

Colombia - National Forest Inventory, 2015-2023

Institute of Hydrology, Meteorology and Environmental Studies (IDEAM, Instituto de Hidrología, Meteorología y Estudios Ambientales)

Report generated on: October 21, 2025

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Identification

SURVEY ID NUMBER

COL_2015-2023_IFN_v01_M_v01_A_ESS

TITLE

National Forest Inventory, 2015-2023

ABBREVIATION OR ACRONYM

IFN 2015-2023

TRANSLATED TITLE

Inventario Forestal Nacional, 2015-2023

COUNTRY

Name	Country code
Colombia	COL

STUDY TYPE

Forest Resource Survey

SERIES INFORMATION

The National Forest Inventory (IFN) 2015-2023 is the first exercise in the collection of national forest information of in Colombia.

ABSTRACT

The National Forest Inventory (IFN) of Colombia is "The statistical operation that, through processes, methodologies, protocols and tools, collects, stores, analyses and disseminates quantitative and qualitative data that allow us to know the current state and composition of the country's forests and their changes over time" (Article 2.2.8.9.3.12 Decree 1655 of 2017).

The IFN 2015-2023 is an initiative led by the Colombian environmental institutions headed by the Ministry of Environment and Sustainable Development and under the coordination of the Institute of Hydrology, Meteorology and Environmental Studies (IDEAM), which aims to record and characterize the country's natural forests.

Its main purpose is to provide reliable and up-to-date information for the planning and sustainable management of forest resources. Its main objectives include:

- Providing periodic information with a multipurpose approach on the structure, composition and floristic diversity, aboveground biomass, carbon in the soil and wood detritus, volume of wood, quality, conditions and dynamics of the country's natural forest;
- Quantify and characterize the country's forest resources, assess carbon stocks in different forest compartments;
- Monitor changes in carbon stocks over time;
- Provide data for the development of forest and climate change policies, which allow the country to comply with international reporting commitments on the state of forests and greenhouse gas emissions (Olarate, et al. 2021; Olarte, et al. 2024).

KIND OF DATA

Sample survey data [ssd]

UNIT OF ANALYSIS

Plots of lands

Scope

NOTES

The National Forest Inventory records information about three habits (trees, palms and tree ferns) of natural forests with information collected on:

- Coordinates of the cluster (latitude and longitude), relative location of the subplots (by compass and ribbon), and distance and azimuth;
- Dendrometric variables: size of the individual, condition (MP, TM, TV, VC and VP), number of stems, diameter (observable

- point of measurement - POM), height (distance and visual), shape of the stem, damage and penetration (TM and MP);
- Taxonomic variables: family, genus and species, collector code;
 - Soils: location of the pit (distance and azimuth), depth, color, carbon, bulk density;
 - Fresh Weight and Fertility Detritus: distance in section, diameter, inclination, penetration, thickness and fresh weight.

TOPICS

Topic
Environmental Study
National Forest Inventory

KEYWORDS

Keyword
Structure, Composition and Floristic Diversity
Biomass
Carbon in the Soil and Wood Detritus
Volume of Wood

Coverage

GEOGRAPHIC COVERAGE

National and by biogeographic region.

UNIVERSE

The study universe encompasses the entire continental and island areas of the country. The target population corresponds to the total continental area of the country for three categories: natural forest, non-forest, and areas without information.

Producers and sponsors

PRIMARY INVESTIGATORS

Name	Affiliation
Institute of Hydrology, Meteorology and Environmental Studies (IDEAM, Instituto de Hidrología, Meteorología y Estudios Ambientales)	Ministry of Environment and Sustainable Development of Colombia (Minambiente, Ministerio de Ambiente y Desarrollo Sostenible)
Amazonian Scientific Research Institute (SINCHI, Instituto Amazónico de Investigaciones Científicas)	Ministry of Environment and Sustainable Development of Colombia (Minambiente, Ministerio de Ambiente y Desarrollo Sostenible)
Alexander von Humboldt Biological Resources Research Institute (IAVH, Instituto Alexander Von Humboldt)	Ministry of Environment and Sustainable Development of Colombia (Minambiente, Ministerio de Ambiente y Desarrollo Sostenible)
Organization for Research, Sustainable Development and Social Promotion (CORPROGRESO, Corporación para el Desarrollo Social Sostenible)	
Pacific Environmental Research Institute (IIAP, Instituto de Investigaciones Ambientales del Pacífico)	Ministry of Environment and Sustainable Development of Colombia (Minambiente, Ministerio de Ambiente y Desarrollo Sostenible)

