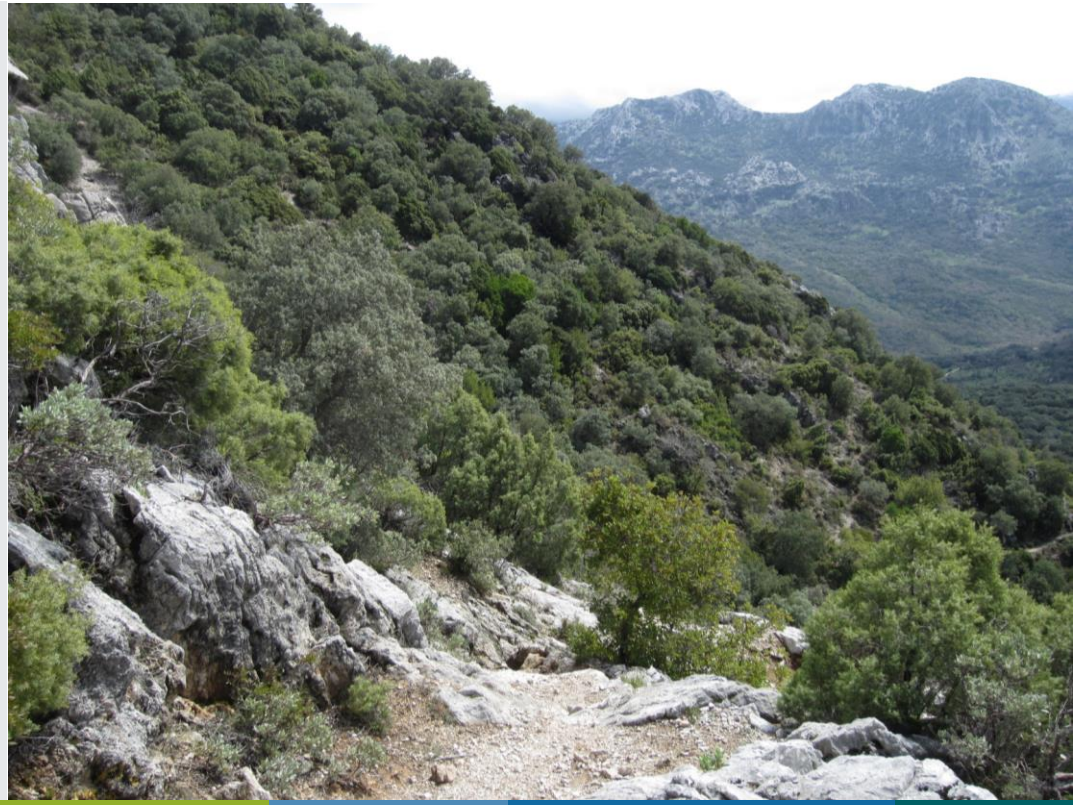
Systematic field and lab monitoring of biodiversity by the National Forest Inventory of Spain



19th October 2022

Integrate Network
facilitated by EFI

GOBIERNO DE ESPAÑA
VICEPRESIDENCIA TERCERA DEL GOBIERNO
MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO

Summary National Forest Inventory Spain

- NFI is part of National Forest Information (Forest Law 43/2003)

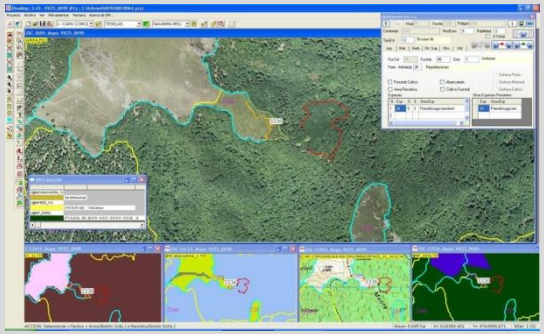
Inventory	Years	Stratification	Sampling method and field plots	Number of plots
NFI 1	1965–1974	Grid over photographs	Optimal allocation of plots; temporary plots	65,000
NFI 2	1986–1995	Grid over maps	Systematic 1-km x 1-km grid; permanent plots	84,203
NFI 3	1997–2007	Grid over digital maps	Same systematic grid as NFI2; permanent plots	95,327
NFI 4	2008- in process	Grid over digital maps	Same systematic grid as NFI3; permanent plots	NA

