



Mapping methodologies in Latvia

Primary and Old-Growth Forest Mapping: Methodologies and Progress

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Who am I ?



- Slītere forest reserve
- Post-graduate studies: SE+LV+FIN
- Since 2023 a full member of Latvian Academy of Sciences
- At EU level contributed significantly to information on tree wind resistance and forest carbon pools, especially in old-growth forests



Photo: Ā. Jansons



DISCLAIMER

Preliminary data to define defining OGF. The approach is not finalized.



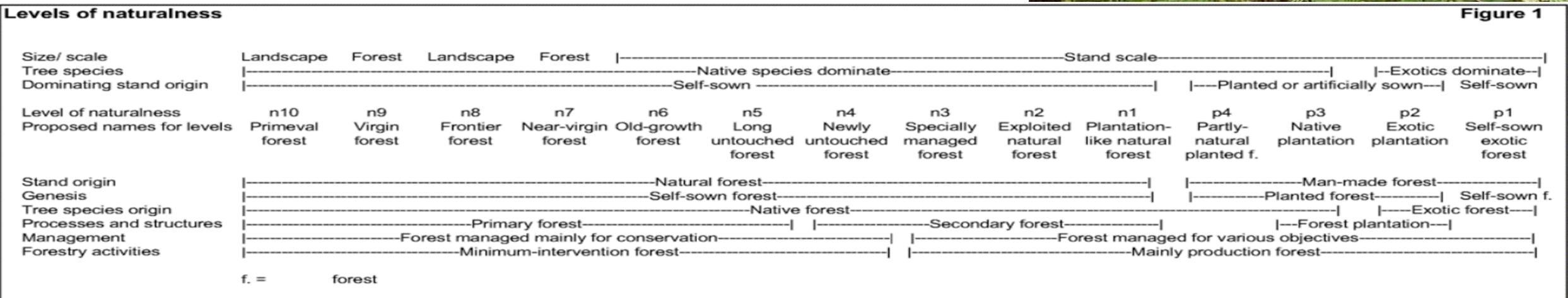
Primary & Old-growth Forests

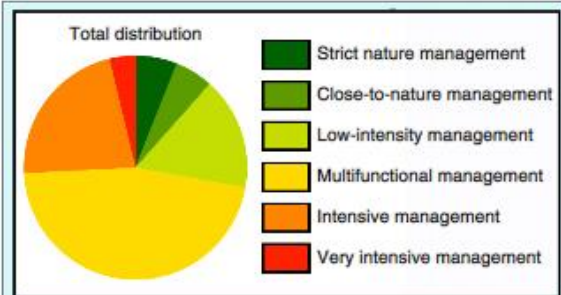
Considering forest stand characteristic in Latvia and the definition of primary forests, we conclude that **there is no primary forests in Latvia.**

Forests stands that can be defined as **old-growth forests** based on Buchwald (2005).

