Old growth forests definition and indicators:

a case study for beech forests in Europe

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Outline

- **Definition** of primary and old-growth forest (EU)
- **Indicators** for (primary) and old-growth forest (EU)
- **Value ranges and thresholds** for delineation
  - → Example USA
  - → Example European Beech Forests (PROGNOSES)
- **The way forward**

Definition: Primary vs. Old-Growth

EU Biodiversity Strategy 2030 (EU Forest Strategy 2030) : "*all of the EU's remaining primary and old-growth forests should be defined, mapped, monitored and strictly protected*".

EU-DG-Envir. (2023) Guidelines for defining, mapping, monitoring and strict protection of EU Primary and Oldgrowth forests

Primary (FAO) = "*Naturally regenerated forest of native tree species, where there are <u>no clearly visible indications of human activities</u> and the ecological processes are not significantly disturbed.*"

Fig. 1. The forest cycle of natural temperate deciduous forest (after Emborg, 1996).
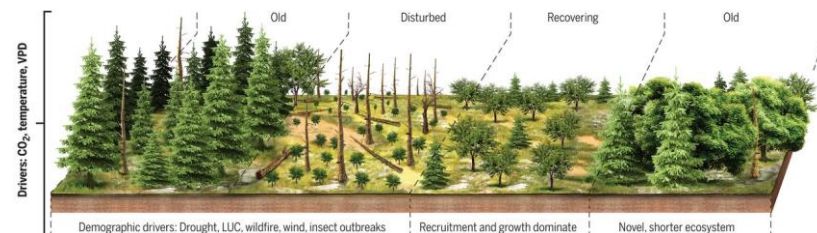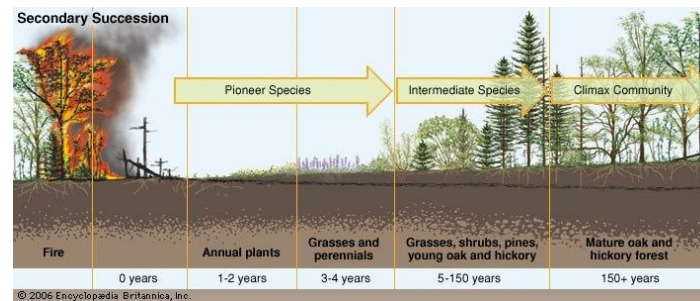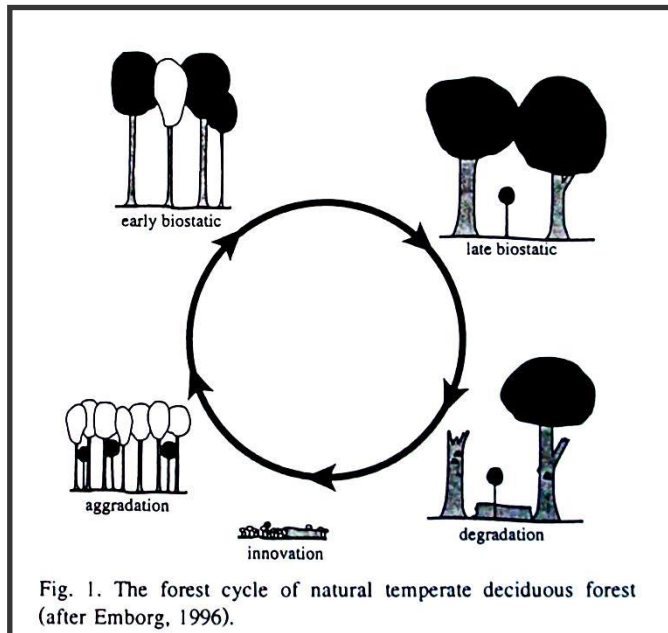
Definition: Primary vs. Old-Growth

Primary (FAO) = "*Naturally regenerated forest of native tree species, where there are <u>no clearly visible indications of human activities</u> and the ecological processes are not significantly disturbed.***"**

EU (2023): Primary forests have a number of key characteristics:

▸ they show <u>natural forest dynamics</u>, such as natural tree species composition, occurrence of dead wood, natural age structure and natural regeneration processes;

▸ the area is <u>large</u> enough to maintain its natural ecological processes;

▸ there has <u>been **no known significant human intervention**, or the last significant human intervention was **sufficiently long ago** to have allowed the natural species composition and processes to re-establish themselves</u>.

