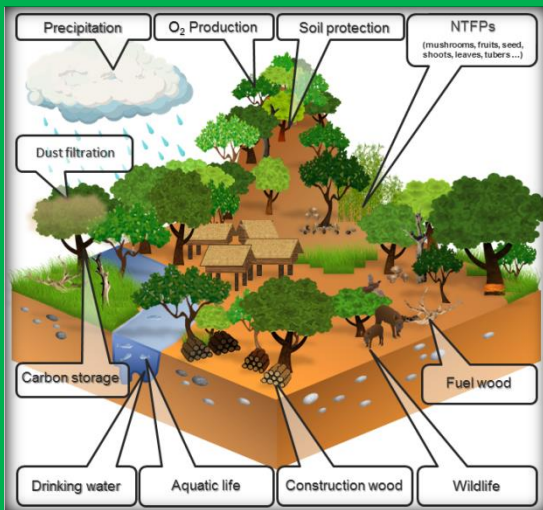


Village Forest Management and Implementation Manual



Climate Protection through Avoided Deforestation Project

Technical Cooperation (GIZ / CliPAD)

January 2017

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Foreword

According to Forestry Law (No.6/NA, 24.12.2007) and the Forestry Strategy to the Year 2020, Village Forest Management is the management, preservation, development and use in a sustainable manner of forest areas inside a village jurisdictional area, which the government has allocated to the village. The management of the forest areas has to follow a management plan.

The aim of this manual is to assist district forestry staff and villagers in the implementation of such management plans in CliPAD pilot villages. The basis of the activities described therein is the *CliPAD FC Annual Forestry Operation Plan*, which defines the management objectives as well as locations and costs of certain activities.

This manual is divided into two parts. "Part 1: Village Forest Management Planning" is a summary of the required working stages and steps of Village Forest Management Planning, which defines activities for all three forest categories as laid out in detail in the *Village Forest Management Guideline* by GIZ/CliPAD TC.

"Part 2: Implementation of the Annual Forestry Operation Plan" serves the purpose of giving simple, but clear instructions on how to implement planned activities in the field.

The Provincial Office of Agriculture and Forestry Houaphan would like to take this opportunity to thank everyone, who has contributed towards the preparation and production of this booklet.

May it be used intensively!



Mr. Khin Thoummala, DDG
(Provincial Office of Agriculture and Forestry Houaphan)

Khin THOMMALA

Part 1

Village Forest Management Planning



Stages and Steps of Village Forest Management Planning

Required information for VFM Planning:

- Satellite Images and Aerial Photos
- Present Land Use Map and Future Land Use and Forest Map
- GIS data
- PLUP Report, Socio-Economic Data
- Creation of the Village Land Use and Forest Management Committee (VLUFMC)
- Approved Village Regulations

Stage 1: Introduction of VFMP in the field

Step 1.1 Organize opening meeting (1st meeting)

- Present the objective and agenda of VFMP
- Review of PLUP data
- Question and answers, discussion with villagers
- Prepare and sign Minutes of Meeting (MoM)

Stage 2: Demarcation of forest areas and preparation of detailed village forest area map

Step 2.1 Preparation of Field Work

Purchase of required materials: GPS, Clinometer, Relascope, Printer etc.

Step 2.2 Implementation of Village Forest Boundary Delineation and Demarcation

Marking the exact boundaries of conservation, protection and use forests in the field. Demarcation per block should be conducted with several teams in order to complete demarcation within one day. However, in some cases an overnight stay might be required.



Step 2.3 Preparation of the detailed Village Forest Map at 1:5.000 or 1:10.000 scale

Download GPS data of exact forest boundaries; compare new boundaries with boundaries of PLUP map; prepare **village forest map**.

Stage 3: Basic Forest Inventory (only in Village Use Forests)

Step 3.1 Selection of Sampling Points

Project the selected sampling points on the village forest map according to satellite image; enter the coordinates of the sampling points as waypoints into one GPS receiver; prepare equipment: GPS, relascope, clinometer, camera, forms, notebook and a print out of the village forest map.

Step 3.2 Conduct Basic Forest Inventory in Village Use Forest (if forest products are NOT used for commercial purpose)

“Horizontal Point Sampling (HPS)” according to explanations in VFM Guidelines. If forest products – especially timber – from Village Use Forests are harvested for commercial production, a more detailed inventory with permanent indicator plots and much more samples is recommended, to achieve an acceptable accuracy.



Step 3.3 HPS data entering and analysis

Fill one form for each sampling point (inventory form) and transfer the inventory data in the related excel sheet, to calculate the standing volume and sustainable extraction rate.

Step 3.4 Updating of the village forest map

Add coordinations of sampling points in the map.

Stage 4: Preparation and approval of 5-year Village Forest Management Plan and Annual Forestry Operation Plan**Step 4.1 Organize meeting of Village Land Use and Forest Management Committee (VLUFMC) and district authorities to jointly prepare first drafts of VFMP (2nd meeting)**

Present collected data and forest map to VLUFMC; draft 5-year VFMP and identify suitable activities for *Annual Forestry Operation Plan* (prepare and sign minutes of meeting).

Step 4.2 Conduct general village meeting as well as official approval of the VFMP documents (3rd meeting)

Organize village meeting in cooperation with district authorities to consult with villagers and to approve 5-year *Plan* and *Annual Forestry Operation Plan* by villagers (sign minutes of meeting and VFMP).

Stage 5: Village Forest Management Agreement (VilFoMA) – supported and moderated by FPIC Team (Free Prior Informed Consent)

Step 5.1 Prepare Village Forest Management Agreement in office with DAFO and PAFO staff

Prepare draft of *VilFoMA* to discuss with villagers.

Step 5.2 Present, discuss and agree on the Village Forest Management Agreement (FPIC 2)

Organize and facilitate a general village meeting to present *VilFoMA* to villagers for discussion and to reach consent on *VilFoMA*.