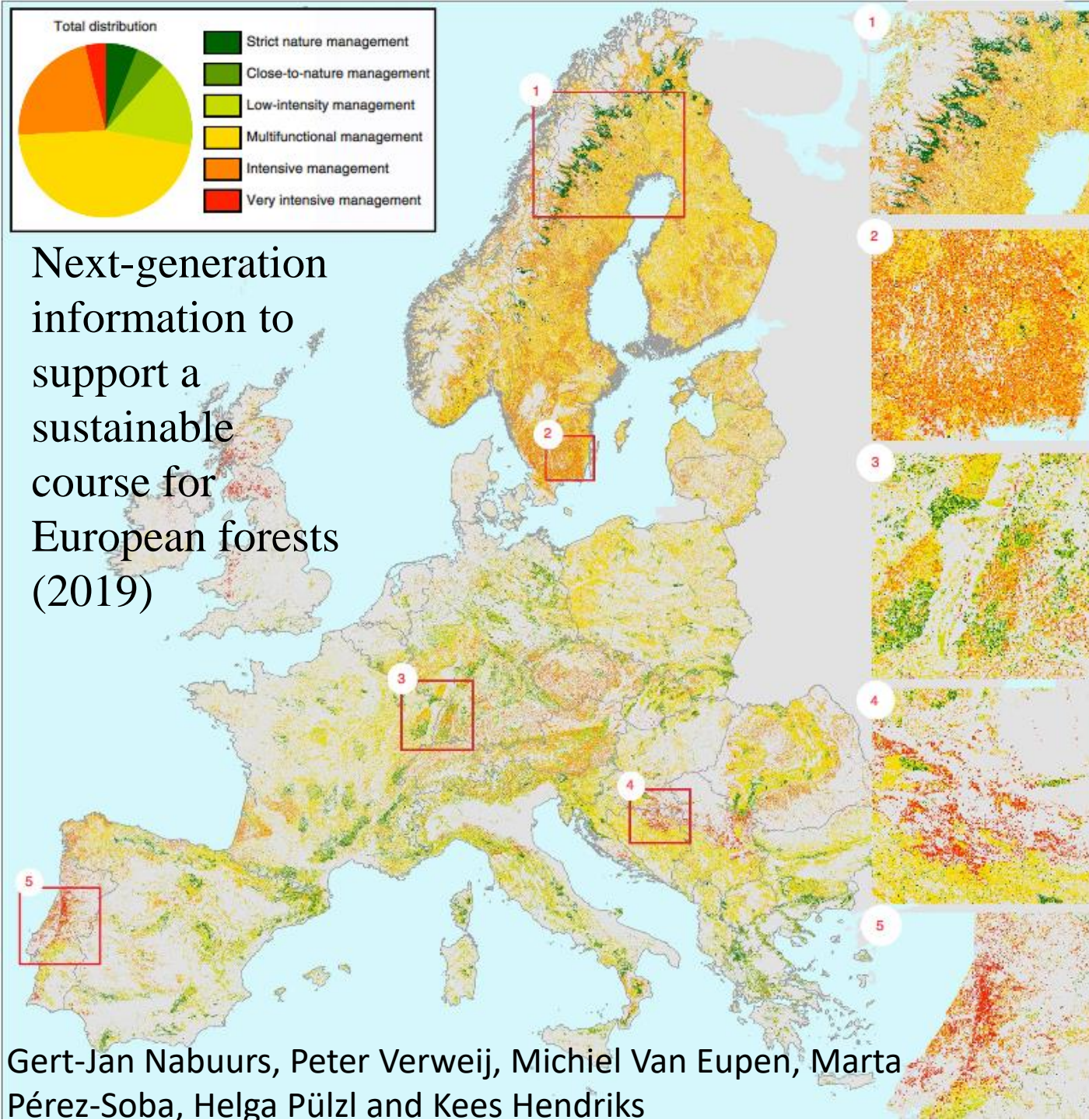


Figure 1





Next-generation information to support a sustainable course for European forests (2019)

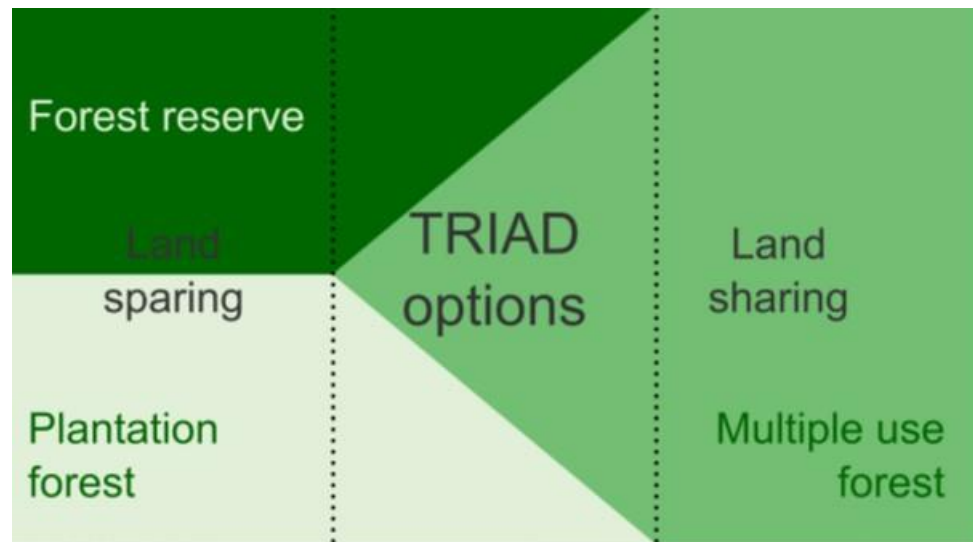


In Latvia (c.a. half of the country is forest) we are practicing multifunctional management, leading to:

- 1) small gap sizes, resulting in mosaic structure of forest – average size of final harvest 1,9-2 ha;
- 2) balanced species composition with 45% of coniferous-dominated and 55% of broadleaved tree dominated stands
- 3) increasing proportion of mature and old stands even in areas, where final harvest is allowed;
- 4) increasing share of deadwood, 20 m³ ha⁻¹ on average

Forest protection: how to allocate?

Currently we are moving towards segregation of forest areas in Europe, and application of triada approach



Thus the selection of areas for each of the goals is crucial. The EU Biodiversity Strategy (2030) makes the preservation of Europe's old-growth forests one of its priorities.