PRODUCERS

Name	Abbreviation	Affiliation	Role
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Ministry of Environment and Sustainable Development of Colombia (Ministerio de Ambiente y Desarrollo Sostenible)	Minambiente	Government of Colombia	Governing body
National Administrative Department of Statistics	DANE	Government of Colombia	Statistically Matters
Food and Agriculture Organization of the United Nations	FAO	United Nations	Technical Guidance
United States Forest Service	USFS	United States Department of Agriculture (USDA)	Technical Guidance
SilvaCarbon		U.S. Government	Technical Guidance
Francisco José de Caldas District University (Francisco José de Caldas University)			Technical Guidance
National University of Colombia (Universidad Nacional de Colombia)	UNAL		Technical Guidance
Colombian Herbarium Association			Technical Guidance
University of Tolima (Universidad del Tolima)			Technical Guidance
Pacific Environmental Research Institute (Instituto de Investigaciones Ambientales del Pacífico)	IIAP	Ministry of Environment and Sustainable Development of Colombia (Minambiente, Ministerio de Ambiente y Desarrollo Sostenible)	Technical Guidance
Amazonian Scientific Research Institute (Instituto Amazónico de Investigaciones Científicas)	SINCHI	Ministry of Environment and Sustainable Development of Colombia (Minambiente, Ministerio de Ambiente y Desarrollo Sostenible)	Technical Guidance
Alexander von Humboldt Biological Resources Research Institute (Instituto Alexander Von Humboldt)	IAPH	Ministry of Environment and Sustainable Development of Colombia (Minambiente, Ministerio de Ambiente y Desarrollo Sostenible)	Technical Guidance

FUNDING AGENCY/SPONSOR

Name	Abbreviation
Federal Government of Germany	
UK Government	
Government of Norway	
World Bank Group	
Inter American Development Bank	
World Wide Fund for Nature	WWF
German Agency for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit)	GIZ
Reconstruction Credit Institute (Kreditanstalt für Wiederaufbau)	KfK
Reducing Emissions from Deforestation and Forest Degradation	REDD+
Government of Colombia	

Sampling

SAMPLING PROCEDURE

The sampling design is a post-stratified Simple Random Cluster Sampling (SRCS), where the first post-stratification variable

is the forest/non-forest category, and the second is the natural region-namely: Andina, Caribe, Pacífica, Orinoquía, and Amazonia. The sampling unit in the field is a cluster, consisting of five circular sub-plots arranged as a cross. These are each 0.0707 hectares (707 m²), spaced 80 m apart from the centre of each sub-plot, with a total area of 0.3535 hectares per cluster.

The unit of analysis in this work is the same as the sampling unit. Three types of observation units are used: saplings, poles and large trees, according to the size of the individuals:

- Saplings L (DBH in between 2.5 cm and 10 cm): Saplings will be measured in five nested and concentric subplots, each with a radius of 3 m, equivalent to 28.27 m², for a total of 141.35 m².
- Poles F (DBH in between 10 cm and 30 cm): Poles will be measured in five nested and concentric subplots, each with a radius of 7 m, equivalent to 154 m², for a total of 770 m².
- Large trees FG (DBH larger than 30 cm): Large trees will be measured in five subplots of 15 m radius each, equivalent to 707 m², for a total sampling area per cluster of 3 535 m².

To define the sample size, three variables considered technically relevant by the INF team were evaluated: diameter at breast height (DBH), basal area (BA), and volume. These variables were used to simulate different sampling error scenarios (5 percent, 6 percent, and 7 percent) using a standard formula adjusted by the design effect.

As a result, and following a conservative approach that ensures sufficient precision across all three variables, volume was selected as the reference variable with a sampling error of 5 percent. This led to an estimated sample size of 1 479 clusters.

The distribution of these clusters is based on the size of each natural region of the country, applying an area-proportional allocation criterion, which ensures adequate spatial representativeness in the sampling design.

DEVIATIONS FROM THE SAMPLE DESIGN

There was no deviation from the sampling design.

Two measures were established to address non-negligible nonresponse, i.e. cases where selected clusters cannot be measured due to operational issues such as security situations, public order, landmines, lack of entry permits, physical inaccessibility (high slopes, cliffs, etc.), sacred sites, uncontacted indigenous community areas, 100 percent of the study area flooded, human settlement, 100 percent water surfaces (rivers, lakes, lagoons, marshes, swamps, etc.), or other circumstances specific to the region, which have not been detected with the use of remote sensors.

The first measure involves the use of an oversample equivalent to an additional 30 percent of clusters, selected following the same sampling design and procedure as the original and using the negative coordination sampling algorithm. This oversample is activated in the field only when it is not possible to access the originally selected clusters, allowing for the maintenance of the expected coverage and representativeness.

When the activation of the oversample is not sufficient to fully compensate for the gaps caused by nonresponse, an adjustment to the expansion factor is applied. This adjustment corrects for coverage errors and missing observations by applying a correction factor to the expansion factor calculated in the design. In this way, the resulting estimates remain valid and representative of the study population, even in the presence of partial sample loss.

RESPONSE RATE

The total response rate was $1\,415/1\,479 = 95.67$ percent at the cluster level. In terms of partial non-response (item response), the average response rate was over 90 percent.

