Old growth forests: how to define?

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COMMISSION STAFF WORKING DOCUMENT

Commission Guidelines for Defining, Mapping, Monitoring and Strictly Protecting EU Primary and Old-Growth Forests

Definitions (EU, 2023)

Old-growth forest: 'A forest stand or area consisting of native tree species that have developed, predominantly through natural processes, structures and dynamics normally associated with late-seral developmental phases in primary or undisturbed forests of the same type. Signs of former human activities may be visible, but they are gradually disappearing or too limited to significantly disturb natural processes.'

Primary forest: 'Naturally regenerated forest of native tree species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed.'[10]

10 FAO definition

Forest protection: for which stands?

- **The EU Biodiversity Strategy (2030) makes the preservation of Europe's old-growth forests one of its priorities.**
- Protected areas will make up 30% of the EU area, with 10% under strict protection. **Intended to include all primary and old forests in the EU**.
- Conclusion of the European Commission: good data is also needed for forest protection: what exactly to protect?

The identification of undocumented primary and old-growth forests in the field remains crucial (EK, 2021)

Which areas to protect?

What kind of forest management would be more appropriate?

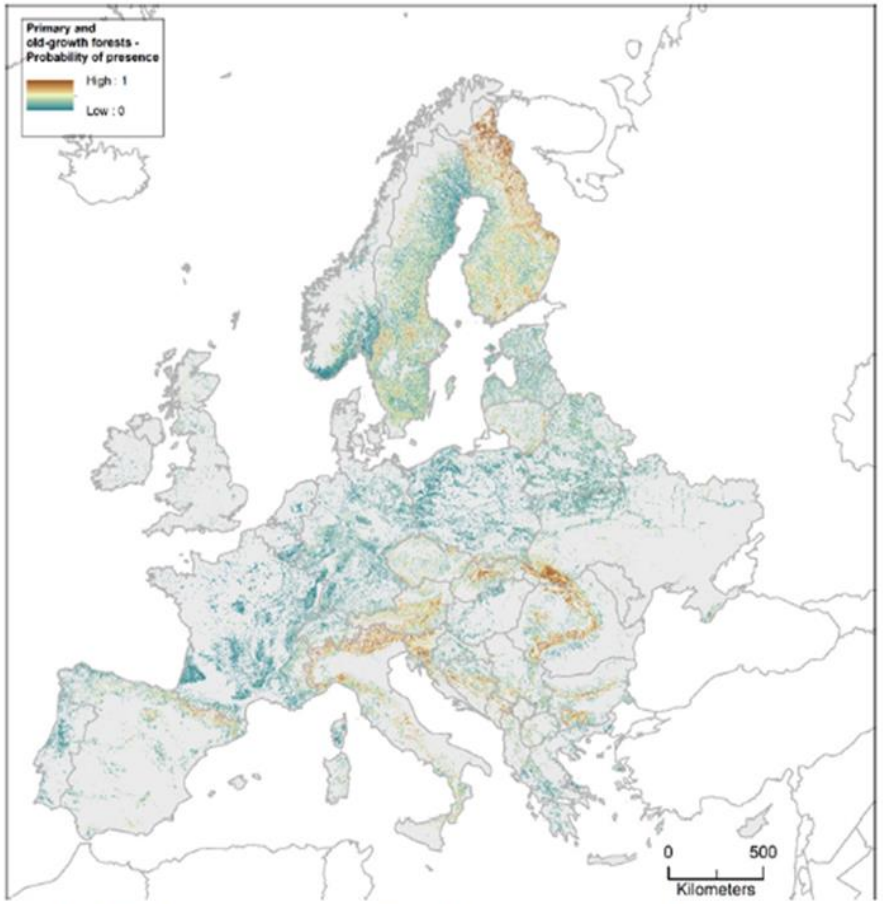

Figure 5. Likelihood of presence of primary and old-growth forests. Map at 250 m grid size implemented by Sabatini et al. (2020b) using a spatially explicit boosted regression trees model relating the presence of primary and old-growth forests and 15 biophysical, socio-economic and historical land use predictors. EU areas outside the domain of the map not included in the model.

Avots: Sabatini et al. 2020

Old growth forests: indicators

Indicators by EU
Guidelines dated of March, 2023

All the main indicators and at least two complementary indicators need to be met.

Main indicators

1. Native species

   Old-growth forests are composed of native species. However, the presence of a small number of non-native trees should not disqualify a forest from being designated as old-growth, if they do not significantly disturb ecological processes.

