



Lao People's Democratic Republic
Peace Independence Democracy Unity Prosperity

Ministry of Agriculture and Forestry
Department of Forestry

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GUIDELINES ON PARTICIPATORY FOREST INVENTORY

- Based on MAF Regulation No. 0221/MAF.00, dated 13/10/2000, on Establishment and Sustainable Management of Production Forest
- Based on MAF Regulation No. 0069/MAF.02, dated 13/05/2002, on pre-harvesting inventory, tree marking and post-harvesting assessment
- Based on MAF Regulation No. 0204/MAF.03, dated 03/10/2003, on Establishment and Sustainable Management of Production Forest

The Director-General of Department of Forestry issues the following implementing guidelines:

I Objectives

This guideline provides the basic for conducting forest inventory, pre-harvesting inventory, tree marking, and post-harvesting assessment to provide forest resources information on tree species, volumes, non timber forest products and other information concerned by participation of Village Forest Organization, Group of Village Forest Organization on sustainable forest management.

II Definition

Production Forest- Production forests are forest and forest lands, which are allocated to continuously provide for the requirements of the national socio-economic development and the populace's regular daily needs in terms of wood and other forest products which do not seriously affect the environment.

Production Forest Area- refers to a legally established forest area and forest land meeting the criteria and definition of production forests, consisting of different forest categories designated according to technical guidelines and placed under sustainable management with participation of villagers.

Production Forest Area at District Level- means the forest and forest land area identified within the PFA located within the administrative boundaries of a district. This is also referred to as a *forest management area (FMA)*

Production Forest Area at Village or Group of Villages Level- means the forest and forest land identified within the PFA within the administrative boundaries one or a cluster or group of villages for purposes of sustainable management and use. This is also referred to as *Forest management sub-area (Sub-FMA)*.

Forest Inventory and Planning – means the collection of information on land use, tree volume, tree species, NTFP and other socio-economic information in Production Forest Area, these information will be used to develop forest management plan, management and utilization of forest resources in sustainable ways.

Pre-harvesting Inventory - means the collection of information on trees; species, diameter allowed cut, height, quality, location to make tree list and determination of skidding trails, and development of harvesting plan.

Tree-marking- is to mark the number of the tree to be cut by painting and stamp on the trunk of the tree.

Post-harvesting inventory - means the inspection of harvesting plan implementation and management plan to evaluate the impact of implementation of forest management activities to forest and environment including identify the solution

Harvesting Rotation – means the rotation of timber harvesting in a particular compartment which mentioned in the forest management plan.

Saplings – means the selection of a particular area to be representative of the whole areas.

Annual Increment- means the increment of the tree volume per year per hectare.

III. Principle

To mark sure that forest resources are managed and used in sustainable manner, the forest inventory need to conduct the following steps;

1. Forest Inventory and planning
2. Pre-harvesting Inventory
3. Tree marking
4. Post – harvesting assessment

IV Forest Inventory and Planning

1. Methods

- 1.1 Lay out a baseline and strip lines in order to facilitate the inventory works
- 1.2 The baseline should be laid out based on the site condition, the main objective is to facilitate the lay out of the strip-lines
- 1.3 Strip lines should be laid at the right angle of the baseline with the distant of 200 m apart, the objective of the strip line is to use to lay out the sample plots.
- 1.4 The forest inventory shall be based on a line-plot systematic sampling. There are three types of sample plots;
 - Plot “A”, the size is 20 m x 30 m with the distant 300 m apart for Dry Dipterocarps Forest and 100 m for high forest. Forest inventory shall be conducted at 3% sampling intensity for the high forest and at 1% sampling intensity for the Dry Dipterocarps Forest. This plot is used to collect information that can be used to estimate the tree standing volume (see figure 1 and 2)
 - Plot “B”, the size is 10 m x 10 m, laid at the corner of plot “A” with corresponds to 0.16% sampling intensity for Dry-Dipterocarps forest and 0.5% for the high forest. This plot is used to collect information that can be used to estimate the richness of small trees including NTFP (see figure 2).
 - Plot “C”, the size is 5 m x 5 m, laid at the corner of plot “B” with corresponds to 0.04% sampling intensity for Dry-Dipterocarps forest

and 0.12% for the high Forest. This plot is used to collect information that can be used to estimate the seedling, sampling and regeneration (see figure 2).