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

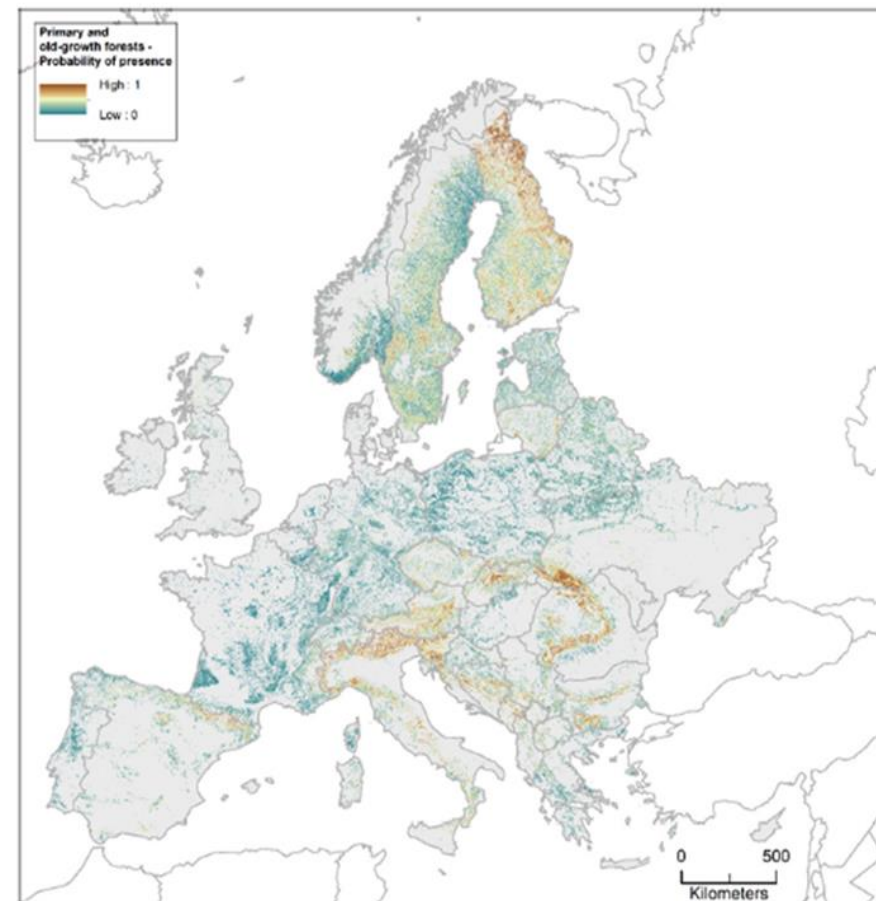


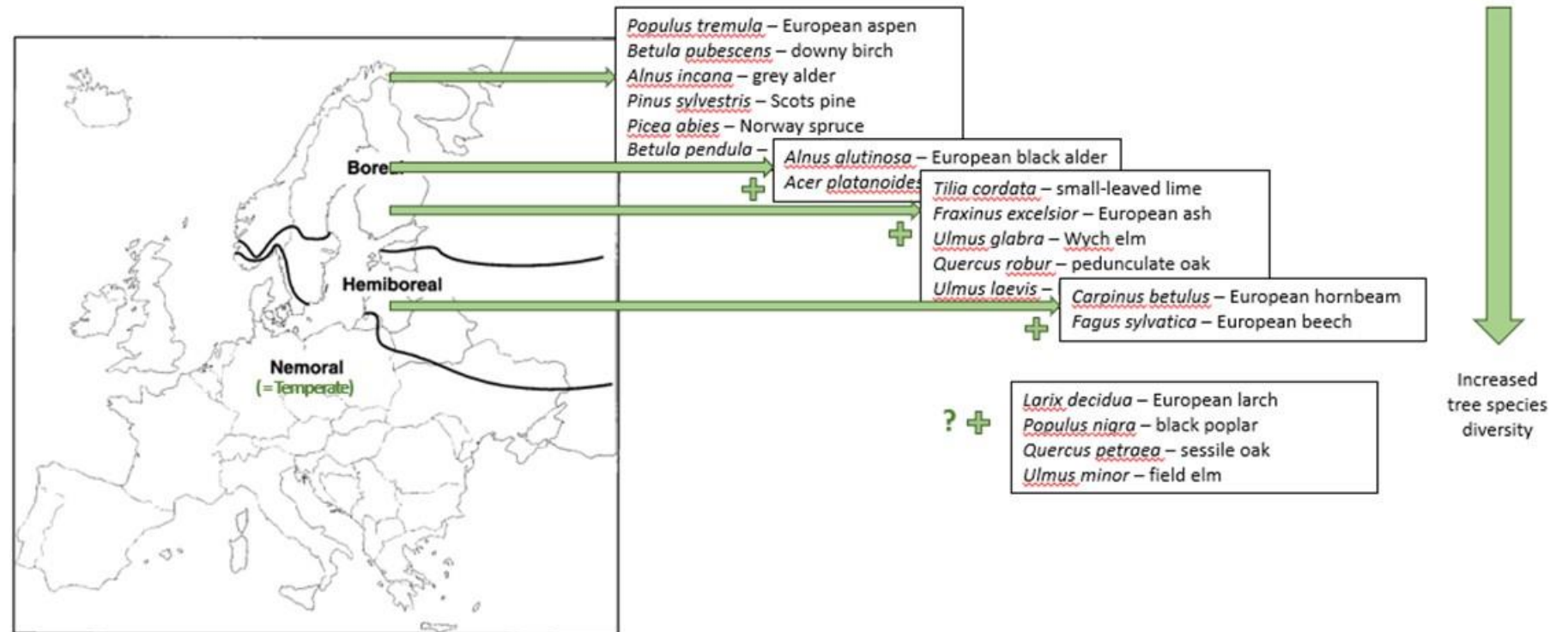
Figure 5. Likelihood of presence of primary and old-growth forests. Map at 250 m grid size implemented by Sabatini et al. (2020b) using a spatially explicit boosted regression trees model relating the presence of primary and old-growth forests and 15 biophysical, socio-economic and historical land use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

Source: Sabatini et al. 2020

Biomes and tree species in the Nordic-Baltic region

Delineation of old-growth forests for protection has to be country/region specific, since the conditions vary between the eco- and forest history regions