NFI website (in spanish), more information and data:

https://www.miteco.gob.es/es/biodiversidad/temas/inventarios-nacionales/inventario-forestal-nacional/default.aspx

NFI SAMPLING DESIGN. STRATIFICATION

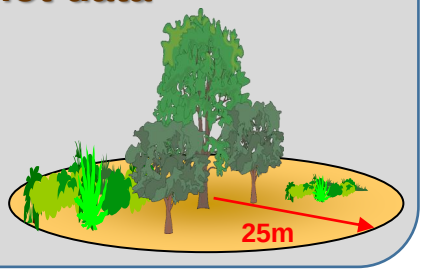
National Forest Map

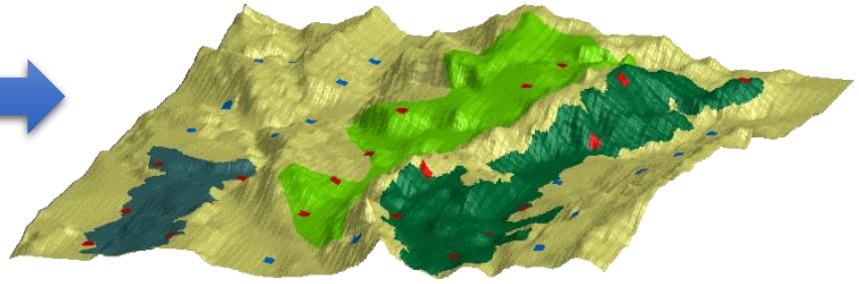


Additional cartography:

- Nature 2000
- Forest tenure
- Administrative regions

NFI plot data

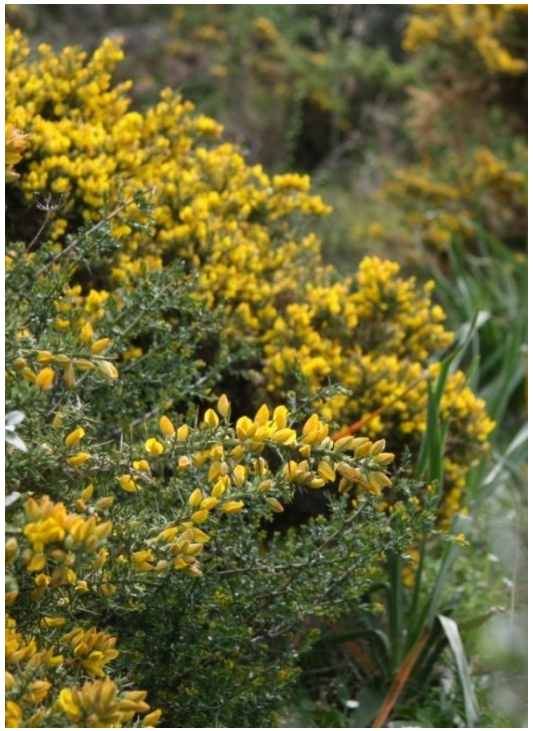




Sampling design. Stratification

SPANISH NATIONAL FOREST MAP:

✓Photo-interpretation of all the forest national territory (1ha resolution).
✓Tessera delimitation based on LPIS on the different land use and input data.
✓Field visits: ±10% tessera (MFE 25)



FOREST LAND- INPUT DATA:

Tree species composition
Canopy cover
Artificial age classes
(young growth; thicket; polewood; high forest)
Forest fire fuel models

OWL – INPUT DATA :

National shrub formation
Shrub cover and estimated average height

Sampling design

✓**Sampling unit**: province (50)

✓**Grid**: 1 km x 1 km UTM

✓ **Sampling intensity**: In the very open forest areas and in some *Quercus* coppice forest areas, the sampling intensity has been drastically reduced.

