each plot). A plan of the plot must also be completed in **form F2 (section C)**. Then, information on forest and tree uses (forest products and services) is reported in **form F6** (one for each plot).
- **Subplots (SP):** topographic and edaphic (soil) data, together with small diameter tree and tree regeneration data, are collected inside forest at this level. Data related to small diameter trees and stumps in subplots level 1 (SPL1) are reported in **form F3 (a/b)**. Data related to tree regeneration from subplots level 2 (SPL2), and topographic and edaphic information collected at the three measurement points (MP), are registered in **form F4**. SPL1, SPL2 and Measurement Point (MP) are established only if they are located in a LUS classified as "forest".
- **Land use/forest type section (LUS):** corresponds to the land use/forest type sections identified along the plot. Information collected at this level will be contained in the field **forms F5** (one for several LUS). Data collected at that level is general information related to the area (legal status, designation, environmental problems etc., in **form F5 section A**) and forest management and structure (harvesting, silviculture, in **section B**).

(i) Plot plan

All details related to the plot must be indicated in the plot sketch in **form F2, section C**. In particular, the following characteristics will be drawn:

- general characteristics such as crossing of water courses, roads, fences;
- limits between land use sections and land use classes in the corresponding sections.

In addition, the sketch must also include all the information and observations that help interpreting the plot.

(ii) Tree measurements

All trees over 20 cm of diameter at breast height (Dbh) found within the plot are measured (Table 5), and these data are recorded on field **form F3a** or **F3b**. Trees located at the border of the plot will be considered as being inside the plot if at least half of the stem diameter is inside at breast height.

For smaller diameters, measurements are carried out within the subplots located at every 120 meters (see Figure 2). The size of trees measure varies according to the subplot level (SPL1 or SPL2) where the measurements are made (see Table 5).

In the LUS classified as “outside the forest”, all trees with a Dbh ≥ 10 cm are measured, and these data are recorded on **form F3a** or **b**.

Stumps are measured as for trees, following the same diameter criteria. Stump diameter is then measured at breast height or at the top of the stump, if less than 1.30 m above ground level.

Table 5. Trees and stumps measured per level and corresponding forms

Level	Measured trees/stumps		Measurements	Field form
	Forest	Other land uses		
Plot	Dbh ≥ 20 cm	Dbh ≥ 10 cm	Species, location, diameters, total height, health, quality	F3a or F3b
Subplot level 1 (SPL1)	10 cm \leq Dbh < 20 cm	None	Species, location, diameters, total height, health, quality	F3a or F3b
Subplot level 2 (SPL2)	Tree height ≥ 1.30 m and Dbh < 10 cm	None	Total number by species	F4 (section C)

Tree regeneration (tree height ≥ 1.3 m and Dbh < 10 cm), within SPL2, are only counted by species. Only tree species (species reaching 5 m *in situ*) are recorded.

For bigger diameter trees, within SPL1 or the plot, collected data are more complete and include, besides the species identification, height, diameter, health and tree quality. Indications on tree diameter and height measurement methods are provided in the appendix (see section 6.2), page 65.

(iii) Forest products and services

Data on forest products and services is collected for each land use class present in the plot. The information will be reported in the form **F6**. If there are several LUS with the same land use class in the plot, they will be grouped together.

The information will essentially originate from interviews with local people or from people accompanying the field crew in the field, but should also be verified through field observations. Interview and group discussion techniques and instructions are included in section 4.4.6.

4.4.5 End of data collection work in the plot and access to the next plot

Once the work in the first plot is completed, the time is recorded on **form F2 (section B)** and the crew need to access the second plot. If the forest cover allows it, it is possible to directly access the plot with the help of the GPS. Otherwise it may be assured by using the compass and measuring 250 m (horizontal distance) along the central line of the previous plot. If the starting point of the next plot to be reached is not accessible on a straight line, the obstacle must be bypassed using auxiliary methods that allow finding the original line.

4.4.6 Interviews

Two major user groups will be interviewed:

- external key informants;
- forest and tree users (considered as individuals or focus groups).

In the absence of local inhabitants, many of the variables related to the focus groups (forest users) will essentially be collected from observation or from key informants.

Table 6 shows an overview of people/groups of people that may provide information.

Table 6. Interviews

Groups/ individuals to be interviewed	How to contact, identify them?	Where?	When?	Information
Key external informants: local forest services, organizations and local administration representatives etc.	By phone, correspondence or visit	At office	During the planning phase of the fieldwork or/and before reaching the site	<ul style="list-style-type: none"> - Logistics, - Background information on the tract - Information on the people living in the tract or in the surroundings - General information on the distance and access to the tract/plots - General information on the land use section (ownership, protection status, management, ecological problems) - Forest products and services
Focus groups or individuals: tree and forest resources users, forest dependant people (owners, women, men, hunters, residents...)	<p>Recommended by external key informants</p> <p>Rapid rural appraisal exercise to identify the stakeholders (see section 6.5.2)</p>	<p>At their house or in the village</p> <p>On the studied site (transect walk, persons working in the fieldwork)</p> <p>Met close to or within the site</p>	<p>Introduction meeting with the local people</p> <p>Previously fixed meeting (group or individual meeting)</p>	<ul style="list-style-type: none"> - Information on local population (history etc.) - General information on the land use section (ownership, protection status, management, ecological problems) - Forest and trees management and uses, forest products and services.

(i) Identifying external key informants and focus groups and individuals

- **Identifying external key informants**

Key informants are external individuals with particular knowledge about the area, the forest and the people. They don't have to be local forest users themselves.

How to identify external key informants? In the planning process of the fieldwork, local foresters, representatives from local development organizations and local administration will

be contacted for logistics and planning activities. Some of these people may provide very useful background information and they will be selected as key informants.

Key informants may sometimes be interviewed before going to the sampling site. Often, the key informants have knowledge of the accessibility to the site. They may also provide literature and other existing data.

Examples of key informants: forestry services (extension, forest guards), NGO staff, local administration staff, etc.

- **Identifying focus groups and individuals**

The focus groups are defined as people who relate to and use the forests on a frequent basis. These people might live in or close to the tract and may be foresters or forest owners. They may be interviewed in groups (focus groups) or individually.

How to identify focus groups? Upon arrival of the field crew to the site, the main forest user groups, or stakeholders, must be identified. This task may be carried out through discussions with village representatives, people living in the forest and external key informants, or through a visual exercise. The Rapid rural appraisal (RRA) exercise on identifying key stakeholders explained in Annex section 6.5.2 page 77 (Venn Diagram) is one way to do a stakeholder identification.

Representativeness is a complex issue to be aware of when identifying forest users or stakeholders to interviews. Many forest users share common characteristics and are classified within a common group, for analytic purpose. Nevertheless, wide variations in cultural and social factors (gender, age, wealth, status, religion, etc.) often exist and should be taken into account. Therefore it is recommended to identify stakeholders together with several local participants in order to appropriately define the forest user groups. Many different groups might be identified but the inventory must put emphasis on the individuals and groups that use forest products and services.

Example of categories of focus group: women, men, long-term residents (for historical changes), young people, forest owners, hunters, mushroom pickers, people coming from other regions, etc.

(ii) Interview organisation

First, data collection from interviews may be collected from external key informants **before going to the field** (planning / preparation phase). Collected data will mainly refer to the tract (**form F1**).

In a second phase, the data may be collected **in the field**, in two different sets:

- Some variables related to the tract may be collected from external key informants and cross-checked with the focus groups;
- Variables related to the use of forest (products and services) at the level of the LUS.

The data collection in the field may start during the introductory meeting with the key external informants and the local people, or during the first meeting with identified focus groups (after stakeholder identification exercise, see previous section).

(iii) Data collection techniques

General explanations on the data collection techniques, plus group discussions and interview recommendations are provided in annex (section 6.5, page 74). Among the tools and techniques that may be adopted there are:

- **Participatory analysis of aerial photographs or maps** (see annex section 6.5.3, page 77) may stimulate discussions with the focus groups on a number of variables. This exercise may be carried out during the introductory meeting, or later on, with identified focus groups. It will provide important information on both the variables (what forest and tree resource uses, who uses what, where, etc.) and the logistics on how the field crew can access the tract.
- **To carry out interviews within the tract itself**, by organizing, for instance, a transect walk (see annexes, section 6.5.6, page 79) or by collecting information from locally recruited workers who participate in the plot measurement work. This will allow to better link collected data with the location of the tract/LUS in the field.
- **A stakeholder identification analysis exercise** (see section 6.5.2, page 77), might be a good opportunity to discuss the use of forest products and services.
- **A forest product and services identification exercise** (see section 6.5.7, page 80) may be organized to collect data on forest products, services and users from the focus group.
- **Cross-checking** may be applied as much as possible (see section 6.5.4, page 78).
- **Direct observation** is also very important tool for data collection and cross-checking of information from the interviews (see 6.5.5 page 79).

The questions should be clear and simple in order to be easily understood by the interviewee. A list of variables and formulated questions to address these variables during the interviews are suggested in the following paragraph. Nevertheless, it must be stressed that a lot of flexibility is necessary when addressing the questions. These are only suggestions and are not pre-formatted. Questions will be asked in the order that is the most natural and should not be repeated. When formulating the questions, interviewee's culture and language must be taken into account.

(iv) Data to be collected from external key informants

- **Background information on the tract (form F1, section A):**
 - Administrative divisions (7-10): *“What are the names of the administrative unit/ district/ province/ village and the local name of the area?”*
- **Information on the people living in the tract or in the surroundings (form F1, section C):**
 - Population on tract (21): *“How many people live in this area?”* (the area refers to the tract).
 - Population since (22): *“How long (from what year) have people lived here?”*

- Population dynamics (23): *“Have most people in the area been living here for the past 5 years?”* or *“Have you seen a lot of changes during the last 5 years of people coming or going?”* If there have been changes *“Why?”*
- Main activity (24): *“How would you describe the livelihood of the majority of the people living in the area surrounding the tract?”* Cross-checking of direct observations and information provided by the interviewees may provide a good overview.
- **General information on the distance and access to the tract (form F1, section D):**
 - Distance to the permanent road, seasonal road, inhabited area, school, market, hospital (26-31): *“What is the distance from the tract to the closest permanent road, etc.?”*
- **General information on the land use section (form F5, section A):**
 - Designation/protection status (82): *“What is the legal designation of the forest? Is it a state forest, a community [communal] Forest, a village forest, a National Park, etc.?”*
 - Ownership (83): *“Who is the legal owner of the land (forest) in the sample area? Is it public, is it private”* If private *“Do people have land titles?”*
- External key informants may also have an opinion on variables asked to the focus groups, such as: most important forest products and services, ecological problems, rights and conflicts. One should keep in mind that in the absence of local people, the information will be provided mostly by the key informants. Moreover, even when the information is provided by the focus groups, it must be cross-checked with the data provided by the key informants and observations.
 - Legislation and forestry incentives awareness (101e and 101g): *“Are there any laws/ incentives concerning this product/service? If yes, which one?”* *“Are the local people aware of this legislation?”*
 - Compliance (101f): *“Is the legislation concerning this product/activity respected?”*
 - Application to forestry incentive (101h): *“Have the people applied for incentives concerning this product/service?”*

(v) Data to be provided by the focus groups

- The focus groups will essentially provide data on the **forest uses and forest products and services** (form F6).
 - Products and services category (99): *“What products do you collect in this part of the forest?”*
 - P/S Rank (99a)/ Species Rank (111a): *“Of all the products that have been identified, for your household/village/group, what is the most important product that is extracted from this forest?”*
 - Harvester / User (101): *“Who are the persons that harvest or use the product/practise this activity?”*
 - Gender (101c)/Children (101d): *“Do the women harvest the product? Are the harvesters mainly women? ”Do the children participate in harvesting the product?”*

- End-use (102): *“Do you sell this product?”* if yes, *“to whom?”*
- User rights (103): *“Who has the right to harvest/use this product/ to practice the activity?”* *“Is there anybody who may exclude the others from collecting it?”* *“If you can harvest it, is it because you are also the owner?”* *“Are the harvesting rights by tradition or are they legal?”*
- User conflicts (104): *“Related to the product that we have been discussing, do you feel that there exist any disagreements, either with other local people or with externals, about harvesting or using this product?”*
- Demand trend (105): *“Do you need more of this product?”* or *“Is the quantity you extract nowadays enough to satisfy your need?”*
- Last activity/extraction (108): *“When did you last collect this product?”* *“How often do you harvest this product/practise this activity?”*
- Trend (109): *“Did you (or your family) harvest as much of this product today as 5 years ago?”*
- Change reason (110): if there has been any change in the quantity of extraction/ frequency of activity, *“Why is it so?”*
- A few **questions related to the tract** (form **F1, section C**) may also be asked to the focused groups, when analysing the maps, especially:
 - Population dynamics (23): *“5 years ago, were there any people living here?”* or *“Do the young people often stay in the area when they have a family of their own or do they go to the city?”*
 - Settlement history (25): *“What are the main historic events that you remember from this area, such as for example, conflicts, change of land tenure, natural disasters etc”.*
- Other **questions related to the LUS** (form **F5**) may also be asked or cross checked with observations or information provided by external key informant:
 - Environmental problems (84): *“What is the most important [ecological] problem in forest around the area where you live? How does it affect the land? Have you seen any changes that are affecting your day to day life? Change in yield?”*

5. Description of field forms

There are six different forms, as indicated in the below table.

Table 7. Field forms description and corresponding information level

Form No.	Information
F1a/b	Tract: General information and access
F2	Plot: Marker position, plot access and plan
F3a/b	Plot and SPL1: Trees and stumps measurements (Dbh \geq 10 cm)
F4a/b	Subplots: Edaphic and topographic measurement points and tree measurements within the SPL2 (Dbh < 10 cm)
F5	LUS: General information, stand structure and management
F6	Plot: Forest products and services and forest users

5.1 Form F1: Tract

This form will be filled for each tract (1 km x 1 km). It contains general information related to the tract location and identification; information on the people living in the surrounding area of the tract and on the distance to the main infrastructures. The name list of persons involved in the inventory is also included.