Step 5.3 Sign the Village Forest Management Agreement (FPIC 3)

FPIC team facilitates a meeting for concerned district and village authorities to review *VilFoMA* and to reach a final agreement and the willingness to sign by both sides the *VilFoMA*. Additionally, the village level conflict mediation mechanism has to be presented to address project related grievance. Finally, the signing ceremony of *VilFoMA* is organized.

Stage 6: Implementation of agreed village forest management activities

After *VilFoMA* has been signed, the district will transfer the annual budget to the second account of the village. The implementation of the Village Forest Management Activities should be based on the approved *Annual Forestry Operation Plan*.

Stage 7: Monitoring and Evaluation

Step 7.1 Quarterly monitoring of implementation progress by village authorities

Follow up on payments to villagers, who implemented VFM activities as well as on illegal activity reporting and conflict situations.

Step 7.2 Annual monitoring by district & village authorities

Achievement of *Annual Forestry Operation Plan* and preparation of a new plan for the following year.

Step 7.3 Monitoring of performance results by district authorities (every 2 years)

Evaluating forest conditions and forest cover by using participatory forest resource assessment and satellite images.

Step 7.4 Monitoring of overall achievement by district and village authorities (after 5 years)

Monitoring of past 5-year *VFMP* and preparation of new *VFMP* and *VilFoMA*.

Summary of VFMP Process

1. Introduction of VFMP in the field
2. Demarcation of forest areas and preparation of detailed village forest area map
3. Basic Forest Inventory (only in Village Use Forests)
4. Preparation and approval of 5-year Village Forest Management Plan and Annual Forestry Operation Plan
5. Village Forest Management Agreement (ViFoMA) – supported and moderated by FPIC Team (Free Prior Informed Consent)
6. Implementation of the agreed village forest management activities
7. Monitoring and Evaluation

Equipment for Village Forest Management



Printer



LCD



Relascope



Camera



Spray and ribbons



Measuring tape



GPS



Clinometer



Diameter tape



Clipboard



Forms



Generator

Number of HPS Points in Village Use Forests

Forest Zone in ha	Number of Sample Points	
	Degraded area	Dense area
0.5 - 20	1-3	1-3
20 – 50	4-5	4-5
50 – 100	5-7	5-7
100 - 200	6-8	6-8
≥ 200	7-10	7-10

Number of representative trees to calculate the average tree height

Number of sample trees counted	Number of representative trees to be measured
1-5	1
6-10	2
11-15	3
16-20	4
21-25	5
26-30	6
31-35	7
36-40	8

Part 2

Implementation of the Annual Forestry Operation Plan



1. Forest boundary demarcation

1.1 Schedule (months)

1. Forest boundary demarcation	1	2	3	4	5	6	7	8	9	10	11	12
1. Forest boundary clearing and demarcation				1x							1x	

Boundary clearing and boundary demarcation can and should take place 2x per year, ideally in April and November.

1.2 Clearing of boundaries

1.2.1 Required Equipment

- handsaws
- bush knives
- tents, sleeping bags (if overnight stay in the forest is necessary)
- sketch map (with forest boundaries)
- materials for marking forest boundaries (see 1.3)

The boundaries are being cleared in a strip with a width of at least 1m or more. During the clearing all vegetation other than ground vegetation is being removed (shrubs, trees as well as bamboo). All plants should be cut as close to the ground as possible to slow down their regrowth.

Disposal of plant material

For a more visible demarcation all cut plant material as well as dry material has to be removed from the cleared area. Fresh material can be discarded in the nearby forest, material fit for use as fuel wood or fodder can be carried out and utilized. Dry material should be **carefully** burned at the site (**see Box A!**).

Box A: Safety measures regarding burning of dry plant material on-site

- ✓ Clear surroundings from any flammable material!
- ✓ Do **not** burn big amounts of material all at once! Only burn in small quantities instead!
- ✓ Do **not** leave fires unattended!
- ✓ Do **not** use fire accelerants (e.g. gasoline, tires)!
- ✓ Do **not** burn during times of drought!

1.3 Demarcation of boundaries

1.3.1 Required Equipment

- paint
- painting brush
- machetes
- sketch map (with forest boundaries)
- sign board

1.3.2 Procedure

The exact forest boundaries are clearly defined by the detailed Village Forest Map. They form the reference for all later demarcation activities.

Materials

While painting, spray paint and nylon cloths can be used for marking longer forest boundary sections, sign boards should be used only at certain strategic points. Their general purpose is that of providing additional information rather than demarcating boundaries themselves. Therefore, they should be placed in points of increased exposure to the population such as road sides.

Demarcation

Trees and other landmarks such as rocks will be marked and old demarcation will be renewed.

Attention should be paid to the following criteria of good demarcation:

✓ **Make sure it lasts for as long as possible!**

Before marking with paint or spray paint, clear the surface (of tree or rock) by removing any layers of dirt, moss or other organic substances. Do not apply markings on small, fragile or movable objects.

✓ **Make sure it is visible!**

Apply the marking in a sufficient height of at least 170 cm above ground level. It should not be covered up by any bushes and shrubs. The markings should always be applied on the same side of the trees / rocks / landmarks so that they are equally visible from all directions. Use only bright, clearly visible colors (e.g. red, yellow, orange), when using paint, spray paint or pieces of cloth.



✓ **Make sure it is explicit!**

For effective sustainable forest management it is necessary to be able to clearly distinguish between the different zones of permitted forest use. A distinction between the core zone and controlled use zone in conservation and protection forest as well as village use forest in general should be made. This can be achieved by using specific colors for indicating specific forest categories and degrees of permitted use.