2. Deadwood

   Old-growth forests are characterised by a high proportion and diversity of standing and lying deadwood. The amount and type of deadwood can vary greatly between old-growth forests (depending on the forest type, the local environmental conditions, and the area's recent disturbance history).

3. Old or large trees

   Old-growth forests are often characterised by a high volume of standing trees relative to earlier development stages for the given forest type and local growing conditions, and by the presence of old or large trees, some of which may reach the maximum age known for the species under the local site conditions.

Complementary indicators

4. Stand origin

   Most old-growth forest stands originate from natural regeneration, but some sown or planted forests can meet the definition, if given enough time to develop the characteristics of old growth forests.

5. Structural complexity

   Old-growth forests are generally characterised by structural complexity. This can include a multi-layer canopy structure, horizontal structural diversity, and soil microrelief structures such as mounds caused by uprooting.

6. Habitat trees

   Old-growth forests are often characterised by the high density and high diversity of tree-related microhabitats. These are defined as a 'distinct, well-delineated structure occurring on living or standing dead trees, that constitutes a particular and essential substrate or life site for species or species communities during at least a part of their life cycle to develop, feed, shelter or breed' [14].

7. Indicator species

Main indicators

- Native species: yes, 100%
- Deadwood: yes
- Old or large trees: not sure…

Which indicators relevant for hemiboreal forests ?

All the main indicators and at least two complementary indicators need to be met.

Main indicators

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Complementary indicators

- Stand origin?
- Structural complexity?
- Habitat trees?
- Indicator species?

Do we have **data** on each indicator? How does **that impact** the area of OGF?

Which complementary indicators relevant for hemiboreal forests ?

Complementary indicators

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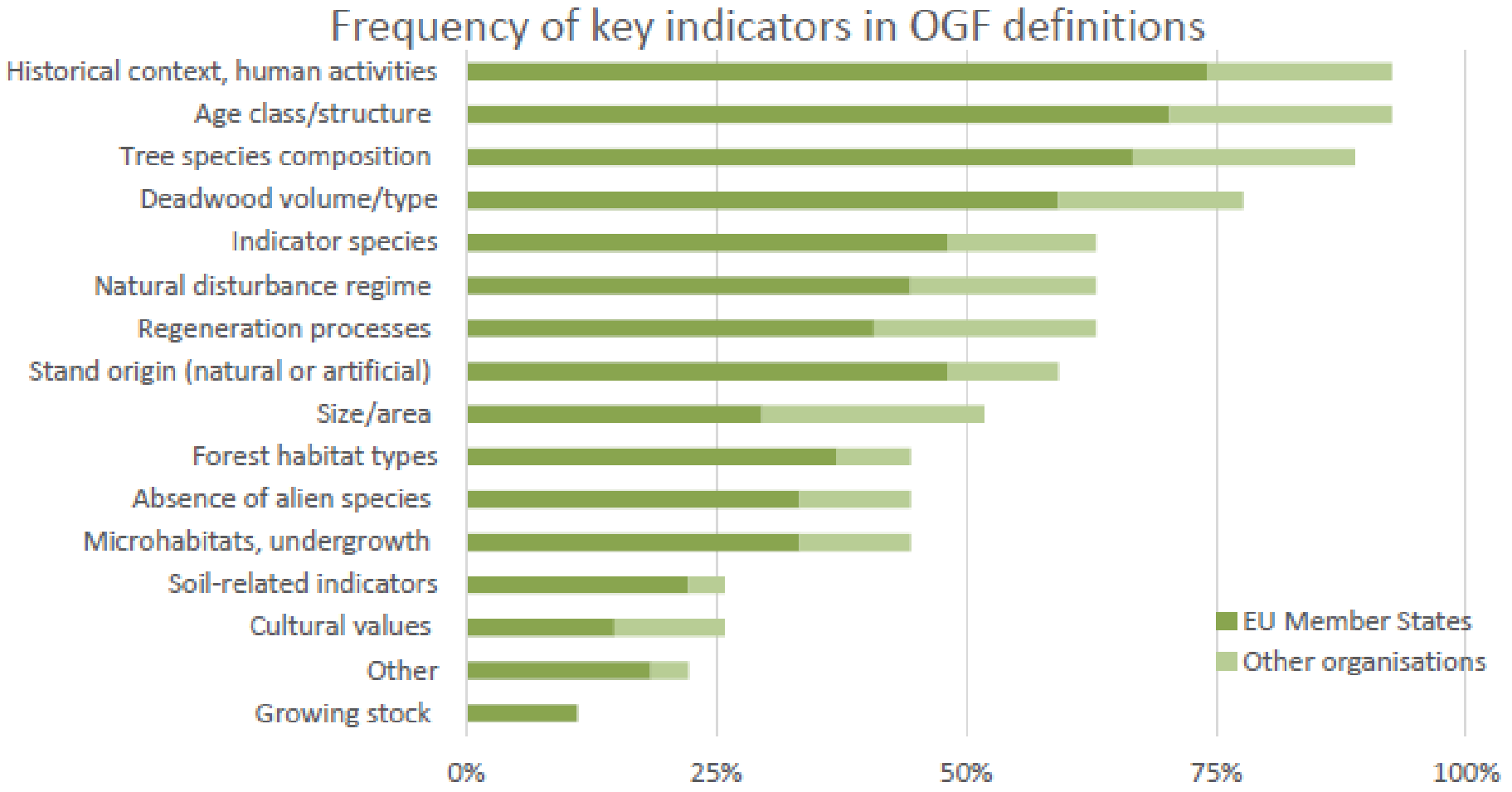
7. Indicator species

