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TOOL I

Field Manual for Timber Verification

Edgar Maravi

Techinical Series
Technical Manual No. 123

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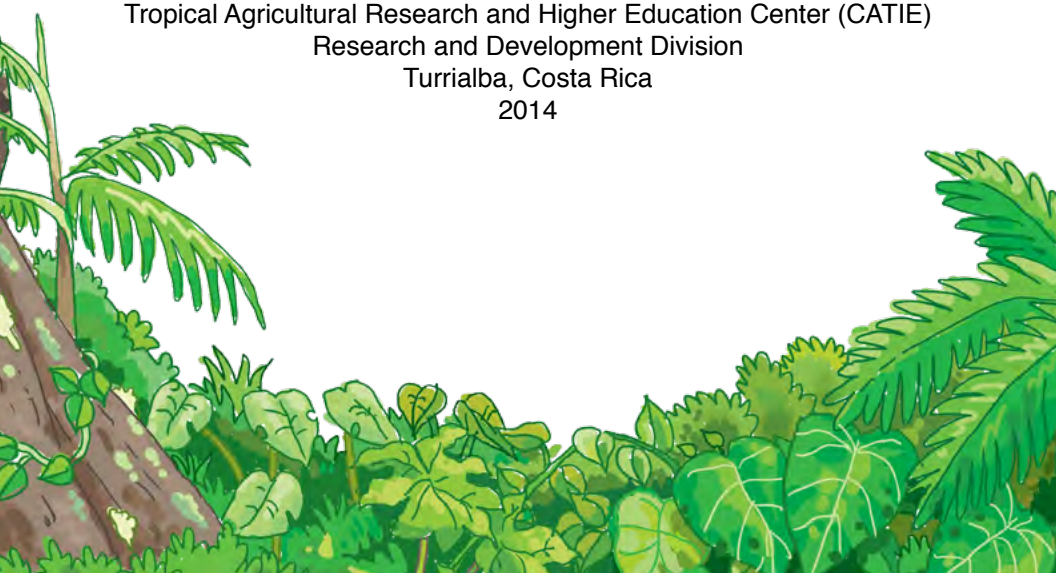
Tool I

Edgar Maravi

Tropical Agricultural Research and Higher Education Center (CATIE)
Research and Development Division
Turrialba, Costa Rica
2014



ISBN 978-9977-57-634-3

634.98
M311 Maravi, Edgar

Field manual for timber verification: tool I / Egar Maravi. – 1º ed. – Turrialba, C.R : CATIE, 2014.
36 p. : il. – (Techinical series. Technical manual / CATIE ; no. 123)

ISBN 978-9977-57-634-3

Título en otro idioma: Manual de campo para la verificación del origen de la madera : herramienta I

1. Madera – trazabilidad 2. Madera – Inspección 3. Arboles - Aprovechamiento de la madera I. Maravi, Edgar II. CATIE III. Título VI. Serie.

Credits

General Coordination:	Marianela Argüello L.
Technical Reviewers:	Julio López, Braulio Buendía y Tuukka Castren
Technical Editors:	Andrea Johnson y Lorena Orozco
Design:	Olman Bolaños
Images:	CONAP

This publication was financed with funds of PROFOR, World Bank and the Finnfor II Project of CATIE.

Contents

Abbreviations and Acronyms

AHP	Annual Harvest Parcel
AOP	Annual Operating Plan
CATIE	Tropical Agricultural Research and Higher Education Center
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CONAP	Consejo Nacional de Áreas Protegidas
DBH	Diameter at Breast Height
FLEGT	Forest Governance Project
FMP	Forest Management Plans
INAB	Instituto Nacional de Bosques
INAFOR	Instituto Nacional Forestal
INRENA	Instituto Nacional de Recursos Forestales y de Fauna
ITTO	International Tropical Timber Organization
NGO	Non-Governmental Organization
OSINFOR	Organismo de Supervisión de los Recursos Forestales y Fauna Silvestre
PGFC	Proyecto Posicionamiento de la Gobernanza Forestal en Colombia
PROFOR	Program on Forest
UTM	Unit Transverse Mercator
UNALAM	Universidad Agraria de La Molina
WB	World Bank

Acknowledgements

These tools draw the generous and valuable contributions, inputs and support, primarily from individuals of the World Bank SDN Forest Team and PROFOR including: Tuukka Castren, Diji Chandrasekharan-Behr, Peter Dewees, Gerhard Dieterle, Laura Ivers, Veronica Jarrin, Nalin Kishor, Flore de Preneuf, Ramon Yndriago; from CATIE's Finnfor II Project team: Marianela Argüello, Guillermo Detlefsen, Andrea Johnson, Lorena Orozco, Noyle Pereira, Carol Valverde. Also a gratitude for the valuable technical contribution from such specialist as: Olman Bolaños, Braulio Buendía, Olvis Camacho, Juan Giron, Isaías Human, Roberto Kometter, Herless Martínez, Rolando Navarro, Jennifer Torrez, Martir Vasquez, Carlos Varela, Nelson Villota, Gustavo Zapata. A special thank is also extended to leaders from indigenous and local communities including: Edda Moreno Blanco, Rigoberto Degaiza, Vicente Franco Leonardo, Juan Morales Obando, Hermes Rodríguez Fasabi, Neofol Silvestre, Juan Tapayuri Murayari, Francisco Xanté.

