

Guatemala - Report on Second National Forest Inventory of Guatemala, 2021-2024

**National Forest Institute (INAB, Instituto Nacional de Bosques), National Council
for Protected Areas (CONAP, Consejo Nacional de Áreas Protegidas)**

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Identification

SURVEY ID NUMBER

GTM_2021_2024_IFN_v01_M_v01_A_ESS

TITLE

Report on Second National Forest Inventory of Guatemala, 2021-2024

COUNTRY

Name	Country code
Guatemala	GTM

STUDY TYPE

Forest Resource Survey

SERIES INFORMATION

National Forest Inventory of Guatemala, 2002-2003 (<https://microdata.fao.org/index.php/catalog/1915>)

ABSTRACT

The Second National Forest Inventory (IFN) was completed in 2024, under the leadership of the National Forest Institute (INAB, Instituto Nacional de Bosques) and the National Council for Protected Areas (CONAP, Consejo Nacional de Áreas Protegidas), with the collaboration of government institutions, the private sector, civil society, and academia. The main objective was to determine and provide information on the biophysical condition of forests and trees outside forests at the national level, providing strategic information to support sustainable forest management, conservation, and restoration. The variables assessed included: land cover, identification of families and species, total volume, basal area and tree density, biomass and carbon content in different pools (above-ground, below-ground, deadwood, litter, and soil), forest products and services, and tree health.

The study also examined aspects related to the forest's vertical structure, non-timber forest products, and the presence of natural and anthropogenic disturbances. On the social front, information was collected on ethnic and linguistic communities, as well as the main economic activities of the populations living near the sampling units, providing an overview of the relationship between communities and forests.

The process began with the creation of committees and the development of a nationwide methodological framework. A field manual, forms, and digital data collection tools were used to ensure the quality and standardization of the information.

KIND OF DATA

Sample survey data [ssd]

UNIT OF ANALYSIS

Fields/plots

Scope

NOTES

The variables assessed in the second IFN are:

- Land cover area
- Identification of families and species
- Total roundwood volume of all species
- Total roundwood volume of commercial species
- Basal area
- Tree density
- Biomass and carbon stocks (above-ground, below-ground, deadwood, litter, and soil)
- Forest products and services
- Tree health status
- Natural and anthropogenic disturbances associated with forests.

Among other elements analyzed related to the forest and trees outside the forest.

TOPICS

Topic
Environmental Study
National Forest Inventory
Forest Assessment
Biomass Study
Species Diversity
Carbon Study

KEYWORDS

Keyword
National Forest Inventory
Forest Cover
Biomass
Carbon
Diversity
Natural Regeneration
Forest Health
Forest Products
Land Uses
Sustainable Forest Management

Coverage

GEOGRAPHIC COVERAGE

The geographical coverage of the national forest inventory encompasses the entire territory of Guatemala, which covers an area of 108 889 km².

UNIVERSE

The population of Guatemala's Second National Forest Inventory includes forest areas and trees in other land-use categories within the country.

Producers and sponsors

PRIMARY INVESTIGATORS

Name
National Forest Institute (INAB, Instituto Nacional de Bosques)
National Council for Protected Areas (CONAP, Consejo Nacional de Áreas Protegidas)

PRODUCERS

Name	Abbreviation	Role
Food and Agriculture Organization of the United Nations	FAO	Technical and Financial Support

FUNDING AGENCY/SPONSOR

Name	Abbreviation
Food and Agriculture Organization of the United Nations	FAO

Sampling

SAMPLING PROCEDURE

The sampling design for Guatemala's Second National Forest Inventory (IFN) was a non-aligned systematic design, with a sample distribution proportional to national land area, using an equidistant grid that covered the entire country. In other words, the grid consisted of cells of the same size, and within each cell, a random point was selected to locate the sampling unit (SU).

The sampling unit (SU) consisted of three circular plots, each measuring 707 m² (15 m radius), arranged in a straight line oriented northward. The distance between the edges of each plot was 10 m, and the distance between their centers was 40 m.

Each plot contained smaller subplots and transects that ran across its length and width, making it easier to take measurements based on tree size and other factors, such as litter, soil, and forest or land-use characteristics.

On the plot, which had a radius of 15 meters and an area of 707 m², all trees with a diameter at breast height (DBH) of 20 cm or more were recorded. Within this area, diameter, total height, health status, and stem form were measured, and stump attributes/characteristics were also recorded/assessed.