***Buchwald (2005)** and **Sabatini et al (2018,2020, 2021):** always or at least for the past 60 to 80 years been essentially unmodified by human activity*

Definition: Primary vs. Old-Growth

Old-Growth (EU 2023) *= : "A <u>forest stand or area</u> consisting of <u>native</u> tree species that have developed, predominantly through natural processes, <u>structures and dynamics normally associated with late-seral developmental phases</u> in primary or undisturbed forests of the same type. <u>Signs of former human activities may be visible, but they are gradually disappearing</u> or too limited to significantly disturb natural processes'.*
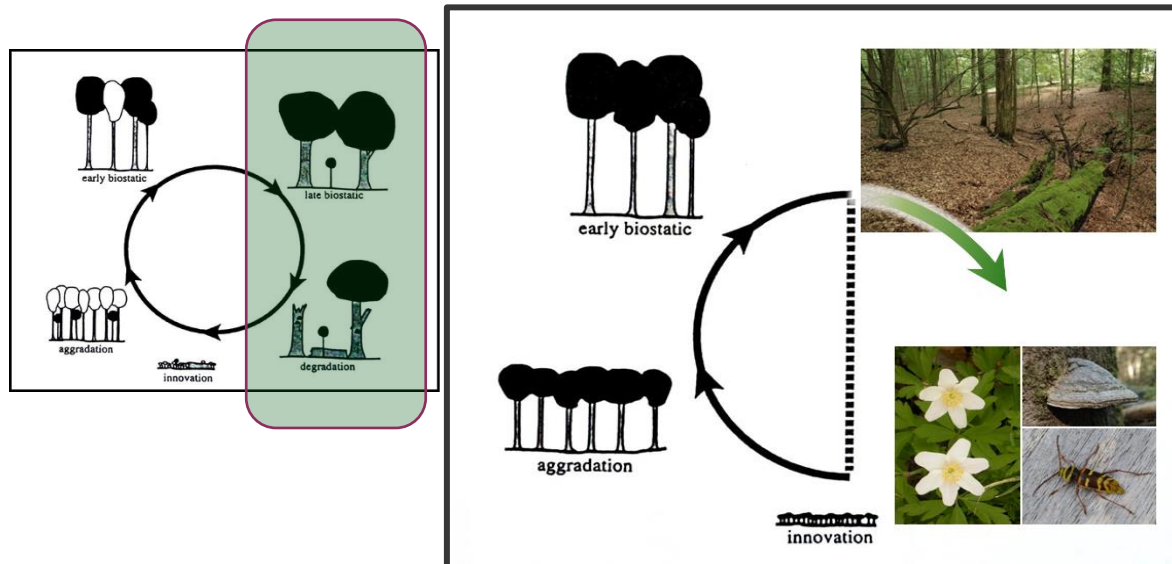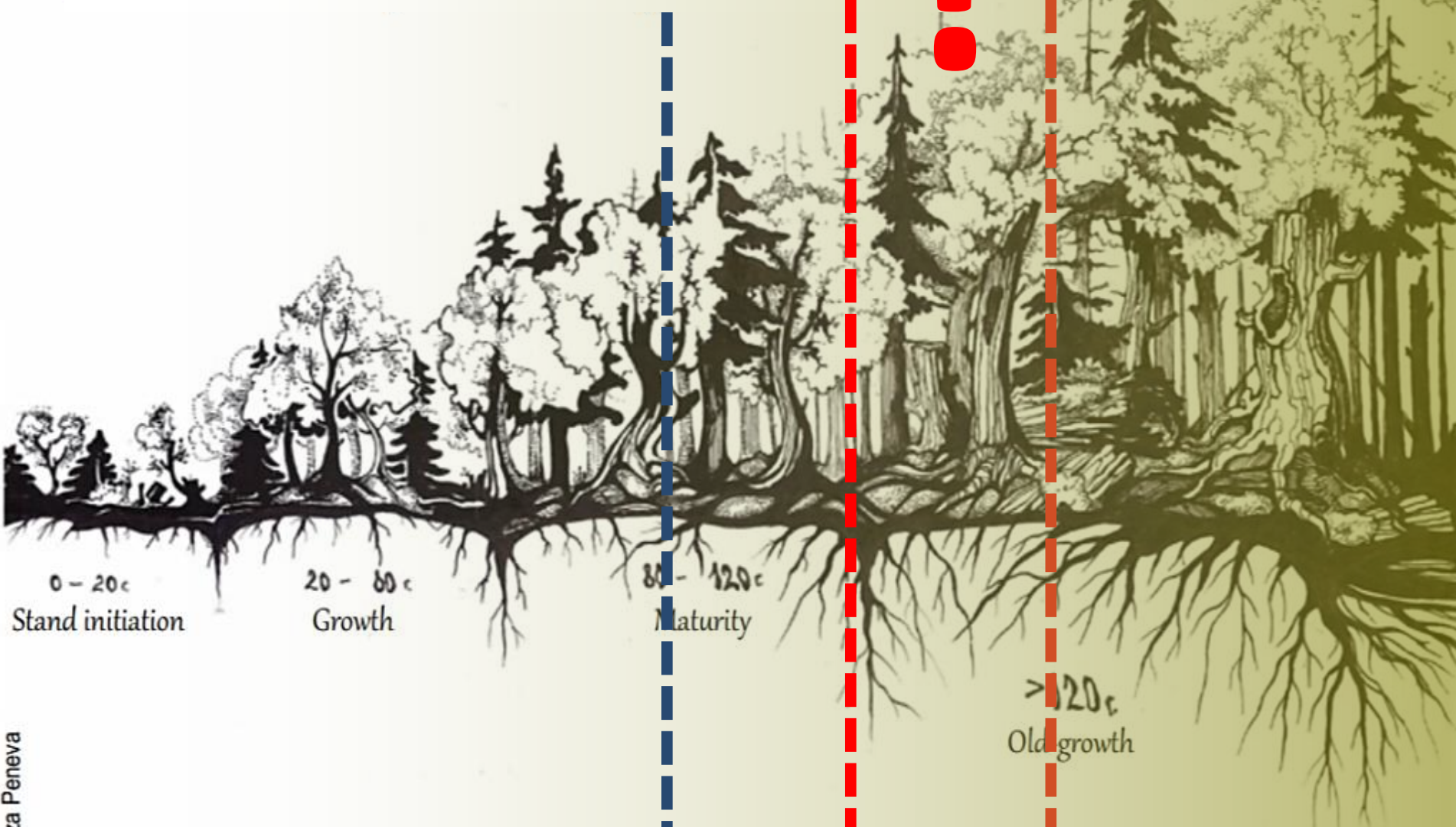
Definition: Primary vs. Old-Growth