Foreword

Responsible economic, social and environmental logging practices remain the exception from the norm, even today, and are often limited to a few showcase areas. In too many places, loggers and traders still engage in unfair commercial practices, illegal logging, over harvesting or timber theft with severe negative impacts on the economy and natural resources of state-owned forestlands, indigenous and local communities. Monitoring and supervision of the legal origin and volumes of round wood and processed timber in forests, lumber yards, sawmills and warehouses are often limited.

CATIE, through its Finnfor II project, with the generous funding, technical assistance and extensive contribution of World Bank and PROFOR, has developed this practical Toolkit for Forest Control and Supervision. This set of tools builds on past experiences and includes: i) a user's field manual for verification of the legal origin of timber; ii) guidelines for achieving and monitoring fair economic benefit sharing and good environmental practices in logging contracts between forest industry and indigenous communities; and iii) a handbook for inspection of wood flows at sawmills and other processing facilities.

These innovative tools were developed in partnership with regional intergovernmental organizations, government agencies, forest stakeholder groups and NGOs. The lessons learned were collected from fieldwork, validation meetings and working events, particularly from stakeholders and prospective end users from Bolivia, Colombia, Costa Rica, Guatemala, Honduras, Nicaragua and Peru.

These tools are designed to complement each other by addressing best practices and monitoring throughout the various links of the supply chain. Primary users of these tools will be government agencies and officers; therefore, we hope that bundling them into one Toolkit will make their use easier and more efficient and increase the degree of their adoption. Use of this Toolkit is expected to generate reliable, low cost data and prove a simple method for verifying timber legality, making the Toolkit particularly useful for tropical forest countries with limited budgets.

We hope that the practical suggestions and recommendations for community leaders, promoters and technical forest authority staff included in the Guidelines for monitoring of logging contracts between the forest industry and indigenous peoples will help communities in negotiating and monitoring compliance with logging contracts with middlemen and the logging industry. If used well, this tool will improve those contracts for the benefit of indigenous and local communities, while preventing illegal logging and forest degradation.

In closing, we would like to extend our gratitude to the World Bank, PROFOR and the Ministry for Foreign Affairs of Finland, as well as to the experts and specialists in forest control and supervision for their extensive contributions to this set of guidelines and recommendations. We would also like to extend our heartfelt appreciation to the leaders of indigenous and local communities for their generous contributions to this Toolkit who endured validation working meetings and consultations. It is our sincere hope that this tool will contribute to improving forest management, reducing illegal logging and ensuring that communities see the benefits from commercial harvest of their forests.

Sincerely,

José Joaquín Campos, PhD.
General Director
CATIE

I. Introduction

This Field Manual provides practical methods and procedures intended to assist forest control activities by offering procedures and guidance for official field inspections and for approval and supervision of Annual Operating Plans (AOP). This tool is expected to help forest authorities in the actual verification of trees and their respective volumes included in the forestholder's forest census, also known as pre-harvesting forest inventories or 100% timber inventories. It is expected that this forest control and supervision tool will be used taking into consideration the appropriate national legal frameworks and local conditions.

This manual aims to assist forest administration authorities to ensure the legal origin of timber, based on actual verification of existing trees in the forests and proper calculation of their respective volumes. The original plan for this manual was to assist forest control and supervision officers and other stakeholders in the use of two existing tools for calculating volumes of allowable timber harvesting. Both tools, the *Methodology for Developing National Volume Conversion Tables* and the *VERITAS Timber Calculator*, provide practical guidance for real-time calculation of timber volumes of standing trees and respective volumes of sawnwood by grades, using only the diameter at breast height (DBH) as the variable. This manual offers practical steps to carry out in situ verification of proposed timber harvesting plans and onsite monitoring of compliance. This tool is particularly helpful for agencies with limited technical and budgetary resources that are inerested in ensuring timber legality through a check and balance approach. Timber verification is an administrative procedure that includes a field inspection to ensure that the forest operator complies with the forest law and other relevant regulatory instruments.

II. Purpose

This Field Manual intends to assist forest authority officers to improve effective control and supervision by providing methods and procedures for field inspections in order to verify and monitor a logging operation's compliance with its AOP. Specifically, this tool will contribute to the proper verification of the number and location of harvestable trees and their respective volumes, the number and location of seed trees to be left standing, and the state of an operation's compliance with prescribed silvicultural and forest management practices in the Annual Harvest Parcel (AHP). The activities outlined in the Manual will enhance timber traceability by establishing baseline data on authorized volumes, allowing for coherent monitoring of timber flow from forest to sawmill.

III. Background on Field Inspections

The value of the Field Manual is its use primarily by forest authorities in activities to ensure compliance with practices outlined in regulations, AOPs and Forest Management Plans (FMP). As this tool gains wider use, forest agencies will have opportunities to determine and formalize new necessary administrative procedures and practices to better ensure the legal origin of timber.

This tool is an effective instrument to enforce compliance with forest legislation and related regulations. While most countries' forest agencies have established formal procedures for supervising and monitoring management plans and AOPs, there remains a need for step-by-step guidance regarding onsite tasks to conduct robust field inspections. In addition to supporting compliance with the law, this tool can also contribute by fostering closer coordination among the many staff and government agencies usually involved in forest products control and trade.

