



Old-growth forests in Latvia

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Skogssällskapet

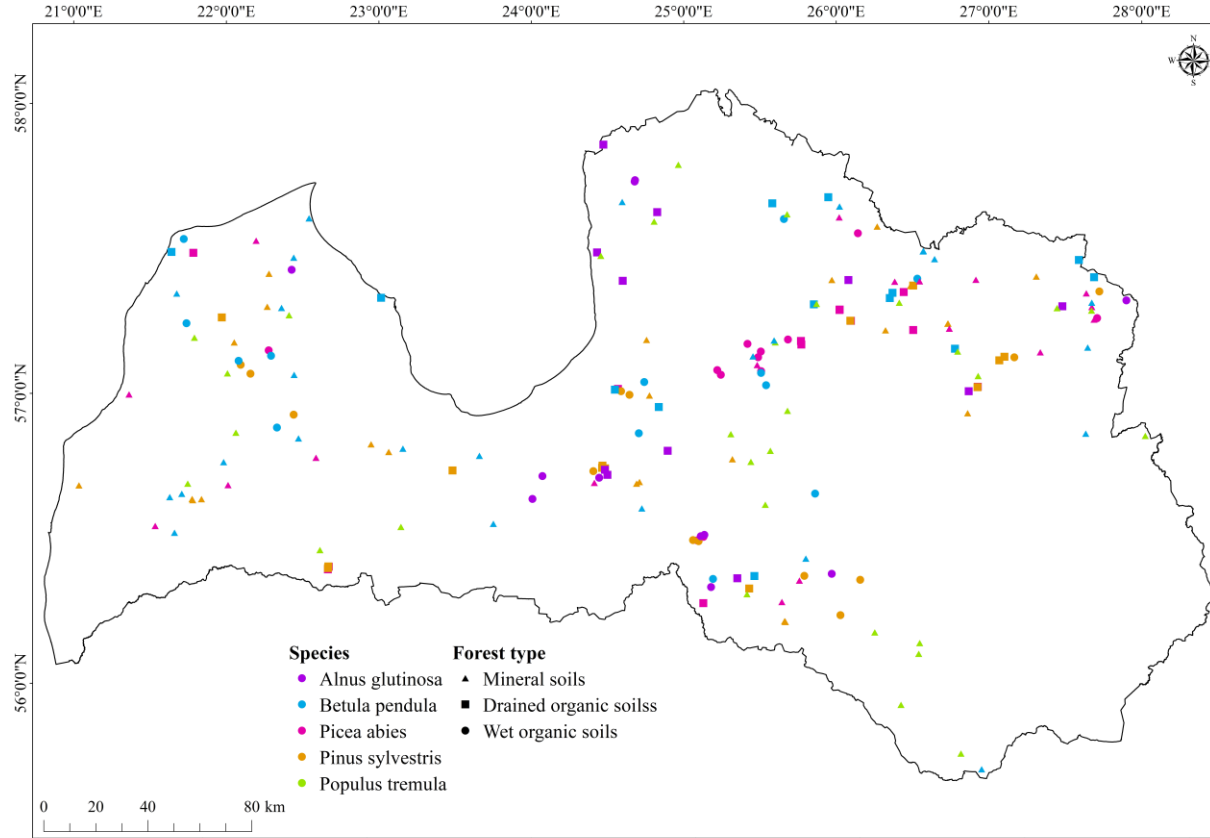
LATVIJAS MEŽU ĪPAŠUMI

INGKATM
INVESTMENTS

Old-growth forests in the context of climate policy: what is and what is not an old-growth forest?

12-13.10.2023.

What have we measured?



- Old trees is (still) the dominant forest element
- No detectable signs of management
- Altogether 188 stands and 1128 sample plots

○ Old-growth forests on mineral soils:

Spruce 170 to 205 years old (182 ± 2 years)
Pine 170 to 218 years old (179 ± 6 years)
Birch 123 to 148 years old (131 ± 4 years)
Aspen 104 to 135 years old (112 ± 3 years)