Headline: identification of the tract

1. NFI Lebanon	- F1 -
2. Tract N°	TRACT

- **Country name (1)**
- **Tract N° (2):** identification number of the tract (from 1 to total tract number). See map with tracts (see Figure 1).

A. Tract location: general information on tract location.

7. Mohafaza	11. GEZ	C	<i>Coordinates Tract south-west corner</i>
8. Caza	12. Altitude Tract centre	m	14a. Latitude _ _ , _ _ _ _ ° N
9. Village	13. Map Name, N°		14b. Longitude _ _ , _ _ _ _ ° E
10. Locality.....	13c. Aerial photo, N°		13d. Projection.....

- **(ADM1) (7):** name of the first administrative division level (e.g. state) where the tract is located.
- **(ADM2) (8):** name of the second administrative division level (e.g. province) where the tract is located.
- **(ADM3) (9):** name of the third administrative division level (e.g. district) where the tract is located.
- **(ADM4) (10):** other administrative divisions (e.g. locality, municipality, etc).

- **Global Ecological Zone (GEZ) (11):** name of the global ecological zone where the tract is located, based on the FRA Global Ecological Zones map. The various classes are as follows:

GEZ class	Code
Tropical rain forest	Tar
Tropical moist deciduous forest	Tawa
Tropical dry forest	Tawb
Tropical shrub land	TBSh
Tropical desert	TBWh
Tropical mountain	TM
Subtropical humid forest	SCf
Subtropical dry forest	SCs
Subtropical steppe	SBSH
Subtropical desert	SBWh
Subtropical mountain	SM
Temperate oceanic forest	TeDo
Temperate continental forest	TeDc
Temperate steppe/prairie	TeBSk
Temperate desert	TeBWk
Temperate mountain	TeM
Boreal coniferous forest	Ba
Boreal tundra woodland	Bb
Boreal mountain	BM
Polar	P

- **Altitude (12):** altitude in meters above the sea level of the central point of the tract. Can be determined from a topographic map or from GPS as the average of the altitude at each plot starting point.
- **Maps and aerial photos (13):** name of used maps, aerial photographs or satellite images (acquisition date, coordinates).
- **Coordinates tract SW corner (14):** latitude (14a) and longitude (14b) in decimal degrees of the south-western corner of the tract.
- **Projected coordinate system (14c):** projected coordinated system used for the NFA (for GPS reading and maps).

B. Crew/Owner/Informant list (15-20)

			18. Crew	18a. Crew leader	19. Owner	20. Informant*				
B. Crew/Owner/Informant list										
15. Name	16. Address	17. Phone number				O	E	M	S	X

This table will include **name (15), address (16) and telephone number (17)** of:

- **Crew leader (18a):** the leader of the crew in current tract. In this case, “crew leader” will be ticked.
- **Crew members (18b):** other crew members working in the tract. In this case, “crew member” (18) will be ticked.
- **Owner (19):** owner(s) of all, or part of the land where the tract is located. In this case, “owner” will be ticked.
- **Informant (20):** the persons interviewed in the tract referred to by a code indicating existing relationship between the informant and the tract. To be indicated by marking the appropriate checkboxes, according to option list (multiple choice possible):

Options	Description/definition	Code
Estate owner	Owner of a plot within the tract	O
Employee	Person working in the tract	E
Manager of site	Person responsible for natural resources management in the tract	M
Settler	Person living in the tract or user from surroundings	S
External	External key informant, with a knowledge about the tract	X

C. Population

- **Population on site (21):** estimate of the number of people living in the tract.
- **Year of settlement (22):** approximate year when the settlement was established in the tract. If there is no inhabitant in the tract, or if the information is not known, write respectively “n.a.” (not applicable) or “unknown” in the box.
- **Population dynamics (23):** trend of the population living in or close to the tract, in the past 5 years. To be indicated according to an option list:

Options	Description/definition	Code
Not applicable	No inhabitants in the tract or surroundings	0
Decreasing	The population living in the site decreased during the last 5 years	1
Stable	The number of people living in the site remained stable during the last 5 years	2
Increasing	The population living in the site increased during the last 5 years	3
Not known	There is not enough information to estimate this trend	90

- **Permanent population main activity (24):** income generation and employment sources of most of the permanent population living within the tract or in the surroundings. The expression “income generation” refers to activities to satisfy basic needs such as food and housing, i.e. self-sufficient farmers or workers in the town. These data are entered according to an option list:

Options	Description/definition	Code
Not applicable	No inhabitants in the tract or surroundings	0
Crop production	Cropping activities	1
Livestock/ Herding	Pasture, herding	2
Forestry	Livelihood and income generation provided by the forest and related activities, including processing and marketing of forest products	3
Urban/peri-urban	Work in the town or in the industrial sector – income generated from services.	4
Tourism	Income generated from tourism or activities related to recreation.	5
Fishery	Livelihood and income generation provided by fishing activities	6
Mining	Mining and land extraction activities	7
Not known		90
Others	To be indicated in the notes. Includes subsidies, etc.	99

- **Overall main activity (24a):** income generation and employment sources of most of the total population including both permanent and seasonal population living within the tract or in the surroundings. These data are entered according to an option list:

Options	Description/definition	Code
Not applicable	No inhabitants in the tract or surroundings	0
Crop production	Livelihood and income generation provided by cropping activities	1
Livestock/ Herding	Livelihood and income generation provided by livestock, pasture, herding	2
Forestry	Livelihood and income generation provided by the forest and related activities, including processing and marketing of forest products	3
Urban/ Peri-urban	Work in the town or in the industrial sector – income generated from services	4
Tourism	Income generated from tourism or activities related to recreation.	5
Fishery	Livelihood and income generation provided by fishing activities	6
Mining	Mining and land extraction activities	7
Not known		90
Others	To be indicated in the notes. Includes subsidies, etc.	99

- **Settlement history (25):** major historical events that have affected the local people and land use in the area and date or periods of these events (25a). To be indicated by marking appropriate checkbox(es) (multiple choice possible):

Options	Description/definition	Code
Not applicable	No inhabitants in the tract or surroundings	0
Wars/conflicts		1
Change of ownership/land tenure		2
Expansion of agriculture	Land converted to agriculture fields or pastures	3
Urban development	Land changed from agricultural production, open rangeland, forest, or recreational uses to residential, commercial, or industrial uses	5
Infrastructure, electric power	Infrastructure, e.g., roads, water or water channel, electric line, recently installed in the tract	6
Socio-economic crisis	Change in consumption patterns due to drastic change in income generation	7
Natural disaster		8
Rural-to-urban migration	Migration of people from rural areas to urban areas	9
Urban-to-rural migration	Migration of people from urban areas to rural areas	10
Rural-to-rural migration	Migration of people from a rural area to another	11
Urban-to-urban migration	Migration of people from a urban area to another	12
Immigration	There has been an influx of people from other country(ies) moving to the area	13
Emigration	There has been an exodus of people from the area to other country(ies)	14
Others	To be specified	

D. Proximity to infrastructure

<i>Distance from Tract centre to:</i>			
26. All-weather road	___, _ km	29. Hospital	___, _ km
27. Seasonal road	___, _ km	30. School	___, _ km
28. Settlement	___, _ km	31. Market	___, _ km

- **All-weather road (26):** distance, in km, to reach the closest all-weather road (accessible by motor vehicle all the year), departing from the tract centre (equal to 0 if the road is located within the tract).
- **Seasonal road (27):** distance, in km, from the centre of the tract to the closest seasonal road (road accessible by motor vehicle during some seasons only, equal to 0 if it is located within the tract).

- **Settlement (28):** distance, in km, from the tract centre to the closest inhabited area (equal to 0 if it is located within the tract).
- **Hospital (29):** distance, in km, to reach the closest hospital, departing from the tract centre (equal to 0 if the hospital is located within the tract).
- **School (30):** distance, in km, to reach the closest school, departing from the tract centre (equal 0 if the school is located within the tract).
- **Market (31):** distance, in km, to reach the closest market, departing from the tract centre (equal to 0 if the market is located within the tract).

E. Tract access

E. Tract Access	
<i>Position when leaving road</i>	
32a. Latitude	_____ m
32b. Longitude	_____ m
<i>Time when:</i>	
33. Leaving road	__ : __ h
34. Arriving at plot N° <input type="checkbox"/>	__ : __ h

- **Starting position (32):** latitude (32a) and longitude (32b) in decimal degrees, or coordinates X (32d) and Y (32c) in meters (in the coordinate system adopted) where the field crew starts accessing the tract by foot (i.e. at the closest road accessible by motor vehicle).
- **Access Time – Start time (33):** time when leaving vehicle to access the tract by foot (hour: minutes).
- **Access Time – End time (34):** time when arriving at the first plot (hour: minutes).
- **Arriving at plot No (34b):** number of the first surveyed plot (from 1 to 4).

Reference points of access path: these points will be used to retrieve the tract in the future. An itinerary sketch representing the access path from the road to the tract will be drawn on a separate page while accessing the tract and attached.

Reference points of access path

36. Description	37a. Latitude N	37b. Longitude E	36b. Photo #	40a. Bearing

The following data must be filled in for each tract:

- **ID (35):** reference point ID (number from 1 to a series of reference points); this number is reported on the attached itinerary scheme.
- **Description (36):** brief description of reference point (i.e. road, river, house, rock)
- **Latitude (37a) and longitude (37b):** position given by GPS (in decimal degrees or in meters in the adopted coordinate system).
- **Photo ID (36b):** “three-digit tract number” + “-0.” + ”running photo on the access path to tract” (e.g. the 3rd photo taken on the access path to tract number 028 = 028-0.3).

- **Bearing (36d):** compass bearing in which the photo is taken (from 0 to 360 degrees).
- **Notes (38):** general notes concerning the tract.

5.2 Form F2: Plot

This form will be filled in for each plot contained in the tract (thus, a total of 4 per tract). The forms will include the general data on the plot and the information on its location and access.

Plot identification

- **Country name (1)**
- **Tract N° (2):** identification number of the tract (from 1 to total tract number). See map with tracts (see Figure 1).
- **Plot N° (3):** identification number of the plot (1 to 4).

A. Plot access

This section is not completed for the first visited plot in the tract.

- **Starting position (34):** latitude (34e) and longitude (34f) in decimal degrees, or coordinates X (34g) and Y (34h) in meters in the coordinate system adopted) where the field crew starts accessing the plot by foot (at the closest road accessible by motor vehicle or from the previous surveyed plot).
- **Access time - Start time (34i):** time when the field crew starts accessing the plot by foot (hour: minutes).
- **Access time - End time (34j):** time when arriving at the plot (hour: minutes).

B. Time record of work within Plot

<i>Starting:</i>	<i>Ending:</i>
48. Date: __ / __ / __	50. Date: __ / __ / __
49. Time: __ : __ h	51. Time: __ : __ h
49b. Time2: __ : __ h	51b. Time2: __ : __ h

- **Date 1 (48):** first date of measurement in the plot (day / month / year)
- **Date 2 (50):** second date of measurement if the work in the plot cannot be completed within one day.
- **Start time (49):** start time of measurement in the plot (hour : minutes) at the first (49a) or second (49b) measurement day
- **End time (51):** end time of measurement in the plot (hour : minutes) at the first (50a) or second (51b) measurement day

C. Plot starting point description

<i>Plot start point (calculated):</i>		<i>Marker coordinates (GPS reading):</i>	
39a. Lat _____ N		40a. Lat _____ N	
39b. Long _____ E		40b. Long _____ E	
		41. Distance from Marker to Plot start point <input type="text"/> m	
		42. Bearing from Marker to Plot start point <input type="text"/> °	
Central line bearing: Plt #1 = 0° Plt #2 = 90° Plt #3 = 180° Plt #4 = 270°		M = Marker position P = Plot start point, if P ≠ M for any reason	

This part contains the indications to identify the plot starting point and the marker location:

Plot starting point (calculated)

- **Latitude (39a) and Longitude (39b):** the coordinates of the plot starting point according to the projection system adopted (meters).

Marker position (GPS reading)

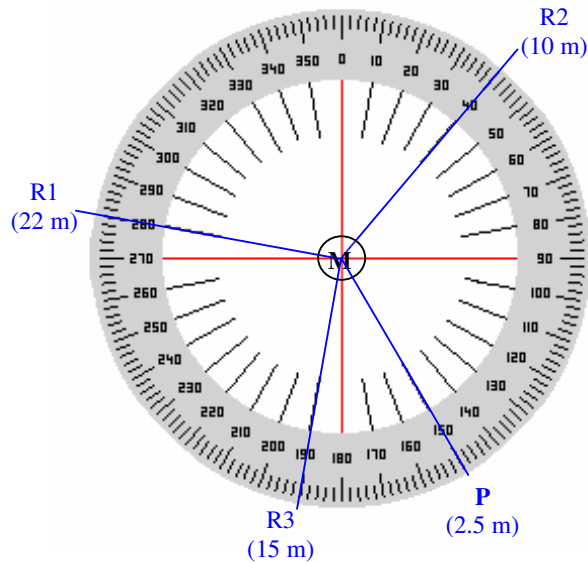
- **Latitude (40a) and Longitude (40b):** latitude and longitude coordinates in the projection system adopted.
- **Distance from Marker to Plot starting point (41):** distance in meters from the plot starting point to the marker (equal to “0” if the marker and the starting point coincide).
- **Bearing from Marker to Plot starting point (42):** compass bearing (from 0 to 360 degrees) from marker to the plot starting point (equal to “0” if the marker and the plot starting point coincide).

Plot starting point plan (43):

Three accurate and, if possible, permanent reference points such as rock, house, bridge, dominant/outstanding trees must be selected in order to be able to find the marker in the future. The orientation and distance of three reference points, from the marker should be measured. The three bearings should preferably be as different as possible and not in alignment. These reference points, as well as the plot start position, will be represented in the plan.

The scheme centre corresponds to the marker (“ M ”). The plot starting point (“ P ”) and the reference points must be represented in the scheme according to the bearing from the marker (as shown on the protractor, from 0 to 360 degrees). The distance from the marker will also be indicated. An example is given below:

Figure 6. Example of Plot starting point plan (form F2)



Information and measurements concerning the reference points will also be reported into a table as following (see example below):

- **ID (44):** identification of the reference points (e.g. R1).
- **Description (45):** description of the reference points (e.g. north side of rock,).
- **Bearing (46):** orientation of the reference points from the marker.
- **Distance (47):** distance of the reference points to the marker.