Recommendations in this Field Manual are intended to be simple enough to align easily with the full diversity of national regulatory frameworks and administrative guidelines. Where necessary, forest authorities should make adjustments to this manual in order to adapt it to national or local conditions.

IV. Planning Field Inspections

Inspection Team

Before launching field inspections, a Coordinator should be appointed in charge of the Inspection Team. The Coordinator is expected to conduct on behalf of the forest authority all activities of the inspection. He/she coordinates with other units within the forest administration to organize the Inspection Team and assign responsibilities for team members. The Coordinator is also expected to lead and conduct other preparatory activities (as dictated by the pertinent regulations), ensuring notification of pending inspections and organizing working meetings with the forest holder or his/her representative to plan the field inspection.

Based on the size of the Annual Harvest Parcel (AHP), the Team would be made up of:

- A Team Coordinator, responsible for planning, setting up initial tasks, managing the field inspection and preparing the inspection report.
- A specialist in field inspections, in charge (together with the Coordinator) of verifying (a) the existence, location and volumes of trees approved for harvest, (b) existence and location of seed trees, and (c) compliance with all other forest management and silvicultural practices contained in the AOP.
- One assistant specialist from the local office of the forest authority.
- A local forest ranger who is expert in tree identification (Meléndez *et al.* 2006).
- In some cases, based on the overall scope of work, it might be necessary to secure the participation of one or two other specialists from the forest authority. Also, the forestholder is expected to participate in field verifications and (depending on regulations) should also provide forest workers and logistical support as necessary for field work;
- Based on the legislation in some countries, field verifications might include participation of representatives from civil society, NGOs or other stakeholders.

Forestry Instruments and Other Materials

Basic forestry instruments to perform field verification tasks include (OSINFOR 2012):

- Compass
- Diametric and metric tapes
- GPS
- Hypsometer (if available) or clinometer
- Survey poles, plates and machetes
- Camera
- Field notebooks and field forms
- Copy of AOP document
- Forest census and species distribution maps
- First aid kit

Dossier Review

Before launching field activities the inspection team should review relevant regulatory and administrative instruments. It is also suggested that the Team consult with the forest agency´s legal advisor in order to make sure all planned procedures are in line with regulations. This will help to increase the quality of the field inspection, for instance, the use of photos, videos and other materials increase quality of inspection findings.

An important task in planning the field inspection is a thorough review of the existing dossier of the forestholder. The Coordinator, together with his/her team, is responsible for obtaining and reviewing all existing hard copy and digital administrative and technical information and data in files. The dossier should include all or most of the following:

1. Contract, forest license/authorization/permit
2. AOP and Forest Management Plan
3. Annual Harvest Parcel location map;
4. Map of tree species distribution included in the AOP

5. Reports of AOP implementation submitted to forest authorities
6. Current balances of trees and volumes harvested, and copies of timber transportation permits
7. Balances from the previous year (if applicable)
8. Prior field inspection reports (if applicable)
9. Other relevant documentation

(INRENA 2007 & OSINFOR 2012)

Review of Location of Annual Harvest Parcel

Reviewing and becoming familiar with the map of the AHP is important as it visually describes the boundaries of the area for inspection. Prior to field work the Team should check to ensure that the Unit Transverse Mercator (UTM) coordinates of the vertices that define the boundaries of the plot (as provided by the forestholder) match those included in the government's forest information system. This review is particularly important for identifying early on any potential overlap with prior AHPs or with the forests of third parties, and also helps the Team to more easily and quickly find the actual plot in the field. In addition to becoming familiar with the logging area, the review will allow the Coordinator to better estimate the duration of field tasks and better prepare for entering the AHP.

Review of Tree Distribution Map

A map of the AHP indicating trees approved for the year's harvest should be a product of the mandatory forest census conducted by the forestholder. This tree distribution map is the key element for in situ verification of standing or already harvested approved trees and seed trees. A detailed review of this map will streamline the process of finding and verifying trees in the AHP.

A careful review of this map will also allow its comparison with previous AOP implementation reports and will provide the basis for estimating harvest balances, filling out field forms, preparing a list of species and a map of trees to be verified.

The following elements should be included in the map:

- Tree distribution patterns
- Topography
- Maps and posts
- Harvest activities reports

Tree Verification, Sampling and Selection

Verifying the harvesting trees, their respective volumes and the seed trees included in the AOP are the central tasks for timber traceability and for assessing forest legislation enforcement needs. Depending on the national legislation and regulations and the Inspection Team's capacity to access and move through the plot, it is recommended that all trees in the census be verified. In particular, those species listed under The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and other high commercial value species should be included as they are the most prone to be subject to over-harvesting and illegal trade.

Based on each country's regulations and the Team's capacity, verification may be limited to a representative sample of all authorized trees included in the AOP. Sample numbers and tree selection methodology are primarily set by forest authority regulations. Tree selection for verification needs special attention, particularly in making sure that the sample includes a proportional number of harvesting trees and seed trees. Samples should include at least 25 – 30% of the total number of trees proposed for harvesting. These percentages would depend on several factors such as forest structure, floristic composition and levels of harvesting of a given species at the national level.