(Distribution of the sample plots along the strip line present in the figure 1 and 2)

1.5 Forest Areas Selection

- Forest Areas to be inventoried are Dense Forest (Evergreen Forest, Deciduous Forest, mixed deciduous and coniferous forests), Dry-Dipterocarps and Bamboo.
- Forest Areas not to be inventoried are degraded forest, regeneration forest, scrub jungle, Protected Forest and NBCAs

2. *Implementation*

2.1. Preparation

2.1.1 Human resources

- Staff of Department of Forestry, Provincial Forestry Sections, Forest Management Units and Village Forest Organization or Group of Villages.
- Organization of training in order to strengthening staff capacity and fully understand the guidelines, inventory manual, field implementation guide including use of equipments.

2.1.2 Other tools and materials. A minimum set of equipment and materials to be prepared are as follows:

- Ø Forest inventory map with a scale 1: 10.000
- Ø GPS
- Ø Forest inventory forms
- Ø Field compass
- Ø Diameter tape
- Ø Calliper
- Ø Measuring tape 50 m
- Ø Ropes
- Ø Machetes and knives
- Ø Writing tools
- Ø First aid kit
- Ø Camping equipment (tent, cooking and eating utensils)
- Ø Food provisions)
- Ø Vehicles

2.2 *Field data collection*

- In the plot “A”, collect information of all tree species that has diameter above 20 cm such as; species, DBH at 1.30 meter, commercial height, total height and stem quality (see table 1)
- In the plot “B”, collect information of tree species that has DBH at 1.30 m between 5-19 cm such as species, DBH at 1.30 meter, total height and NTFP information; bamboo, rattan, cardamom... (see table 2).
- In the plot “C”, collect information of small trees with DBH less than 5 cm and height 1.3 m including seedling has total height about 0.3 to 1.3 m (see table 2).

2.3 *Summary and analysis of data*

- 2.3.1 Village Forest organization or group of village summary document and field data collection and send to Forest management Unit concerned for collection.
- 2.3.2 FMU monitor, make summary and document information and data received from VFO or GVFO and submit to PFS based on recommendation of DAFOE concerned.
- 2.3.3 PFS summary information received from different PFAs and collaborate with FIDI to analyze data and produce management plan based on PAFO's acknowledgement and submit to DOF for approval.
- 2.3.4 After management plan approved, DOF will keep one copy and send to PFS and FMU for implementation.

3. Contracting and conducting the forest inventory fieldwork

1. FMO shall sign a forest inventory work contract with VFO or GVFO
2. VFO or GVFO shall be responsible for organizing the village teams and ensuring that the fieldwork will be conducted by the village teams according to signed agreement.
3. Village teams shall be paid wages at standard rates prescribed in the government regulation. Cost shall be calculated on the basis of 6 members per village team and output rates of 6 plots per day for high forest types and 9 plots per day for dry dipterocarp forest types.
4. FMU shall be responsible to pay wages from VFO or GVFO based on signed agreement, the payment shall be divided into 3 times as follows;
 - First payment is 25% at the start of the field work.
 - Second payment is 25% when the work has completed 50%

- Third payment is 50 % upon completion based on satisfaction and recommendation of FMU. In case there is some mistakes on implementation of forest inventory techniques, VFO has to do it again.

V Pre-harvesting Inventory

1. Methods

- 1.1 The baseline should be laid out based on the site condition, the main objective is to facilitate the lay out of the strip-lines
- 1.2 Strip lines should be laid at the right angle of the baseline at 50 m apart
- 1.3 Full enumeration for large trees (above the diameter cutting limit or above 50 cm DBH).
- 1.4 Lay out sample plot with the size of 20 m by 30 m at 100 m apart along the strip lines which corresponds to 6% sampling intensity in order to estimate the standing timber distribution in the compartment. This information will be used for select harvesting areas.

2. Implementation

2.1. Preparation

2.1.1 Human resources

- Staff participated on pre-harvesting inventory included staff from Department of Forestry, Provincial Forestry Sections, Forest Management Units and Village Forest Organization or Group of Villages.
- Organization of training in order to strengthening staff capacity and fully understand the guidelines, inventory manual, field implementation guide including use of equipments.