2. Boundary monitoring and patrolling

2.1 Schedule (months)

2. Forest boundary patrolling	1	2	3	4	5	6	7	8	9	10	11	12
2.a) Border patrols, incl. clearing, if necessary	2x	2x	2x	2x	2x	2x	2x	2x	2x	2x	2x	2x

2.2 Required Equipment

- tents, sleeping bags (if overnight stay required)
- bush knives / machetes (for additional clearing if necessary)
- means of documentation of violations (e.g. camera, if possible)

2.3 Patrolling and control of boundaries

While on patrol, patrolling teams should observe the immediate area for signs of violations of the “Forest and Wildlife Laws”, the “Village Forest Management Plan” as well as “Village Land Use and Forest Use Regulations”.

If possible and necessary, teams can and should make use of elevated points like hills in the immediate surroundings to gain an overview over bigger forest parts to be able to better recognize violations and not be limited to the immediate area along the forest boundaries.

Maintenance of border lines

Beside this, patrolling teams are encouraged to do additionally clearing of regrown vegetation during patrols if necessary to ensure the function of the border lines.

2.4 Monitoring and reporting of violations

Patrolling by villagers has the aim to detect illegal activities in all forest categories according to the Forest and Wildlife Laws and the certain village land use and forest use regulations. Relevant offences have to be reported to the “Village Land Use and Forest Management Committee” (see Annex 11 “Violation Case Report” in the “Village Forest Management Guidelines). Cases which can't be solved within the village have to be forwarded to the District Forest authorities for further action.

The patrolling teams have to avoid under any circumstances physical or armed confrontations with delinquents and focus exclusively on observations and reporting!

3. Fire monitoring and control

3.1 Schedule (months)

3. Fire monitoring & control	1	2	3	4	5	6	7	8	9	10	11	12
3.a) Clearing fire lines		1x	1x	1x								
3.b) Patrolling fire lines and clearing, if necessary			4x	4x	4x							

3.2 Decision chain for forest fire protection activities

A) If certain forest areas are known to be susceptible to fires and can be expected to be subject to fires based on past experiences, these areas should have **highest priority** for the execution of forest fire protection measures.

B) Forest fire protection measures in certain forest areas are likely to be necessary if **some of the following conditions apply**:

- ✓ Forest is dry evergreen forest or pine forest
- ✓ Forest borders with shifting cultivation area
- ✓ Forest borders with or contains grassland
- ✓ Forest has open canopy and much undergrowth
- ✓ Forest has much natural regeneration

To minimize the risk of forest fires, fire lines should be established and regular fire patrols organized.

C) If none of the above conditions apply, fire protection measures might be not necessary.

3.3 Establishing fire lines

3.3.1 Schedule (months)

3. Fire monitoring & control	1	2	3	4	5	6	7	8	9	10	11	12
3.a) Clearing fire lines	1x	1x	1x									

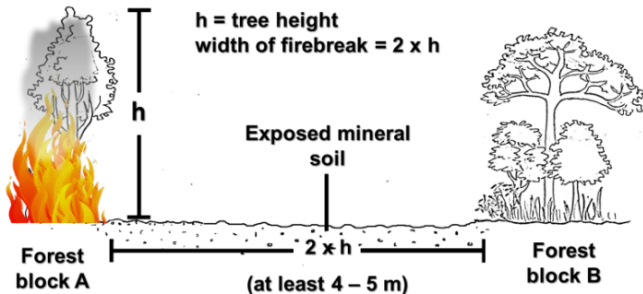
Fire lines can be cleared in March or April or better a bit earlier and according to weather conditions.

3.3.2 Required Equipment

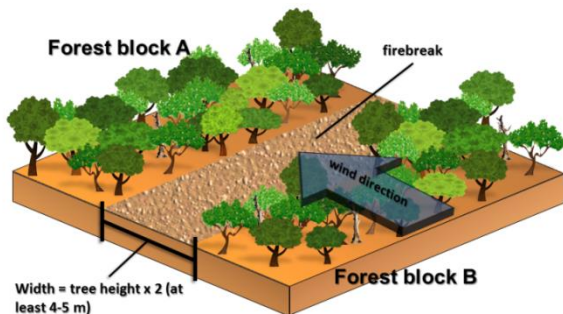
- bush knives
- rakes
- shovels
- tents, sleeping bags (where applicable, if overnight stay in the forest is necessary)

3.3.3 Design

Established fire lines should be **at least** 4 – 5m wide to prevent the skipping of fire from one forest block to another. In general, it is recommended that the width of a fire line should be twice as wide as the average height of the surrounding forest (**see picture below**).



Fires generally spread in wind direction. For this reason they are placed along the edge of the forest block that faces the direction of the wind. More precisely, fire breaks must run at a right angle to the main wind direction (**see picture below**).



3.3.4 Establishing Fire Lines

During the establishing of fire lines, it is necessary to remove all vegetation and dry leaves until the top or mineral soil is visible. The aim is to minimize flammable material as much as possible. This needs to be done consistently along the complete length of the fire line so that no plant material can act as a “bridge” enabling the fire to spread to neighboring forest blocks.

Dry branches etc. should also be removed in the surrounding forest stands. Accruing firewood/leaf material can be carried out and remaining material should be carefully burnt at the side (**see page 14: Box A**).

3.4 Monitoring and patrolling along fire lines

3.4.1 Schedule (months)

3. Fire monitoring & control	1	2	3	4	5	6	7	8	9	10	11	12
3.b) Patrolling fire lines and clearing, if necessary			4x	4x	4x							

Patrols along fire lines can and should take place 4x per month in March, April and May (3 months a year).

3.4.2 Required Equipment

- bush knives
- tents (if overnight stay in the forest is necessary)
- rake, shovel (if additional clearing during patrol might be necessary)

3.4.3 On patrol

Patrolling teams should walk in teams of at least two people along the fire lines and watch out for signs of smoke (columns of smoke, smell...). Besides this, patrolling teams are encouraged to do additional clearing of the fire lines during patrols, if necessary to ensure the function.

If possible and necessary, teams can and should make use of elevated points like hills in the immediate surroundings to gain an overview over bigger forest parts to be able to better recognize fire or smoke and not be limited to the immediate area along the fire lines.