The **estimated error** (at the 95%) for the growing stock varies generally between 5% and 10%. The error is calculated from a systematic stratified (*a posteriori*) sampling.

Sampling design. Stratification

STRATIFICATION "A POSTERIORI"
PLOT LEVEL INPUT DATA :

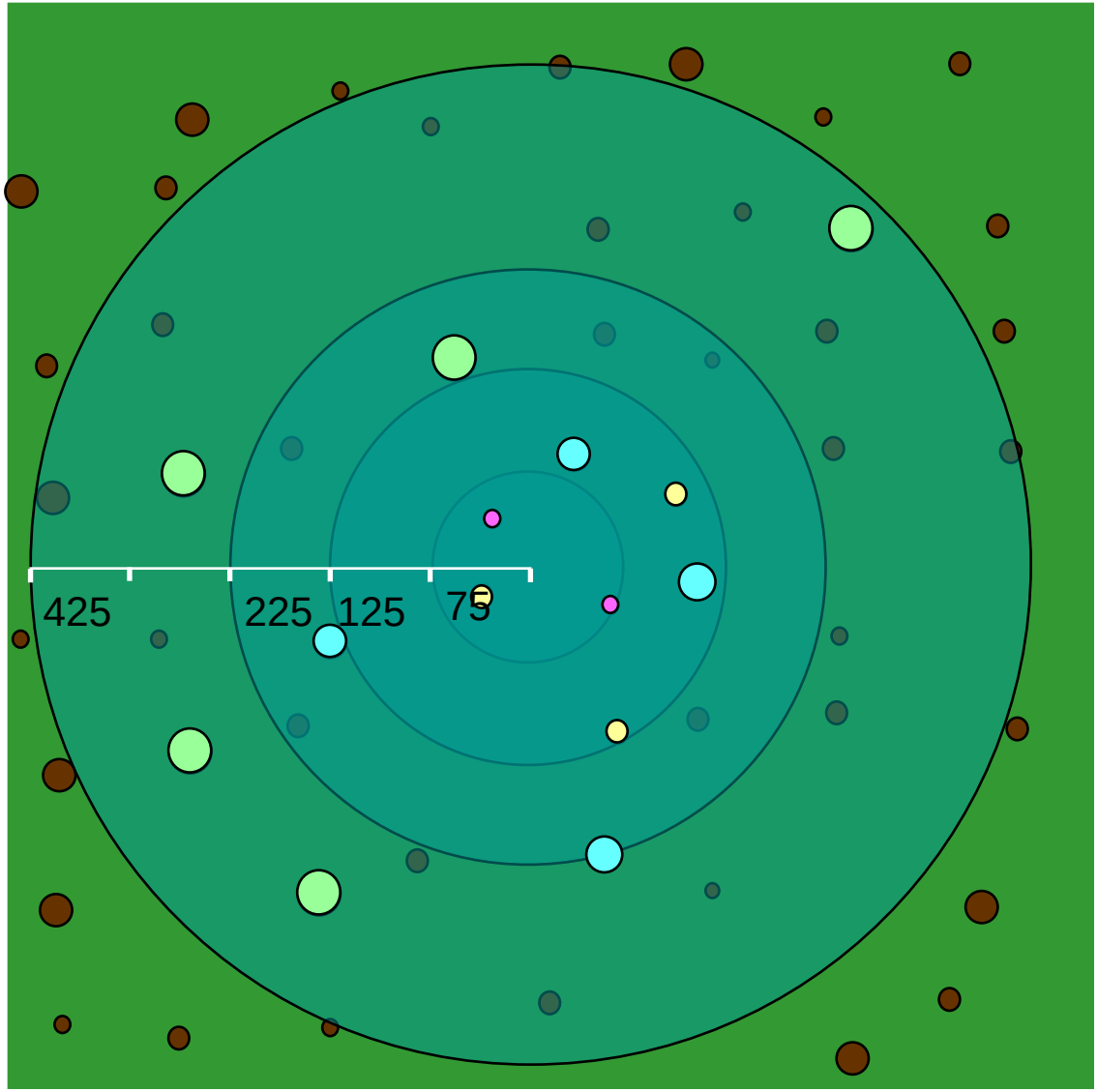
- **National forest types**:
  - Ecological forest types (floodplain forest)
  - Man-made open forest stands (dehesas, resin tapping stands)
  - Productive plantation
  - Alien/native species
- **Age classes**
- **Tree species composition**
- **Crown cover**
- **Management regime**