2.1.2 Other tools and materials. A minimum set of equipment and materials to be prepared are as follows:

- Ø Forest inventory map with a scale 1: 10.000
- Ø GPS
- Ø Forest inventory forms
- Ø Field compass
- Ø Diameter tape
- Ø Calliper
- Ø Measuring tape 50 m
- Ø Ropes
- Ø Machetes and knives

- Ø Writing tools
- Ø First aid kit
- Ø Camping equipment (tent, cooking and eating utensils)
- Ø Food provisions)
- Ø Vehicles

2.2. Field data collection

- 2.2.1 Collect information of all tree species that has diameter above the diameter cutting limit or above 50 cm DBH such as; species, DBH at 1.30 meter, commercial height, total height, stem quality and location (see table 1)
- 2.2.2 Collect information of tree that has DBH from 10 cm to the diameter cutting limit in the 20 m by 30 m sample plots such as species, DBH at 1.30 meter, commercial height and total height (see table 2)

2.3. Summary and analysis of data

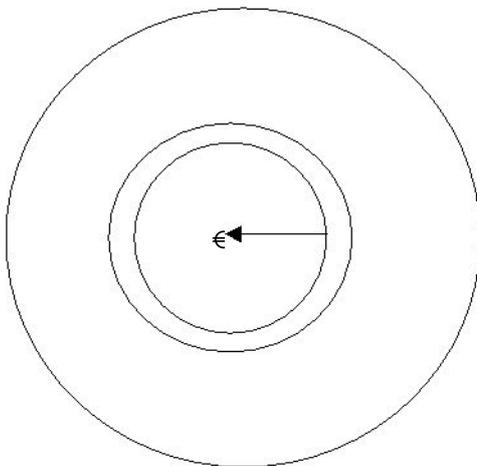
2.3.1 Village Forest organization or group of village summary document and field data collection and send to Forest management Unit concerned.

2.3.2 FMU make summary and analysis:

- Calculate volume per hectare present in the sample plots
- Produce tree location map
- Priority of areas to be harvested based on standing timber volume
- Select tree to be cut with following criteria:
 - A) Must not be a rare species (less than 1% of large trees) in the harvesting compartment
 - B) Market demand (it is good if we can select more tree as many as possible so that the stand composition is not changed so much)
 - C) At most 20% of the number of large trees of that species to ensure that the proportion of the species in the stand does not change so much.
 - D) Cutting one or two trees from a cluster shall be preferred over cutting solitary trees.
 - E) In the sub-compartment with stand density of at least 100 m³/ha, the standing timber quality class 1, 2, 3, 4, 5 can be cut.
 - F) In the sub-compartment with stand density of 80-99 m³/ha, the standing timber quality class 2, 3, 4, 5 can be cut.
 - G) In the sub-compartment with stand density of 75-79 m³/ha, the standing timber quality class 3, 4, 5 can be cut.

- H) Must have at least 7 mother trees (large trees of commercial species and quality class 1 or 2) within a 1-ha area (radius of 56.4m) surrounding it.
- I) Quality of standing tree can be classified as follows;
- Quality 1: Tree has a straight stem and round and less defect.
 - Quality 2: Stem is lightly straight and round and has defect a little more than Quality 1
 - Quality 3: Stem is twist, bends and has such as; knot, decay, burnt, broken, forks and other defects.
 - Quality 4: Death standing tree, hollows and broken at tops but it can be utilized
 - Quality 5: Tree fallen down but it can be utilized (live tree).
 - Quality 6: Tree fallen down but it can be utilized (death tree).
- J) In order not to leave the big gap after logging the cutting intensity must practice as follows; the sub-compartment with standing density less than 100 m³/hectar, the selection of tree to be cut at least 30 m apart and 25 m³ apart for standing density above 100 m³/hectar.

The circle for measuring the distance of the tree to be cut



Centre: use to overlay the selected tree to be cut

Circle 1: Radius with 25 meter used to measure the distance between two trees

Circle 2: Radius with 30 meter used to measure the distance between two trees

Circle 3: Radius with 56,4 meters used to count the mater tree per hectar

- Tree list should present as following information: the code of base line, strip line, tree number, species, DBH at 1.30 m, commercial height, volume and stem quality (see the list of tree to be cut

attached) including tree location map (see tree location map in the figure 5).

- After tree selection completed, in the tree location map must mark tree to be cut, mother trees, existing road, skid trails, first log landing and second logs landing.
- Produce harvesting plan and submit to PFS based on DAFOE recommendation.

