Ethiopia - National Forest Inventory of Ethiopia 2014-2016

Ethiopian Forestry Development (EFD)

Report generated on: November 17, 2025

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Identification

SURVEY ID NUMBER
ETH_2014_2016_NFI_v01_M_v01_A_ESS

TITLE
National Forest Inventory of Ethiopia 2014-2016

ABBREVIATION OR ACRONYM
NFI_Ethiopia_2014_2016

COUNTRY

Name	Country code
Ethiopia	ETH

STUDY TYPE
Forest Resource Survey

SERIES INFORMATION
One previous National Forest Inventory took place in 2004 which was called 'Woody Biomass Inventory and Strategic Planning Project (WBISPP)'.

ABSTRACT
Ethiopia’s first National Forest Inventory (NFI), conducted from 2014 to 2016, aimed to establish a comprehensive baseline on biomass and forest resources to support sustainable forest management, inform policy, track climate actions, and meet national and international reporting needs. Using a stratified systematic sampling approach, 539 sampling units were measured across the country's biomes. About 40.3 percent of aboveground biomass is found in naturally regenerated forests, while Trees Outside Forests (ToFs) represent a significant share of the growing stock, particularly in agricultural and urban landscapes. The NFI established a permanent network of forest inventory plots, a national database using Open Foris tools, and a methodological framework for long-term forest monitoring.

KIND OF DATA
Sample survey data [ssd]

UNIT OF ANALYSIS
Fields/ Plots

Scope

NOTES
1. Land use cover sections
2. Tree, Stumps, Regeneration, Shrubs/Bushes/Lianas, FDW
3. Threatened and extinct species
4. Insect pests, diseases and invasive species
5. Biodiversity indicators
6. Environmental problems
7. Forest and other wooded land management structure
8. Products and Services
9. LULC change
10. Land tenure
11. Vegetation cover

TOPICS

Topic
Forest Resources Assessment

KEYWORDS

Keyword
Sampling
Forest
Trees
Shrubs
DBH
Tree Height
Stumps
Tree Biomass
Tree Volume
Carbon
Deadwood
Land Use
Tree Biodiversity
Land Cover

Coverage

GEOGRAPHIC COVERAGE
National

UNIVERSE
The target population of the assessment comprises all land areas within the territory of Ethiopia, classified under the Forest Resources Assessment (FRA) land use/land cover classes: Forest, Other Wooded Land, Other Land, and Inland Water. The universe includes natural and planted forests, woodlands, bamboo, and trees outside forests (ToFs), as well as other land use and land cover types relevant to biomass estimation and carbon accounting.

Source: MEFCC (Ministry of Environment, Forest and Climate Change). 2018. Ethiopia’s National Forest Inventory: Final Report. Addis Ababa, Ethiopia.

Producers and sponsors

PRIMARY INVESTIGATORS

Name
Ethiopian Forestry Development (EFD)

PRODUCERS

Name	Abbreviation	Affiliation	Role
Food and Agriculture Organization of the United Nations	FAO	United Nations	Lead technical partner (2013-2025)
Regional Forestry Institutions	RFI	Local governments	Operating through the District Forestry Offices (DFO), which in turn provided field-level support

FUNDING AGENCY/SPONSOR

Name	Abbreviation

The Norwegian Agency for Development Cooperation	NoRAD

Sampling

SAMPLING PROCEDURE

The NFI applied a country-specific stratification into five biome categories: Acacia-Commiphora, Combretum-Terminalia, Dry Afromontane, Moist Afromontane, and an additional "Other" biome class. The survey excluded sampling units located within water bodies, non-vegetated permanent land uses such as urban and industrial zones, and inaccessible or boundary-overlapping areas.

In total, 627 sampling units were planned across the country, of which 539 were accessible and measured. This stratified systematic cluster sampling design ensured statistically robust representation of Ethiopia's diverse ecological zones, providing reliable national-level estimates of forest resources, biomass, and land-use transitions.

The determination of the number of sampling units for the National Forest Inventory (NFI) was guided by three key factors: the statistical reliability required for the data, the financial and human resources available for the assessment, and the goal of enabling consistent, long-term monitoring.

To ensure optimal sampling intensity, the country was first divided into meaningful ecological strata. This stratification was a foundational step, achieved through a series of consultative meetings with experts, including foresters, plant ecologists, and statisticians. Insights from previous forest inventory efforts were also reviewed to extract valuable lessons and refine the current approach.

For the implementation of the systematic sampling design, Ethiopia's agroecological zones (defined by altitude, temperature, and rainfall) were combined with the land use/land cover map from WBISPP (2004) to create distinct, non-overlapping strata. Initially, four major strata were identified. However, due to ecological variations within the extensive woodland areas in the north, southwest, and east, this category was further subdivided to ensure balanced sampling intensity across regions.