Old growth forests indicators used



EC, 2023

Old growth forests indicators used

Indicators of Old-Growthness (OGI's)

- Large/old trees
- Dead wood quantity & quality
- Structural complexity: age, tree size, biomass distribution, layering, gaps,…)
- Tree species composition
- Soil microstructures (pits and mounds)
- Tree related microhabitats
- Presence of indicator species

Old growth forests indicators used

Indicators of Old-Growthness (OGI's)

Criterium 1 : presence of large and old trees :

- presence of old (overmature) and/or Very Large Trees (N/ha)
- dominance of large and very large trees : share of biomass/basal area covered by LT and VLT (m^2/ha; m^3/ha; % of BA/growing stock)
- presence of old trees : tree age surpasses ½ of its maximum lifetime for local conditions (N/ha) Age of the 3 oldest trees per ha; Average age of dominant trees
- presence of trees with specific lifetime growth trajectories
- Tree with the highest DBH

(Helms, 2004; Wirth et al., 2009; Nagel et al., 2013; Hofmeister et al. 2015; Piovesan et al. 2019; Piovesan and Biondi, 2021, Meyer et al., 2021)

Old growth forests indicators used

Indicators of Old-Growthness (OGI's)

Criterium 2 : quantity and quality of lying and standing deadwood

- total quantity of deadwood (m^3/ha)
- DBH-range of deadwood (SD, Min/Max, interquartile range)

- presence of coarse woody debris (DBH threshold 30-50cm or 1 m^3): volume/ha;
- share of deadwood on total aboveground biomass (%)
- diversity and share of different types of coarse woody debris : decay stages, standing and lying (% per category)

(e.g. Wirth et al., 2009, Nagel et al., 2013, Hofmeister et al., 2015; Meyer et al., 2021)

Old growth forests indicators used

Indicators of Old-Growthness (OGI's)

Criterium 3 : Structural diversity of living stand:

- high aboveground biomass (BA or volume/ha)
- diameter/size distribution + spatial pattern of tree sizes (SD on diameter, InterQuartile Range, ...)
- presence of different age cohorts
- horizontal diversity : random or clumped spacing of trees (vs. regular spacing : Ripley's function)
- horizontal diversity : diversity in canopy density (scale or %); spatial patterns of canopy dimensions and canopy gaps (gap pattern and size distribution,...)
- vertical diversity : layering and vertical continuity of the canopy (Height-distribution)

(e.g. Wirth et al., 2009; Alessandrini et al. 2011; Ziaco et al. 2012; Nagel et al., 2013, Meyer et al., 2021)

Old growth forests indicators used

Indicators of Old-Growthness (OGI's)

Criterium 4 : Tree species composition:

- tree species diversity (N/plot; N/ha or Shannon-index)
- share of non-native species (presence/absence or admixture: % of BA or volume)
- share of late-successional species (% of BA or vol.)
- composition of regeneration (native vs. non-native; planted vs. natural regeneration)

(e.g. Wells et al., 1998; Mosseler et al., 2003; McElhinny et al., 2006; Larrieu & Cabanettes, 2012, Meyer et al., 2021)

Old growth forests indicators used

Indicators of Old-Growthness (OGI's)

Criterium 5 : soil microstructures (micro-relief)

- density and size of pit-and-mound structures (N/ha)

(e. g.. Barker Plotkin et al. 2017; Meyer et al., 2021)

Criterium 6 : tree microstructures

- Density of habitat trees = trees bearing Tree related Microhabitats (TreMs) (N/ha)
- share of trees with TREMs
- diversity and density of TREMs per plot or per ha

(Paillet et al., 2017; Larrieu et al.2018; Meyer et al., 2021)

Old growth forests indicators used

Indicators of Old-Growthness (OGI's)

Criterium 7 : presence of indicator species

- presence of indicator species (fungi, lichen, insects, birds) of late-seral stages or indicative for long continuity of late-seral stages with overmature trees and large dead wood.