The subplot, with a radius of 10 meters and an area of 314 m², was the unit in which all trees with a diameter at breast height (DBH) between 10 and 19.9 cm were recorded. In this subplot, diameter and total height were measured, phytosanitary condition and stem form were assessed, and non-timber forest products were identified.

The regeneration subplot, with a radius of 3 meters and an area of 28 m², was used to count seedlings and saplings, i.e., individuals with a diameter at breast height (DBH) ranging from 0.1 to 9.9 cm, according to their category.

Within each plot, a 0.25 m² quadrat was selected, and all surface litter was collected to determine its fresh weight in situ. A subsample was then taken for laboratory analysis of dry weight and moisture content.

Soil sampling was conducted in the same quadrat used for litter sampling, and material was collected from the surface to a depth of 30 cm. Bulk density, carbon content, and other physical properties were determined from this sample.

For fallen deadwood, a 30-meter linear transect oriented east-west was established, and all pieces of deadwood with a diameter of 5 cm or greater that intersected the transect line were recorded. Their diameters and degree of decomposition were measured.

The vertical structure of the forest was assessed using a 30-meter transect running north to south. At 3-meter intervals, the presence of four vegetation strata was recorded: dominant trees, intermediate trees, understory, and herbaceous vegetation.

DEVIATIONS FROM THE SAMPLE DESIGN

Data were collected from 494 of the 715 sampling units (SUs) originally planned for measurement nationwide. Of the remaining units, 150 were inaccessible, 70 could not be sampled, and 1 was located outside the national territory. Of the 494 sampling units (SUs) for which data were collected, 440 have complete data from all three plots, while 54 have partial data, as information could only be obtained from one or two plots due to difficult terrain or lack of permission from landowners.

The 150 inaccessible sampling units (SUs) were located and visited but could not be fully measured due to lack of landowner permission, land tenure conflicts, and difficult access conditions resulting from the terrain.

The 70 unsampled SUs correspond to units that were neither located nor visited. Most are situated in the Sierra del Lacandón and Laguna del Tigre, areas characterized by high levels of conflict associated with illegal activities. In addition, many are located in areas with steep and rocky terrain, which further limits accessibility. Of these units, 66 are located within protected areas and 4 outside protected areas.

RESPONSE RATE

Of the 715 sampling units (SUs) planned nationwide, data were collected from 494 SUs, representing 69% of the total

sample planned. The remaining 31% (221 SUs) could not be sampled for the following reasons:

- 150 SUs (21% of the total) were inaccessible due to lack of access authorization and difficult terrain;
- 70 SUs (10%) were located in areas with high levels of social conflict or security concerns; and
- 1 SU (0.1%) was located outside the national territory at the time of field verification.

WEIGHTING

Quantitative variables were analyzed using post-stratification and ratio estimators. First, a non-aligned systematic sample was selected from the population, after which post-stratification was applied.

Three strata were delineated based on physiographic, edaphic, and climatic characteristics associated with the regions where Guatemala's REDD+ strategy is being implemented.

The northern and southern strata correspond to the REDD+ implementation regions of the same name, while the central stratum comprises the Occidente, Sarstún-Motagua, and Centro-Oriente regions.

For each variable, the total value was summed by land-use category within each stratum to calculate a weighted stratified mean. The resulting estimate is similar to that obtained through stratified random sampling; however, in post-stratification, the sample sizes within each stratum are random variables because they are not predetermined and may vary from one sample to another.

Data collection

DATES OF DATA COLLECTION

Start	End
2021	2024

DATA COLLECTION MODE

Field measurement

Data Processing

DATA EDITING

The quality control of the database was carried out using R Studio and Access software, verifying and validating the variables and sub-variables per plot, a process that was carried out in the national database.

- Sampling Unit (SU) code

The identification codes were verified to ensure they matched between physical forms, the digital database, and GPS routes collected in the field. Those that did not match the official coding of the National Geographic Institute were corrected.

Likewise, the SUs were classified according to complete or incomplete information, excluding the latter from the analysis of results. Information regarding villages, indigenous peoples, and linguistic communities associated with each SU was also reviewed and supplemented.

- Land use category

The consistency between data reported in the field and the interpretation of satellite images was reviewed, validating the definitions and thresholds established for each land use class. Inconsistencies detected during the process were corrected.

- Permanent mark coordinates and accessibility

The X and Y coordinates of each plot were corroborated, verifying format, number of characters, and correct geolocation. In addition, the accessibility classification was adjusted in the office for those SUs initially classified as inaccessible but which were actually visited during fieldwork.