3. Contracting and conducting the Pre-harvesting inventory fieldwork

3.1 FMO shall sign a Pre-harvesting inventory_work contract with VFO or GVFO and providing tools and train on how to use tools and equipment for Village Forest Volunteers.

3.2 VFO or GVFO shall be responsible for organizing the village teams and ensuring that the fieldwork will be conducted by the village teams according to signed agreement.

3.3 Village teams shall be paid wages at standard rates prescribed in the government regulation. Cost shall be calculated on the basis of 6 members per village team and produce an output of 2 hectares per day including inventory in the sample plots.

3.4 FMU shall be responsible to pay wages fro VFO or GVFO based on signed agreement, the payment shall divided into 3 times as follows;

- First payment is 25% at the start of the field work.
- Second payment is 25% when the work has completed 50%
- Third payment is 50 % upon completion based on satisfaction and recommendation of FMU. In case there is some mistakes on implementation of forest inventory techniques, VFO has to do it again.

VI Tree marking

1. Principle

Each tree identified to be cut need to mark the number and stem on the

1.1 marking procedure

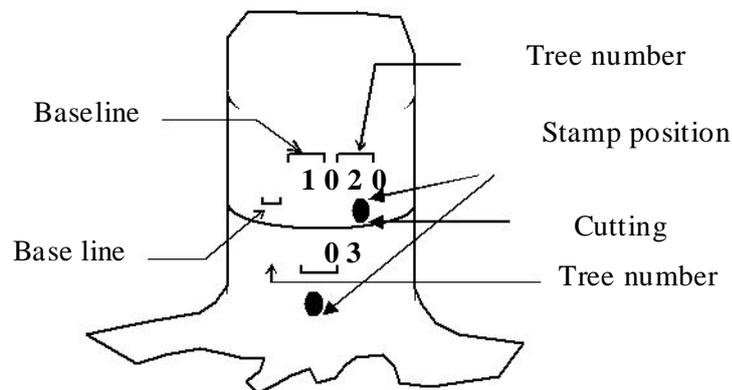
- € Painting a line around the tree at cutting level.
- € Painting an upright arrow to indicate the direction of felling that minimizes destruction of the standing tree crop, taking into further consideration the direction of lean of the tree.

- € Painting the tree number under the cutting line. The number shall include base line number, the strip number and the tree number at the opposite side of the lower cutting level and the above cutting level.
- € In case tree has flock, marking shall be conducted as follows; if the flock is lower than 1.3 m height, this tree shall be counted as two trees and marked two numbers, if the folk is higher that 1.30 m height shall be counted as oOne tree and mark only one number.
- € After marking completed, stamp at the lower and above cutting limit at the trunk of the tree shall be given (details refer to the regulation on the n use of hammer stamp).
- € Code number :
- € There are three Code at the front of the cutting side and 5 digits as follows; ABCC represent a base line, strip line and tree number.

A = -base line, has 1 digit
 BB = strip lines, has 2 digits
 CC = tree number, has 2 digits.

- € Information present at the lower cutting limit is tree numbers

Example:



1.2 Stumps and logs marking

- € Repaint the tree number at the stump, if it is erased after tree felling.
- € Cross cutting shall be followed the MAF regulation no. 60/MAF. 03, dated 24/02/03. Mark sure that tree being felling including tops and branches shall be fully utilized.
- € Marking of logs after crosscutting completed as follows; compartment number, sub- compartment number, baseline number, strip number and log number, after that skidding shall be carried out to the first landing.
- € Marking and use the code mark at the logs:

WXYZZ
ABBCCD

W = PFA, has 1 digit

X= Compartment, has 1 digit

Y = Sub-compartment, has 1 digit

ZZ = harvesting block, has 2 digits

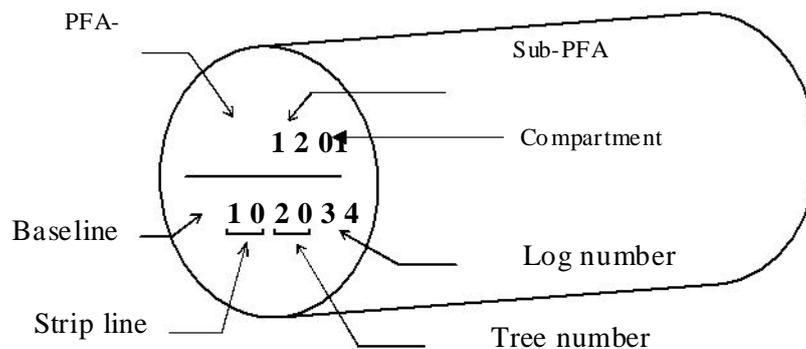
A = -Strip number, has 1 digit

BB = Strip number, has 2 digits

CC = Tree number, has 2 digits

D = -Logs number, has 1 digit

Example



Note: This log harvested from PFA 1, sub PFA 2, compartment 01, base line 1, strip number 02, tree number 03 and log number 4.