(cfr. Nitare et al. 2000; Christensen et al. 2005b; Eckelt et al., 2018; Hofmeister et al., 2019).

This last criterium is commonly applied in the delineation of High Nature Value forests, often old-growth forests in Scandinavia. In other countries, the delineation or assessment of old-growth is mainly based on the above structural features.

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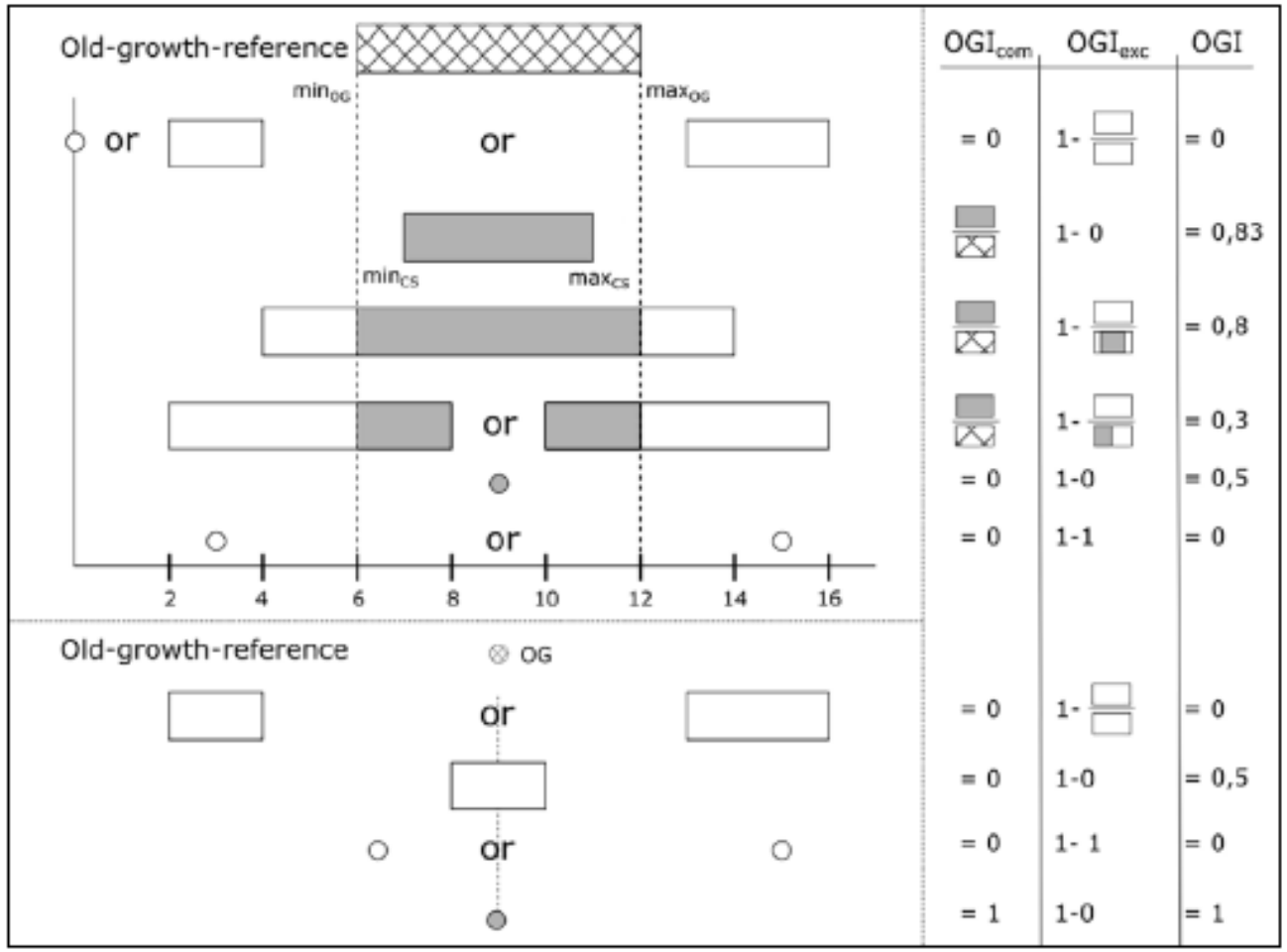
Old growthness measured



Source: Meyer et al. (2021) Ecol. Indic.