- Scientific name and common name of tree species

Scientific names were assigned to trees registered as "unknown" using official INAB lists and IFN 2003 species records. The corrections were directly incorporated into the national database.

- Diameter at breast height (DBH), height, basal area, volume, and density of trees

It was verified that only trees with a DBH greater than or equal to 5 cm were included in dry forests. Maximum and minimum values were reviewed by plot type, ensuring that diameters matched the subplot defined according to its category. For heights measured without an instrument, a comparative statistical analysis was applied with heights measured with an instrument, generating a mathematical model for conifer species when it was not possible to validate the original data.

Incorrect units (cm instead of m) and typing errors were also reviewed. Allometric equations were evaluated to ensure their correct application to species and forest type. Volume calculations were verified by comparison between Silvametricus and R Studio.

- Biomass and above-ground and below-ground carbon

The application of equations by stratum, forest type, and species was reviewed, as well as the valid DBH ranges for each formula. Specific densities in mangrove species were verified, and the IPCC factor for carbon was updated from 0.50 to 0.47.

- Biomass and carbon in leaf litter

Consistency between weights taken in the field and in the laboratory was verified, ensuring that dry weight values were lower than wet weight values. Units were corrected when necessary and the IPCC carbon factor was updated to 0.47. Plots without information were differentiated for exclusion from the analysis.

- Biomass and carbon in stumps

Extreme values for diameters and heights were verified by reviewing physical forms. The correct assignment of the carbon factor according to the level of decomposition was ensured. In addition, the consistency of information between data sources was evaluated, and cases without field collection were excluded.

- Biomass and carbon in fallen dead wood

Minimum diameters were verified to meet the threshold (greater than or equal to 5 cm) and the proper use of the carbon factor according to decomposition was confirmed. Plots with valid data and those without information were distinguished for their respective inclusion or exclusion.

- Soil carbon

The calculation depth was verified to be 0–30 cm. When the actual depth was less, the value recorded in the field was used. The consistency of laboratory data with the values used in database calculations was reviewed.

ANONYMIZATION PROCESS

The personal details of the individuals who provided the information and granted access to each sampling unit are not public, nor the actual coordinates of the sampling plots (the actual coordinates are those recorded in the field using GPS, whilst the theoretical coordinates are those established in the office); furthermore, the details of the technicians and professionals who collected the information are not available.

Data Appraisal

ESTIMATES OF SAMPLING ERROR

For the various variables analysed, the precision target is set at a sampling error of 10 percent with a 95 percent confidence level.

The results are classified into five accuracy categories, based on defined ranges of sampling error: very high (<10percent), high (10–15percent), medium (15–20percent), low (20–40percent), and very low (>40percent).

Access policy

CONTACTS

Name	Affiliation	Email
Dulce Mejía (IFN INAB Manager)	INAB	inventarioforestalnacionalgt@inab.gob.gt
Adrián Gálvez (IFN CONAP Manager)	CONAP	adrian.galvez@conap.gob.gt
Wyllsson Adiel Martinez (INAB Director)	INAB	wyllsson.martinez@inab.gob.gt
Edson Flores (CONAP Director)	CONAP	edson.flores@conap.gob.gt
Bruno Enrique Arias Rivas (INAB Manager)	INAB	gerencia@inab.gob.gt
Igor de la Roca (CONAP Executive Secretary)	CONAP	secretaria.ejecutiva@conap.gob.gt

CONFIDENTIALITY

The institutions responsible for conducting the National Forest Inventory protect the personal data of the owners and

respondents who provided the information.

ACCESS CONDITIONS

Data available from an external repository. The access conditions will be based on the conditions of the external repository.

CITATION REQUIREMENTS

INAB, & CONAP. (2025). Informe de resultados del segundo inventario forestal nacional de Guatemala 2021-2024. Instituto Nacional de Bosques y Consejo Nacional de Áreas Protegidas. Guatemala.

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DISCLAIMER

The user of the data acknowledges that neither the original data collector, nor the authorized data distributor, nor the relevant funding agency assumes any liability for the use of the data or for any interpretations or conclusions derived from such use.

Metadata production

DDI DOCUMENT ID

DDI_GTM_2021_2024_IFN_v01_M_v01_A_ESS_FAO

PRODUCERS

Name	Abbreviation	Affiliation	Role
Statistics Division	ESS	Food and Agriculture Organization of the United Nations	Metadata producer

Data Dictionary

Data file	Cases	Variables
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