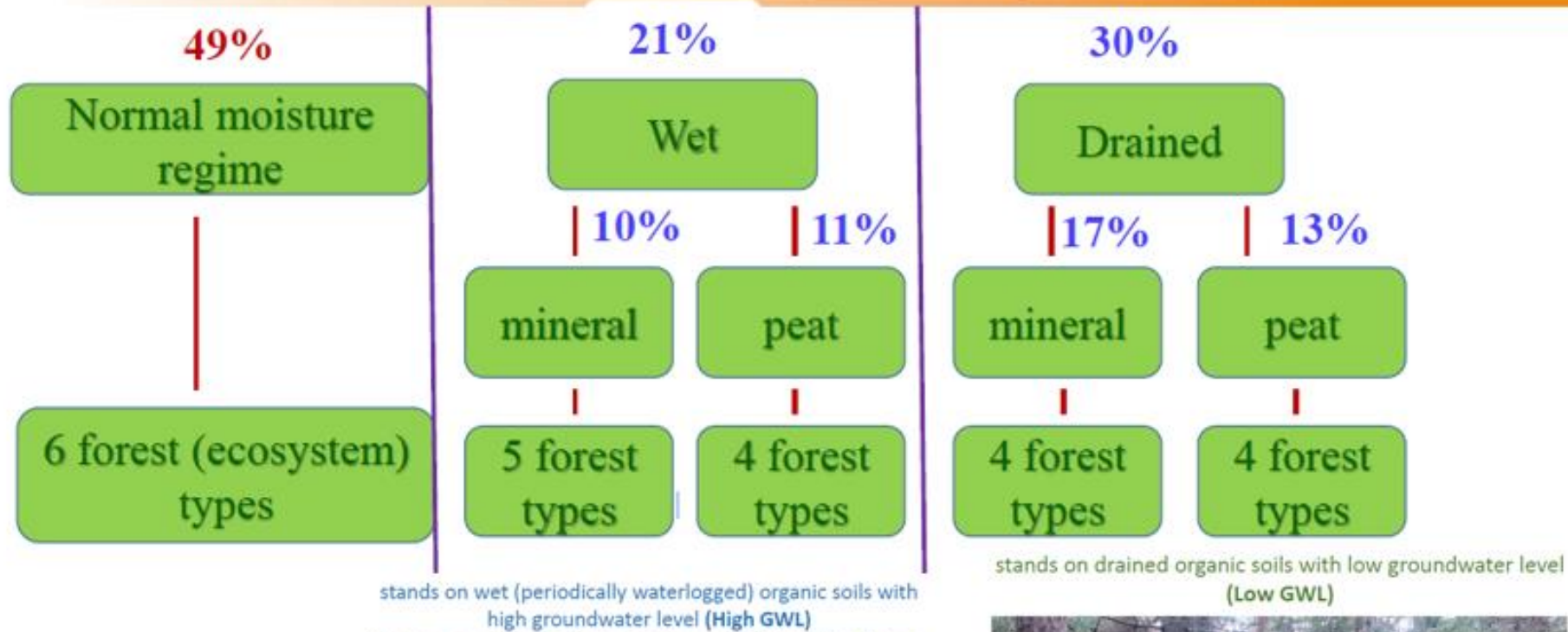
Hemiboreal forests



.1 The forest zones of north-west Europe as defined by Ahti et al. (1968)