Old-Growth (EU) – explanatory notes

▶ This definition includes forest stands that originate not only from natural regeneration, but **also from planted or sown native tree species**

(…)

▶ This definition **includes forest stands with visible signs of abiotic damages** (e.g. storms, snow, droughts and fires) and biotic damage (e.g. from insects and diseases) that meet the definition

▶ **Forests with visible signs of past human activity are not excluded** from the definition of old-growth forests, unless the magnitude of the impact of the activity is such as to prevent the forest stand from counting as old-growth (see Section 3.2).

▶ Oldgrowth forest stands **do not include stands** for which there is evidence that they are **under active productive management**.

▶ **Some key characteristics of old-growth forest stands are:**

▶ they contain structural features and dynamics such as natural regeneration, gap dynamics, large and diverse **dead wood**, **structural complexity**, and the presence of **old trees**, or trees reaching senescent stage and tree-related **microhabitats**.

▶ they have acquired these structural features and dynamics through **several decades of natural development without significant human intervention**.

EU-DG-Envir. (2023) Guidelines for defining, mapping, monitoring and strict protection of EU Primary and Oldgrowth forests

Level of 'old-growthness'

Old-Growth = gradual process

$0 - 20c$	$20 - 80 c$	$80 - 120c$	$> 120c$
Stand initiation	Growth	Maturity	Old growth

Indicators of Old-Growthness (OGI's)

- **Tree species composition (Native)**

- **Dead wood quantity & quality**

- **Large/old trees**

- Structural complexity: age, tree size, biomass distribution, layering, gaps,...)

- Microhabitats :
  - Tree related microhabitats
  - Soil microstructures (pits and mounds)

