

**Forest Service Handbook
National Headquarters (WO)
Washington, DC**

**Forest Service Handbook 2409.12a – Timber Volume Estimator Handbook
Zero Code**

Amendment: 2409.12a-1993-1

Effective date: December 23, 1993

Duration: This amendment is effective until superseded or removed.

Approved by: Jack Ward Thomas, Chief

Date approved:

Responsible Staff:

Last Change: None

Superseded Document(s):

Digest: Following is an explanation of the changes throughout the directive by section.

2409.12a: Establishes new Timber Volume Estimator Handbook that provides Service-wide standards and instructions for preparation of equations or tables used to estimate the timber content of trees.

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This handbook provides guidance for preparing highly complex mathematical representations of trees and standard procedures for producing, selecting, and using tree volume estimators. The intended audience of this text is Region and Station specialists responsible for timber measurements, contractors developing volume estimators and associated software, and individuals involved in collecting and maintaining felled tree information. The procedures in this handbook relate to the measurement of trees using cubic feet or board feet measure.

01 - Authority

Under the rules at section 223.36 of Title 36 of the Code of Federal Regulations (36 CFR 223.36), the Forest Service may sell timber based on cubic volume, board foot volume, or weight.

02 - Objective

To compile and maintain consistent, standardized tree measurement records that are suitable for preparing tree volume equations.

03 - Policy

When measuring felled trees or standing trees using precision optical devices, follow the minimum data collection standards of this section.

1. When measuring felled or standing trees for the purpose of creating volume equations:
 - a. Use the minimum data collection standard specified in sections 11-15.35c
 - b. Store in a local data base that meets the specified standards stated in section 21.
 - c. Manage the data with multiple users in mind.
 - d. Use the technique of stem profile equations (chapters 30 through 60) under all but the most unusual circumstances.
2. All resource functions which need estimates of tree volume should use the same estimators and computer software to the extent possible. Use the same tree volume estimators for timber inventories, land management plans, timber surveys, timber sales, silvicultural examinations, and growth and yield models.
3. Use estimators that have the ability to provide volume and other product estimates at different merchantability specifications, top diameters, and log lengths, and that include options that simulate actual measurement practices applied in the general geographic area as appropriate. Use the same measurement technique for inventory volumes, planned sell, and harvest figures.
4. Apply the appropriate scaling rules when developing merchantable volume estimators. Use the Cubic Rule (Cubic Scaling Handbook, FSH 2409.11a) for determining cubic volume. Use the Scribner Decimal C or the International 1/4 Inch rules (National Log Scaling Handbook. FSH 2409.11) for board foot volume determination. Use other scaling rules only when required.

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04 - Responsibility

04.1 - Washington Office

04.11 - Deputy Chief, National Forest System

The Deputy Chief for the National Forest System is responsible for approving scale rules used to determine timber content for volume estimators (FSM 2443.04a).

04.12 - Director, Timber Management

It is the responsibility of the Director of Timber Management to:

1. Ensure the standard procedures are updated as new technology or research improves methods for volume determination.
2. Ensure maintenance of the data bases used to store data collected for determination of volume estimators.
3. Designate a national data base coordinator.
4. Secure Washington Office approval for data elements and standards recommended by Regional Foresters and Station Directors.
5. Provide consistency in timber volume estimator data across all Regions and Research stations.

04.13 - National Data Base Coordinator, Timber Management

It is the responsibility of the national data base coordinator to:

1. Assist field units in making changes to the structure of their data base.
2. Assist field units in storage and retrieval of data maintained in their data base.
3. Ensure the information in the data bases is in a usable state.

04.2 - Field Offices

04.21 - Regional Foresters

It is the responsibility of the Regional Forester to:

1. Provide accurate and reliable timber volume estimators for each major timber species and area within the Region.
2. Ensure that the estimators are validated at least once every 10-year period.
3. Ensure training of and assistance to Forest level personnel in using local timber volume estimators which meet the standards of this Handbook.

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4. Ensure that those assigned to prepare volume estimators have advanced statistical (particularly applied regression analysis), mathematical, and mensurational skills (training or experience equivalent to an advanced degree in forest mensuration) needed to select and prepare appropriate timber volume estimators.

5. Ensure that all felled tree data and data collected through precise measurement of standing trees for the purpose of preparing volume estimators are taken and stored according to the standards presented in this handbook.

6. Recommend necessary additional data elements or revisions of data standards or procedures to the Washington office Director of Timber Management.

7. Ensure preparation and maintenance of a data base for the purpose of storing and retrieving information used by the Region to prepare timber volume estimators.

8. Justify use of other than stem profile equations when new estimators are prepared.

9. Ensure consistency of use of volume estimators among all timber management functions.

10. Ensure correct application of tree volume estimators.

11. Ensure a correct segmentation rule for Forest use.

12. Approve minimum merchantability specifications for top and breast high diameters.

13. Provide direction needed to measure poles and pilings, where National Forest trees are to be appraised as poles or piling.

14. Approve Regional and local volume estimators to use for all tree species found within the Region.

04.22 - Station Directors

It is the responsibility of the Station Director to:

1. Ensure that all felled tree data and data collected through precise measurement of standing trees for the purpose of preparing volume estimators are taken and stored according to the standards presented in this handbook.

2. Recommend necessary additional data elements or revisions of data standards or procedures to the Washington office Director of Timber Management.

3. Prepare and maintain a data base for the purpose of storing and retrieving information used by the Station to prepare timber volume estimators.

4. Provide advice to mensurationists and users on technical volume estimation procedures.

04.23 - Region and Station Mensurationists

Mensurationists are responsible for choosing a technique most appropriate to the forest area being evaluated and to derive estimators for use by field units in tree volume estimation projects.

05 - Definitions

Calibration. The process of adjusting to local conditions that are known to vary from those upon which the model was based.

Estimation. The statistical process of deriving information about a tree as a function of the measured tree variables.

Estimators. The equations and procedures used to derive volumes.

Evaluation. Involves the consideration of how, where, and by whom the model should be used, how the model and its components operate, the quality of system design, and its biological realism.

Model Formulation. The specification of a in a thematical function to be used to relate actual taper rates to measured stem data.

Validation. The testing of a model against one or more independent data sets.

Verification. The process of testing a model with data on which it was based to eliminate gaps in programming logic, flaws in algorithms, and bias in computation.

08 - REFERENCES. Users may consult the following references for additional guidance.

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