3.4.4 Response to fire

Potential contamination with Unexploded Ordnances (UXO) in forests

In the event of forest fires, the possibility of UXO contamination must be taken into consideration. Do not attempt to extinguish forest fires in areas known for potential UXO presence!

Possible measures for combating forest fires

In case of small fires the prevention of flash-overs from flames onto tree crowns has the highest priority. Ground fires turn into more dangerous and destructive full fires when flames manage to ignite tree crowns and are then much more difficult to extinguish.

Type of fire		Measures	Responsibility
Ground fire	Flame height up to 1m from ground	Can be extinguished on encounter: <ul style="list-style-type: none">cover with soil by using shovelsuse about 1m long green branches or small trees to put out fire	Villagers
	Flame height 1 – 2m	Can be extinguished on encounter: <ul style="list-style-type: none">cover with soil by using shovelsextinguish using water buckets	Villagers with support of fire fighting units (army & police)
	Flame height 2 – 3m	Manual extinguishing by civilians not possible!	Fire fighting units (army & police)
Full fire	Flame height more than 3m from ground (tree crowns on fire)	Manual extinguishing by civilians not possible! Possibility to establish emergency fire breaks in a certain distance (in wind direction) to contain forest fire in an area	Fire fighting units (army & police)

In the event of fire, the following tactical priorities should be considered:

1. Protection of humans
2. Protection of animals
3. Protection of structures (buildings, roads, supply lines)
4. Protection of highly flammable vegetation or vegetation threatened by full fire

4. Assist natural regeneration & stand improvement (planting, weeding, thinning etc.)

Whenever possible, forest cover should be kept under any circumstances to ensure all forest functions. Therefore, proper Forest Management is always targeting on the protection of natural resources in the context of a diverse forest and the production of valuable timber and NTFP's according to a sustainable forest management plan!

According to the forest type, the needs and the management objective, different options for forest management operations can be chosen:

4.1 Forest Protection

4.2 Support of forest regeneration

4.3 Pruning

4.4 Stand improvement through thinning/harvesting in:

A) *Young aged stands (height: 2 – 3 m)*

B) *Middle aged stands (height: 3 – 12 m)*

C) *Old aged stands (height: > 12 m)*

4.1 Forest Protection

4.1.1 General

Objective

Improve conditions and timber volume in degraded or devastated forests and protect them from illegal harvesting, livestock grazing and forest fire.

Schedule (months)

4.1 Forest Protection	1	2	3	4	5	6	7	8	9	10	11	12
Forest Law Enforcement incl. patrolling	1x	1x	1x	1x	1x	1x	1x	x	1x	1x	1x	1x

Forest protection activities are being carried out all year round.

4.1.2 Activities (different options)

- Enforce existing Forest Law and “*Village Land Use and Forest Use Regulations*”
- Implement measures according to the “*Annual Forestry Operation Plan*” under: “1. Forest boundary demarcation (see page 14)”
- Implement measures according to the “*Annual Forestry Operation Plan*” under: “2. Boundary monitoring & patrolling (see page 16)”
- Implement measures according to the “*Annual Forestry Operation Plan*” under: “3. Fire monitoring and control (see page 17)”

4.2 Support of forest regeneration

4.2.1 General

Objective

Support of regeneration in stands or the creation / re-establishing of forests in degraded or even blank areas.

Regeneration Types

Natural Regeneration: Renewal of the forest achieved either by natural seeding or from the vegetative reproduction of plants.

Artificial regeneration: Renewal of a tree crop by direct seed sowing or by planting seedlings or cuttings.

Schedule (months)

4.2 Support forest regeneration	1	2	3	4	5	6	7	8	9	10	11	12
Thinning	1x	1x									1x	1x
Planting					1x	1x	1x					
Support germination (wedding...)	1x	1x	1x	1x	1x	1x	1x	1x	1x	1x	1x	1x

4.2.2 Required Equipment

- shovels
- bush knives

4.2.3 Activities (different options)

a) Forest existing

Support natural regeneration through thinning in forests (missing sun light and a too dense stand might be the reason), which should lead to an uneven-aged managed forest through snapping or cutting (see 4.4).

Removing and clearing of unwanted plants/tree species to promote high valued ones (see 4.4)

Artificial regeneration to complete and support the renewal of existing forests

- with nursery plants or
- with cuttings or
- with transplanted wildlings or
- seed sowing

b) No forest existing (blank areas or heavily degraded forests)

Artificial regeneration in blank areas or degraded forests. New species can be introduced, but selected species must match in general with the location/habitat!

- with nursery plants or
- with cuttings or
- with transplanted wildlings or
- seed sowing or
- supporting the germination of seeds from existing trees (open top soil, remove litter)

Weeding within regeneration sites should be done whenever necessary.

! Note:

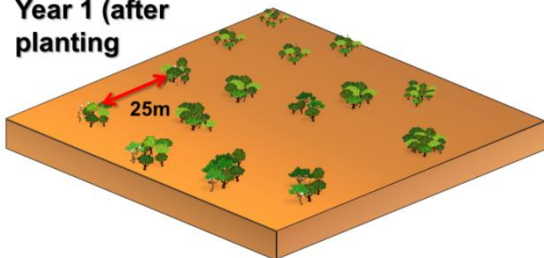
An extensive reforestation in strips of **large** areas by sowing or planting does not seem to be feasible due to limited human and financial resources.

Apart from easier protection of such sites from forest fire and intensive livestock grazing, a clustered arrangement of tree seedlings is a good solution for deforested areas and is recommended in favorable and small locations (for example warm and moisty places with less grass cover).