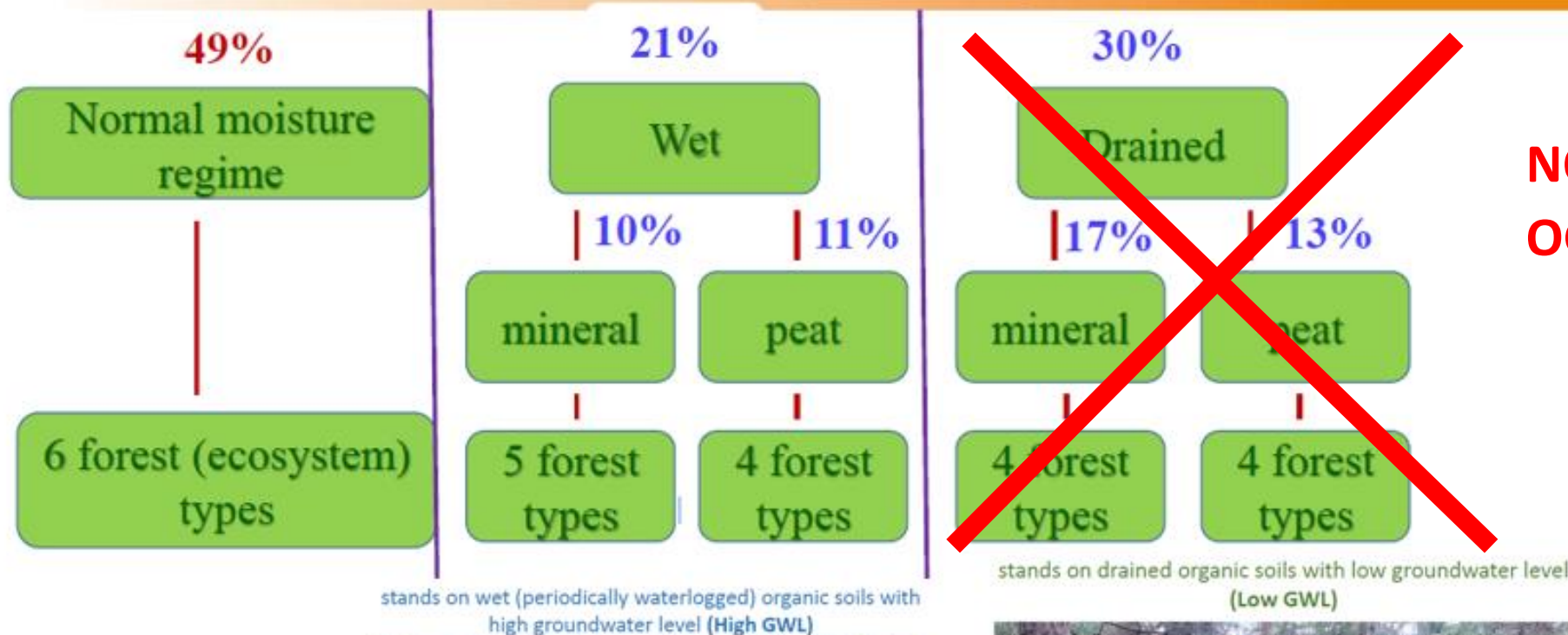
Graph: Bradshaw and Edenius 1998

Different forest growing conditions in Latvia



More than 20 different forest types!

Different forest growing conditions in Latvia



NOT a subject of OGF delineation



Old growth forests indicators used

Old-growth forests represents very complex and diverse ecosystems within Europe. Age is the only one indicator for old-growth forests.

LIFE-PROGNOSES project



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 stands in Latvia I

Preliminary data for defining OGF. The approach is not decided yet.

In total assessed 188 stands (1128 sample plots). Stands without signs of management with old trees still being the dominant element.

Mineral soil

Spruce, mean age 182 ± 2 yrs.

Pine, mean age 179 ± 6 yrs.

Birch, mean age 131 ± 4 yrs.

Aspen, mean age 112 ± 3 yrs.

Organic soil

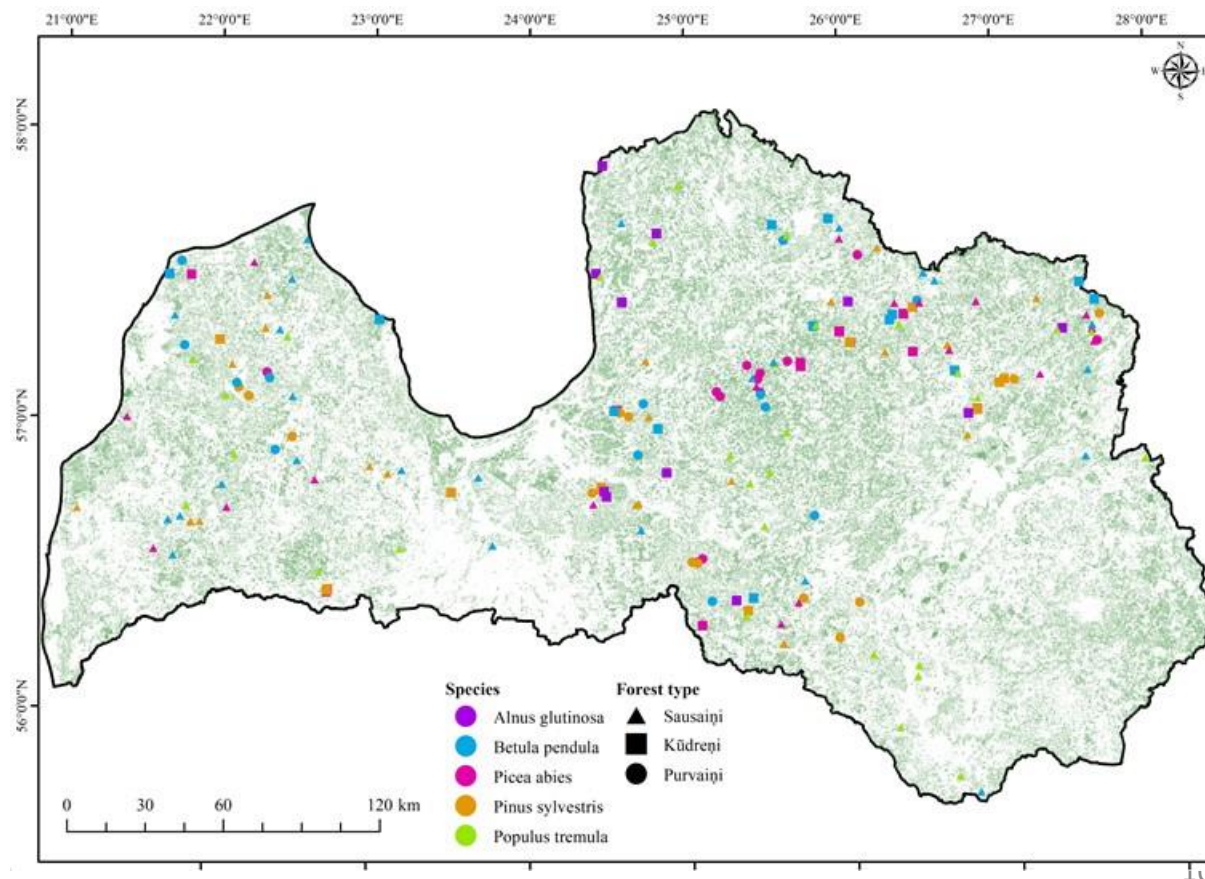
Spruce, mean age 147 ± 7 yrs.