Sample plots

- **Permanent plots** (permanently marked by metallic tube)

-**Concentric sampling plots**: four circular concentric fixed areas with radius 5 (DBH ≥ 7.5 cm), 10 (DBH ≥ 12.5 cm), 15 (DBH ≥ 22 5 cm) and 25 m (DBH ≥ 42 5). 5 m radius; trees with DBH between 2.5 and 7.4 cm are counted.

-**Field data**: including plot identification, forest type, trees mensuration, sample tree data, shrub, erosion factors and tree damages.



Biodiversity survey. Main characteristics

- Started in some provinces in NFI3 (19.690 plots)
- NFI in process (75% of the total plots)

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Centro Nacional Instituto de Investigación y Tecnología Agraria y Alimentaria

FOREST BIODIVERSITY INDICATORS BASED ON FIELD DATA

FOREST TYPES DESCRIPTION

IFN-4

1. Stand naturalness
2. Ground cover
3. Tree and shrub species composition
4. Stand structure
    - 4.1. Horizontal structure
    - 4.2. Vertical structure
    - 4.3. Vertical and horizontal structure (combined trees and shrubs)
    - 4.4. Old trees
5. Deadwood
6. Herbivores browsing impact
7. Ages
8. Singular elements frecuency
9. Invasive exotic species