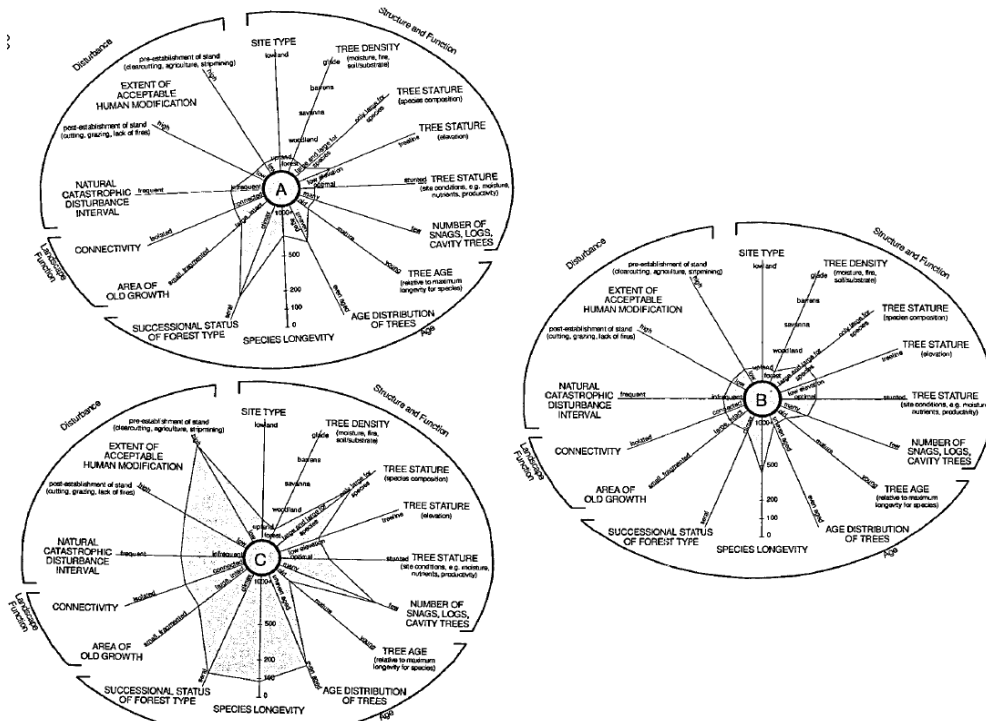- Presence of indicator species

Indicators of Old-Growthness (OGI's)

Figure 2.—Examples of the old-growth model for: (A) Douglas-fir, (B) northern hardwoods, (C) aspen.

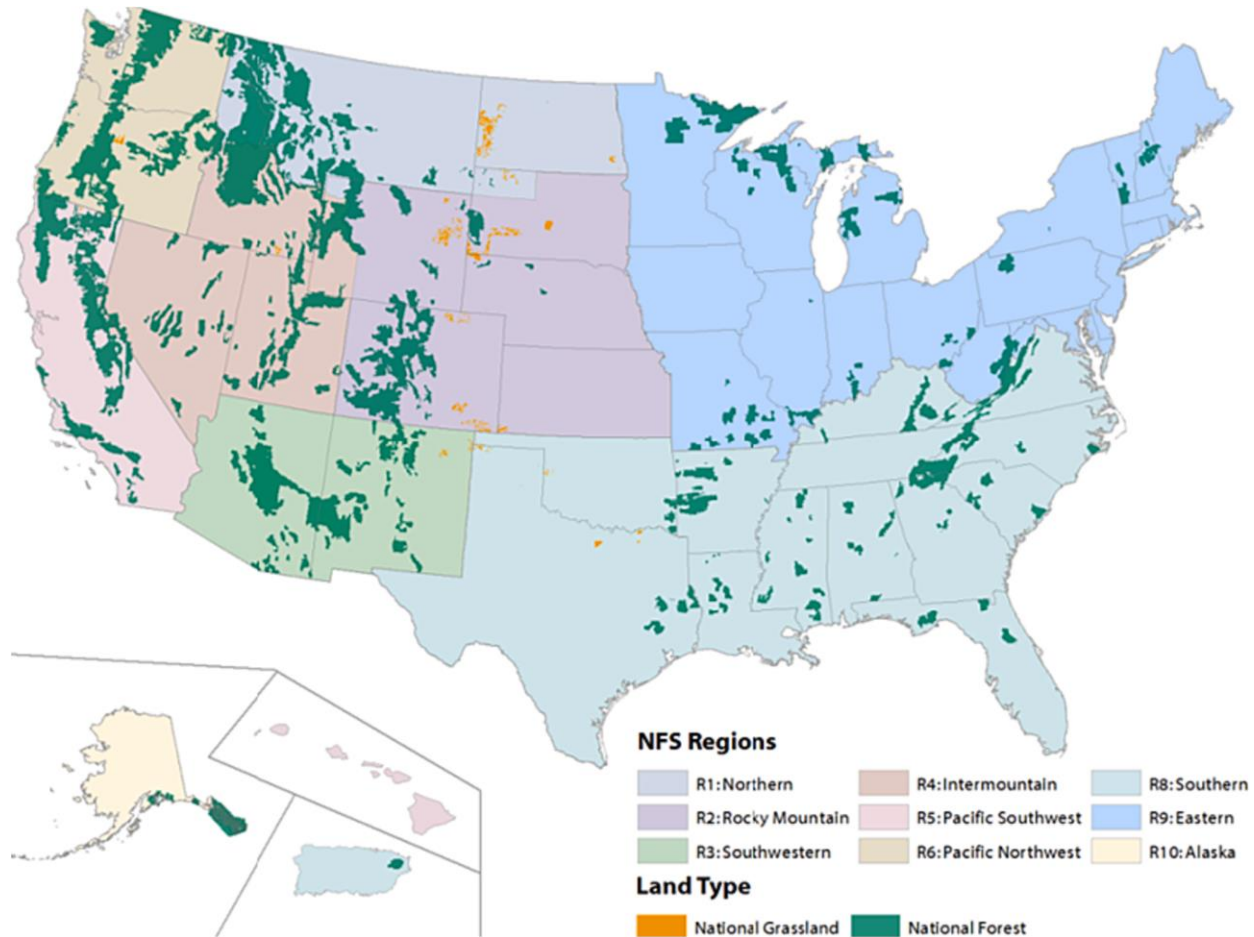Tyrell et al. 1998 - USDA General Technical Report NC-197