Usually, these and other elements, according to the conditions in each country, are taken into account for setting the minimum numbers of trees per sample. In this way sample representation reflects the overall population of the forest census. Accepted margin of error of sampling fluctuates between 5 – 10%. Tree selection for samples should be distributed throughout the Annual Harvest Parcel and particularly within areas of higher tree concentration per species and of a high concentration of species regulated by CITES (OSINFOR 2012). The result of all

of this will be the preparation of the final list and map for tree verification, both very important tools for the field inspection.

Field Inspection Plan

After the review of the dossier and the AHP map, the Team prepares the field inspection plan and timeline. The plan will include a tentative duration and timetable for the inspection based on the distance, accessibility, total area of the plot, number and location of trees to be verified, etc. It will also describe tasks, responsibilities, field crew organization and participants. In addition to methodology and logistics, the plan will identify potential obstacles for field work and administrative and operational needs for meeting inspection objectives. It will also carefully review critical elements of the inspection such as the AHP map, approved AOP, the species distribution and seed tree maps.

Formal Notification to Interested Parties

Based on relevant regulations, the corresponding officer will issue a notice for the field inspection to the forestholder with the date of the inspection and a request for his or her participation as an interested party.

Notification will be sent with sufficient anticipation to the legal residence of the interested forestholder on file. In some cases notifications should be mailed registered and certified by a notary. Official notification is also made public in the most appropriate local media. As regulations dictate, the forestholder may appoint his/her representative to participate in the field inspection. Additionally, along with the notification, an invitation for a formal working meeting with the Inspection Team will be issued to discuss the plan, agree upon logistical needs for field work, receive input and make any final adjustments. In case the interested party denies participation and cooperation for the inspection, the Coordinator will initiate the proper administrative process according to relevant legislation.

V. Steps for Field Inspections

Duration

The required time for the inspection will depend on the distance, accessibility, size of the AHP and the requirements for field information. Forest authorities will set the inspection date and the deadline for presenting the field inspection report.

Entrance to the Annual Harvest Parcel

Verification tasks and data to be completed should follow the same procedures as those used by the forest census. In general, activities in the plot include verification of the AHP's geo-referenced vertices, main transect line, transect lines, belts and rows, standing trees, stumps and cut trees or logs around stumps. The inspection process also includes verification of forest roads, skid trials and other relevant infrastructure within the AHP.

In some cases, depending on the GPS, coordinates in maps may present considerable margins of error; however with current technologies those margins have been greatly reduced. Margins of error may increase due to the position of the satellite in space, forest cover, branches and overall forest density. This becomes evident when comparing UTM coordinates obtained in the forest census and those during the verification (Contreras *et al.* 2001). In absence of a signal or other inability to use GPS, localization and identification of coordinates can be completed using a compass and metric tape.

Verification of AHP Vertices, Transects and Belts

Field activities are launched with the GPS configuration, adjusting coordinates to one of the vertices of the overall area of the Forest Management Plan, identifying one boundary and verifying some of its survey markings.

An important initial activity is a walk through the AHP boundaries and verification of UTM coordinates of all vertices. Verification includes

checking that AHP boundaries are market by cleared lines with their respective land marks (OSINFOR 2012).

Verification also includes main transect lines and census belts that should have been established previously by the forest census. In the event that vertices and other census work have not been done, the team should take note for the technical report and, based on standing regulations, decide whether the field work should continue.

If field work continues, key steps would be to identify and mark vertices and boundaries of the AHP based on the coordinates proposed in the AOP (INRENA 2007). Using the tree distribution maps prepared by the forestholder, tasks include opening trails to establish geo-referenced transect lines and census belts with respective markings and numbering, following guidelines for a forest census, so that tree localization and identification will be simpler and more accurate.

Verification of Trees and Stumps

Before initiating tree verifications, the Team should be prepared to take samples or make sure it is ready for proper tree description and identification in order to avoid species confusion. The most important task of the Team is the identification and verification of all trees established by the forest census and included in the tree verification map. According to the UTM coordinates on the map, trees will be verified by checking marks and codes and comparing them with those on the map. If for any reason a tree is not located precisely at the given coordinates, a search continues in surrounding areas. Variation of distances of coordinates for a given tree should be within a radius of about 10 m.

For differences beyond 50 m, the AOP, field notebooks and census methodology should be checked carefully in order to identify inconsistencies. Another tree in the same census belt may be verified to re-confirm geo-referencing and make needed adjustments (OSINFOR 2012). The general rule is that if a tree is not found beyond 50 m of given coordinates it should be reported as not found. In case plates or markings are not visible in a given tree, new plates and markings should be posted following the census code. This activity should be assisted by the local ranger expert in tree identification.

Once the tree is found, data verification takes place, registering the following information:

1. UTM coordinates indicating if it is a harvesting or seed tree
2. Common and scientific name
3. Tree identification marking and code based on census
4. Census belt number locations
5. DBH
6. Merchantable height
7. Other relevant observations and comments

All of this information should be similar to the forest census in the AOP. Each verified tree should already be registered in the AOP; consequently, its respective data according to the forest census (DBH, merchantable height and phytosanitary condition) should already be noted. It would be helpful to prepare tables or another format to compare both sets of information. Formats should also include the UTM coordinates of the AHP vertices, information related to skid trails, forest roads and temporary skidding infrastructure, etc.