A recommendable supplement to the registration of reference points could be to photograph each reference point from the marker position (**36c**).

- **Photo ID (36c):** “Three-digit tract number” + “-“ + ”plot number” + “.” + ”running photo number within plot” (e.g. 3rd photo taken in the 2nd plot tract number 028 = 028-2.)

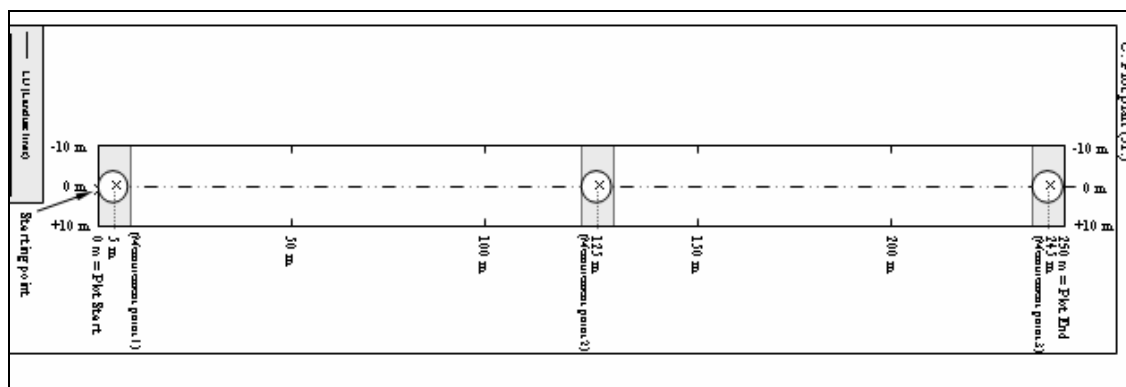
Figure 7. Example of table recording the Reference points surrounding marker position

Reference points surrounding Marker position

44. ID	45. Description	Beating ⁺ 46. (°)	Distance ⁺ 47. (m)	Photo# 36c
1	North side of rock	280°	22	028.1.1
2	West corner of house	40°	10	028.1.2
3	Big tree (Cedrus libani) Dbh=160 cm	190°	15	028.1.3

* From Marker position

D. Plot plan (52): Scheme displaying plot layout



The scheme represents the plot as a whole. The rectangular and the circular subplots are both drawn in the scheme. The starting point is located at the bottom of the page. The central axis of the plot (X axis), at 0 m on the vertical axis (Y axis), and the locations of circular and rectangular subplots centres (located on the main axis, at 5 m, 125 m and 245 m) are included.

The following objects should be drawn:

- **Borderlines of the LUS**, including the code of the land use classes in the corresponding sections.
- **Intersections with infrastructure** (roads, paths...) **and water courses**, as line object, including the code and width of the road/water course. The line drawing corresponds to the centre of the road/stream.

Codes must be attached to the lines according to the legend included in the form (water course, road type).

In the plot plan, any explanatory notes may be written. When entering the fieldwork data in the database these notes must be entered in the field **52a** plot plan notes in the database.

- **Plot end point (39e and 39f)**: latitude and longitude coordinates of the plot end point in meters, in the coordinate system adopted (GPS reading).
- **Notes (53)**: general notes concerning the whole plot.

5.3 Form F3: Plot - Tree and stump measurements (Dbh > 10 cm)

This form consists of a table where information related to all the trees and stumps measured in the plots will be recorded, apart from tree regeneration (height over 1.3m and Dbh under 10 cm) whose data, collected at subplot level 2, will be reported in the form F4 (see Table 5).

Plot identification

- **Country name (1)**
- **Tract N° (2):** identification number of the tract (from 1 to total tract number). See map with tracts (see Figure 1).
- **Plot N° (3):** identification number of the plot (1 to 4):

Table: This table will contain data related to:

- All trees and stumps with Dbh \geq 20 cm present in the plot ;
- Trees and stumps with a Dbh between 10 to 20 cm measured in rectangular subplots;
- Trees and stumps with a Dbh \geq 10 cm present in all non-forest sections.

When a stump is lower than 1.3m, the diameter it is measured at stump height (Dsh).

4. LUS N°	55. Tree N°	Species		Tree/Stump location			58. Dbh	59. D height	60. Year(s) since cut	61. Total height	Health	
		56a. Common name	56b. Scientific name	57a. Along Plot axis	57b. Left axis	57c. Right axis					64. Condition	65. Causing element
				(m)	(m)	(m)	(cm)	(m)	C	(m)	C	C

- **LUS No (4):** identification number (from 1 to number of land use sections) of the LUS where the tree/stump is found.
- **Tree No (55):** tree identification number. Trees are numbered consecutively in the order they are measured.
- **Species (56):** either common/local (**56a**) or scientific (**56b**) species name of the tree.

Tree/Stump location: Tree/Stump location in plot:

- **Along plot axis (57a):** Horizontal distance in meters along the plot axis from plot starting point to the tree (from 0 to 250 m).
- **Left or right axis (57b):** Horizontal distance in meters from the plot central axis to the tree (from 0 to 10 m).
- **Dbh (58):** tree or stump diameter, in centimetres:
 - In the case of a tree, diameter in centimetres at breast height (1.3 m) (see Appendix section 6.2.1 for diameter measurements and particular cases).
 - In the case of a stump, the stump diameter in centimetres at breast height (Dbh) or measured at the top of the stump if the stump is lower than 1.3 m (Dsh).

- **Diameter height (59):** height of diameter measurement in meters, if different from breast height (1.3 m).
- **Year(s) since cut (60):** only for stumps. Estimated time since the tree was cut according to option list:

Options	Description/definition	Code
< 1 year		1
1 – 5 years		2
6 – 10 years		3
> 10 years		4

- **Total height (61):** total tree or stump height in meters (see appendix section 6.2.2. In the case of a stump, to be indicated only if the stump is more than 1.3 m.
- **Commercial height (62):** commercial tree height in meters (only for trees).
- **Stem quality (63):** estimated stem quality (only for trees). To be indicated according to option list:

Options	Description/definition	Code
High	Straight tree without visible damage due to fire, pests, diseases, animals, etc.	1
Medium	Tree with little defects or damage due to fire, pests, diseases, animals, etc.	2
Low	Tree with several defects or damage due to fire, pests, diseases, animals...	3

Health (only for trees):

- **Condition (64):** intensity of the symptom, to be indicated according to option list:

Options	Description/definition	Code
Healthy	A tree is healthy when it does not show symptoms of disease or presence of parasites, fire or other that have any substantial affect on the tree's growth and vitality.	1
Slightly Affected	A tree is slightly affected when it shows symptoms of disease or presence of parasites that to some extent affect the tree's growth and vitality.	2
Severely affected	A tree is severely affected when it shows symptoms of disease or presence of parasites that substantially affect the tree's growth and vitality without being lethal.	3
Dead/dying standing tree	A tree is dead when none of its parts are alive (leaves, buds, cambium) at 1.3m or above. A tree is dying if it shows damage that will surely lead to death. Standing.	4
Dead/dying fallen tree	A tree is dead when none of its parts are alive (leaves, bud, cambium) at 1.3m or above. Diameter of a fallen tree is measured at the estimated previous breast height. A tree is dying if it has damage that will surely lead to death. Fallen.	5

- **Causing agents (65):** causing agents that have been identified (diseases, insects, animals, etc.) according to option list:

Options	Description/definition	Code
Not applicable	Healthy tree, with no signs of disease, parasites, etc.	0
Insects	Traces of insect attacks	1
Disease/Fungi	Fungus or other disease	2
Fires	Burned	3
Animals	Damage due to wild or domestic animals	4
Humans	Human induced damage (cuttings, bark damage, logging...)	5
Climate	Damage induced by climate (wind, snow, lightning, etc.)	6
Other	To be specified	

Branches: Up to four major branches (minimum diameter > 25 cm and length > 2 m) per tree should be measured if the branches represent a relatively large proportion of the tree woody volume.

- **D1, D2, D3, D4(66a-d):** mean diameter, in centimetres, of measured part of branch
- **L1, L2, L3 L4 (67a-d):** length, in meters, of measured branch.

Tree Notes (68): notes concerning the trees and stumps.

5.4 Form F4: Subplots and measurement points

This form contains the information on tree regeneration on the circular subplots (subplot level 2, SPL2) as well as on edaphic and topographic variables from the measurement points (MP). **Subplots and Measurement Points are only established in land use section classified as “forest”.**

Plot identification

- **Country name (1).**
- **Tract N° (2):** identification number of the tract (from 1 to total tract number).
- **Plot N° (3):** identification number of the plot (1 to 4).

A. Measurement points: Topography and Soil

Variables on topography and soil are collected in three fixed measurement points located in the centre of each subplot (measurement points).

This section of the form includes three boxes corresponding to the three measurement points.

Measurement point N° 1	Measurement point N° 2	Measurement point N° 3																																																															
4a. LUS N° <input style="width: 40px;" type="text"/>	4b. LUS N° <input style="width: 40px;" type="text"/>	4c. LUS N° <input style="width: 40px;" type="text"/>																																																															
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>70a. Exposition</td><td><input style="width: 30px;" type="text"/></td><td>°</td></tr> <tr><td>71a. Slope</td><td><input style="width: 30px;" type="text"/></td><td>%</td></tr> <tr><td>72a. Relief</td><td><input style="width: 30px;" type="text"/></td><td>C</td></tr> <tr><td>73a. Soil texture</td><td><input style="width: 30px;" type="text"/></td><td>C</td></tr> <tr><td>74a. Soil drainage</td><td><input style="width: 30px;" type="text"/></td><td>C</td></tr> <tr><td>75a. Organic matter</td><td><input style="width: 30px;" type="text"/></td><td>C</td></tr> <tr><td>76a. SP Area (≤50m²)</td><td><input style="width: 30px;" type="text"/></td><td>m²</td></tr> </table>	70a. Exposition	<input style="width: 30px;" type="text"/>	°	71a. Slope	<input style="width: 30px;" type="text"/>	%	72a. Relief	<input style="width: 30px;" type="text"/>	C	73a. Soil texture	<input style="width: 30px;" type="text"/>	C	74a. Soil drainage	<input style="width: 30px;" type="text"/>	C	75a. Organic matter	<input style="width: 30px;" type="text"/>	C	76a. SP Area (≤50m ²)	<input style="width: 30px;" type="text"/>	m ²	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>70b. Exposition</td><td><input style="width: 30px;" type="text"/></td><td>°</td></tr> <tr><td>71b. Slope</td><td><input style="width: 30px;" type="text"/></td><td>%</td></tr> <tr><td>72b. Relief</td><td><input style="width: 30px;" type="text"/></td><td>C</td></tr> <tr><td>73b. Soil texture</td><td><input style="width: 30px;" type="text"/></td><td>C</td></tr> <tr><td>74b. Soil drainage</td><td><input style="width: 30px;" type="text"/></td><td>C</td></tr> <tr><td>75b. Organic matter</td><td><input style="width: 30px;" type="text"/></td><td>C</td></tr> <tr><td>76b. SP Area (≤50m²)</td><td><input style="width: 30px;" type="text"/></td><td>m²</td></tr> </table>	70b. Exposition	<input style="width: 30px;" type="text"/>	°	71b. Slope	<input style="width: 30px;" type="text"/>	%	72b. Relief	<input style="width: 30px;" type="text"/>	C	73b. Soil texture	<input style="width: 30px;" type="text"/>	C	74b. Soil drainage	<input style="width: 30px;" type="text"/>	C	75b. Organic matter	<input style="width: 30px;" type="text"/>	C	76b. SP Area (≤50m ²)	<input style="width: 30px;" type="text"/>	m ²	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>70c. Exposition</td><td><input style="width: 30px;" type="text"/></td><td>°</td></tr> <tr><td>71c. Slope</td><td><input style="width: 30px;" type="text"/></td><td>%</td></tr> <tr><td>72c. Relief</td><td><input style="width: 30px;" type="text"/></td><td>C</td></tr> <tr><td>73c. Soil texture</td><td><input style="width: 30px;" type="text"/></td><td>C</td></tr> <tr><td>74c. Soil drainage</td><td><input style="width: 30px;" type="text"/></td><td>C</td></tr> <tr><td>75c. Organic matter</td><td><input style="width: 30px;" type="text"/></td><td>C</td></tr> <tr><td>76c. SP Area (≤50m²)</td><td><input style="width: 30px;" type="text"/></td><td>m²</td></tr> </table>	70c. Exposition	<input style="width: 30px;" type="text"/>	°	71c. Slope	<input style="width: 30px;" type="text"/>	%	72c. Relief	<input style="width: 30px;" type="text"/>	C	73c. Soil texture	<input style="width: 30px;" type="text"/>	C	74c. Soil drainage	<input style="width: 30px;" type="text"/>	C	75c. Organic matter	<input style="width: 30px;" type="text"/>	C	76c. SP Area (≤50m ²)	<input style="width: 30px;" type="text"/>	m ²
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71a. Slope	<input style="width: 30px;" type="text"/>	%																																																															
72a. Relief	<input style="width: 30px;" type="text"/>	C																																																															
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75c. Organic matter	<input style="width: 30px;" type="text"/>	C																																																															
76c. SP Area (≤50m ²)	<input style="width: 30px;" type="text"/>	m ²																																																															

- **LUS N° (4):** Identification number (from 1 to number of land use sections) of the LUS where the measurement point is located.
- **Orientation (70):** slope orientation at measurement point. To be indicated as compass bearing (from 0 to 360°). On flat terrain write “n.a.” (not applicable).
- **Slope (71):** the average inclination at the measurement point. To be indicated in %.