Old growth forests currently defined in Latvia

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Assessment of old-growth stands in Latvia

SILAVA

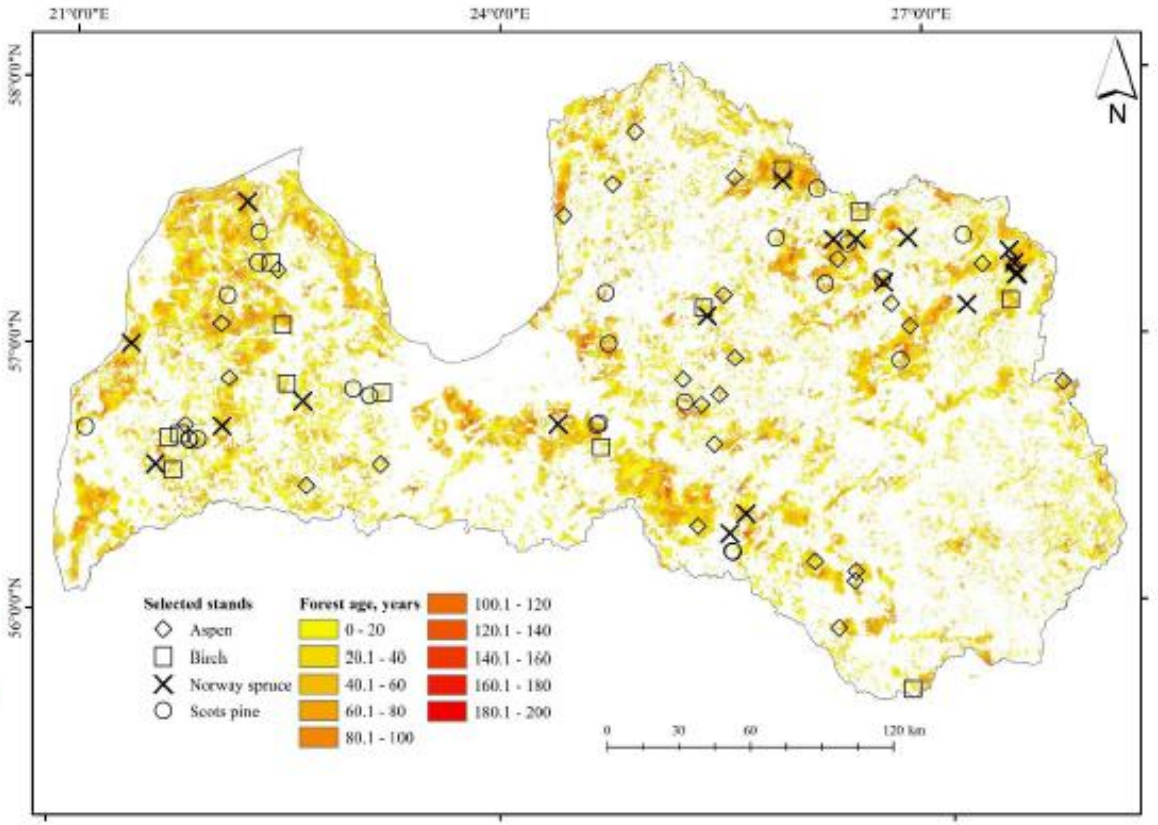
- *Stands*: 82 (507 plots);
- *Age:*

Pine 163 - 218 years
Spruce 170 - 205 years
Birch 123 - 148 years
Aspen 104 - 135 years

- *Forest on mesotrophic and oligotrophic mineral soils:* Dm, Vr.

- *Dominant species and age class*

> 50% from basal area of first layer;
Thus we are assessing the maximum, rather than the average: the specific case, where old-trees dominate the old-growth forests



Kenina et al.