In the case of felled trees around stumps, the coordinates, markings and codes should match with tree data on the Forest Holder's map: dasometric data should be verified as described in section (v) below.

In the event that the only evidence of a tree in the forest is the stump, then in addition to verifying UTM coordinates, the corresponding stump's diameter should be measured (Global Witness & INAFOR 2008) following the method detailed below. In the case of existing logs already moved to a landing area, verification can continue in those areas by checking markings and codes on logs and comparing them with those on the map.

Verification of dasometric information will follow as described below or in section V of Tool No III.

Dasometric Information: DBH and Merchantable Height

Obtaining dasometric data from each of the harvesting trees in order to verify proposed volumes in the AOP is another key task that allows establishment of the baseline for successful forest control and

supervision. Without this information it would be impossible to monitor and control approved volumes.

DBH

The diameter is the key data point to measure standing timber volume. Conventionally, the diameter at breast height (DBH) or normal diameter is used to measure volumes of standing trees. DBH measurement is made in the tree trunk at 1.30 m from the bottom of the tree (UNALAM & ITTO 2006).

In the case of existing buttress or tabular roots, the DBH is measured at 0.25 – 0.30 m above the buttress; in other words, where the usable portion of the tree begins. Measurements that include decimals and fractions should be rounded accordingly. This will contribute to securing better precision in calculating volumes (CONAP & INAB 2004). Conventionally, dimensions are taken using diametric tape and a tree caliper. Lately new instruments include laser beam readers. If only normal metric tape is available for the field inspection, calculations can be made to convert circumference to diameter.

Figure1. **DBH measurment in a tree of La Unión management unit, Guatemala** (CONAP *et al.* 2010)

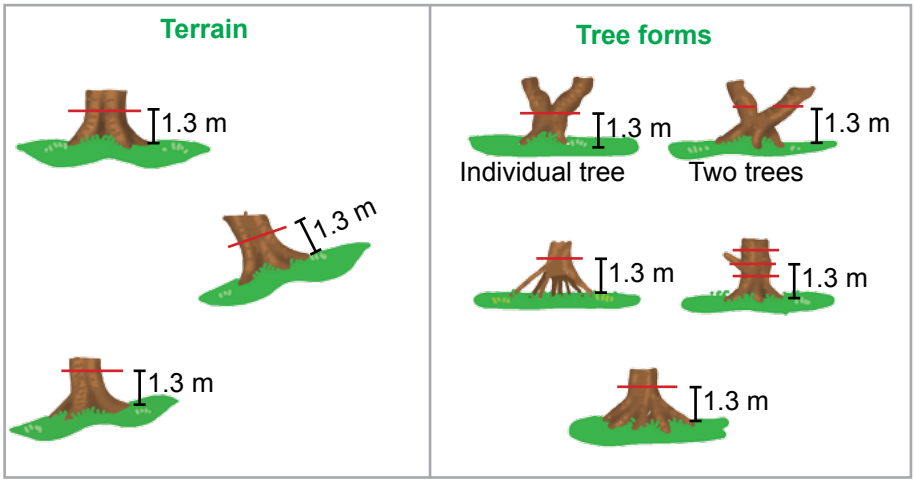


Figure 2. **DBH measurement based on terrain and tree forms** (PGFC 2012)

Merchantable Height

In the absence of national conversion tables that can be used to calculate volume from solely DBH, the merchantable height or commercial height is necessary to measure the timber volume of a standing tree. The merchantable height is defined as the vertical distance between the level of the stump (0.25 – 0.30 m) and the first major branch of the tree trunk that is the end of the last merchantable portion of the tree (CONAP & INAB 2004).

To avoid confusion it is important to differentiate between the merchantable height and the total height of a given tree. The latter is the vertical distance between the bottom of the trunk and the terminal tip of the tree. The total height is irrelevant for volume measurement in this case. The merchantable height is measured through several methods, some of which are described below. (See figures).

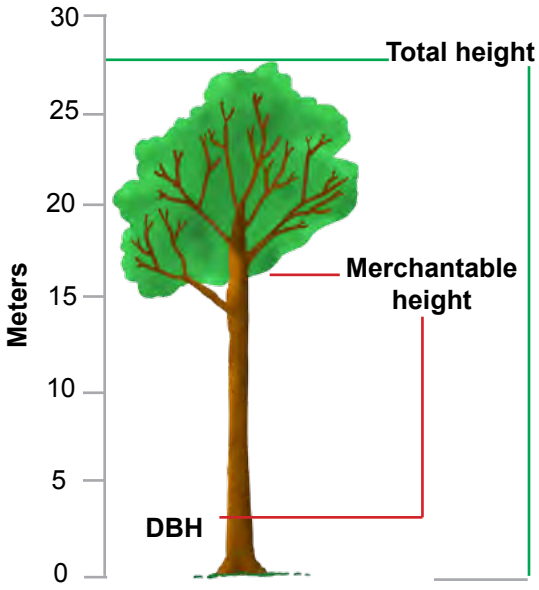


Figure 3. **Merchantable and total height of one standing tree** (CONAP & INAB 2004)

There are instruments available to measure the merchantable height with low margin of error, among them the hypsometer and the clinometer; both are useful in resolving the dilemmas of measuring tree height depending on their availability and particularly on ground conditions around the trees to be measured. Given slope and vegetation conditions in the forest, frequently the merchantable height measurements have to be done visually or by an indirect manner as described in the figures below.