Example USA

▸ Presidential Executive Order (EO#14072, April 22, 2022) :

▸ The Secretary of the Interior (...) shall, **within 1 year of the date of this order, define, identify, and complete an inventory of old-growth and mature forests on Federal lands**, accounting for regional and ecological variations, as appropriate, and shall **make such inventory publicly available.**

▸ **Forest on public land : 95 mio ha**

▸ Narrative frameworks (descriptive general definitions) => Working definitions (measurable structural parameters) : minimum number of trees of certain size or age per ha. (dead standing trees; trees with rotten or dead portions,

▸ criteria included measures of density and size of living and standing dead trees, decay measures on living and dead trees, tree or stand age, downed woody material, or diameter variation

▸ 13 mio ha of Old-growth

Example USA

▸ 10 regions

NFS Regions

- R1: Northern
- R2: Rocky Mountain
- R3: Southwestern
- R4: Intermountain
- R5: Pacific Southwest
- R6: Pacific Northwest
- R8: Southern
- R9: Eastern
- R10: Alaska

Land Type

National Grassland   National Forest

Example USA

▶ 10 regions

▶ Every main forest type per region : Threshold DBH, N/ha, tree age

Table 17.—Eastern Region old-growth community types, corresponding FIA forest types, and large tree diameter and density and stand age minima.

Old-growth type	FIA forest type code	Tree diameter (inches)	Trees per acre	Stand age (years)
Beech maple basswood	805	16	10	141
Northern hardwood	520, 801, 802, 809	16	10	141
Dry oak	162, 163, 165, 167, 182, 184, 404, 405, 501, 502, 506, 507, 509, 510, 513, 515	16	20	101
Mesic northern oak	503, 504, 505, 511, 512, 516	20	5	161
Wetland hardwood	701, 702, 703, 704, 705, 706, 707, 708, 709	18	10	121
Conifer northern hardwood	104, 105, 401	16	10	141
Northern pine	101, 102, 103	12	20	101
Montane spruce	121, 123, 124, 128, 129	15	10	141
Sub-boreal spruce/fir	122, 125	12	10	141
Other	All others	14	10	101