Pine, mean age 159 ± 7 yrs.

Birch, mean age 124 ± 5 yrs.

Black alder, mean age 128 ± 3 yrs.

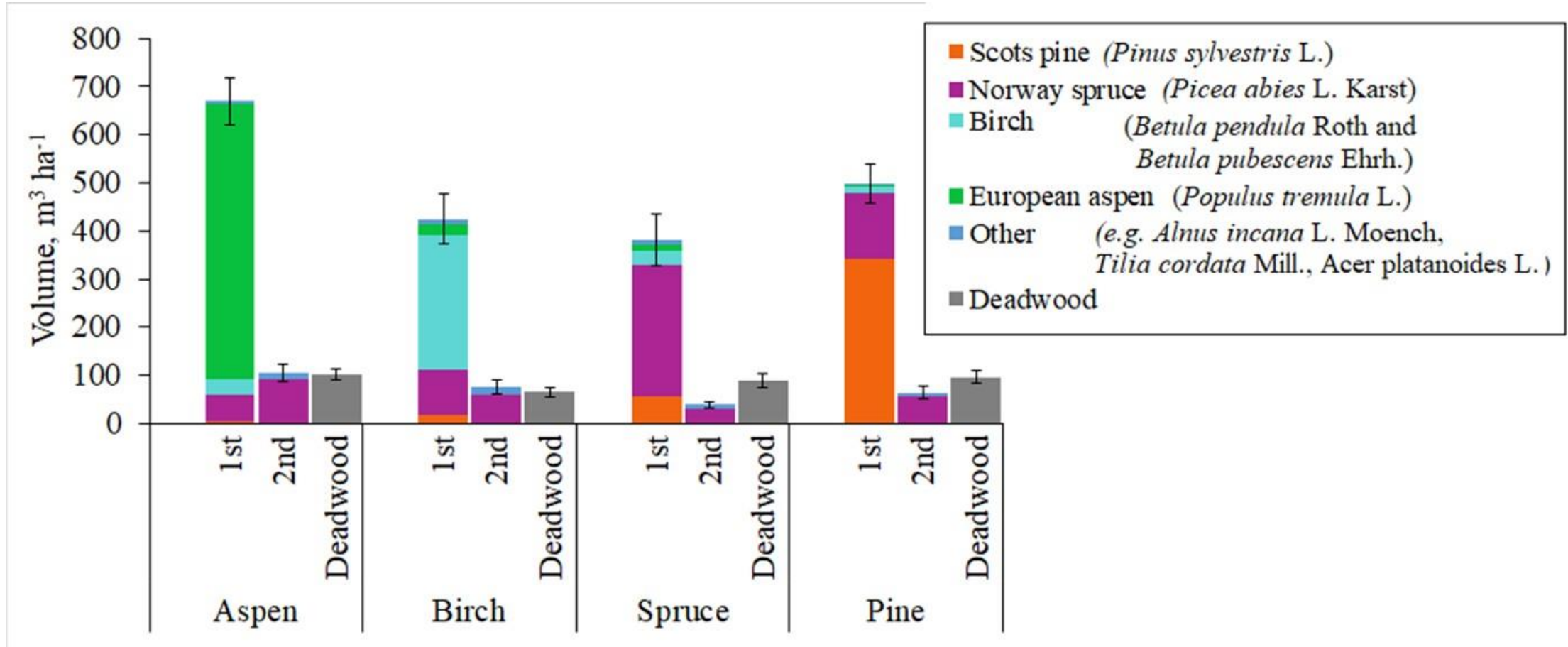
A subset of information, useful for OGF characterization, not the whole picture



Old-growth stands in Latvia II



Stand age is a complicated (and certainly not only) indicator of OGF.



- Dominant tree species ($p < 0.001$) had a significant impact on the carbon stock.
- Spruce dominance in the second layer in all the analyzed old-growth stands, indicated ongoing succession both in the old-growth coniferous (aged 163 to 218 years) and deciduous (aged 104 to 148 years) stands.

Data: Kēniņa, 2023, Samariks et al., 2023

Old growth forests: how to define?



Hemi-boreal boreal forests

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.

- Native species
(*non-specific*)

- Deadwood
(*recent-disturbance history dependent*)

- Old or large trees
(*relative to assessed species*)

Complementary indicators



- Stand origin (natural regeneration)
 - Structural complexity
 - Habitat trees
 - Indicator species
- (combined as set of EU habitats with highest biodiversity value scores)*

Which complementary indicators are relevant for hemiboreal forests ?

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.