- **Relief (72):** topographic position of subplots. Characterized by microrelief. To be indicated according to option list:

Options	Description/definition	Code
Flat terrain	Flat terrain with slope $\leq 5\%$	1
Upper valley slope	Upper valley slope	2
Middle valley slope	Middle valley slope (slope $>5\%$)	3
Lower valley slope	Lower valley slope	4
Bench	Horizontal zone of average width over 30 m interposed by a hillside (slope $\leq 15\%$) or terrace over 6 m width	5
Depression, at the bottom of a small, narrow, or anticlinal	Enclosed depression or confinement situation at the bottom of a small, narrow or anticlinal valley	6
Summit	Crest of any kind, sharp, rounded crest or escarpment	7
Wide valley depression	Large valley or very wide depression in the bottom of a small valley	8

- **Soil texture (73a):** texture class (grain or basic particles of the soil dimensions) of a soil sample collected at the measurement point level (centre of subplot). To be described according to option list:

Options	Description/definition	Code
Fine	No sound when rubbed between fingers. Plastic and possibly even slippery when handled. Can be formed into a string. Includes clay or clay loam	1
Medium	Makes a (light) sound, when rubbed between the fingers close to the ear. Allows to be formed into a stick of cigarette size or possibly thinner. Includes loam and sandy loam	2
Coarse	A wet sample does not stain hands or is only slightly sticky. Cannot be formed. Includes sand and loamy sand	3
Rock	Surface rock	4

- **Detailed soil texture (73b):** texture class (grain or basic particles of the soil dimensions) of a soil sample collected at the measurement point level (centre of subplot). To be described according to option list:

Options	Description/definition	Code
Sand	A wet sample does not stain hands	1
Loamy sand	Slightly sticky, but no ribbons can be formed	2
Sandy loam	Makes a sound, when rubbed between the fingers close to the ear. Allows to be formed into a stick of cigarette size	3
Loam	Only a relatively thick ribbon can be formed which will break soon after formation from its own weight. Rubbing between fingers makes a very light sound only	4
Clay loam	Forms a thin ribbon which will readily break from its own weight when about 2-4 cm long. No sound when rubbed between fingers	5
Clay	Highly plastic and slippery when handled. Allows to be formed into a thin string	6
Rock	Surface rock	7

- **Soil drainage (74):** average soil drainage within subplot. To be described according to option list:

Options	Description/definition	Code
Very good drainage	The water/humidity does not stay in the soil during more than a few consecutive days	0
Good drainage	The water/humidity does not stay in the soil more than a few consecutive weeks	1
Poor drainage	The water/humidity does not stay in the soil more than a few consecutive months	2
No drainage	Land covered with water most of the year, such as lakes, swamps and mangroves, etc.	3

- **Organic matter (75):** is defined by the thickness of the organic matter stratum, excluding litter. To be indicated according to option list:

Options	Description/definition	Code
Absent		0
< 1 cm		1
1-5 cm		2
> 5 cm		3

B. Subplots level 1 and level 2 – Area covered by forest

- **SP1L1, SP2L1, SP3L1 width (54a):** width of the part of subplot level 1 (SPL1) covered by forest in meters. If the whole subplot level 1 is covered by forest, then the default width is 10 m. If part of the subplot falls into land use classes other than “forest”, this area should be reduced accordingly.
- **SP1L1, SP2L1, SP3L1 length (54a):** length of the part of subplot level 1 (SPL1) covered by forest in meters. If the whole SPL1 is covered by forest, then the default width is 20 m. If part of the subplot falls into other than “forest”, this area should be reduced accordingly.
- **SP1L2, SP2L2, SP3L2 (76a-c):** area of the subplot level 2 (SPL2) covered by forest in square meters. The default area is 50m². If part of the SPL2 falls into “other than “forest”, this area should be reduced accordingly.

C. Subplots level 2 - Tree measurements (trees above 1.3 m height with Dbh <10 cm)

As in previous cases, this section must be filled for each Subplot level 2 that falls into a Land Use Section classified as “forest”.

Each line of the table corresponds to one species found in any of the Subplot level 2. In the columns of the table the tree species name and the corresponding number of individual found in each subplot are registered.

B. SUBPLOTS – Tree regeneration measurements (0cm < Dbh < 10cm)

Species		78aa. Counts	78. Total number		
77a. Common name	77b. Scientific name		Nº1	Nº2	Nº3

- **Species (77):** either common/local (77a) or scientific (77b) species name of the tree.
- **Counts (78a):** allows to count individual trees over 1.3 m and with a Dbh < 10 cm, per species, present in each subplot level 2;
- **Total (78):** Total number (sum of counts) of individual trees over 1.3 m and with a Dbh < 10cm, per species, present in each subplot level 2.
- **Notes (79):** Notes concerning measurement points and subplots level 1 and level 2.

5.5 Form F5: land use/forest type section (LUS)

Information on Land Use Sections (LUS) found in a given Plot will be registered on this form. It contains general data related to the LUS as well as data on forest structure and management and the use of forest and tree resources. Up to 3 different LUS can be recorded in one form.

1. NFI Lebanon

- F5 -

2. Tract N°

3. Plot N°

LAND USE SECTION

4. LUS N°

A. General

80. Land use <input type="text"/> C	84. Environmental problems
81a. Width <input type="text"/> m	0 Not Applicable (urban areas ...)
81b. Length <input type="text"/> m	1 Not existing
92. Tree canopy coverage <input type="text"/> C	2 Loss of water levels in rivers...
82. Designation/ prot. status <input type="text"/> C	3 Drought
83. Land tenure <input type="text"/> C	4 Inundation
Future Trees:	5 Poor water quality
88. Expected <input type="text"/> C	6 Pests
89. Desired <input type="text"/> C	7 Erosion
	8 Loss of soil fertility
	9 Burning
	10 Landslide
	11 Windthrow
	12 Overexploiting forest resources
	14 Overgrazing
	90 Not known
	Other

B. Woodland management and structure

90. Stand origin* <table border="1"><tr><td>N</td><td>P</td><td>C</td><td>nk</td></tr><tr><td><input type="text"/></td><td><input type="text"/></td><td><input type="text"/></td><td><input type="text"/></td></tr></table>	N	P	C	nk	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	94. Disturbances <input type="text"/> C	85. Fire occurrence <input type="text"/> C
N	P	C	nk							
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>							
91. Stand structure <input type="text"/> C	94a. Grazed <input type="text"/>	86. Fire area <input type="text"/> m ²								
92a. Shrub coverage <input type="text"/> C	94b. Pruned <input type="text"/>	87. Fire type <input type="text"/> C								
92b. Shrub height <input type="text"/> C										
95. Timber exploitation	96. Silviculture	97. Technology used								
1 No felling	1 No practice	0 Not Applicable								
2 Clearing	2 Improvement	1 Manual								
3 Selective felling	3 Release of desirable trees	2 Chainsaw								
4 Group felling	4 Removal of undesirable veg.	3 Mechanised (tractors)								
5 Strip felling	5 Enrichment	90 Not known								
Other	6 Sanitary cutting	Other								

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

98. Notes:

Plot identification

- Country name (1).
- Tract N° (2): identification number of the tract (from 1 to total tract number).
- Plot N° (3): identification number of the plot (1 to 4).
- LUS number (4): identification number of the Land use section, from 1 to the number of LUS identified.

A. General: This section should be filled out for each LUS.

- Land use (80): alphanumeric code describing the land use/forest type class in the LUS, according to classification described in section 3, page 9. In case of inaccessible areas where the LU class cannot be specified, write “nk” (=“not known”) in the box.
- Width (81a): average width of the LUS in meters.
- Length (81b): average length of the LUS in meters.

- **Accessibility (80b):** Condition of accessibility of the Land Use Section. To be indicated according to option list:

Options	Description/definition	Code
Accessible		0
Inaccessible due to slope	Very steep hill making the field work dangerous	1
Inaccessible due to owner refusal		2
Inaccessible due to restricted area	E.g. military areas, border areas, land mines areas	3
Inaccessible due to water body		4
Other inaccessibility	To be specified in the notes	99

- **Tree Canopy cover (92a):** ground surface covered by the vertical projection of the tree canopies, expressed as percentage of the total ground area in the LUS. To be indicated according to option list:

Options	Description/definition	Code
No trees		0
< 5%		1
5-10%		2
10-40%		3
40-70%		4
>70%		5

- **Designation / Protection status (82):** protection status and legal/official designation. To be indicated according to option list:

Options		Description/definition	Code
Protection / Conservation	Strict nature reserve/ Wilderness area	Strictly protected area, managed mainly for science or wilderness protection. Corresponds to IUCN category I (see Annex section 6.6, page 82).	1
	National Park	Protected area managed mainly for ecosystem protection and recreation. Corresponds to IUCN category II (see Annex section 6.6, page 82)	2
	Natural monument	Protected area managed mainly for conservation of specific natural features. Corresponds to IUCN category III (see Annex section 6.6, page 82)	3
	Habitat/ species management area	Conservation through active management - Protected area managed mainly for conservation through management intervention. Corresponds to IUCN category IV (see Annex section 6.6, page 82).	4
	Protected landscape / seascape	Protected areas managed mainly for landscape/seascape conservation and recreation. Corresponds to IUCN category V (see Annex section 6.6, page 82)	5
	Multiple purpose	Land designated to production, protection and social functions. Encompasses IUCN category VI (see Annex section 6.6, page 82)	6
	Production	Land designated for production and extraction of products. Includes concessions, exploitation licenses, community forests etc.	7
	Not known	No information available	90
	Other	To be specified in the notes	99

- **Land ownership (83):** land ownership designation under which most of the LUS is defined. To be indicated according to option list:

	Options	Description/definition	Code
Private	Individual	Owned by individuals and families	1
	Industries	Owned by private enterprises or industries	2
	Others private	Owned by private co-operatives, corporations, religious and educational institutions, pension or investment funds, NGOs, nature conservation societies and other private institutions	3
Public	State	Owned by national and state governments, or by government-owned institutions or corporations	4
	Regional or district level	Owned by regional or district governments	5
	Municipality	Owned by the cities or municipalities	6
	Community/group owned	Owned by a collective, a group of co-owners, a community who hold exclusive rights and share duties	7
	Indigenous or tribal people	Owned by indigenous or tribal people	8
	Not known	No information available on the land ownership	90
	Other	To be specified	

- **Environmental problems (84):** main environmental problems observed/identified within the LUS. To be indicated by marking the appropriate checkbox (multiple choice possible):

Options	Description/definition	Code
Not applicable	E. g urban areas	0
Not existing		1
Loss of water levels in rivers and other sources		2
Drought		3
Flooding		4
Poor water quality		5
Pests		6
Erosion		7
Loss of soil fertility		8
Burning		9
Landslide		10
Windthrow	Including storms, cyclones, hurricanes...	11
Overexploitation of forest resources		12
Overgrazing		14
Not known		90
Other	To be specified	

- **Trees expected (88):** Trend in tree density expected in LUS within 5 years. To be captured through interview and indicated according to option list:

Options	Description/definition	Code
Increasing	Increased tree density expected within 5 years	1
Decreasing	Decreased tree density expected within 5 years	2
Stable	No change in tree density expected within 5 years	3

B. Forest¹ management and structure: This section should be filled out only for LUS within forest and other wooded land

- **Tree origin (90):** to be indicated by marking the appropriate checkbox (multiple choice possible):

Options	Description/definition	Code
Natural	Natural regeneration of stand by seed	N
Plantation	Artificial regeneration by seeding or planting	P
Coppice	Regeneration by shoots from stump or roots	C
Not known		nk

- **Stand structure (91):** distinct canopy layers in the stand. To be indicated according to an option list:

Options	Description/definition	Code
Not applicable	Non forest area	0
Single layer	Stand with only one well-defined layer formed by the tree canopies	1
Two-layer vegetation	Stand with two distinct canopy layers: an upper layer (a dominant canopy layer with two thirds above the lower layer, forming a clearly defined layer with at least 20% cc), and a lower layer (under storey).	2
Three-layer vegetation	Stand with three distinct canopy layers each with at least 20% cc: - a dominant upper layer two thirds above the lowest layer; - an intermediate layer where the canopies is from one to two thirds above the lower layer; - a lowest layer (under storey) growing at a maximum height of one third of the dominant layer.	3
More than three layers	Stand with more than three distinct layers of tree canopies at different heights.	4

¹ Woodlands may be included for dry forest countries.

- **Shrub coverage (92b):** vertical projection of the shrub canopies as percentage of the total ground area. To be indicated according to option list:

Options	Description/definition	Code
Not applicable	Non forest area	0
<10 %		1
10-40 %		2
40-70 %		3
>70 %		4

- **Shrub height (92c):** average height of the shrubs expressed in meters.
- **Management plan (93):** any existing forest² management plan. To be indicated according to option list:

Options	Description/definition	Code
Formal	Formal management plan formulated and implemented	1
Traditional	No formal management plan formulated or, formal management plan formulated but not implemented	2
Not known		90

² Woodlands may be included for dry forest countries.

- **Management agreement (93b):** management arrangement between the land owner and other groups. To be indicated according to option list:

Options		Description/definition	Code
Owner is the exclusive manager		The owner retains management rights and responsibilities within the limits specified by the legislation	1
Joint management	with communities	Management decisions remain with the owner and the management activities are executed by local communities, according to an agreement. The agreement allocates temporary exploitation rights for specific forest products or activities. Are included forests allocated for extraction purposes through licenses or timber concession	2
	with private companies / private sector	Management decisions remain with the owner and the management activities are executed by private companies, according to an agreement. The agreement allocates temporary exploitation rights for specific forest products or activities. Are included forests allocated for extraction purposes through licenses or timber concession	3
Devolution of management	to communities	The owner devolves forest management to the local communities according to leases or management agreement.	4
	to private companies/ private sector	The owner devolves forest management to the private companies according to leases or management agreement	5
Not known			90
Other		To be specified in notes	99

- **Disturbances (94):** impact level of human activity in the forest³. To be indicated according to option list:

Options	Description/definition	Code
Not disturbed	Protected areas, all resources conserved	1
Slightly disturbed	Exploitation of goods and services is carried out according to management plans	2
Moderately disturbed	Many products collected without conforming to management plans, notion of sustainability not respected	3
Heavily disturbed	Removal of products at rates higher than Mean Annual Increment (MAI), biodiversity degradation due to high pressure on selected species, encroachment of agriculture leading to high rate of deforestation	4

³ Woodlands may be included for dry forest countries.