2.1. Preparation

2.1.1 Human resources

- Staff participated on pre-harvesting inventory included staff from Department of Forestry, Provincial Forestry Sections, Forest Management Units and Village Forest Organization or Group of Villages.
- Organization of training in order to strengthening staff capacity and fully understand the guidelines, inventory manual, field implementation guide including use of equipments.

2.1.2 Other tools and materials. A minimum set of equipment and materials to be prepared are as follows:

- Ø Tree location map
- Ø GPS
- Ø Paint blush and color
- Ø Field compass
- Ø Diameter tape
- Ø Measuring tape 50 m
- Ø Ropes
- Ø Machetes and knives
- Ø Writing tools
- Ø First aid kit
- Ø Camping equipment (tent, cooking and eating utensils)
- Ø Food provisions)
- Ø Vehicles

2.1.3 Contracting and conducting the Pre-harvesting inventory fieldwork

- € FMO shall sign a tree marking work contract with VFO or GVFO and providing tools and train on how to use tools and equipment for Village Forest Volunteers.
- € VFO or GVFO shall be responsible for organizing the village teams and ensuring that the fieldwork will be conducted by the village teams according to signed agreement.

- € Village teams shall be paid wages at standard rates prescribed in the government regulation. Cost shall be calculated on the basis of 4 members per village team and produce an output of 50 trees per day.
- € FMU shall be responsible to pay wages fro VFO or GVFO based on signed agreement, the payment shall divided into 3 times as follows;
 - First payment is 30% at the start of the field work.
 - Second payment is 70% upon completion based on satisfaction and recommendation of FMU. In case there is some mistakes on implementation of forest inventory techniques, VFO has to do it again.

2.2 marking trees in the filed

FMU received tree list that has already conducted pre-selling and hand over to VFO or GVFO to organize village team to mark the trees to be cut based on marking procedure mentioned in point 1 and 6 of this guideline.

VII. Pos-harvesting assessment

To collect information on the status of the forest after harvesting operation completed. The objective of post harvesting inventory is to evaluate and prove that the implementation of harvesting activities are based on the approved work-plan and techniques and inline the harvesting regulations. At the same time the impact of logging operation in the harvesting areas need to be assessed and the regeneration plan should be formulate. The assessment shall be done not tater than 1 month after harvesting operation completed-. Post-harvesting assessment shall be addressed on the following issues;

- € Felling of marked trees, stump height, branches, directional felling, damage to trees and crop residuals, leave felled tree in the forest. Sampling intensity for post harvesting assessment is about 15% of the total number of felled trees.
- € Actual cutting volume shall be correct according to the approved harvesting plan by comparing standing volume with logs volume.
- € Termination of harvesting contract such as logging contractors have committed some mistake like hunting, NTFP collection, waste deposal, cleaning of forest after logging operation completed.
- € Damage from skidding from stump to first landing (damage to seedling, small tree, NTFP and soil surface.

VII. Jobs- allocation

- € FIPD is responsible for; design forest inventory method, train foresters at local level, supervise, advice, monitoring forest inventory team in order to

implement forest inventory at the field more effectively and complete in time. To gather with local forestry staff summary field data, analysis, produce forest management plan and storage of inventory data.

- € PFSs (Forest inventory Unit) facilitate forest inventory techniques and participate with FIPD summary, analysis, produce management plan and storage of inventory data.
- € FMUs formulate a forest inventory works contract with VFO or GVFO, -- payment of wages, training and allocation of Forest inventory activities to villages inventory teams, collection of data from villages team and send to PFS concerned.
- € VFO or GVFO shall responsible for organizing village team and lead the team to implement activities in the signed agreement.
- € -Village team is responsible for implementing activities based on tasks allocated by VFO or GVFO.

VIII. Effectiveness

This guideline shall be effective after signing.

Director General Department of Forestry

VeaunVang Bouthalath