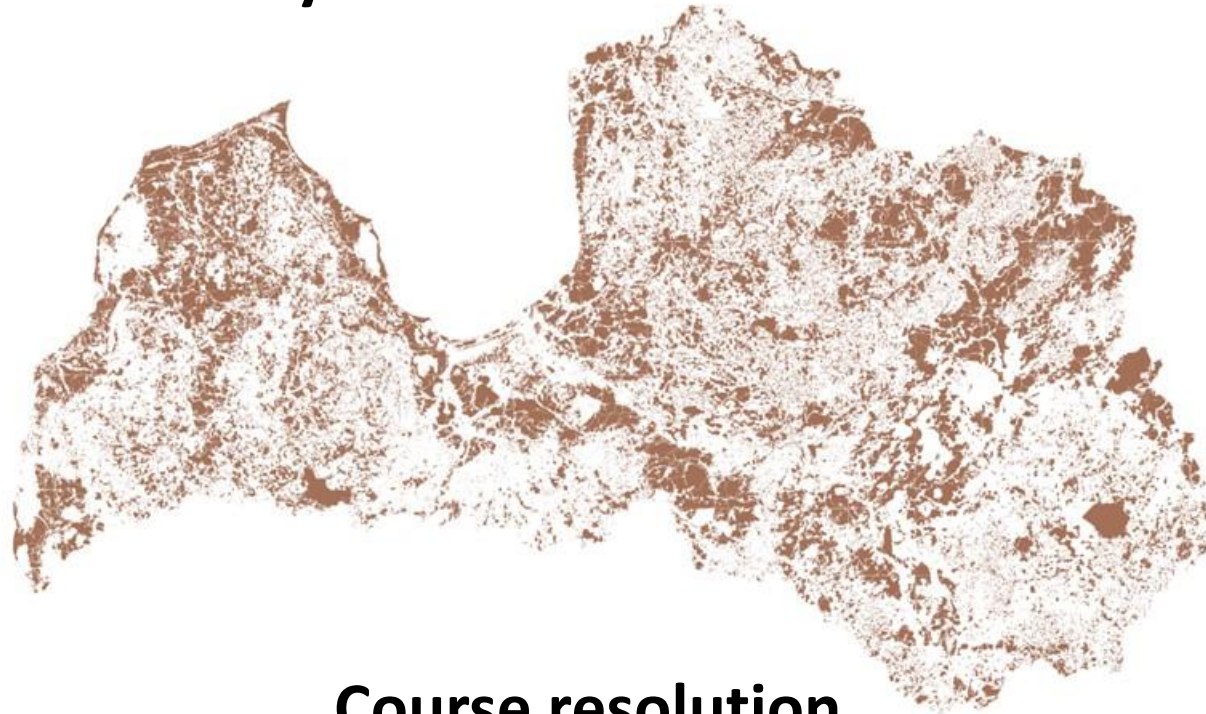
7. Indicator species

Complementary indicators: forest continuity



Forest area maps: 1941 vs 2020

Very important to identify the actual OGF areas with forest continuity!



Source: J. Donis et al.

Course resolution

Additional data source – historic forest inventory information, requires large number of human-hours, needs to be considered after the preliminary selection for each of the sites

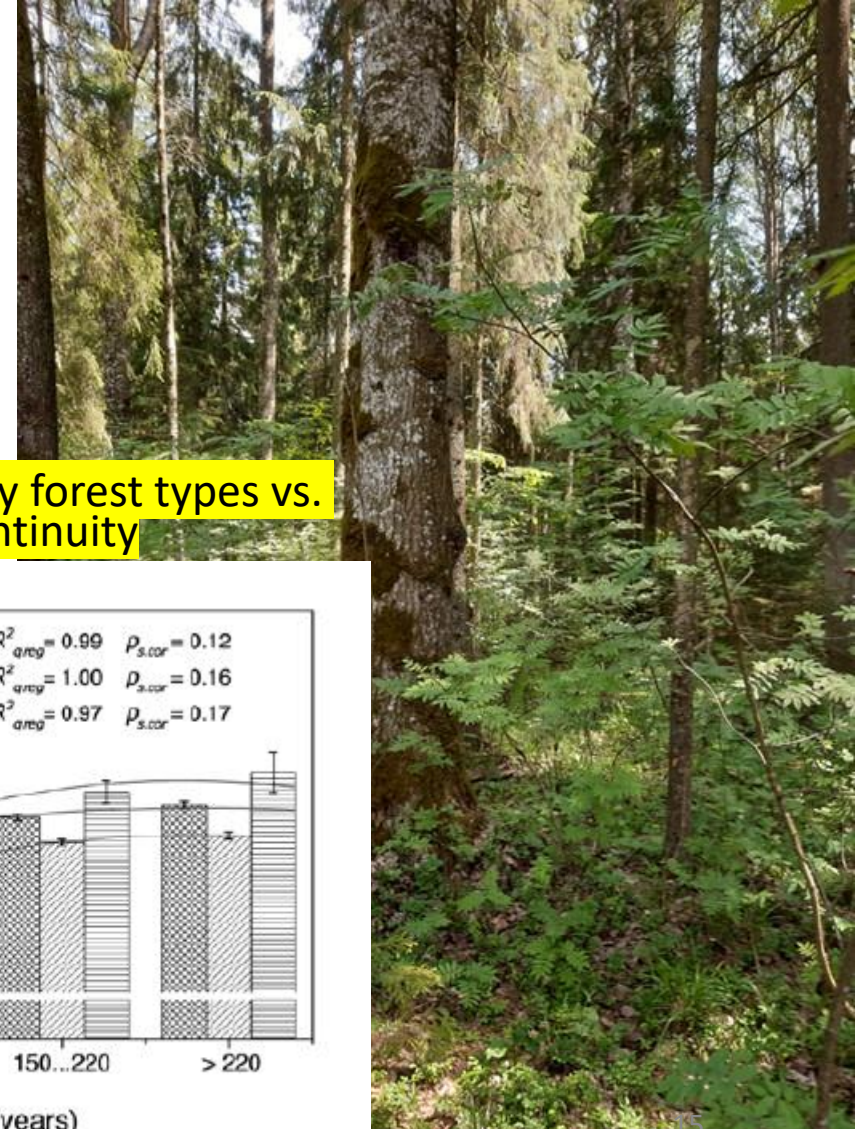
Complementary indicators: patch size

Considering the minimum size of forest stands we underline, that it should be **area large enough to maintain its natural ecological processes** (e.g., 60 ha).