Fire:

- **Fire occurrence (85):** the presence or absence of fire evidence in the LUS. To be indicated according to options list:

Options	Description/definition	Code
No evidence of fire	There is no evidence of fire in the LUS	1
Recent fire	Evidence of fire during the current season/year	2
Old fire	Evidence of fire during the previous years but not during current season	3

- **Fire area (86):** surface of fire in the LUS. To be indicated in **m²**.
- **Fire type (87):** to be indicated according to option list (multiple choice):

Options	Description/definition	Code
Not applicable		0
Underground fire	Fire spreading under the surface through roots or any other underground means	1
Surface fire	Fire spreading through the ground cover where it consumes litter and ground vegetation without reaching the tree canopies	2
Crown fire	Fire spreading through the canopies of woody vegetation	3

- **Timber exploitation (95):** exploitation system applied in the LUS. To be indicated by marking the appropriate checkbox (multiple choice possible):

Options	Description/definition	Code
No felling		1
Clear-cutting	Felling of most commercial-sized trees in a stand	2
Selective felling	Selective felling extracting only trees of certain species, dimensions, value, etc., not taking into account silvicultural needs.	3
Group felling		4
Strip felling		5
Other	To be specified	

- **Silviculture (96):** visible silvicultural practices (cutting). To be indicated by marking the appropriate checkbox (multiple choice possible):

Options	Description/definition	Code
No practice		1
Improvement	Operation that aims at improving the yield and quality of the stand. It includes clearing, selective thinning, pruning and regeneration by natural or artificial seeding	2
Release of desirable superior trees	Removal of higher and larger and intermediate diameter trees to allow the development of desired future trees. It includes selective thinning.	3
Removal of undesirable vegetation layer	Intervention aimed at freeing trees from disturbing vegetation layer (e.g. lianas)	4
Enrichment planting	Supplementary planting or seeding of indigenous species for increasing the percentage of desirable species in natural forest	5
Sanitary cutting	Removal of dead, damaged or unhealthy trees, with the aim of stopping or preventing the spreading of insects and diseases	6
Prescribed burning	Controlled application of fire to vegetation in either their natural or modified state, under specified environmental conditions which allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to attain planned resource management objectives	7
Other	To be specified	

- **Technology used (97):** technology used for tree exploitation. To be indicated by marking the appropriate checkbox (multiple choice possible):

Options	Description/definition	Code
Not applicable		0
Manual	Manual saw, axe, machete etc.	1
Chainsaw	Chainsaw	2
Mechanized	Tractors, mechanization, etc.	3
Not known		90
Other	To be specified	

- **Notes (98):** general notes concerning the LUS.

- **Product/service category (99):** categories of products, services and benefits provided by the trees and forest⁵ in a given land use class (one line for each product/service category). To be indicated according to option list:

	Options	Description/definition	Code
Wood products	Industrial wood	Includes timber, chips	101
	Fuelwood		102
	Charcoal		103
	Wood carvings	Tools, household equipment, carvings and other small woods	104
NWFP- Plant products	Plant food	Vegetable foodstuffs and beverages provided by fruits, nuts, seeds, roots, mushrooms etc.	201
	Fodder	Animal and bee fodder provided by leaves, fruits, etc	202
	Plant medicines	Medicinal plants (e.g. leaves, bark, roots) used in traditional medicine and/or for pharmaceutical companies	203
	Soap / cosmetics	Aromatic plants providing essential (volatile) oils and other products used for cosmetic purposes such as soaps, perfumes	204
	Dying / tanning	Plant material (bark and leaves) providing tannins and other plant parts (especially leaves and fruits) used as colorants	205
	Herbs and spices		206
	Exudates	Substances such as gums (water soluble), resins (water insoluble) and latex (milky or clear juice), released from plants by exudation	207
	Utensils, handicrafts	Non wood products	208
	Construction material	Includes thatch, bamboo, rattan, wrapping, leaves and fibres	209
	Ornamentals	Entire plants (e.g. orchids) and parts of plants (e.g. pots made from roots) used for ornamental purposes	210
	Seeds	Seeds collected for regeneration purposes	211
	Other plant products	To be specified	299
NWFP- Animal products	Living animals	Mainly vertebrates such as mammals, birds, reptiles kept/bought as pets	301
	Honey, beeswax	Products provided by bees	302
	Bush meat	Meat provided by vertebrates, mainly mammals	302
	Other edible animal products	Mainly edible invertebrates such as insects (e.g. caterpillars) and other “secondary” products of animals (e.g. eggs, nests)- To be specified	398
	Hides, skins for trophies	Hide and skin of animals used for various purposes	304

⁵ Woodlands may be included for dry forest countries.

	Medicines from animals	Entire animals or parts of animals such as various organs used for medicinal purposes	305
	Colorants	Entire animals or parts of animals such as various organs used as colorants	306
	Other non-edible animal products	e.g. bones used as tools - To be specified	399
Forest services and benefit	Employment (salary)	Local employment	401
	Grazing		403
	Scientific studies	Including bio-prospecting	405
	Protection	Including soil and water conservation, protection against erosion and landslides	406
	Recreation and tourism	Including ecotourism, including hunting or fishing as leisure activity	407
	Religious / spiritual		408
	Windbreaks		411
	Shade		412
	Other services	To be specified	499

- **P/S Ranking (99a):** ranking of the product or service (P/S) according to importance. To be indicated according to option list:

Options	Description/definition	Code
High	Products of high importance	H
Medium	Products of medium importance	M
Low	Products of low importance	L

- **Species (111):** list of species collected in the P/S category by land use. The species will be ranked according to their importance (high, medium or low) and indicated in the corresponding lines as mentioned in the column labelled **Species Rank (111a)** (respectively H, M or L)⁶.
- **Conflicts (104):** existence of conflicts between different users of the P/S. To be indicated according to option list:

Options	Description/definition	Code
No	No conflicts due to use/collection of the P/S	1
Yes	Conflicts due to use/collection of the P/S	2
Not known		90

⁶ If a product is collected from shrubs in "other wooded land", it should be mentioned.

- **Demand trend (105):** trend of P/S demand during the last 5 years. To be indicated according to option list:

Options	Description/definition	Code
Not applicable		0
Decreasing		1
No change		2
Increasing		3
Not known		90

- **Supply trend (106):** trend of P/S supply or stock during the last 5 years. To be indicated according to option list:

Options	Description/definition	Code
Not applicable		0
Decreasing		1
No change		2
Increasing		3
Not known		90

Harvesting/Use: each line of this section of the table corresponds to a harvester/user category.

- **Harvester /user (101):** the harvester/user group of the P/S is indicated by the following codes:

Options	Description/definition	Code
Individuals	Individuals and families with rights to harvest/use the P/S	I
Companies	Companies with rights to harvest/use the P/S. Includes public or private enterprises, industries and organizations	C
No rights	User (individuals or companies) without any right to harvest/use the P/S	X

- **Harvester/User Rank (101a):** ranking of the user groups according to the harvested quantity/frequency of use of the product/service. To be indicated according to option list:

Options	Description/definition	Code
High	User group with high use of the P/S	H
Medium	User group with medium use of the P/S	M
Low	User group with low use of the P/S	L

- **User rights (103):** right to harvest/use the P/S. To be indicated according to option list:

Options	Description/definition	Code
Property rights	The user is the land owner or has been transferred property rights	1
Customary or common rights	Rights to harvest/use the P/S based on tradition or habit, to satisfy local people's needs or a specific group. Might be regulated through permits and licenses	2
Open access	The use of the P/S is a common right. Everybody has the right to harvest/use the P/S.	3
No right	The use of the P/S is prohibited	4
Not known		90

- **Organization level (101b):** level in which regime activity is carried out. To be indicated according to option list:

Options	Description/definition	Code
Organized	Harvesting or activity is carried out in a coordinated manner	1
Spontaneous	Harvesting or activity is carried out in a spontaneous, non organized manner.	2
Organized and spontaneous	Harvesting or activity is carried out both in a coordinated and spontaneous manner	3

- **Gender balance (101c):** Gender balance of harvesters/users. To be indicated according to option list:

Options	Description/definition	Code
<30% women		1
30 – 70% women		2
>70% women		3

- **Child labour (101d):** if more than 30% of the work related to harvesting/activity is done by children indication should be made in check box.
- **End-use (102):** main end-use of P/S. To be indicated according to option list:

Options	Description/definition	Code
Domestic	Mainly non commercial use of the P/S (home consumption)	1
Commercial	P/S mainly sold in the local, national or international markets	2
Domestic and commercial	P/S is both sold in the markets (local, national or international) and used for home consumption	3
Not known		4

- **Frequency (108):** frequency of harvesting/use of the P/S. To be indicated according to option list:

Options	Description/definition	Code
Not applicable		0
Daily	P/S is harvested/used practically every day	1
Weekly	P/S is harvested /used practically every week	2
Seasonally	P/S is harvested /used every year during well defined seasons	3
Intervals larger than 1 year	P/S is not harvested/used every year	4
Not known		90
Other	To be specified	

- **Trend (109):** trend of harvesting/use of the P/S during the last 5 years. To be indicated according to option list:

Options	Description/definition	Code
Not applicable		0
Decreasing		1
No change		2
Increasing		3
Not known		90

- **Change reason (110):** reason of change in trend of harvesting/use of the P/S during the last 5 years. To be indicated according to option list:

Options	Description/definition	Code
Not applicable		0
Decreasing benefits		1
Market	Change in market	2
Substitution by other products/services		3
Change in the quantity of product in the surroundings		4
Change in the access to the resource		5
Not known		90
Other	To be specified in notes	99

Legislation:

- **Awareness (101e):** awareness of the legislation regarding the P/S related to the harvester/user. When major parts of the user group are aware of the legal restrictions, this should be indicated by marking the checkbox.

- **Compliance (101f):** compliance to legislation for the P/S (any user). If the majority of the user group act in compliance with the legislation, this should be indicated by marking the checkbox.

Forestry incentives:

- **Awareness (101g):** awareness of forestry incentives for the product/service by legal users. If the majority of the user group is aware of the forestry incentives, this should be indicated by marking the checkbox.
- **Application (101g):** application to forestry incentive for the product/service by legal users. If the majority of the user group has applied or is applying for forestry incentives, this should be indicated by marking the checkbox.
- **Notes (98):** notes regarding forest products and services in the plot.

6. Appendices

6.1 Land cover class definitions

Categories	Code	Definition
Total area⁷		Total area (of country), including area under inland water bodies, but excluding offshore territorial waters.
Forest		<p>Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.</p> <p>Notes:</p> <ol style="list-style-type: none"> 1. Forest is determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 meters in situ. 2. Areas under reforestation that have not yet but are expected to reach a canopy cover of 10 percent and tree height of 5 m are included, as are temporarily unstocked areas, resulting from human intervention or natural causes that are expected to regenerate. 3. Included areas with bamboo and palms provided that height and canopy cover criteria are reached. 4. Includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific scientific, historical, cultural or spiritual interest. 5. Includes windbreaks, shelterbelt and corridors of trees with an areas of more than 0.5 ha and width of more than 20 m. 6. Included plantations primarily used for forestry or protection purposes, such as rubber-wood plantations and cork oak stands. 7. Excludes trees stands in agricultural production systems, for example in fruit plantations and agroforestry systems. The term also excludes trees in urban parks and gardens.
Forests with natural and/or assisted natural regeneration		<p>Forest of native species established through planting, seeding, natural regeneration or assisted natural regeneration.</p> <p>Note: may include areas with naturally regenerated trees of introduced species</p>
Broadleaved forest	BF	Forest in which more than 75 percent of tree cover consists of broadleaved tree species.
Coniferous forest	CF	Forest in which more than 75 percent of tree cover of coniferous tree species.
Bamboo/palms formations	OF	Forest in which more than 75% of the tree cover consists of tree species other than coniferous or broadleaved species (e.g. tree-form species of the bamboo, palm and fern families).
Mixed forest	MF	Forest in which neither coniferous nor broadleaved nor palms nor bamboos account for more than 75 percent of the tree cover.

Forest plantations	FP	Forests of introduced species and in some cases of native species established through planting or seeding for production of goods and services, characterized by few species, straight tree lines and even-aged stands
Other wooded land	OWL	Land not classified as “forest”, spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5-10 percent, or trees able to reach these threshold <i>in situ</i> ; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.
Shrubs	Sh	Refers to vegetation types where the dominant woody elements are shrubs i.e. woody perennial plants, generally of more than 0.5 m and less than 5 m in height on maturity and without a definite crown. 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.
Fallow	Fa	It encompasses fallow where the woody vegetation is under 5 m. Height. It refers to woody vegetation deriving from the clearing of natural forest for shifting agriculture. It is part of a fallow consisting of a mosaic of various reconstitution phases. The vegetation should not reach a height of 5 m.
Wooded grasslands (5-<10%)	WGL	Land where the trees cover between 5 to 10 percent of the area and their height may reach 5 m at maturity.
Other land	OL	Land not classified as forest or other wooded land, as described above. Notes: Includes cultivated land, grasslands and pastures, built-on areas, barren land etc.
Natural	N	Land not classified as forest or other wooded land not used by man.
Barren land	BL	Barren land
Grasslands	GL	Natural grasslands
Marshland	ML	Marshland, swamps
Cultivated land		Land not classified as forest or other wooded land used by man for agriculture or pastures.
Annual crop	AC	Annual crops
Perennial crop	PC	Perennial crops
Pastures	Pa	Land under permanent meadows and pastures
Built-up areas (urban or rural)	BUA	Built-up areas Notes: a road is considered as a distinct Land Use Section (built-up area) is wider than 15 meters (from bottom of ditch on one side to the bottom of ditch on the other side when ditches exists, otherwise the width of the road bank) and is not a forest road.
Inland water	IW	Area occupied by major rivers, lakes and reservoirs. Notes: a river is considered as a land use section if the actual riverbed is more than 15 meters wide and never without water during any period of the year.
Outside land area	OA	Sea, ocean or neighbouring countries.