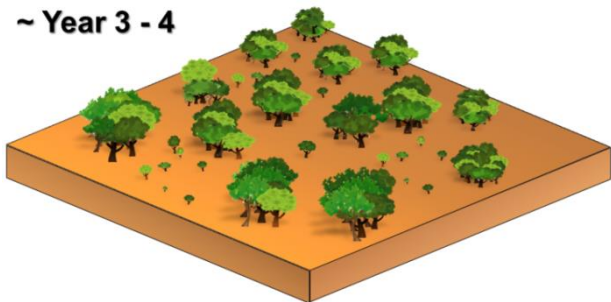
Up to 20 - 30 trees of one or two species should be planted densely in a group. It is expected that such clusters with the support of natural regeneration in the spaces in-between can lead in a medium term to a satisfactory forest cover. The distance between clusters should be around 25 m. **(See pictures below)**

Tree clusters are also less costly compared with conventional extensive reforestation since it requires less labor input, less weeding and less plants.

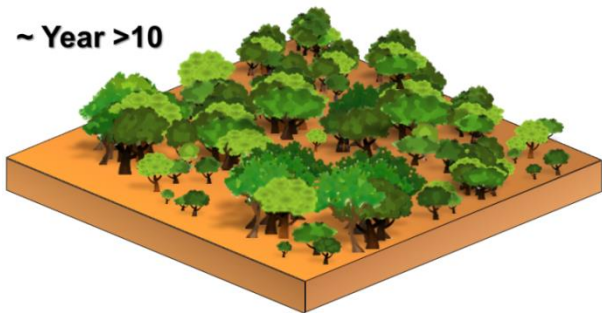
Year 1 (after planting)



~ Year 3 - 4



~ Year >10



4.3 Pruning

4.3.1 General

Pruning refers to the removal of living or dead branches from standing trees for the quality improvement of the stem. Usually the lower branches of young trees and of multiple leaders are removed.

Objective

Improving timber quality by minimizing knots/branches of the lower stem part, producing firewood (pruned branches) and reducing risk of forest fires.

Schedule(months)

4.3 Pruning	1	2	3	4	5	6	7	8	9	10	11	12
Pruning	1x	1x	1x									1x

Pruning should preferably take place during or at the end of the cold season.

4.3.2 Required Equipment

- Handsaws

4.3.3 Activities

- Do pruning of the lower part of a tree and not more than 60% of the tree height (at least 40% should be reserved for the crown)

→ Normally, this measure takes place during thinning in middle aged stands (height: 3 – 12 m)



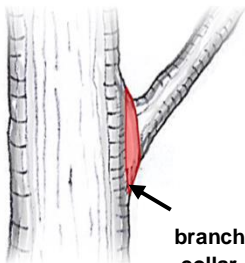
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!!Note: When pruning, cut the whole branch but **the branch collar should not be removed!** If pruned correctly, the collar will overgrow resulting in timber of higher quality and value.

4.4 Stand improvement through thinning/ harvesting

4.4.1 Schedule (months)

4.4 Stand improvement	1	2	3	4	5	6	7	8	9	10	11	12
Thinning / harvesting & timber accrues (older stands)	1x	1x									1x	1x
Thinning / harvesting & no timber accrues (younger stands)	1x	1x	1x	1x	1x	1x	1x	1x	1x	1x	1x	1x

Thinning

Thinning refers to a tree removal practice that reduces density and competition between trees in a stand. Thinning concentrates the growth (annual increment) on fewer and high-quality trees (*crop trees*). It provides periodic income and leads to improved stands with better stability, vitality and quality. Depending on the intensity, it should also support the natural regeneration within a stand.

Crop tree

Any tree selected to grow to finally be harvested or to a selected size.

Criteria for the selection of **crop trees** (sorted according to their importance):

- 1. Stability** (good formed crown)
- 2. Vitality** (healthy)
- 3. Quality** (straight, lower part of stem without branches, no damages)
- 4. Average distance between crop trees** (7 – 10 m are recommended)

Number of crop trees/ha in fully stocked stands (1,0) according to the average distance between each other	
Average distance between Crop trees	Crop trees/ha (10.000 m ²)
7m*	200
8m	150
9m	120
10m	100

* Example: $7\text{ m} \times 7\text{ m} = 49\text{ m}^2 \rightarrow 10.000\text{ m}^2 : 49\text{ m}^2 = 200\text{ crop trees/ha}$

! Note:

- Growing stock should be never removed completely (no clear cut)!
- Ensure sufficient demand for harvested timber!
- Commercial timber trade is not allowed!
- Avoid damage of regeneration and other trees during the harvest of bigger trees!
- Before thinning/harvesting, the procedure regarding timber transport, forwarding and skidding roads should be clear and well considered!

4.4.2 Possible activities

Silviculture activities can be chosen according to the height of a stand.

Stand	Average height of trees
A) Young aged stands	2 – 3 m
B) Middle aged stands	3 – 12 m
C) Old aged stands	> 12 m

4.4.2.1 Young aged stands (height: 2 – 3 m)

Objective

Support and keep dense stands, remove wolf trees

Required equipment

- handsaws
- bush knives

Activities

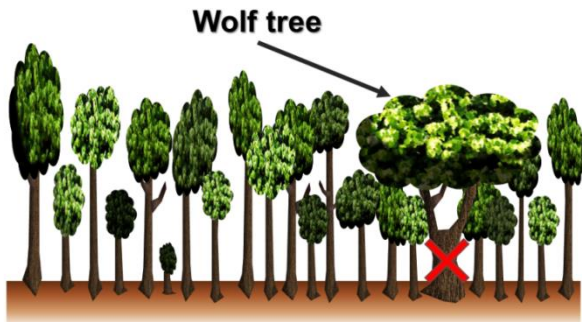
- About every 3 – 5 years
- Snap or cut unwanted species or wolf trees, if favored species are available and hindered in their growth by them
- Singling various shoots from existing rootstocks and coppices to stimulate new growth and to put the focus on high quality shoots for timber production
- Coppicing respectively cutting back of tree stems for fuelwood production, but leave certain mature trees untouched

→ Negative selection (removing low qualities, but keeping an eye on potential crop trees)