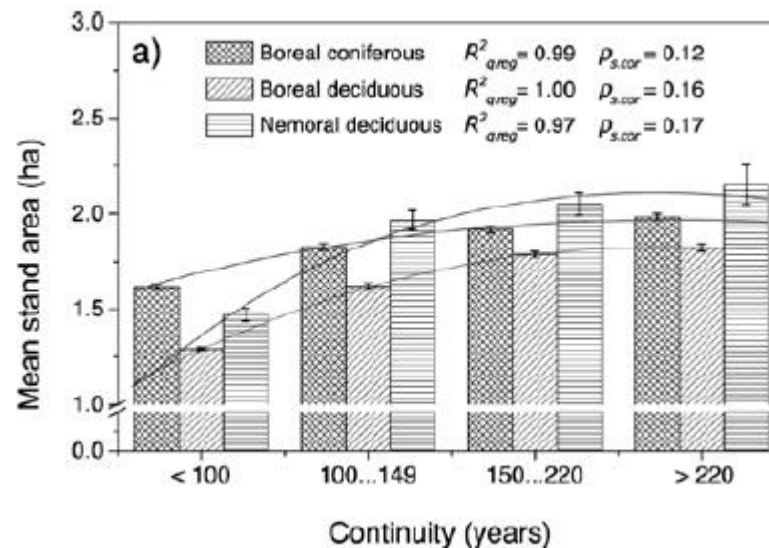
The mean stand area is positively correlated on forest continuity for all forest types

(Fescenko et al., 2016).

Moreover, most strict forest reserves in Europe are < 50 ha in size, likely too small to capture the minimum dynamic area that is necessary to maintain many old-growth and disturbance dependent taxa (Nagel et al., 2024, in prep.).



Mean stand area by forest types vs. forest continuity



Natural disturbances

How would natural disturbance impact the status of old-growth forest? Recently disturbed forests e.g., by windthrow.



Indeed, late successional forests and old-growth forests are prone to natural disturbances. **Old-growth forest** remains old-growth forest regardless of different forest stand development stages. **It includes the young generation, originating from natural succession.**

This approach requires, that delineation of OGF is one-time action, monitoring of delineated OFG is a continuous measure.



In Latvia, most of terrestrial area would become OGF, if left alone for sufficiently long time. We need to identify and protect the territories, where it has been the case already, sufficient in size for natural dynamics occurring, to ensure a diverse forest landscape

Stakeholders



Have stakeholders (e.g. forest owners, environmental NGOs, public forest managers) and/or the public been involved in the process of establishing the mapping methods?

Have multiple agencies or relevant stakeholders been involved in the process of defining and mapping primary and old growth forests, such as national agencies that manage forests, agencies that deal with conservation, as well as research institutions and universities?

We are very open to work with stakeholders!
(work has just begun currently)

LSFRI Silava

Latvia University of Life Sciences and Technologies

4 PhD students with 1 doctoral thesis defended in 2023

NGOs

Latvian Forest Certification Council


PROMOCIJAS DARBS
zinātnes doktora grāda
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meža un veterinārās zinātnēs iegūšanai

**OGLEKĻA UZKRĀJUMS VECĀS MEŽAUDŽĒS
HEMIBOREĀLAJOS MEŽOS
AR SAUSĀM MINERĀLAUGSNĒM**

Laura Kēniņa

**CARBON STOCK IN OLD-GROWTH STANDS
ON MINERAL SOILS
IN HEMIBOREAL FORESTS**

DOCTORAL THESIS
for the doctoral degree
Doctor of Science (Ph.D.)
in Agriculture, Forestry and Veterinary Sciences



Conclusions



- Old-growth forests represents very complex and diverse ecosystems within Europe. Age certainly is not the only one indicator for old-growth forests.
- Even old-growth stands can be very widely regarding different characteristics, highly **impacted** by both the dominated tree species and stand growing conditions. **Therefore, it is essential to obtain empiric data for each region in Europe separately.**
- **Old-growth forests and old forest stands are not the same.** Within old-growth forests can grow not only old forest stands as dominating element, but it is also possible that e.g. due to natural disturbances old stands are lost and with regeneration replaced by young stands as the dominated element.
- Self-sustaining size, no drainage, natural regeneration and forest continuity are essential characteristics to delineate and protect the truly valuable OGFs and one-time assessment with continuous monitoring is the essential part of the concept to learn from these areas.
- ***With new forest science publications, during the recent years the knowledge on old-growth forests has improved. However, on the EU level still large uncertainty remains due to the wide variety of old-growth forests and lack of data.***



Thank you!

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