Forest Types

51%

49%

Normal moisture regime

6 forest (ecosystem) types

21%

Wet

10%

mineral

5 forest types

11%

peat

4 forest types

30%

Drained

17%

mineral

4 forest types

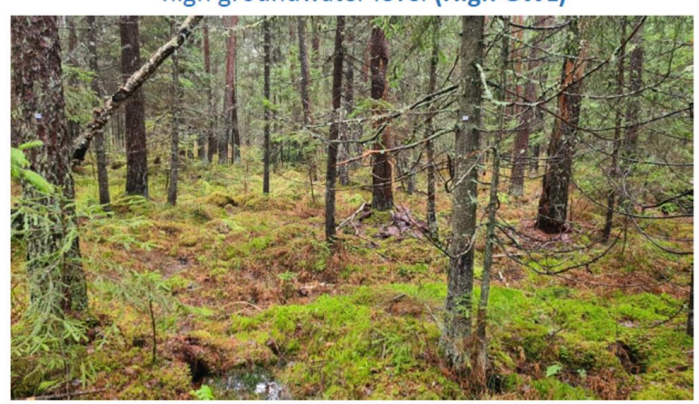
13%

peat

4 forest types

Drained mineral soil – organic layer less than 20cm, drained peat soil – organic layer more than 20cm

stands on wet (periodically waterlogged) organic soils with high groundwater level **(High GWL)**



stands on drained organic soils with low groundwater level **(Low GWL)**

Reference stand for old growth forests

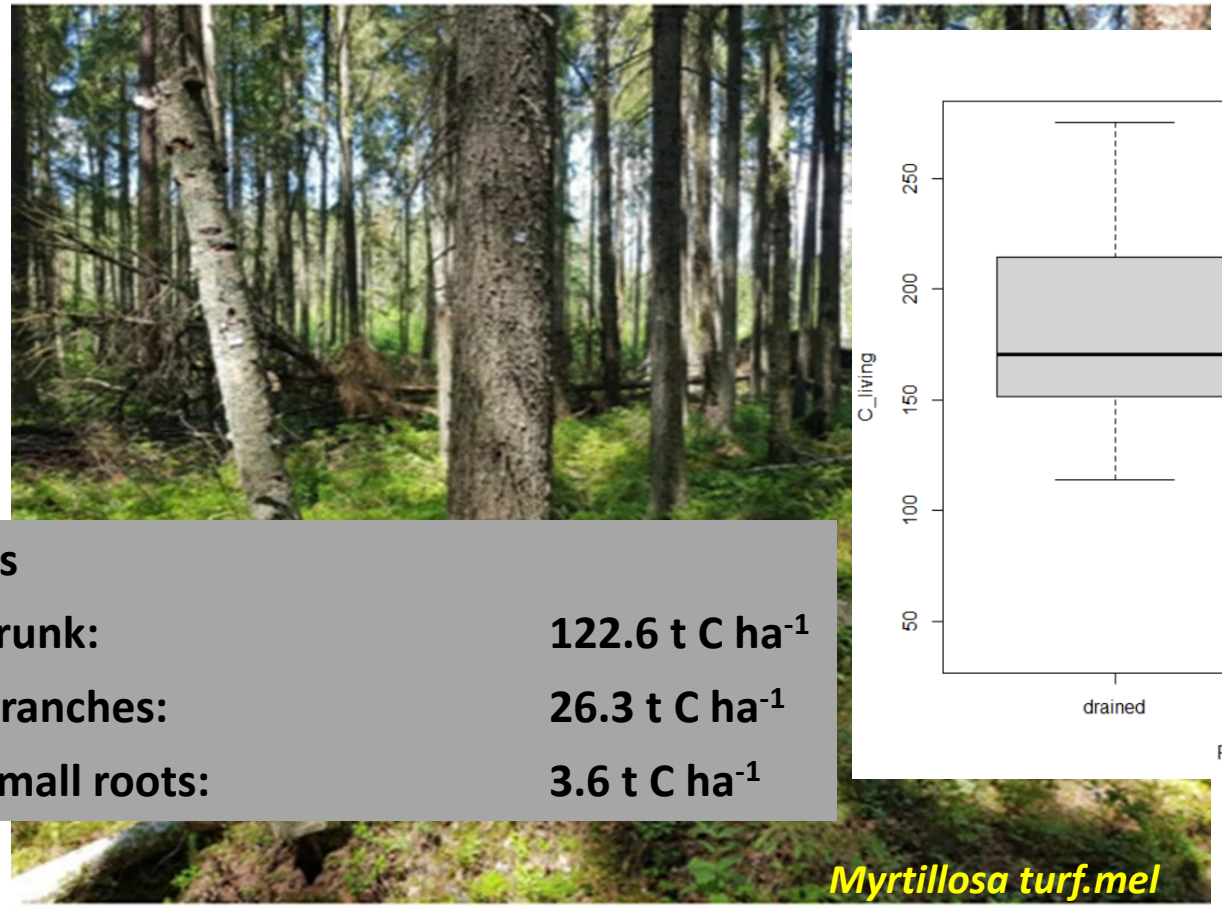
Potential reference stand:

- Slitere National Park?
- Moricsala ?
- Other area?
- Area from another country (e.g., Estonia)

How many reference stands?