6.2 Tree height and diameter measurements

6.2.1 Tree (Dbh) measurement

Tree diameter is measured over bark, at 1.3m breast height above the ground (see Figure 8) with the exception of particular cases mentioned below. Measurement may be carried out with the help of a diameter tape (tape whose diameter unit is in centimetres) or with the use of a calliper. In order to avoid overestimation of the volume and to compensate measurement errors, diameter is measured in cm and adjusted in a decreasing sense (example: 16.8 cm become 16 cm).

The calliper usually has two sides (see Figure 9):

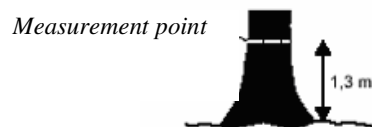
- One side of the main axe shows a graded scale in diameter centimetres
- The other side shows a diameter category (compensated calliper). This side is mainly used in silviculture, to carry out inventories.

The side in cm will be used.

Some preventive measures must be taken into account:

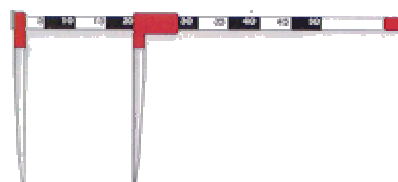
- Measurement instruments are kept in a position that perpendicularly cuts the tree axe at 1.3 m, see Figure 11;
- Make sure the calliper tightly holds the stem, in order to prevent the calliper clasps from grasping without compressing the bark ;
- If the diametric tape is used, make sure it is not twisted and is well stretched around the tree in a perpendicular position to the stem. Nothing must prevent a direct contact between the tape and the bark of the tree to be measured.

Figure 8. Position for diameter measurement at breast height in flat terrain.



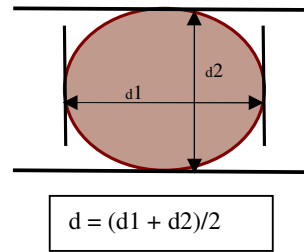
Notes: After Dallmeier 1992. One single dotted line indicates the place for Dbh measurement. If there are two lines on the stem because of a defective tree, the appropriate place to do the measurement is thus indicated.

Figure 9. Calliper.



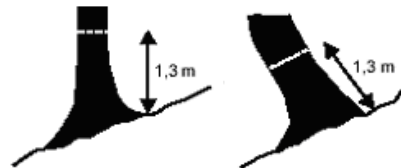
- If the calliper is used, non circular trees are to be measured in two perpendicular diameters located as close as possible to the largest and the smallest diameter in that point, the average of these two is thus retained.

Figure 10. Non circular tree measurement with calliper.



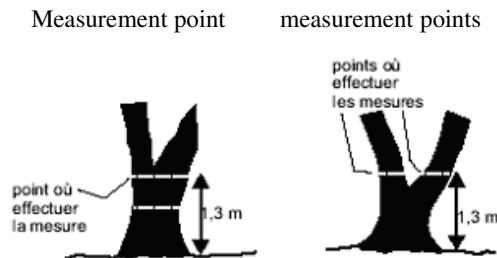
- **On inclined terrain**, Dbh tree measurement at 1.3 m is taken from an uphill position (see **Figure 11**).

Figure 11. Dbh measurement position for a tree on steep terrain.



Note: see Figure 8.

- **Fork tree:** Several cases exist, according to the point where the fork divides the stem.
 - If the fork begins (the point where the core is divided) below 1.3 m height, each stem having the diameter required (≥ 20 cm in the whole plot, ≥ 10 cm for rectangular subplots) will be considered as a tree and will be measured. Diameter measurement of each stem will be taken at 1.3 m height.
 - If the fork begins between 30 cm and 1.3 m, each stem will be considered as separate tree and will be measured. The diameter measurement will be taken at 1 meter above the fork origin.
 - If the fork begins at 1.3 m or a little higher, the tree will be counted as a single tree. The diameter measurement is thus carried out below the fork intersection point, just below the bulge that could influence the Dbh.



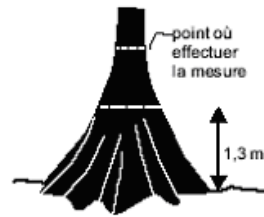
Note: see Figure 8.

- **Coppice:** Coppice shoots originate between ground level and 1.3m on the stem of a dead or cut tree. These are considered in the same way as forked trees, except that the coppice shoots do not necessarily reach 1/3 diameter of a dead tree. Coppice shoots originating below 30 cm are measured at 1.3 m above the ground; those that originate between 30 cm and 1.3 m are measured at 1 meter above the originating point.

- **Trees with an enlarged stem base or buttressed tree:** diameter measurement is made at 30 cm above the enlargement or main width of buttress, if the buttress/enlargement reaches more than 90 cm height above the ground (see Figure 12).

Figure 12. Dbh measurement position for buttressed tree

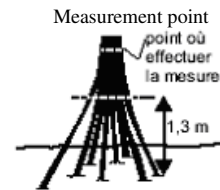
Measurement point



Note: see Figure 8.

Trees with aerial roots: diameter measurement is done at 1.3m from the limit between the stem and roots (see Figure 13).

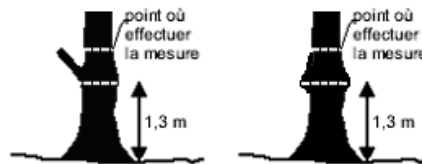
Figure 13. Dbh measurement position for a tree with aerial roots



Note: see Figure 8.

- **Trees with irregular stem at 1.3m:** trees with bulges, wounds, hollows and branches, etc. at breast height, are to be measured just above the irregular point, there where the irregular shape does not affect the stem (Figure 14 and Figure 15).

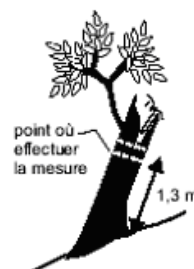
Figure 14. Dbh measurement position for a tree with branch enlargement at 1,3m



Note: see Figure 8

Figure 15. Dbh measurement position for other trees.

Measurement Point



Note: see Figure 8.

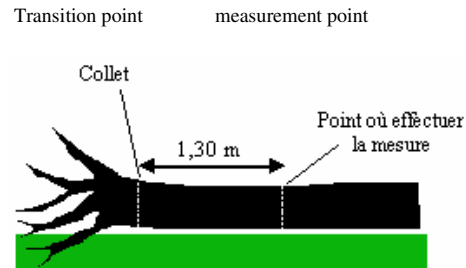
- **Inclined trees:** diameter measurement is made at 1.3 m. The stem height is measured where the stem base and the ground meet forming an angle (see Figure 16).

Figure 16. Dbh measurement position for an inclined tree.

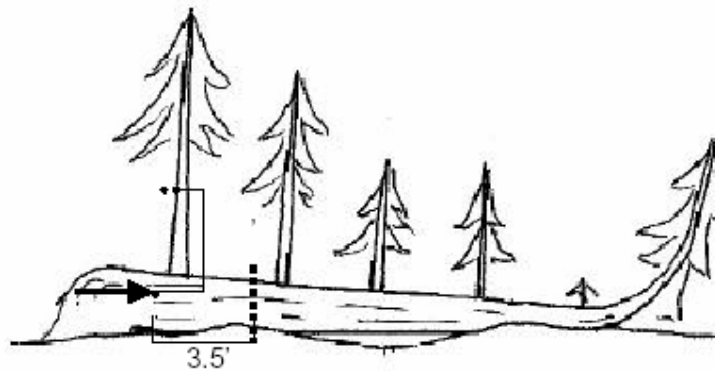


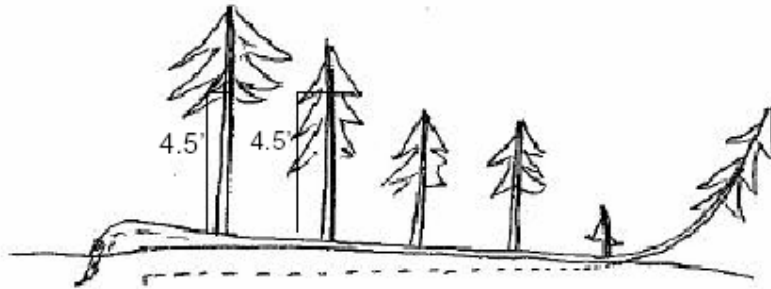
- **Fallen tree:** diameter measurement is made at 1.3 m from the transition point between the stem and the root (see Figure 17).

Figure 17. Dbh position for a fallen tree.



- **Living tree lying on the ground with branches in the shape of a vertical tree.** When a living tree is laying on the ground and its vertical branches (at $<45^\circ$ vertical position) grow from the main stem, it is recommended to determine first if the main stem is above the litter or not. If this is the case, use the same rules applied to a forked tree, if the pith of the main stem is under the litter, do not take the main stem into account and treat each one of the branches in the shape of a tree, as a separate tree. Dbh may be measured (and its height too) at 1.3 m from the ground, but not from the top of the laying stem. If the top of the laying stem forms a vertical curve, compared to the ground, treat this tree portion as if it was an individual tree, beginning at the point where the pith detaches from the litter.





- **If the Dbh is not measured at 1.3 m from the ground**, indicate the height where it was measured. Measure and separately indicate the branch Dbh that originates at a lower height than 1.3 m.
- **In the case of stump**, if the stump height is less than 1.30 m, stump diameter is measured outside bark at stump height, immediately under the cutting point (felling cut) and perpendicular to the longitudinal. If the bark is damaged or missing, a judged addition for bark is done.

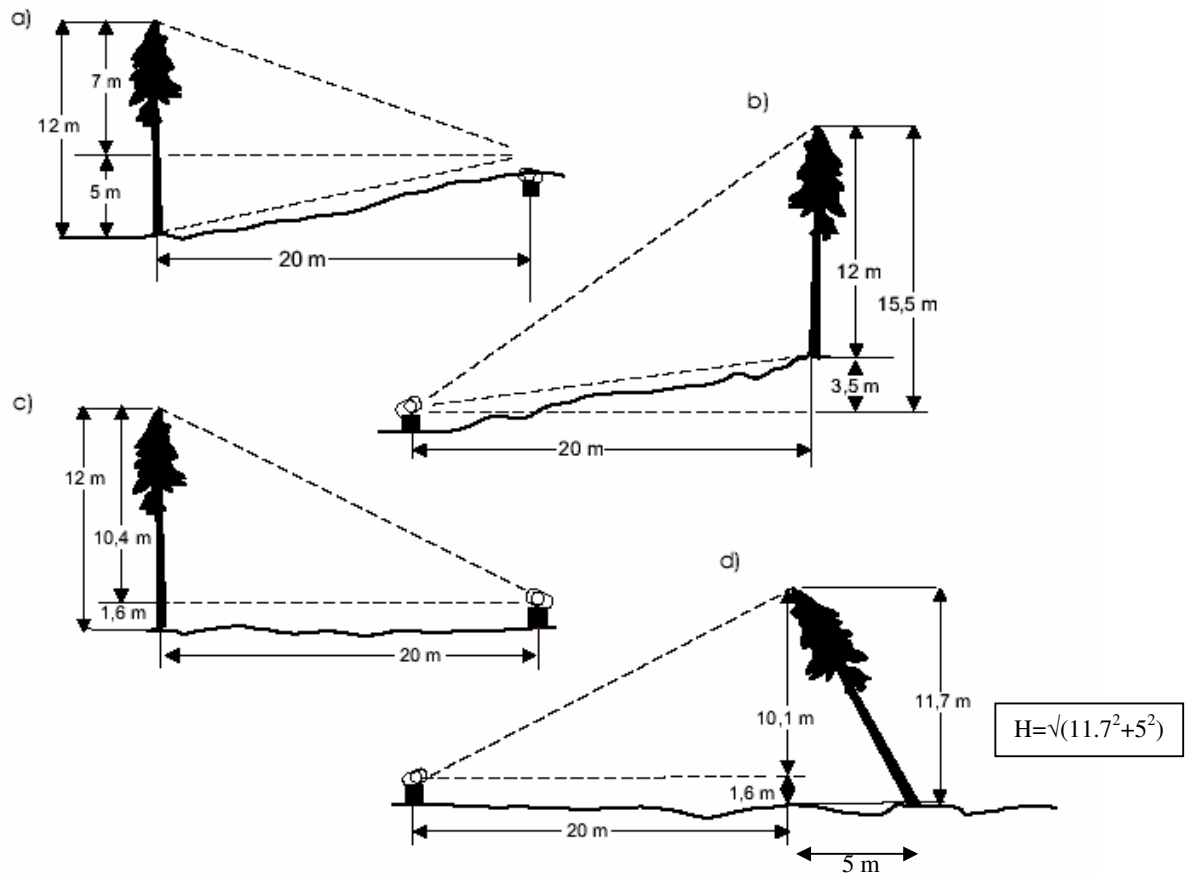
6.2.2 Tree height measurement

Tree height measurement may be carried out by means of several instruments such as: dendrometric table, Blume-Leiss, Suunto, Haga, Blitterlich Relascope

Height measurement is made during several stages:

1. Tree distance (at 15, 20, 30 or 40 meters). To avoid measurement errors, the distance from the tree must be equivalent to the tree height
2. Observation of the tree crown
3. Observation of the tree base
4. Addition or subtraction of the two observation results according to the case: addition if the operator is standing uphill (see Figure 18a), subtraction if the operator is standing downhill in relation to the tree (see Figure 18b)
5. Slope correction

Figure 18. Tree height calculation



Note: You may find out the height of a tree (12 m for a, b, and c, and 11, 7 m for d):

- By adding the results above and under the horizontal measurement
- By subtracting from the total, the distance between the base of the tree and the horizontal line
- By adding to the height of the instrument from the ground, the distance measured above the horizontal line
- By adding the instrument measurement from the ground to the distance measured from the crown of the tree up to a point located just below on the horizontal (use the telescopic rod), the height is H_0 . If D is the distance from the base of the tree to the point located below the horizontal of the top of the tree then the tree height H is calculated by applying the formula: $H = \sqrt{(H_0^2 + D^2)}$

Measurement with a Blume-Leiss dendrometer.