Field data were gathered through a combination of direct observation, physical measurements, and interviews conducted at multiple hierarchical levels. These levels included the main Sampling Units (SUs) and their internal subdivisions: plots, subplots, Land Use/Cover Sections (LUCS), and Land Use/Cover Classes (LUCC).

Each Sampling Unit is a square area measuring 1 km × 1 km. The southwest corner coordinates of each SU align with points selected from a systematic sampling grid. Every SU contains four field plots strategically placed for comprehensive coverage. Plots are rectangular, each measuring 20 meters wide by 250 meters long, positioned at the corners of an inner 500-meter square centered within the SU. Plots are numbered clockwise from 1 to 4, starting from the top-left corner.

Each plot includes three types of subplots, designed to capture data at varying levels of detail: three Rectangular Subplots (RSP, 20 m × 10 m, 200 m²) corresponding to Level 1; three Circular Subplots (CSP, radius 3.99 m, 50 m²) corresponding to Level 2, located in the left-hand half of the rectangular subplots; and three Litter Subplots (LSP, radius 18 cm, about 0.1 m²) corresponding to Level 3, located at the center of the circular subplots. Each subplot type is numbered 1 to 3, following the layout from the start to the end of the plot.

A Measurement Point (MP) for soil and topography is placed at the center of each rectangular subplot, and a Fallen Deadwood Transect (FDT) is established at the end of each rectangular subplot to assess fallen deadwood. Each plot is further divided into LUCS, which represent areas of uniform land use or vegetation type (e.g., forest, cropland, grassland). These sections vary in shape and size based on field observations. Within LUCS, data are collected on grazing practices, crop types, forest structure, resource management, and user interactions.

Source: MEFCC (Ministry of Environment, Forest and Climate Change). 2018. Ethiopia's National Forest Inventory: Final Report. Addis Ababa, Ethiopia.

RESPONSE RATE

Out of 627 planned sampling units, 539 were accessible and measured (86 percent).

WEIGHTING

Ratio estimators (relationship between tree variables and hectares of forest)

Data collection

DATES OF DATA COLLECTION

Start	End
2014-03	2016-06

DATA COLLECTION MODE
Field measurement

Data Processing

DATA EDITING
To ensure the reliability of the dataset, multiple quality control measures were implemented. Specifically, 10 percent of the field plots underwent peer review, during which the following aspects were evaluated:

• Misidentification of tree and shrub species
• Trees and shrubs missing from plots where they should have been recorded
• Trees and shrubs incorrectly included in plots where they did not belong
• Errors in Diameter at Breast Height (DBH) measurements, expressed as percentage deviation
• Errors in height measurements, also expressed as percentage deviation
• Errors in recording plot coordinates
• Inaccuracies in documenting land use and land cover types

Following data collection, a post-processing data cleaning phase was carried out. This involved checking species names, tree heights, DBH values, and tree density per hectare. The process focused solely on eliminating clear data entry or measurement errors, while statistical outliers were retained for further analysis. Data processing was conducted using Microsoft Excel and R Statistical Software.

STATISTICAL DISCLOSURE CONTROL

Plot and Cluster locations (X and Y coordinates) and variables with high sensitivity value have been removed.

Data Appraisal

ESTIMATES OF SAMPLING ERROR
Sampling error estimates are influenced by the reporting domains (aggregation categories), the stratification structure of the design, and the varying weights assigned to individual cluster plots.

DATA APPRAISAL
Tree height measurements were conducted using hypsometers and the tangent method. Previous research has indicated that this technique may lead to overestimations, especially when the observer's distance from the tree is shorter than the tree's actual height. This scenario frequently arises during forest inventories, as dense vegetation often obstructs clear lines of sight, forcing survey teams to take measurements from close proximity.

Access policy

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CONFIDENTIALITY

For information on Confidentiality, please contact: info@efd.gov.et

ACCESS CONDITIONS

For information on Access Conditions, please contact: info@efd.gov.et

CITATION REQUIREMENTS

MEFCC (Ministry of Environment, Forest and Climate Change). 2018. Ethiopia’s National Forest Inventory: Final Report. Addis Ababa, Ethiopia.

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Metadata production

DDI DOCUMENT ID

DDI_ETH_2014_2016_NFI_v01_M_v01_A_ESS_FAO

PRODUCERS

Name	Abbreviation	Role	Affiliation
Ethiopian Forestry Development	EFD	Metadata producer	
Statistics Division	ESS	Metadata adapted for FAM	Food and Agriculture Organization of the United Nations

Data Dictionary

Data file	Cases	Variables