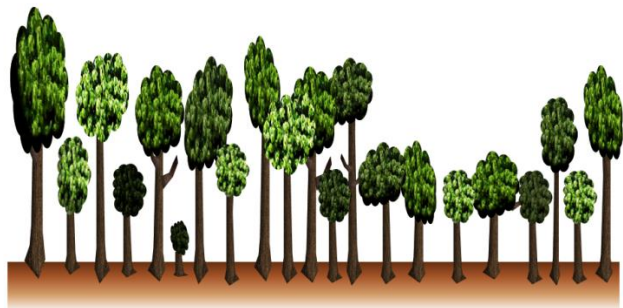
→ Careful and **only selective removal of trees – stands should be kept dense! (see pictures below)**

→ High stand density encourages height growth and competition between young trees (resulting in naturally **branch free tree trunks**)

Young aged stand: Selective and careful removal of wolf trees



Young aged stand after careful thinning:



4.4.2.2 Middle aged stands (height: 3 – 12 m)

Objective

Support stability, quality and vitality through

- a closed crown cover,
- the selection and availability of sufficient crop trees,
- a dense stand and
- the removal of damaged or disturbing trees (support crop trees)

and aim on adequate mixed stands.

Required equipment

- handsaws & bush knives

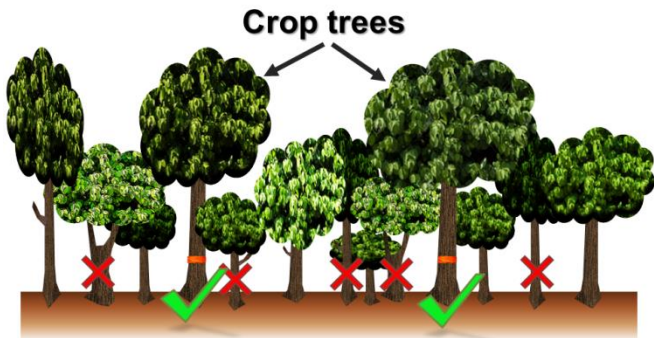
Activities

- About every 5 years and if necessary
- Ideally, start at a tree height of about 7 m (easier accessibility/walking)
- Select about every 7 – 10 m about 200 or less crop trees per ha and mark each tree durable and visible with paint spray or nylon ribbon
- If necessary, support crop trees by removing closely located, disturbing trees with less vitality and quality
- Pruning of crop trees, if necessary
- Cut unwanted species or wolf trees, if crop trees are available
- The establishing of timber transport ways – especially for future harvesting – should be considered (about 3 m wide and about 30 -40 m distance between each transport ways)

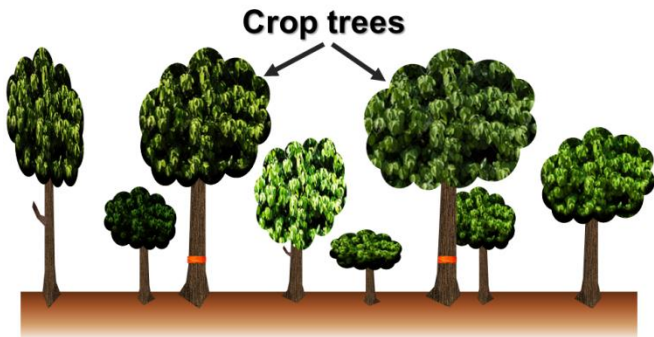
→ Positive selection (look for **high quality crop trees, see pictures below**)

→ Careful and only selective removal of trees (2 rounds of careful thinning is better than 1x heavy thinning)

Middle and old aged stand: Selection of crop trees before thinning



Middle and old aged stand after 2 rounds of thinning:



4.4.2.3 Old aged stands (height: > 12 m)

Objective

Support stability, quality and vitality through the selection and availability of sufficient crop trees and the removal of damaged or disturbing trees (support crop trees) in adequate mixed stands.

Required equipment

- chain saws (only with permission from forest authorities!)
- handsaws
- bush knives

Activities

- About every 5 years, if necessary
 - If not already done, select about every 7 – 10 m about 200 or less crop trees and mark each tree durable and visible with paint spray or nylon ribbon
 - If necessary, support crop trees and remove maximal 1-2 closely located, disturbing trees with less vitality and quality
 - If diameter meets needs and expectations, also certain crop trees can be harvested
- Careful and **only selective removal** of trees! (see **previous picture**)
- Keep an eye on the natural regeneration!

Annex 1:

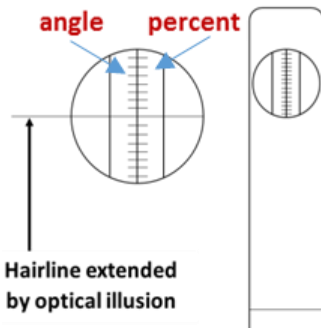
Use of SUUNTO PM-5 (Clinometer) for Tree Height Measurement

“SUUNTO Height Meter PM-5” is an instrument for reading the height **angles or percent** directly through the optics or the round side-window face to the left (top and ground reading).



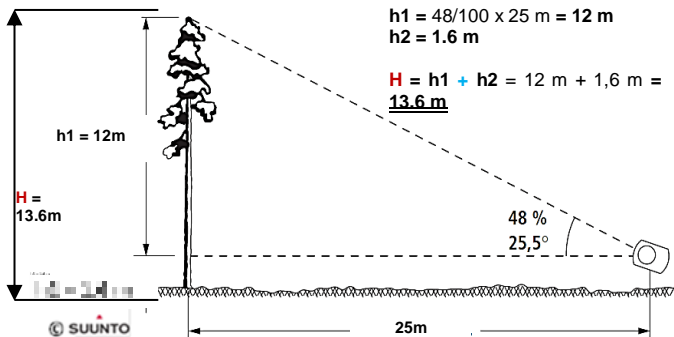
Height measurements are possible in combination with distance **measurements** from your position to a tree. To measure the distance, it is recommended to use a tape and choose a position, which reflects approximately the tree height.