This dendrometer is mainly composed of:

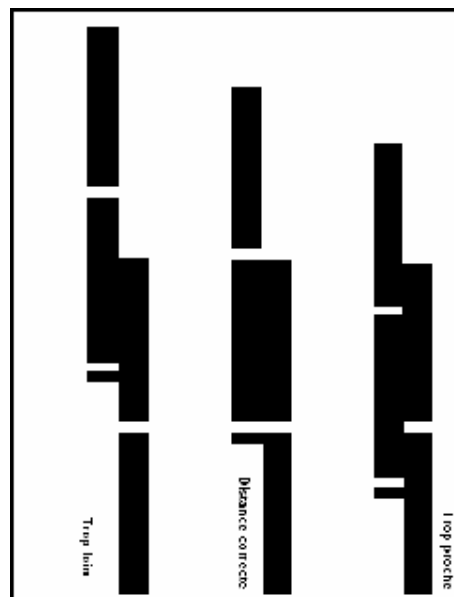
- A dioptric viewer providing two shifted images.
- Four height scales and one angle scale (the height scales correspond to a tree distance to measure at 15, 20, 30, and 40 m).
- An oscillating pendulum placed in front of the scales. The pendulum may be stopped as required with the help of a trigger or button to read the measure. A more recent model has two oscillating pendulums that may be stopped by means of two different triggers.

The instrument includes a rod with landmarks corresponding to different height scales. In order to carry out the measurements, the operator proceeds as follows:

On slight slope terrain:

1. He/she chooses the scale at 15, 20, and 30 or 40 m, the scale should approximate as much as possible to the estimated height of the stem.
2. He/she places the rod: the rod is fixed on the tree in order for the scale mark chosen is in front of him/her.
3. Distance positioning from the tree: with the help of a dioptic viewer, the operator looks at the landmark placed on the rod, in correspondence with the scale selected. If the distance from the tree is not correct, the operator will notice two shifted images. In order to achieve a correct positioning, the operator will either go forward or go backwards in order to see on his viewer two images aligned on the same line.

Figure 19. Distance from the tree. Rod use.



Note: the first figure (on the right), shows that the operator is too distant; the second one (centre) shows that the distance is correct; and the third one (left) shows that the operator is too close.

4. **Observation angles:** in order to measure the height of a tree, the operator tries two observation angles. The first one at the top level and a second one at the base of the tree.
5. **Determining the height:** after each sighting, the operator reads the measure indicated on the scale which corresponds to the landmark chosen in the rod and then adds the results of the two measurements. The result of this addition corresponds to the height of the tree.
6. For the new model, the operator will read the measurements after the second sighting because each pendulum allows the determining of a separate measurement.

On inclined terrain:

1. The operator carries out the same operations indicated above, with the exception of the height calculation. If the operator is standing uphill, the results of the two measurements are added. If the operator is standing downhill, the sighting will be

directed to the base of the tree and the result will be subtracted from the one directed at the top of the tree.

2. Apply a slope coefficient to the height result.
3. Carry out the observation of a tree point located at the same height where your eye is positioned in relation to the ground).
4. Check the angle's measurement in the appropriate scale.
5. Then check the table located on one side of the instrument, on top of which you will find a coefficient table that helps in making the necessary corrections.
6. Apply such coefficient following the formula below:

$h' = h - hk$ in which h' = is the real height h = measured height k = coefficient correction

Height measurement with a Suunto:

1. **Distance:** in order to carry out this measurement, a rod is fixed to the tree in a vertical position and at operator's eye height. The Suunto must be held firmly in vertical position.
2. **Height determination:** target the tree top, read the height measurement result, target the tree base, add or subtract, according to the case. If the distance between the tree and the operator is 30 or 40 m, it is convenient to repeat the measurements carried out, on a 15 or 20 m scale.
3. **Slope measurement and height correction:** measure the slope by targeting the point corresponding to the same height your eye is positioned in. If the Suunto does not include a scale in degrees or in percentage, make a conversion (printed text in the back, or calculator) then multiply the height you obtained by **the angle cosine**.

In case the estimation is simply done by direct observation, it is necessary to calibrate from the beginning of the inventory and when the stand type changes.

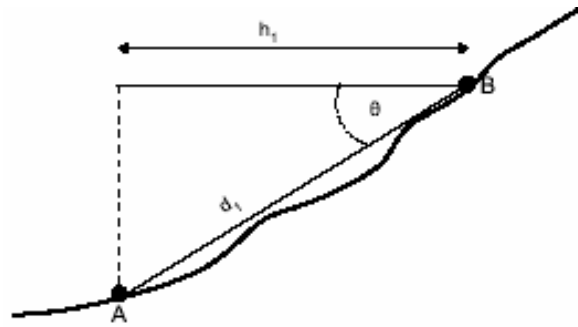
6.3 Use of receivers for Global Positioning Systems, GPS

See separate manual.

6.4 Horizontal distance measurements

Reference distances: such as plots and subplot dimensions, tree coordinates, all of them are horizontal distances. When the terrain is flat, these distances may be measured directly. Nevertheless, in steep terrain, horizontal distances differ from distances covered, measured in the field (see Figure 20). A correction factor must be applied to find out the distance to cover in the field in order to reach a given point. Corrections will be made for all slopes above or equal to 15 percent.

Figure 20. Slope correction.



Note: The distance between two points, measured along one slope (d_1) is always longer than an equivalent horizontal distance (h_1). On slope terrain, the horizontal distance must be multiplied by a factor that corresponds to the inclination in order to obtain a corrected distance. θ is the angle between the horizontal and the right A-B. $d_1 = h_1 / \cosine (\theta)$.

1. With the help of a clinometer (or other slope measuring device) measure the slope of landmark A in direction of point B. When the slope angle has been determined, it is important to make sure that the measurement is taken along one parallel observation line to the average slope of the ground: the instrument must be located at the same height level of the target.
2. Find out the corrected distance d_1 which corresponds to the desired horizontal distance, by using the slope correction table (see Table 8).
3. Go to point B and measure the slope again in direction of point A. If the result is different from the first measurement, repeat the operation

Table 8. Slope correction table.

Slope %	Degree °	Factor f_s	Horizontal distances										Slope %
			5	10	15	20	25	30	40	50	125	245	
15	9	1.0112	5.1	10.1	15.2	20.2	25.3	30.3	40.4	50.6	126.4	247.7	15
20	11	1.0198	5.1	10.2	15.3	20.4	25.5	30.6	40.8	51.0	127.5	249.9	20
25	14	1.0308	5.2	10.3	15.5	20.6	25.8	30.9	41.2	51.5	128.8	252.5	25
30	17	1.0440	5.2	10.4	15.7	20.9	26.1	31.3	41.8	52.2	130.5	255.8	30
35	19	1.0595	5.3	10.6	15.9	21.2	26.5	31.8	42.4	53.0	132.4	259.6	35
40	22	1.0770	5.4	10.8	16.2	21.5	26.9	32.3	43.1	53.9	134.6	263.9	40
45	24	1.0966	5.5	11.0	16.4	21.9	27.4	32.9	43.9	54.8	137.1	268.7	45
50	27	1.1180	5.6	11.2	16.8	22.4	28.0	33.5	44.7	55.9	139.8	273.9	50
60	31	1.1662	5.8	11.7	17.5	23.3	29.2	35.0	46.6	58.3	145.8	285.7	60
70	35	1.2207	6.1	12.2	18.3	24.4	30.5	36.6	48.8	61.0	152.6	299.1	70
80	39	1.2806	6.4	12.8	19.2	25.6	32.0	38.4	51.2	64.0	160.1	313.8	80
90	42	1.3454	6.7	13.5	20.2	26.9	33.6	40.4	53.8	67.3	168.2	329.6	90
100	45	1.4142	7.1	14.1	21.2	28.3	35.4	42.4	56.6	70.7	176.8	346.5	100
110	48	1.4866	7.4	14.9	22.3	29.7	37.2	44.6	59.5	74.3	185.8	364.2	110
120	50	1.5620	7.8	15.6	23.4	31.2	39.1	46.9	62.5	78.1	195.3	382.7	120
130	52	1.6401	8.2	16.4	24.6	32.8	41.0	49.2	65.6	82.0	205.0	401.8	130
140	54	1.7205	8.6	17.2	25.8	34.4	43.0	51.6	68.8	86.0	215.1	421.5	140
150	56	1.8028	9.0	18.0	27.0	36.1	45.1	54.1	72.1	90.1	225.3	441.7	150

Note: The table provides corrected distances for some horizontal distances, in function of the slope. For instance, the distance correction for a horizontal distance of 20 meters, with a slope of 30% is 20.9 m.

For other horizontal distances, not included in the table, it is possible to get a corrected distance by multiplying the horizontal distance by the slope correction factor (scf). For instance, on a terrain with

a 25 % slope, if the aim is to find the horizontal distance of 7.5 meter, it is necessary to carry out the following operation: $7.5 * 1.0308 = 7.73$ meters

When the operator cannot see the position of the next point or when the slope is not constant, one or several intermediate measurements become necessary. The horizontal distance is corrected by segments.

6.5 Interviewing and group-discussions techniques

6.5.1 Advice and recommendations

Interviewing is very important for the data collection, and it is not easy. Good interview techniques are achieved through experience, training, and by following certain procedures. Specific advices and tools have been developed suggesting how to approach people. The following section tries to advice as well as to foresee difficult situations.

- **Preparations:**

- Background information through literature review and secondary data increases knowledge of the area and people, and is important for interviewing.
- **Plan** which variables you need to know from the different key informants and focus groups etc.
- Go over the topics and sub-topics and prepare ‘helper questions’ to be explored.
- Each crew member, who interviews, carries out the interview/visual tool following *one’s own* line of questioning and reasoning.

- **Building rapport:** A good working relationship with the local people is easier to establish when the interviewer is well prepared as it shows respect and, also, underlines that it is the fieldworkers who are there to learn from the forest users on how they are using and benefiting from their local forest.

- **Scheduling interviews:** Respect of people’s time can be demonstrated by trying to make appointments with informants at a time and location where the interview is less likely to be disturbed. It is also important to be aware of when it is correct to end an interview. So called unscheduled interviews are also important. They may take the form of an informal dialogue with people met while walking in the forest, buying drinks in the local shop, etc.

- **Interpreter:** Although, by far, the best is to be able to interview in the original language, there might be occasions where the use of an interpreter is necessary. If using an interpreter, it is important to use simple language and ensure that there is a good mutual understanding about procedures and what information is needed to be obtained. It must be remembered that the role of the interpreter is to interpret, not to interview. Asking the same question in different ways (a form for cross-checking) is a way to verify that communication is working. Other hints suggested are: have the translator sit behind you, maintain eye-contact with the respondent,

even though you do not understand what exactly is being said. Often mentioned as the most important, is the fact of taking time. Make sure that you understand what is being said and what it means, and that the interpreter understands what you mean. Interviewing with translators is, of necessity even slower, a more difficult and more sensitive process than if in original language.

- There are different opinions on **taking notes and filling out field forms or questionnaires in front of the respondents**. In semi-structured interviews many argue that one should never pull up an official-looking questionnaire form. And it is often recommended not to take notes until rapport has been built (ask permission) as people are often reluctant to talk freely if notes are taken. If you take notes explain clearly for what use they are and, after an interview, sum up what you have written. Doing visual exercises, such as RRA⁸, is a way where the noting or drawing is shared by all. Pre-noting some of the variables and topics to ask about in a small notebook as one gets familiar with the procedure is good practice and recommended.
- **Rural women** are often busy and are often shy with strangers, regardless of whether the stranger is a man or a woman. Fieldworkers should be sensitive to the constraints facing women when undertaking interviews. Preferably, a woman should interview the women thus respecting the female space.
- **Avoid asking questions** that are beyond the knowledge or experience of informants. Avoid giving opinions or using questions that may adversely affect the answers given. To be polite, local people will often agree with the opinions of field workers even if they do not really agree or know.
- **Modifications:** Be prepared to modify the question or how you ask for information as new issues emerge and old issues become less critical. Issues should be explored as they arise in the conversation.
- **Use open-ended questioning** style that seeks explanations and opinions rather than yes-or-no-answers. Ask, for example, “where do you collect fuelwood?” Rather than, “do you cut fuel wood from the government forest?” (IUCN, 1998). To relate it to the sample site, follow up with “Do you also collect in this part of the forest” (pointing on a map at the sample site).
- **Probing and the use of non-leading ‘helper questions’:** Probing is an art that is learned through careful practise and means delving into a subject. Often, topics are not easily comprehended at first; thus several questions around a sub-topic might be useful to ensure understanding (both yours and the participants’). Use non-leading helper questions such as: “Who?” “What?” “Where?” “When?” “Why?” “How?” “How many?” “How often?” and so forth. What are the implications, aims, intent, significance, or explanations of something? Ask yourself frequently – are you on the right track? (Messerschmidt, 1995). But it is

⁸ For this study, the participatory techniques are referred to as Rapid Rural Appraisal (RRA) as it involves field workers learning from local people according to the field workers’ agenda (IUCN, 1998). RRA uses a variety of tools and techniques to gather information. All its tools are designed to promote the participation of local people in both the collection and the analysis of the information. The tools approach facilitates questioning from different angles. Some are particularly helpful in addressing spatial issues, some gather more temporal information, and others help local people to analyse their situation by ranking issues or problems (Freudenberger, K, 1995).

also important to bear in mind that we do not need more information than the objectives have set out.