- One universal (hemiboreal)?
- Broadleaves and coniferous?
- Mineral soil vs organic soil?

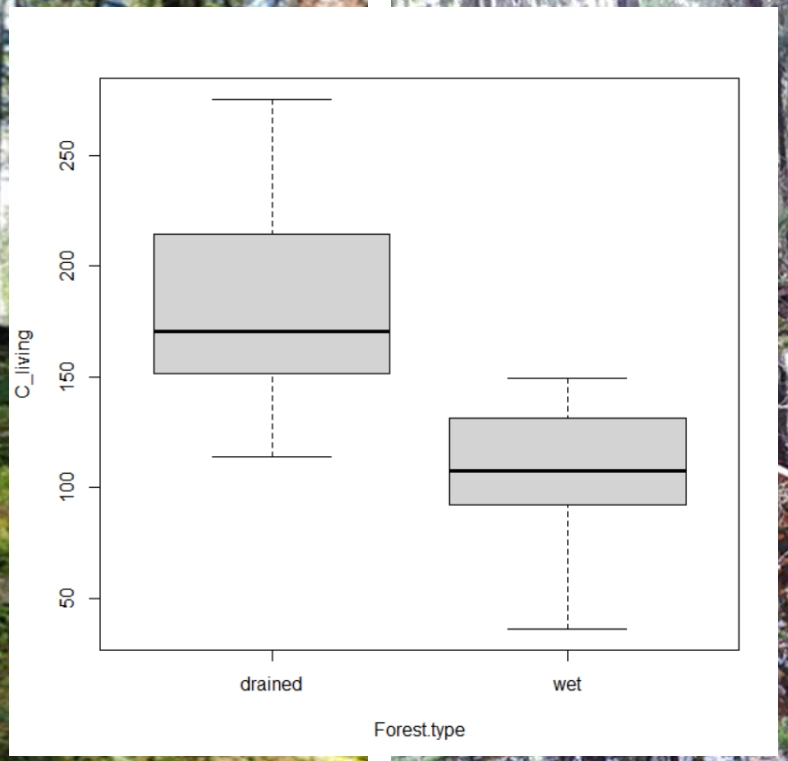
Results: C pools in living biomass

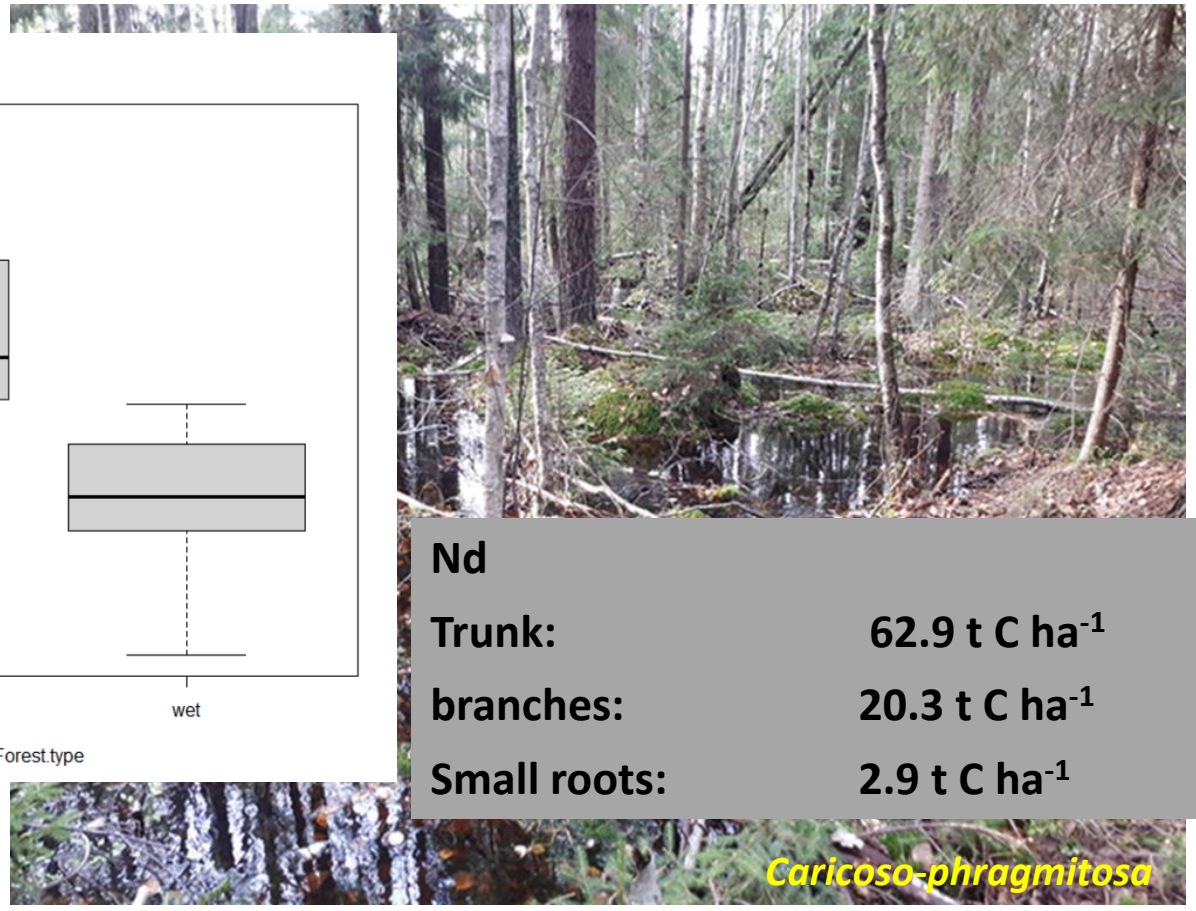


Ks

Trunk:	**122.6 t C ha^{-1}**
Branches:	**26.3 t C ha^{-1}**
Small roots:	**3.6 t C ha^{-1}**

Myrtillosa turf.mel





Nd

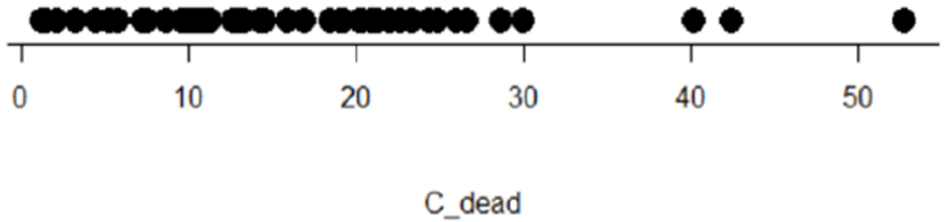
Trunk:	**62.9 t C ha^{-1}**
branches:	**20.3 t C ha^{-1}**
Small roots:	**2.9 t C ha^{-1}**

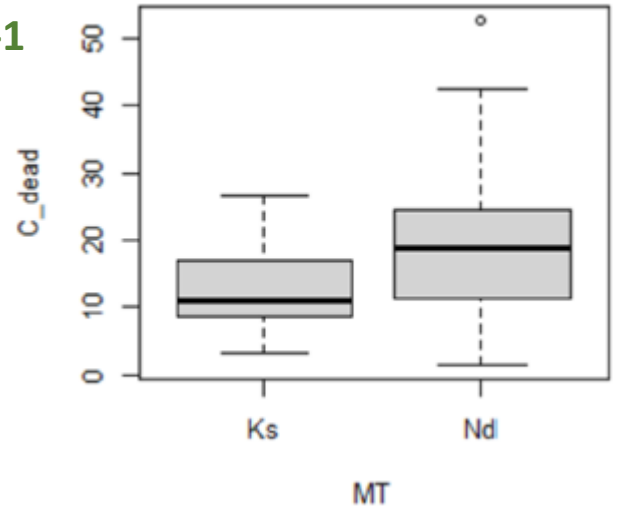
Caricoso-phragmitosa

- C in living biomass on wet soils stored 105.6 t C ha^{-1} and on drained 186.6 t C ha^{-1}
- **C storage by growing conditions differs significantly (p=0,0001)**
- Most prominent differences in stem C pool, respectively on drained and wet organic soils 122.6 vs 62.9 t C ha^{-1}

Results: C in deadwood

Mean C in deadwood **16.5 t C ha^{-1}** with high variability ranging from 1.2 t C ha^{-1} to 52.7 t C ha^{-1}





Ks -*Myrtillosa turf.mel*
Nd- *Caricoso-phragmitosa*

Photo credit: *LVMI Silava*

Deadwood C was larger on wet soils (18.8 t C ha^{-1}) and comparatively smaller on drained soils (12.7 t C ha^{-1}), however the difference was not significant (p=0,05687)


Photo credit: *LVMI Silava*

Thank you!

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