The actual measurement of a tree height should be done in the following way: the observer sights the top and the base of a tree with both eyes open. If the objects are sighted, the hair line and the scale will be simultaneously visible. The **left-hand scale** gives the **angle in degrees** and the **right-hand scale** gives it in **percent**.



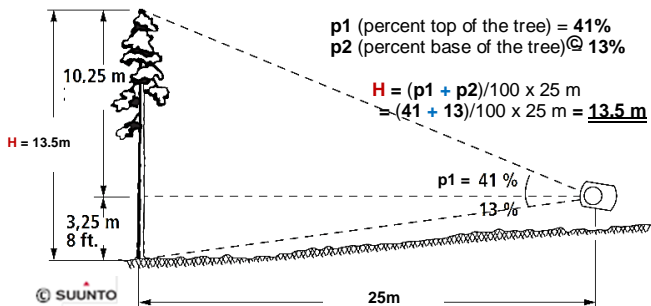
On ground level:

Beside to the distance measurement from your position to the tree, only the tree top reading in percent (or angle in degree) is necessary to measure. As a last step only the height from the observer's eye to the ground has to be added. The tree height in meter (m) can be calculated as shown in **Example 1:**



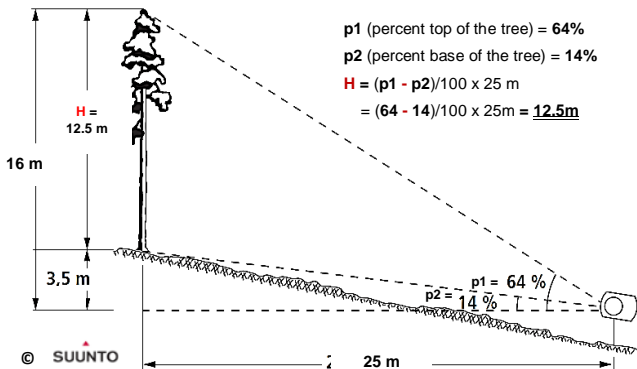
Eye level lies above the base of the tree:

On slopy grounds two readings are taken, one to the top and the other to the base of the tree. Both **percent** (or angles in degree) readings have to be **add up (+)** as shown in **Example 2:**



Eye level lies below the base of the tree:

The actual height of the tree is calculated by subtracting (-) the two percent (or angles in degree) readings as shown in **Example 3**:



On slopes, the height should be always measured slope downwards or sideways to avoid slope correction! (see table at the right side of the instrument!)

Annex 2:

Use of SUUNTO PM-5/1520 (Clinometer) for Tree Height Measurement

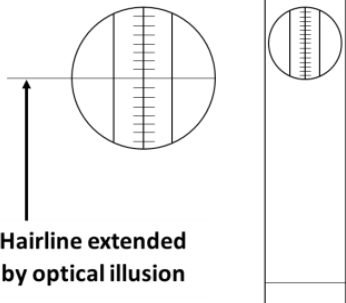
When measuring from distances of 15 m or 20 m, tree heights can be read straight off the instrument's scales. For measurement of the distance to a tree, it is recommended to use a tape. The reading should be doubled when measuring from distances of 30 m or 40 m.

The actual measurement of the tree height should be done in the following way: the observer sights the top of the tree with

both eyes open. The object sighted, the hair line and the scale will be simultaneously visible in the instrument's field of vision. As soon as the hairline coincides with the top of the tree, the tree height can be read off from the **20 m scale on the left** or from the **15 m scale on the right** of the instrument's sights – depending on the distance to the tree.



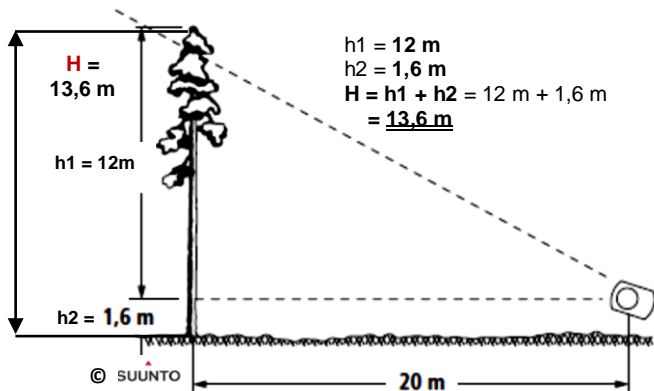
20 m 15 m



On ground level:

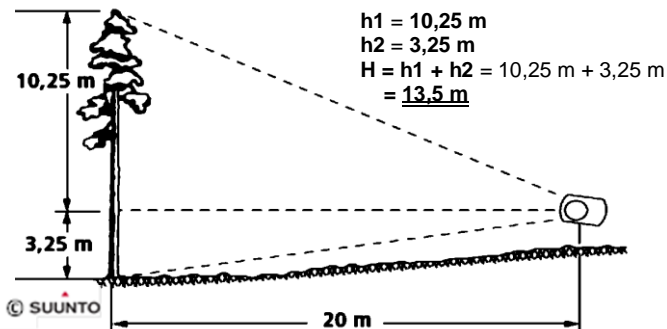
Only the top reading is usually necessary, because only the height of the observer's eye level to the ground has to be added as shown in

Example 1:



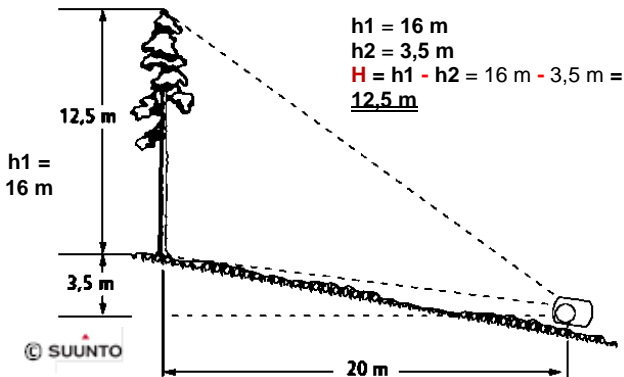
Eye level lies above the base of the tree:

On slopy grounds two readings are taken, one to the top, the other to the base of the tree. The total height is the sum (+) of both readings as shown in Example 2:



Eye level lies below the base of the tree:

If this situated of the observer the actual height of the tree is obtained by reducing (-) the second (base of the tree) from the first (top of the tree) reading as shown in Example 3:



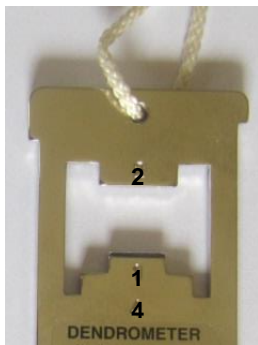
On slopes, the height should be always measured slope downwards or sideways to avoid slope correction (see table at the right side of the instrument)!

Annex 3:

Relascope (Dendrometer) to estimate the Basal area in m^2/ha

The Göttingen Relascope is a simple and useful gauge consisting of a metal plate with a string of 50 cm length. The instrument has sights for three different Relascope Factors (**RF**), which are used in certain forest stands:

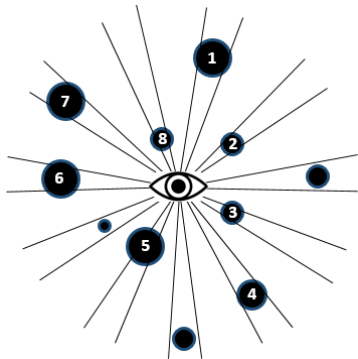
- **RF 1** for small-sized timber (10-30cm DBH*)
 - **RF 2** for medium size timber (30-60cm DBH*)
 - **RF 4** for large sized timber stands (trees with DBH* >60cm)
- **diameter at breast height*





Before starting, find a suitable position (sample point), where you can observe the surrounding trees easily and keep a sufficient distance from the edge of the forest. Hold the knot of the string next to the eye with one hand, the metal plate in the other hand with outstretched arm and hold the string tight. Aim through the

sight of a selected RF at every stems breast height (DBH 1.3m).

If the outer edges of the stem are visible besides the metal edges of the sight, the tree is a sample tree and counts as **one**. If the edges of the plate are wider than the sides of the tree, none tree is counted. Continue by turning clockwise until you have completed a 360 degree rotation around the plot center and sum up all sample trees.



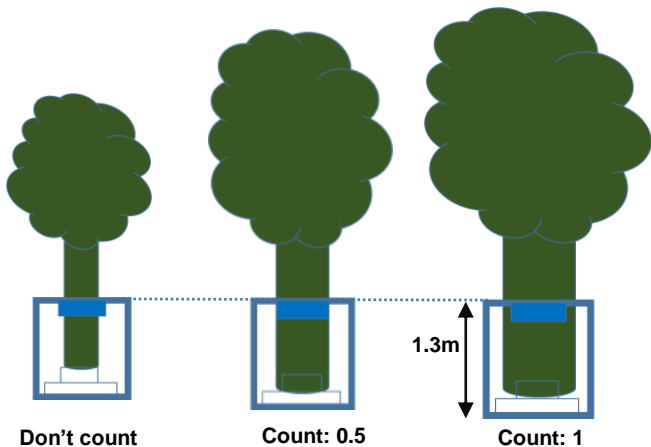
 = Sample point

 = No Sample

The **basal area** is a function of the angle and the number of stems, which are wider than the angle opening. The opening creates an angle where every counted tree corresponds to 1 m^2 basal area per ha by using the RF 1. Trees, which are smaller

at DBH than the RF and understory ones are not counted. If RF 2 or RF 4 is used, the number of trees must be multiplied with the corresponding Relascope Factor.

$$\text{Number counted trees} \times \text{Relascope factor (RF)} = \text{Basal area } \text{m}^2/\text{ha}$$



Example: 10 trees counted \times Relascope Factor 4 = **$40 \text{ m}^2/\text{ha}$**

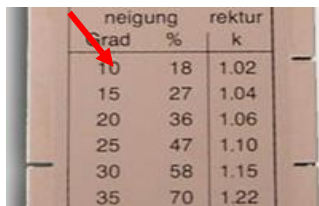
Boundary Trees: Sometimes trees seem to have about the same width as the plate sight of a certain Relascope Factor, so it might be not clear, if this tree is to count or not. To avoid time consuming detailed control measurements, it is recommended to count only every second boundary tree as one or give each one a score of 0.5 (see previous picture).

Hidden Trees: Sometimes trees are fully or partly hidden by other trees. In such cases the surveyor should move one step aside from the plot center to be able to aim at breast height of these trees and afterwards moving back to the center.

Hillside: The calculated basal area per hectare has to be corrected with the coefficient k ($k=1/\cos\alpha$) – see table on the Relascope. The angle of the slope can be measured with a clinometer.

Example: Angle (α) = 20 $\rightarrow k=1.06$
40 m^2/ha (Basal area) $\times 1.06$ (k) =
42.4 m^2/ha

α k



neigung Grad	neigung %	rektur k
10	18	1.02
15	27	1.04
20	36	1.06
25	47	1.10
30	58	1.15
35	70	1.22

Number of sample points:

The more the forest stand is inhomogeneous, the more sample plots should be selected! In homogeneous stocked forest stands, it is recommended to select at least 3 sample points per hectare with a minimum distance of 50m to each sample point.

Separation by tree species and tree layers: By separating the counted trees according to their species, tree species composition ratios can be calculated. Furthermore, a separate count of unique tree layers in a forest stand improves the overall data interpretation e.g. for upper, medium layer etc.