IFN-3

6. Abundance of herbaceous and ferns
7. Lichens

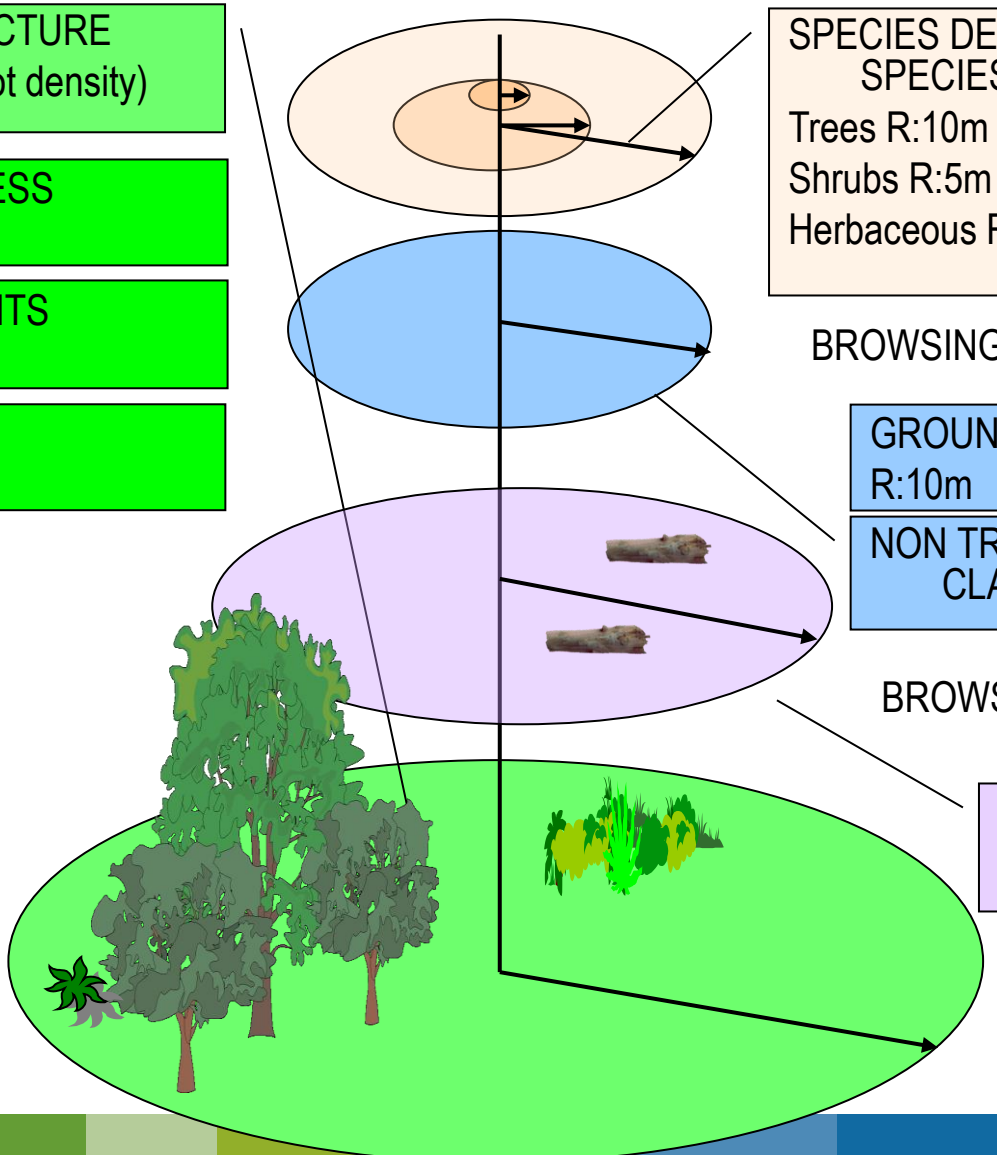
Biodiversity plot

PLOT STAND STRUCTURE
(depending on the plot density)

STAND NATURALNESS
R:25m (Tessera)

SINGULAR ELEMENTS
R:25m

PLOT AGE
R:25m



SPECIES DENSITY: INVASIVE EXOTIC SPECIES; PROTECTED SPECIES
Trees R:10m
Shrubs R:5m
Herbaceous R:1m

BROWSING IMPACT .Regeneration(R=5)

GROUND COVER-(bare soil…)
R:10m

NON TREES SPECIES COVER BY CLASSES. R: 10m

BROWSING IMPACT (R=10)

DEAD WOOD
R: 15 m

Biodiversity metodology

STAND NATURALNESS

Description of the degree of stand naturalness based on FAO classification

Category
Primary forest
Disturbed natural forest
Semi-natural forest
Forest productive plantations
Forest protective plantations

Area covered by each naturalness category by forest type

Biodiversity metodology

GROUND COVER

CUANTIFICATION (%) :

- Bedrock, rocks, bare soil
- Peatland, water, flooded land
- Paths, infraestructures
- Organic matter
- Vegetation

Different kinds of coverage imply higher micro-hábitat diversity (patterns, species associations…)