DBH>40 cm; 25/ ha

Example European beech forests

12 sites : managed up to primary beech dominated forest stands

>2000 sample plots
      1000 in managed;
      500 in set-aside;
      700 in primary and
            long set-aside
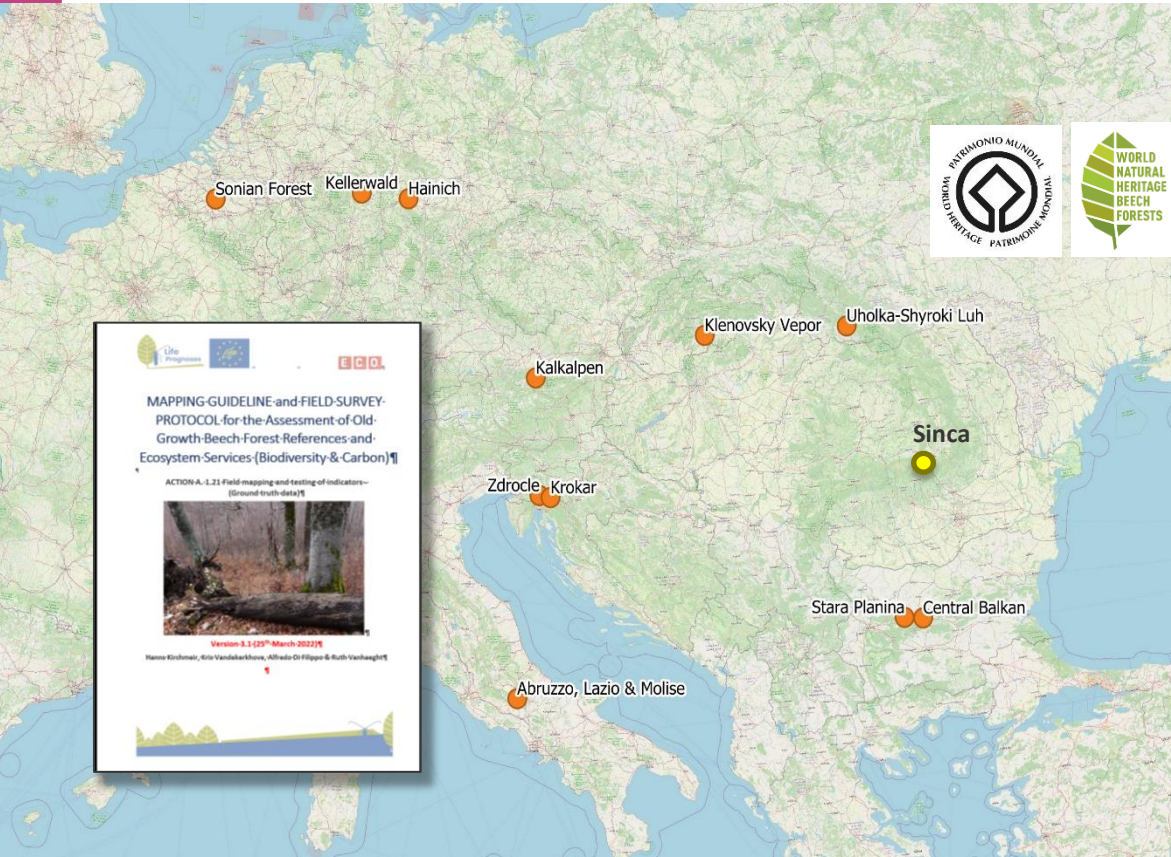
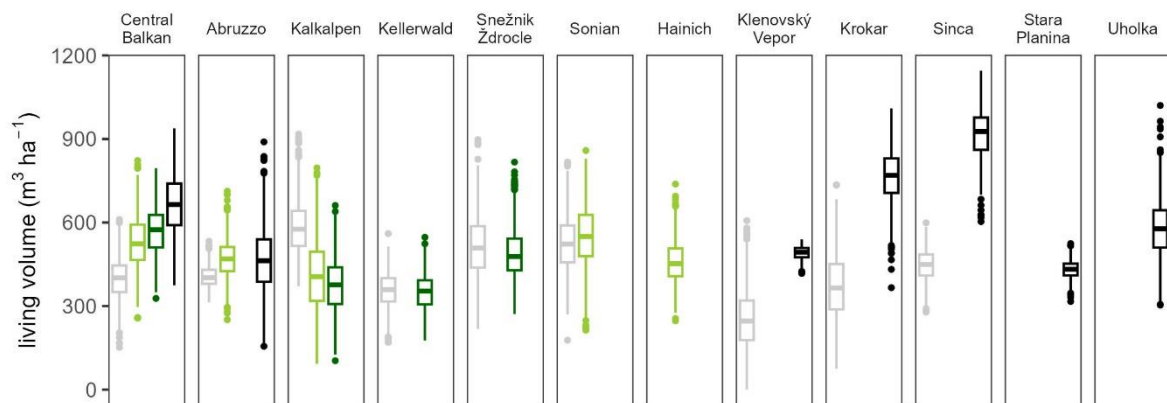# Example European beech forests

Results

Living volume:

Primary :

        M: 450-950 m³/ha
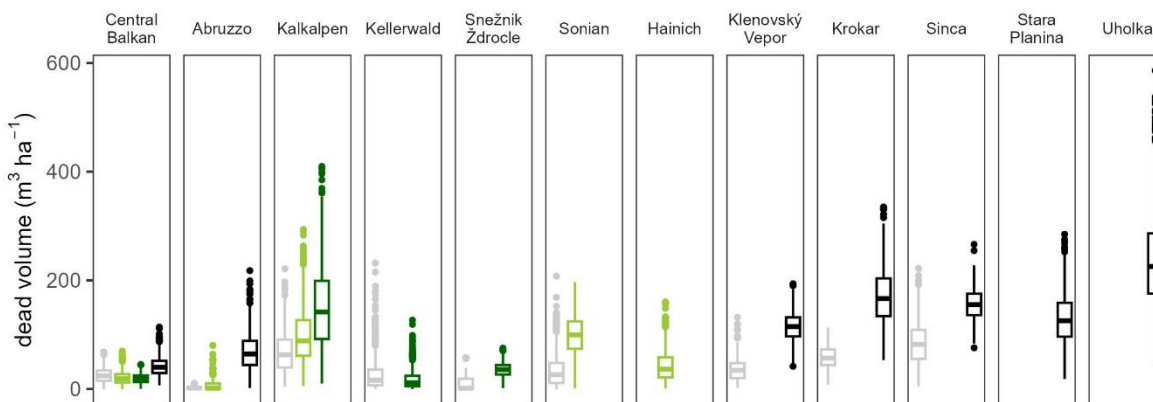   Q1: 400-800 m³/ha
        Q3: 500-1000 m³/ha