The following figures, obtained from the Practical Guide for Calculating Wood Volume *(Guía Práctica para Cubicación de Maderas)* of the Colombia-FLEGT Forest Governance Project (Proyecto Gobernanza Forestal), show practical methods and formulas for measuring the height with a clinometer. The position of the technician as related to the tree is important as shown below:

1. When the horizontal sight of the observer falls between the base of tree trunk and the tip of the tree.

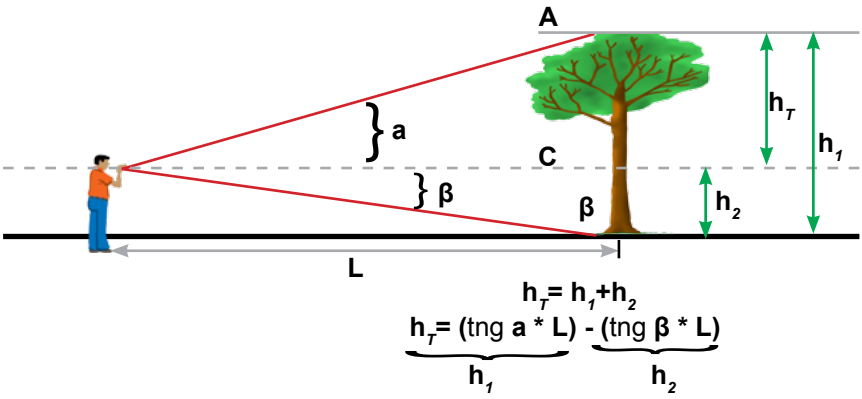


Figure 4. **Measurement of height when the horizontal vision of the technician is between the base and the apex of the tree** (PGFC 2012)

2. When the horizontal sight of the observer falls below the tree trunk

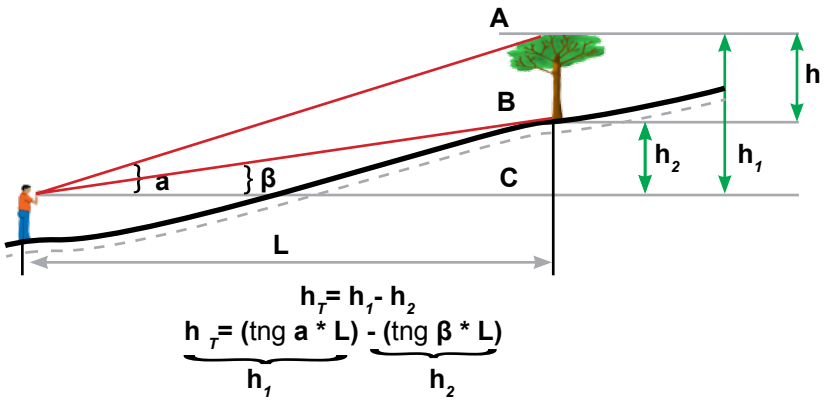


Figure 5. **Measurement of the height when the horizontal vision of the technician is below the base of the tree** (PGFC 2012)

3. When the horizontal sight of the observer falls above the tip of the tree

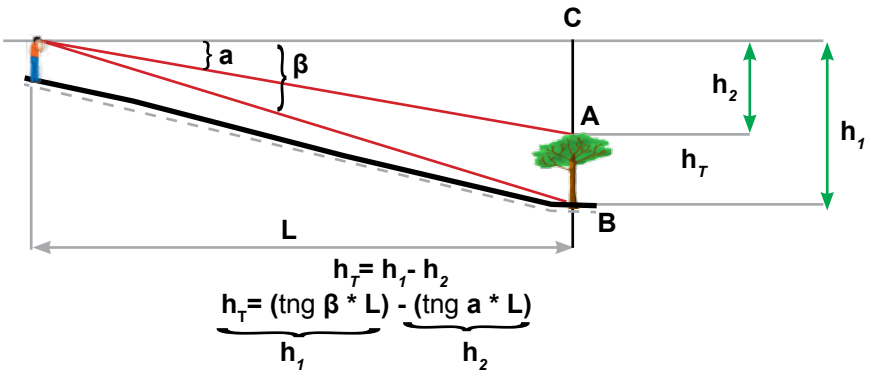


Figure 6. **Measurement of height when the horizontal vision of the technician is above the apex of the tree** (PGFC 2012)

Another practical method is the Biltmore stick, which has a type of simple hypsometer used to estimate the number of merchantable logs in a tree. When measuring tree height with a Biltmore stick, the observer stands 66 feet away from the tree and holds it 25 inches away from his/her eye. The very bottom of the stick is aligned with the tree's stump height, assumed to be one foot. Once aligned, the observer sights through the stick to align the number of logs with the merchantable height of the tree. The number of logs is then read directly from the Biltmore stick. Figure 7 shows use of a Biltmore stick to measure merchantable height (O'Hara *et al.* s.f.).

The use of the Biltmore stick is very sensitive to having exactly right distance to the tree and having clear visibility; therefore its use in dense tropical forests may be limited.