Important for different issues: erosion, forest management, forest fires…

Biodiversity metodology

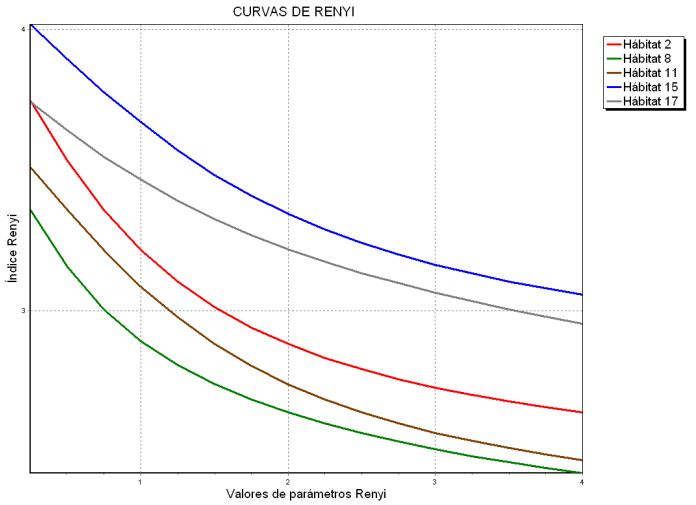
TREE AND SHRUBS SPECIES RICHNESS

Data from “classic” inventories

Calculated indicators

Composite indexes. Examples:

Shannon-Weaver	$H = \sum_{i}^{S} (-\ln p_i) p_i$
Berger-Parker	$1 - D_{BP} = 1 - \frac{N_{\max}}{N}$



Rényi curves

Ecological models (geometric, logaritmic, etc…)

Biodiversity metodology

STAND STRUCTURE

- Appropriate variables for measurement in NFIs (ease of data collection and accuracy)
- The inventoried dasometric variables are used and also crown height

Horizontal structure: indicators:

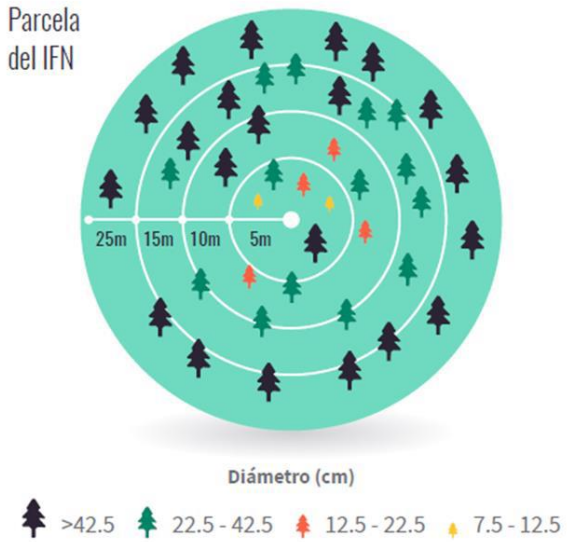
Structural diversity, trees distribution, neighboring trees…

Parameters and indexes:

- Mixture of conifers/broadleaves
- Forest density
- Diameter variation range
- Diameter standard deviation
- Diametric asimetry
- ***Clark Evans Index***
- ***Gadow Index***
- ***Mingling Index***

- **Old trees** (diameter, quality, location)

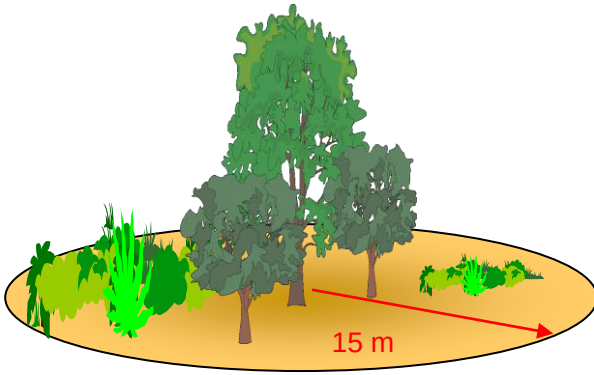
- Percentage of area covered (plots) by shrubs by percentage of coverage