Total deadwood volume:

Primary :

        M: 100-200 m³/ha
        Q1: 50-125 m³/ha
        Q3: 150-325 m³/ha

Example European beech forests

Results

Density VLT:

Primary :

        M: 10-30/ha

        Q1: 5-15 /ha

        Q3: 20-40 /ha

Share VLT in living volume:

Primary :

        M: 25-40 %

        Q1: 10-25 %

        Q3: 35-50 %
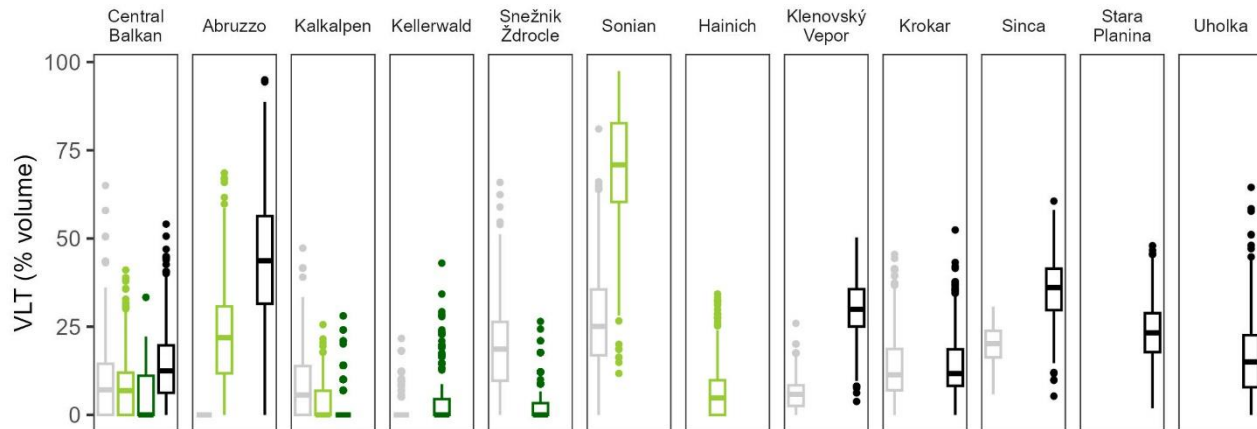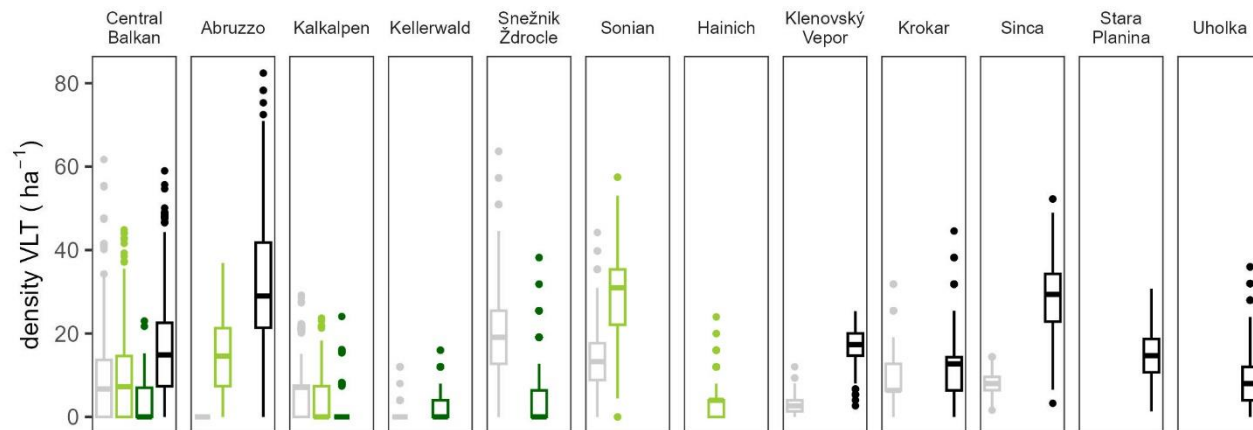
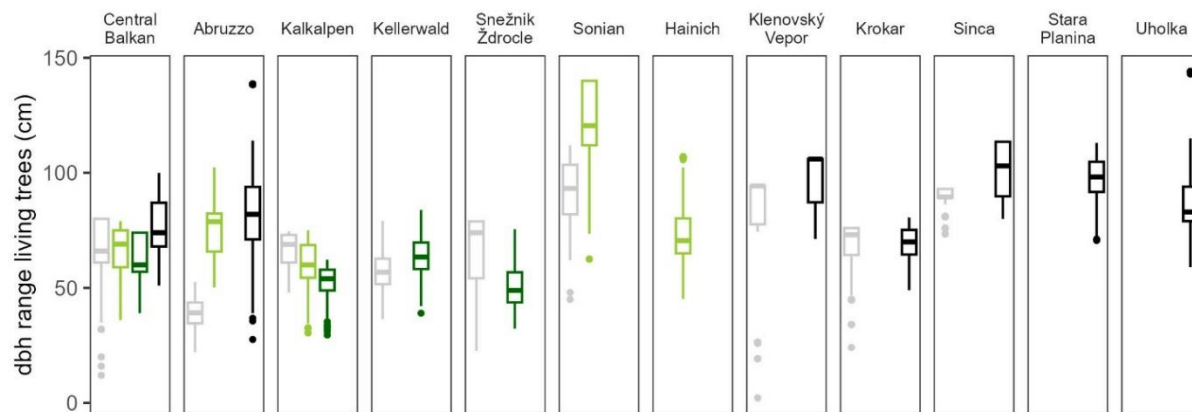# Example European beech forests