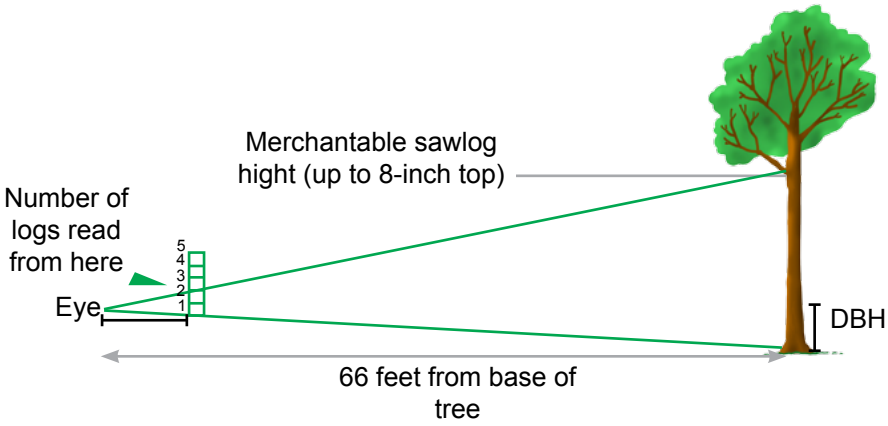


Figure 7. **Using a Biltmore stick to measure merchangtable height** (O' Hara *et al.* s.f.)

Stumpage Timber Volume Measurements

For practical purposes of this manual, the merchantable volume is the same as the approved volume or allowable/harvesting volume. The merchantable volume is limited only to those authorized trees proposed in the AOP whose DBH are equal or greater than the minimum commercial diameter established by the country's forest authority for that species.

The general formula to measure the overall standing or stumpage volume of a tree uses the basal area of a tree multiplied by merchantable height times a tree shape form factor. Based on the international conventional protocols for tropical timber, the adjustment factor for tree trunk form is 0.65.

The basal area in squared meters is calculated by dividing π by 4 and multiplying this result by the DBH squared. The following formula can be used to calculate the stumpage volume of a given tree:

Merchantable volume
(stumpage volume or standing timber) **=** *BA* x MH x ff (0.65)

MV= Total merchantable volume (m^3)

BA = Basal area (m^2) = ($\pi/4$) x DBH^2 = 3.1416/4 x DBH^2

MH = Merchantable height (m)

ff = Form factor 0.65 (recommended for tropical trees)

(PGFC 2012)

As mentioned above, measuring tree height in the forest can be complicated and time consuming given the ground conditions and vegetation. Given these limitations, in many cases the calculation of tree merchantable volume becomes a serious problem due to lack of proper tree height measurement. Therefore, creation of *National Volume Conversion Tables* for each species is highly recommended.

The methodology and the *VERITAS Timber Calculator* included in this Toolkit (Tools No. IV and V respectively) negate the need for measuring the merchantable height and logs of each tree. Conversion Tables are very useful for verifying and controlling the approved harvesting volumes throughout the supply chain. The average national yield ratios obtained through these tools have high statistical rigor, and are field-friendly as they enable relatively precise calculation of the volumes of standing timber of each tree using only the DBH (Kometter & Maravi 2007). The VERITAS calculator, because it requires only the DBH, also allows a user to obtain expected volumes of sawn wood by grades in real time.

Measuring Felled Trees, Logs and Stumps

As mentioned previously, in case of felled trees left by the stump, the Team should verify markings and codes, and subsequently take diameter measurements of both the larger and smaller ends of the tree trunk. The diameter dimensions include measuring two cross sectional diameters and the merchantable height, in this case the length of the tree trunk (OSINFOR 2012). Volume calculation is completed using the formula showed above. In the case of logs and squared timber, measurement methods and formulas described in section V of Tool No. III should be followed.

As described previously, when the only evidence of a tree in the forest is the stump, it is necessary to use the stump's diameter as the only dimension (McClure 1968). In this case the volume is estimated through a two-step process. First, DBH will be predicted based on the stump. Considering the strong correlation between the diameter of the stump and the DBH, measurements should focus on the diameter of stump as described in Figure 8, excluding the bark. Second, a volume calculation is obtained using local volumetric tables if available (Bylin 1982). In these cases the National Volume Conversion Tables would be very useful. In their absence and when in the field, a practical procedure can be used to compare diameter dimensions at the stump height with the DBH of actual standing trees in the AHP. By using simple comparative averages, the volume of those already harvested trees can be predicted. In order to increase accuracy of this prediction, estimated volumes should be compared with data included in the AOP for those particular trees.

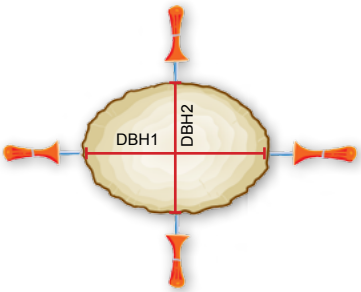


Figure 8 **Measuring stump diameter and bark**
(UNALAM & ITTO 2006)

Verification of Forest Management and Silvicultural Practices

Assessing the status of seed trees is as important as monitoring harvesting trees and volumes. Regulations and guidelines in most countries provide specific factors for assessing seed tree conditions:

1. Seed trees' height, position and the vigor of their crown compared with other standing trees in the forest, placing seed trees in one of

three sociological positions or strata: superior or dominant strata; medium or co-dominant strata; and inferior or sub-dominant strata.