- **Tract and subplot specific:** It is important to always be clear about relating the question to the site or the stand. Geographic reference is possible. If people say that they collect fuelwood in the forest, but they are referring to the general forest or another part clearly outside the sample site, a follow up question can be: “Do you then also collect fuelwood in this [specific] area”? And at the same time show the area visually, describe it, etc.
- The persons being interviewed might feel a reason to hide information on some of their usual practices, or at least not talk openly about these issues, especially if he/she perceives the interviewer as being a representative of organizations or authorities that are preoccupied with hunting endangered species, entering national parks for foraging fuelwood, etc. It is therefore crucial to establish an atmosphere of understanding between the interviewer and respondent. However, if they perceive you as already aware of these practices, you will be able to learn more about the extent of these practices than if they perceive you as unaware of them. One technique is just to assume that the practices exist and directly move to the question more important for their livelihood: “In the neighbouring village, they’ve explained us that they hunt almost every week, how often do you need to go to feed your family?/or how often do you hunt?” This type of question shows that you understand the reality in which they live. Whether you can use such a direct approach depends on the relation you have established and needs careful consideration of the “mood” of the situation. In other circumstances a much more indirect approach is needed. The subject can be approached from different angles such as, for example, a conversation about food and hunting practices of children. Often, also, you might observe small things made of nwfp's while present in the community that may provide good starting points for a discussion on sensitive issues. Make use of these observations (AIDEnvironment, 1999).
- It is recommended adding a last question to the interview schedule which is: “Are there any questions that you would like to ask us?” This allows the interviewer to get information that might have been missed, puts the respondent(s) more at ease since the interview is not totally one-sided and also provides a cross-check as to whether the respondent and interviewer understood what each was getting at. If the question is out of the blue, there is a good chance that the respondent did not really understand what the interview was about and the interviewer is unlikely to have elicited an accurate picture of the respondent’s behaviour or attitudes (Molnar, 1989).
- A common mistake in interview situations is to promise respondents that they will achieve tangible profits from co-operation. Never promise anything that cannot come true. As a general rule, explain that the best effort you can make is to relay a true picture of the situation that you encounter during the study. The field crews’ task is to let the outside world know about local uses and importance of forest resources and, at best, the decision-makers will be better informed about the issues of forest resources.

6.5.2 Tool: stakeholder identification and analysis (Venn Diagram)

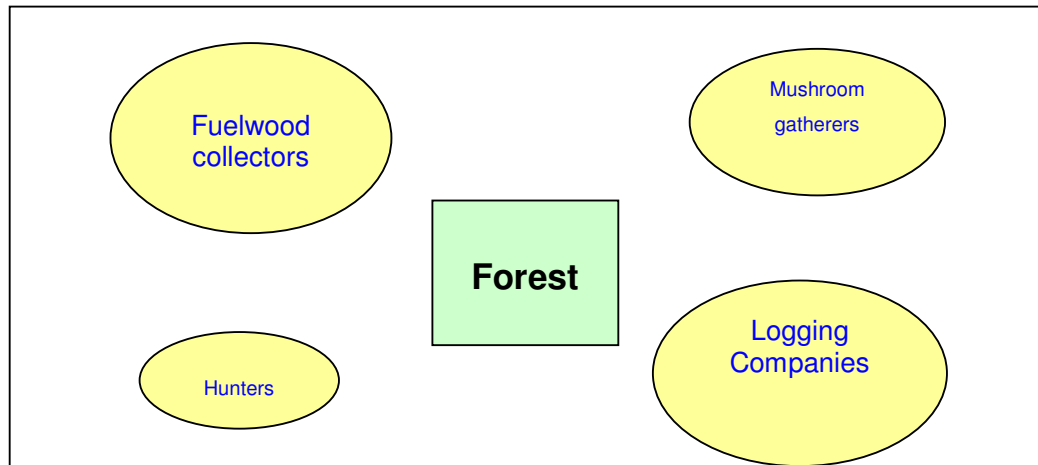
This exercise identifies and provides information about the different forest user groups that can be important to schedule and plan interview with.

1. Organize a meeting with the local people (those who live close to the tract, women, men and maybe some key informants as well), and explain to them the objectives of the interview. During this brainstorming session, the group may be encouraged to work with the help of a flipchart or a similar tool.
2. List the users, or groups of people, institutions and organizations who have an interest in the forest. Ensure that external stakeholders (those not physically represented, such as logging or pharmaceutical companies) are mentioned. Can large groups of stakeholders be divided into smaller groups? Are there certain groups who depend more on forest than others, or are there groups that use the forest more frequently?
3. Rank the groups, organizations, institutions and individuals:

Draw the sampling site in the shape of a box (for example) at the centre of the paper sheet or flip chart. Explain that each stakeholder group should be represented as a circle. The size of the circle represents how big their interests to the forest are: if their interests are large, intermediate or small draw respectively a big, medium or small circle.

Arrange the stakeholders circles in or around the sampling site square to show the link existing between them and the sampling site under analysis. Discuss the rights that different stakeholders have on the forest products and what products and services they are interested in.

Figure 21: Example of Venn diagram.



6.5.3 Tool: Participatory analysis of aerial photographs and maps

Looking at aerial photos and maps will stimulate discussion with both external key informants and focus groups, as well as acting as a good icebreaker (pocket

stereoscopes, magnifiers etc.). Aerial photos are known to be especially useful for recording spatial information (IUCN, 1998).

When looking together at the aerial photos or maps it is natural to start to discuss aspects of access to the sample site, land use of the area of the sample site and the surroundings. If various aerial photos from different times (years, seasons) are available, it is possible to explore the changes occurred. This will also give a chance to obtain information on landmarks, location and names, administrative boundaries, forest products and in what seasons they are available. If possible, try to mark the site on the photo with a transparency overlay. By noting on the photo, or sketching another map on another piece of paper, one can record the information that comes out of the group discussion.

On the contrary of sketched maps, **aerial photographs** represent a *true* image (however interpretation may be biased) of an area at a point in time. Adding local information to this provides very important data. This information can also be relatively easy to transform to a conventional map or to a sketch map based on the photo.

Topographic maps are indispensable, whether or not aerial photographs are available, in order to discuss and relate the sample site to a bigger geographic area.

Another exercise that opens for a lot of discussion and analysis is community mapping. In a community mapping exercise, the local people draw their community and surrounding. A facilitator might often help to start off the work by drawing one reference point, a road, etc. But during the rest of the exercise, the people should draw their own map with as little interference as possible. During the drawing exercise, there is a lot of time for discussions on ownership, what is harvested in different parts, etc. However, a drawback for this study is that the sample site, which is where we are collecting the data from, might not be physically close to the area where people live. In the context of the NFI, it will be important to focus the mapping exercise as much as possible to the sample site (tract) and to the variables related to it. What could be done is to locate the sample site on the community map, if this is possible in the scale that is made.

6.5.4 Tool: Cross-checking and triangulation

This technique is important for interviewing. When doing any study, the researcher must be aware of bias. If a study is biased, it means that the results do not reflect the reality because one situation or perspective was favoured. A study that fails to include the perspective of women, may be gender biased. A study that fails to probe issues deeply may be subject to a bias of “politeness” if people tell only what they think the interviewer wants to hear. Triangulation, also known as cross-checking, is a way to ensure that the results of a study are as accurate and unbiased as possible.

Dates and perceptions, for example, may be explored using different methods, each exploration building a more comprehensive understanding of complex local realities. Similarly, by using a single method with several different groups (men, women, children etc.), the different perspectives surrounding a particular issue can be revealed. Trustworthiness of data is strengthened through community verification of the findings (IIED, 1997).

Triangulation means looking at any problem or issue from as many perspectives as possible, but from at least three (Freudenberger, 1995).

1. Triangulation of the perspectives on the crew by having at least three people with different points of view (women/men, social scientist/technical specialist, insiders/outsideers, youth/elders etc.).
2. Triangulation of the perspectives of informants by ensuring that a wide range of people are interviewed and all information is verified by at least three different sources (women/men, old/young, diverse ethnic groups, etc.).
3. Triangulation of information gathering methods by addressing the same issue using several different tools (historical interviews, spatial maps, seasonal calendars, etc.). Does the direct observation or mapping exercise coincide with what people declare later during the fieldwork?

It is necessary to keep good records on where information came from and whether the interviewer is confident on its accuracy. Cross-checking can be a time-consuming process and requires patience.

6.5.5 Tool: Direct Observation

Direct observation might seem obvious but is, nevertheless, very important. The field crew must be attentive and observe the sample site and surroundings noting the general land-use, facilities such as shops, schools and markets as well as housing and infrastructure. Observing these characteristics may clarify discrepancies and information gaps that occur during data collection. Additional questions can be asked to address these information gaps. Misunderstandings and contradicting information can often occur if local people have not completely understood what is being asked. This usually happens because the questions were poorly phrased, too complex, or too general from the outset. The understanding of concepts may also be unclear across languages and culture.

Direct observation can increase the accuracy and reliability of information and also reduce the number of questions that need to be asked to local people. For example, there is no need to ask whether people use wood to build houses if all the houses that can be observed are built of wood.

6.5.6 Tool: Transect walk to the sample site

If the conditions and circumstances permit organizing such a walk, this is highly recommendable. A transect walk can be defined as a walk designed to follow a specific route, often across contour lines with different elevations and different ecological zones etc. If a map is a bird's eye view of an area, a transect cuts across the same territory in order to get an idea of the diverse micro-ecological zones found in the landscape. In the context of the National inventory, it is useful to go to the centre of the sample site (tract) or, sometimes better, to a high point in the tract from which there is a good view. It is often possible to see boundary markers, different land use practices etc. Both members of the field-crew as well as local forest users should participate (and also key-informants if needed). Being able to discuss the forest and

the forest products at the sample site with the forest users helps to tie the data-collection to the site.

Examples of directing questions:

- As the different land uses are crossed, questions should be asked to get a sense of what kind of tenure arrangements exist. *“Is the land owned? Borrowed? Subject of conflict? Is it farmed by women? Men? Outsiders?”*
- *“Are there some areas that are more in demand than others? How is this land allocated?”*
- *“What is the significance of any fences or boundaries that are observed? Are there more in some areas than in others? Why?”* (Fences are often indicators that there is a competition for land or competing uses, such as grazing and cultivation).
- *“What was the use of the land here ten years ago?”*
- *“Where we are standing now, what are the forest products that you/your family extract?”*
- *“That fruit we see over there- does anyone harvest that? Who? – Do you eat that? Etc”.*
- Uses of various trees should be investigated. *“Who is allowed to use the trees and for what purpose? Are the rules the same for all tree species? Do they vary depending on where the tree is located?”*
- *“Is the group passing through any land that is borrowed?”* If so, it is useful to begin to find out about borrowing practices.
- *“Is the group crossing through any communally owned areas?”* If so, it is an opportunity to begin to find out how they are managed.

One of the advantages of doing a transect is that people are often more willing to address sensitive issues such as land ownership patterns or conflicts, when they are away from the community. If a question is related to the things being observed, it can seem less intrusive than if the same question is asked in a more formal interview situation (Freudenberger, 1995).

In addition, a transect walk will give the field crew a chance to show what they are doing and, also, a chance to clarify queries after observations from the field measurements.

6.5.7 Tool: Identifying the forest products, services and their use

This exercise may be carried out with different focus groups to collect data on the forest products, services and their use for the different land use class in the plot. Gender issues should be considered and it may be more reliable to organize focus groups by grouping men and women separately, at least when discussing preference and importance of the products and services.

Steps and recommendations of the exercise are described below:

- 1) Make a list of the forest type classes (if necessary). It is important to clarify with the users whether the different forest types mean that they collect different products.
- 2) Ask which are the forest products and services used in the tract: *“Here, where we are standing (if in the tract) – or in this area on the aerial photograph/map (point it), what are the forest products that your family (/you/the village) extract?”*, *“What is the local name?”* *“What do you use the product for?”*

Let the focus group brainstorm on the products they collect and note them down on a flipchart or paper. If you feel that some are left out, you might ask some indirect questions such as: *“Are there any medicinal healers here”* (if yes, does this mean that they must be extracting medicine plants etc.), *“What do you usually cook with? Firewood, electricity or gas?”*

If different types of forest have been identified, *“Do different forest products belong to specific forest type?”*

- 3) Discuss about one product at a time, draw the product on the flipchart and systematically work on each one of them in order to gather all the necessary variables that are concerned with it.
- 4) If possible, an attempt must be done to find the species in the field.

6.6 IUCN protected area management categories

<i>Protected Areas – IUCN categories for nature protection</i>	
I – Strict nature reserve / wilderness area.	Protected area managed mainly for science or wilderness protection. These areas possess some outstanding ecosystems, features and/or species of flora and fauna of national scientific importance, or they are representative of particular natural areas. They often contain fragile ecosystems or life forms, areas of important biological or geological diversity, or areas of particular importance to the conservation of genetic resources. Public access is generally not permitted. Natural processes are allowed to take place in the absence of any direct human interference, tourism and recreation. Ecological processes may include natural acts that alter the ecological system or physiographic features, such as naturally occurring fires, natural succession, insect or disease outbreaks, storms, earthquakes and the like, but necessarily excluding man-induced disturbances.
II – National Park	Protected area managed mainly for ecosystem protection and recreation. National parks are relatively large areas, which contain representative samples of major natural regions, features or scenery, where plant and animal species, geomorphological sites, and habitats are of special scientific, educational and recreational interest. The area is managed and developed so as to sustain recreation and educational activities on a controlled basis. The area and visitors' use are managed at a level which maintains the area in a natural or semi-natural state.
III – Natural monument	Protected area managed mainly for conservation of specific natural features. This category normally contains one or more natural features of outstanding national interest being protected because of their uniqueness or rarity. Size is not of great importance. The areas should be managed to remain relatively free of human disturbance, although they may have recreational and touristic value.
IV – Habitat/species management area	Protected area managed mainly for conservation through management intervention. The areas covered may consist of nesting areas of colonial bird species, marshes or lakes, estuaries, forest or grassland habitats, or fish spawning or seagrass feeding beds for marine animals. The production of harvestable renewable resources may play a secondary role in the management of the area. The area may require habitat manipulation (mowing, sheep or cattle grazing, etc.).
V – Protected landscape/seascape	Protected areas managed mainly for landscape/seascape conservation and recreation. The diversity of areas falling into this category is very large. They include those whose landscapes possess special aesthetic qualities which are a result of the interaction of man and land or water, traditional practices associated with agriculture, grazing and fishing being dominant; and those that are primarily natural areas, such as coastline, lake or river shores, hilly or mountainous terrains, managed intensively by man for recreation and tourism.
VI – Managed resource protection area.	Protected area managed for the sustainable use of natural ecosystems. Normally covers extensive and relatively isolated and uninhabited areas having difficult access, or regions that are relatively sparsely populated but are under considerable pressure for colonization or greater utilization.

7. References

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