Results

DBH-range

Primary :

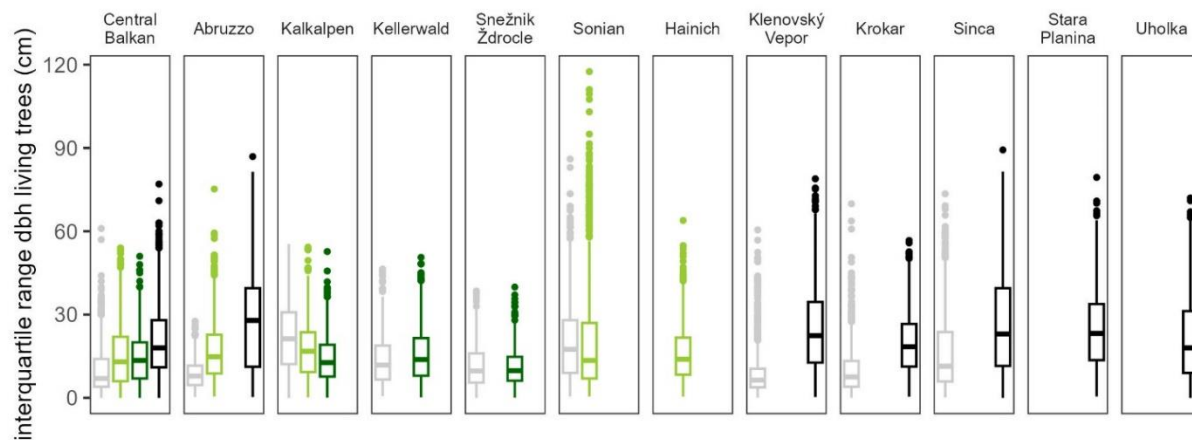   M: 50-90 cm

        Q1: 45-80 cm

        Q3: 65-100 cm

DBH-IQR

Primary :
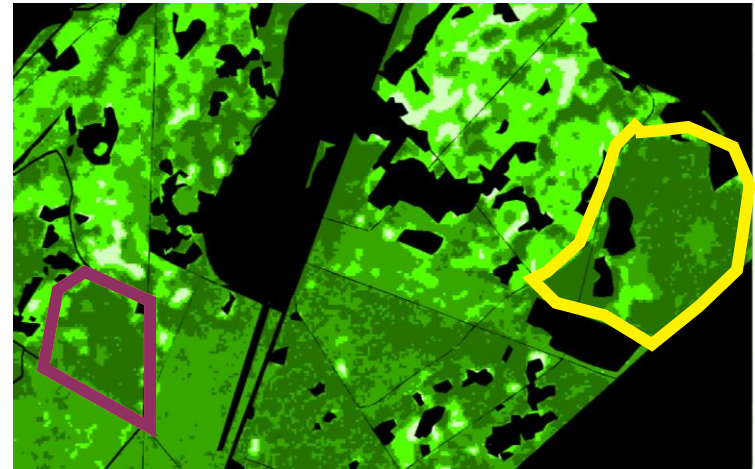
        M: 30 cm

        Q1: 20 cm

        Q3: 40-50 cm

The way forward

1. Produce maps of 'high probability' for OGF, based on RS and existing maps (historic maps, stand maps)

2. Decide on threshold values for stand age, presence of VLT, deadwood amounts, TSA,… (EU: *scientifically sound; transparant*)

3. Check at stand level (desktop and in the field) and allocate the areas with Primary and Old-growth stands

Thank you