2. Crown shapes and position of seed trees described as one of six forms: circular crown; circular irregular; half circular; less than half circular; and only some branches.

3. Crown exposure to sunlight described in 5 degrees: total exposure; plenty of superior exposure; some superior exposure; lateral sunlight; or no sunlight exposure.

4. Relationship of the tree trunk and crown and degree of infestation by lianas and other aerial plants described by four degrees: free; presence on the trunk; presence on the trunk and crown, and presence in trunk and crown affecting tree growth.

5. Tree trunk shape and structure described in three degrees: high, medium, and low quality.

6. Phytosanitary conditions of the seed tree described in four degrees of trunk damage caused by fungi, insect or other pests: no attacks; attacks in one third of the trunk; attacks in two thirds of the trunk, and attack in more than two thirds of the trunk (OSINFOR 2012).

A Team's complete field inspection also focuses on verification of silvicultural practices described in the Forest Management Plan and AOP. Particularly important is verification of compliance with mandatory practices for proper demarcation of the AHP, forest census design, and identifying and marking/tagging harvesting trees and seed trees according to established protocols.

Verification tasks also include a quick assessment of the forestholder's compliance with such practices as natural regeneration, protection of freshwater streams and lagoons, and soil degradation prevention particularly resulting from logging infrastructure such as skid roads and trails, temporary and permanent roads, and log landing areas.

In cases where harvesting activities have already taken place, verification focuses on compliance with maintaining the productive capacity of remaining forests and protection of high conservation value forests. Regarding remaining forests, special attention should be paid to verify the quality of practices for maintaining tree density, phytosanitary quality and crown cover, as well as the quality and extent of tree thinning practices. Also important is assessing appropriate felling, topping, de-

branching and bucking techniques; planning and use of appropriate skidding practices and road and log landing areas construction as well as management of solid waste and debris.

Finally, of critical importance, the inspection verifies the balance of approved harvesting volumes and the actual harvested volumes, by cross-checking existing documentation with volumes calculated based on verified stumps.

Field Inspection Minutes

Field inspection minutes need to be prepared based on the formats and guidelines developed by forest authorities. Minutes need to describe all tasks implemented, findings and observations from field work. Minutes for each day of the inspection should be prepared and signed by all involved parties, particularly the Team Coordinator in representation of the forest authority, the forestholder and a participant witness (usually a local authority or agency).

Field Inspection Initial Minutes

Minutes of the first day of initial tasks in the AHP are prepared at the end of the day describing in detail the list of all participant parties, tasks performed, technical and administrative data related to the actual location of the AHP, compliance with forest census, findings and issues encountered. Minutes should be signed by all attending parties.

Field Inspection Closing Minutes

As field inspection tasks are completed, detailed minutes should be prepared using forest authority approved forms and guidelines. Minutes prepared by the Team Coordinator may include inputs from the forestholder or other participants as necessary.

The field inspection closing minutes describe all tasks completed during the inspection, all findings, observations and issues resulting from the inspection process. Since minutes are official documents that could be used in administrative and judicial processes, special consideration must be made to ensure inclusion of all appropriate information, raw data and detailed findings and observations so that they reflect as thoroughly and accurately as possible the field inspection work.

VI. Inspection Report

In order to complete the inspection process, the team coordinator will be responsible for preparing the overall report of the field inspection. The following is a suggested structure for an inspection report:

1. Date and official report number, according to the filing system of the forest authority
2. Name and address of officer
3. Name of team coordinator
4. Subject: code number of AOP /contract/authorization/permit and name of forestholder
5. AHP location, UTM coordinates vertices
6. Objective of field inspection
7. Background
8. Tasks description and analysis
9. Findings and observations related to verification of AOP compliance (for example AHP location and demarcation, forest census implementation, standing and cut harvesting trees location, marking/tagging and their volumes, seed trees conservation status, quality of silvicultural and forest management practices, use of forest documentation, etc.).
10. Results, conclusions and recommendations
11. Date of signature
12. Team coordinator name and list of team members

Once the report is completed it will be submitted to the respective unit for technical evaluation. Through this evaluation, the forest authority will make the final decision as to whether the forestholder has complied with the approved or proposed AOP and forest management plan. If evaluation results are favorable, the forestholder will be formally informed and the case will be filed.

In case of violations or offenses, if the mandatory forest census has not been implemented or completed, harvesting outside of the AHP has taken place, seed trees have been cut, misinformation or misuse of official forest administration documentation is detected, or any other irregularity is noted, a separate technical report is helpful to describe such findings. This report should gather all additional information, questioned documentation and other related material that can be used as evidence for the case (maps, pictures, geo-referenced data, stumps, witness deposition, volume data, and proof of official documentation misuse).

Following standard regulations, once the technical evaluation of the report is completed, the report with additional documentation will be delivered to the respective authorities for administrative or judicial processes.

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CATIE

Headquarters, CATIE 7170
Cartago, Turrialba, 30501
Costa Rica
Phone: + (506) 2558-2000
Fax: + (506) 2558-2060

www.catie.ac.cr

Program on Forests (PROFOR)

The World Bank
1818 H St NW
Washington DC 20433
USA
Phone: + 1 202 458 1692
Fax: + 1 202 522 3307

http://www.profor.info/