Biodiversity metodology

DEADWOOD

Quantity and quality (decay categories) Standing and downed deadwood



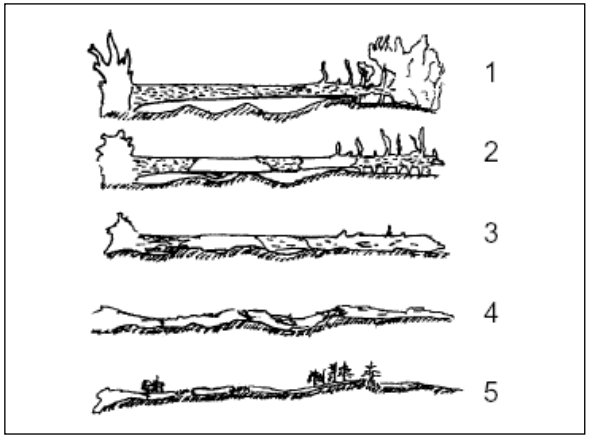
Important element of the functioning of ecosystems and an important carbon pool. Relationship with naturalness, complexity. Fires and pests. Stability and balance of Biodiversity.

Classes

The Spanish National Forest Inventory (SNFI) considers seven categories:

- standing dead trees;
- downed dead trees;
- standing saplings;
- downed saplings/small dead trees;
- downed coarse wood pieces/downed branches;
- stumps;
- coppice stumps.

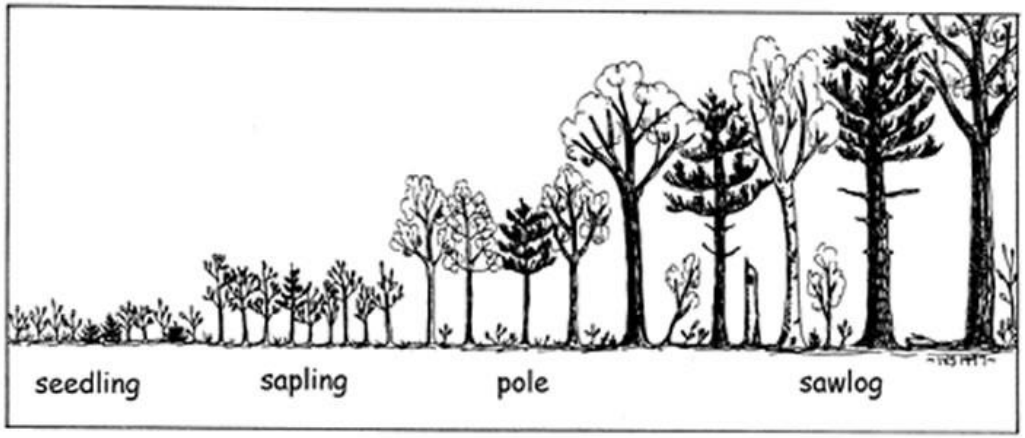
Decay categories, (based on Hunter)



Biodiversity metodology

AGE ESTIMATION

International definition for NFI. COST E43



Stand form	Size class	Age estimation procedure
Even-aged stand	Seedling or sapling	Indirect methods (e.g.: counting whorls in conifers)
	Pole or sawlog	Simplified Assmann method for the estimation of the dominant height, Ho: •The thickest 100 trees per hectare are located and their average height is calculated. •Identification of the tree with height closest to Ho.
Two-aged stands and Uneven-aged stands	Seedling or sapling	Indirect methods (e.g.: counting whorls in conifers)
	Pole or sawlog	Simplified Assmann method for the estimation of the dominant height, Ho: •The thickest 100 trees per hectare are located and their average height is calculated. •Identification of the tree with height closest to Ho.

Biodiversity metodology

INVASIVE SPECIES

Province-level list

Determination of presence and density.

This list is compiled from the following sources:

- Lists of threatened species provided by the Autonomous Communities
- Atlas and Red Book of threatened plant species in Spain
- National Catalog of Endangered Species
- Atlas of invasive non-native plant species of the Iberian Peninsula
- Provincial catalogs and others

Biodiversity metodology

SINGULAR ELEMENTS FRECUENCY

Presence of elements indicating naturalness:

- Cavities in logs
- Nests
- Anthills
- Moles / Burrows / Caves
- Footprints and traces (fauna)
- Fauna droppings

Presence of elements indicating human presence:

- Piles of branches or firewood
- walls
- hedges

Thank you for your attention

Contact

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