WEIGHTING

The weighting of the basic expansion factors is calculated as the area of the entire country divided by the area of cluster. This weighting is then adjusted in the post-stratification for each forest/non-forest category and for each natural region.

Data collection

DATES OF DATA COLLECTION

Start	End
2015	2023

DATA COLLECTION MODE

Field measurement [field]

Data Processing

DATA EDITING

The data analysis and editing process was carried out by IDEAM.

To carry out the validation and analysis of the data collected in the field, the IFN of Colombia has a quality assurance program, consisting of two components: (1) quality control and (2) quality evaluation.

The primary purpose of quality control is to ensure that throughout the chain of collection and custody of information, the minimum tolerance limits of each variable are met, thus ensuring the desired level of quality. To carry it out, there are manuals, guides, and formats, which have been designed to ensure that the activities are always developed, recorded and documented in the same way and that it is carried out in various stages and levels of the process: i) pre-operational field, in which training and sensitization are carried out for brigade personnel in order to ensure that the personnel know the procedures and formats in their updated versions; ii) field operation, data quality controls are applied through four levels: brigade chief, field supervisors, regional coordinators and IDEAM information criticism group. Parallel to this process, an additional control is applied, through a brigade external to the field operation team, who for each assigned operator measures seven percent (7%) of the sample through quality checks: hot, cold and blind.

Once the data has been collected, the IDEAM information control and criticism group begins the process of filtering and validating the databases, in order to correct erroneous data, through the application of algorithms, tolerance verification, criticism, validation rules, consistency and imputability. This is done both manually (through data analysts, who review forms), and automatically. For automatic data validation, a comprehensive data cleansing protocol was implemented, combining validation rules for the logical ranges that variables should have, identification of outliers, and correction by data imputation.

Imputation methods were applied, depending on the type of variable, the availability of auxiliary information and the nature of the error. In general, the following approaches were used:

- Deterministic imputation: a single value is assigned to the missing data based on a specific rule or logical procedure, without this implying randomness. This is appropriate when there is a stable and well-defined relationship between variables.
- Substitution-based imputation: values are assigned using external databases or reliable secondary sources (such as censuses, administrative records, or previous surveys). This approach corresponds to the cold cover technique.
- Regression-based imputation: statistical models (e.g., linear or logistic regression) are used to predict missing values based on other variables observed within the same record.
- Cold imputation: a representative summary value (such as mean, median, or mode) is assigned to a relevant subset of the dataset. This method is not based on individual donors, but on measures of central tendency.
- Hot Deck Imputation: a set of donor records is selected within the same dataset based on similarity to the case with missing data. A value is then assigned from this group of donors, either deterministically or randomly. This method helps preserve the internal structure and distribution of data.

STATISTICAL DISCLOSURE CONTROL (SDC)

IDEAM, as an entity that produces statistical data, is part of the National Statistical System (SEN) and as such must comply with the principles and good statistical practices defined in Law 2335 and 2023 of the Code of Good Practices of the SEN, which, according to the National Administrative Department of Statistics (DANE; 2017:11) "promotes access to and use of microdata, as well as the anonymization of microdata to ensure the protection of the identification or geographical location of sources used in the statistical process". In view of the above, and in compliance with both this standard and the NTCPE 1000:2020 Technical Standard, IDEAM applies an anonymization process to cluster coordinates through randomization.

Data Appraisal

ESTIMATES OF SAMPLING ERROR

Sampling errors were quantified using standard deviation and estimated coefficient of variation. Non-sampling errors identified were mainly typing errors, measurement errors in some devices, observation errors, and location errors.

Access policy

CONTACTS

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CONFIDENTIALITY

Law 1753 of 2015 and the technical standard NTC PE 1000 establish that all individual data collected for official statistics in Colombia must be treated with strict confidentiality and must be anonymized to prevent the identification of respondents. The information may only be used for statistical purposes and Law 2335 of 2023 and the Code of Good Practices of the National Statistical System (SEN).

Disclaimer and copyrights**DISCLAIMER**

The user of the data acknowledges that the original collector of the data, the authorized distributor of the data, and the relevant funding agency bear no responsibility for use of the data or for interpretations or inferences based upon such uses.

Metadata production**DDI DOCUMENT ID**

DDI_COL_2015-2023_IFN_v01_M_v01_A_ESS_FAO

PRODUCERS

Name	Affiliation	Role
Institute of Hydrology, Meteorology and Environmental Studies (Instituto de Hidrología, Meteorología y Estudios Ambientales)	Ministry of Environment and Sustainable Development of Colombia (Minambiente, Ministerio de Ambiente y Desarrollo Sostenible)	Metadata producer
Statistics Division	Food and Agriculture Organization of the United Nations	Metadata adapted for FAM

Data Dictionary

Data file	Cases	Variables
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