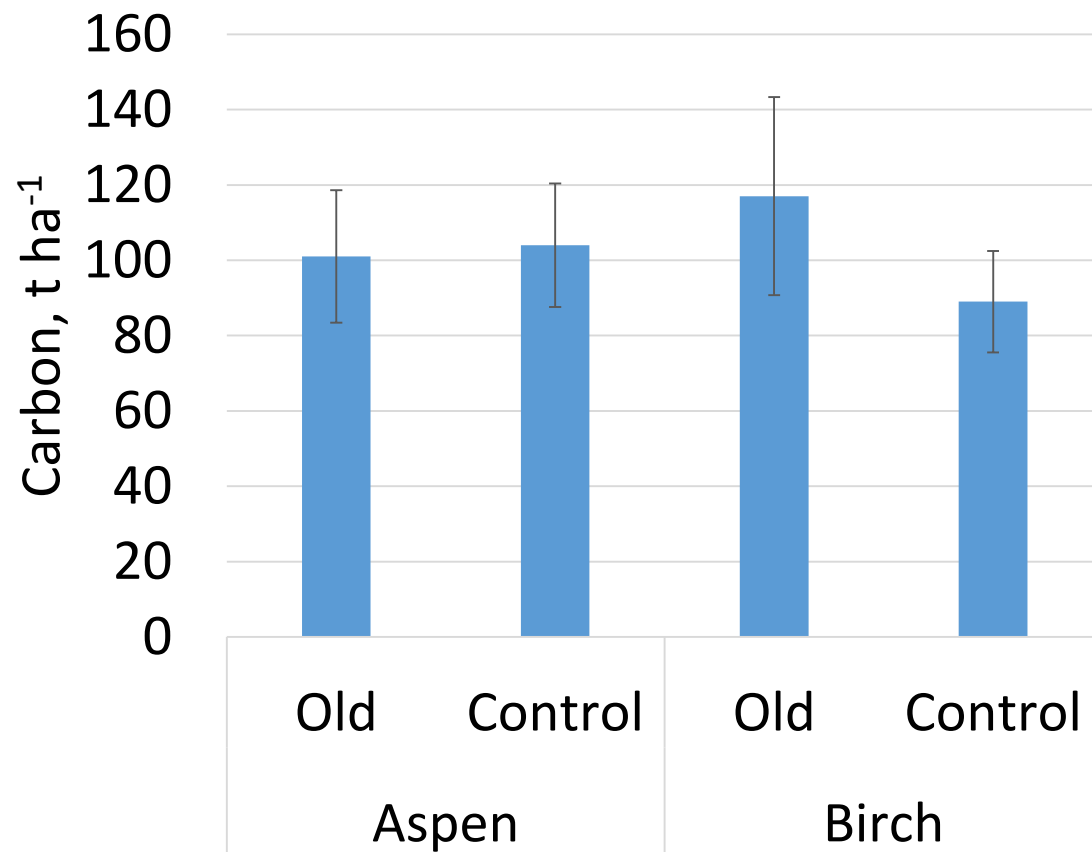
○ Old-growth forests on organic soils:

Spruce 124 to 175 years old (147 ± 7 years)
Pine 131 to 188 years old (159 ± 7 years)
Birch 111 to 164 years old (124 ± 5 years)
Black alder 111 to 146 years old (128 ± 3 years)

What have we found?

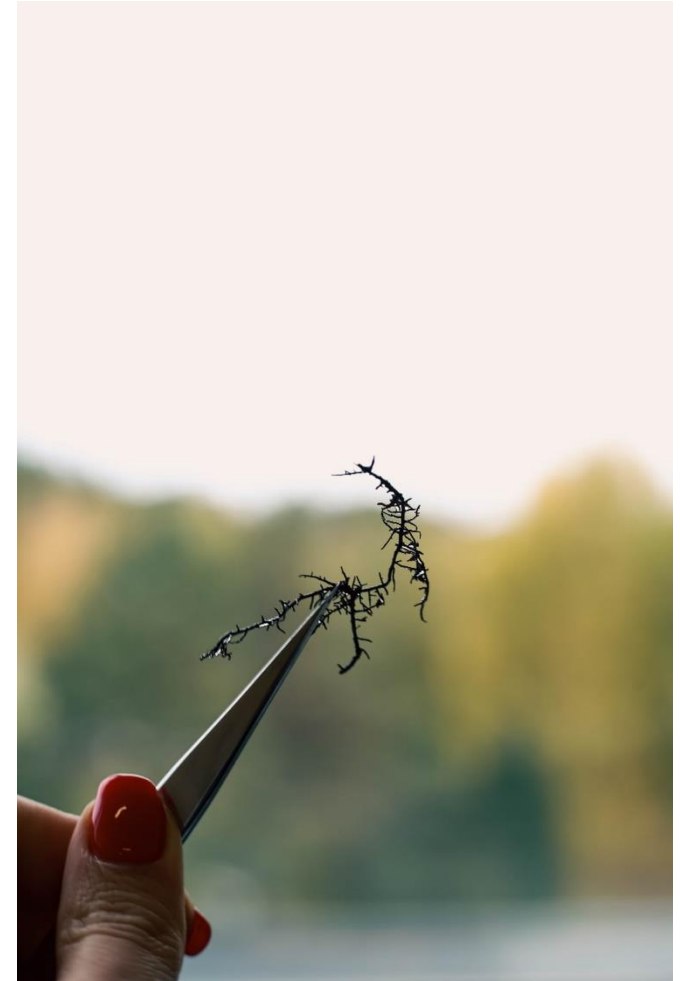
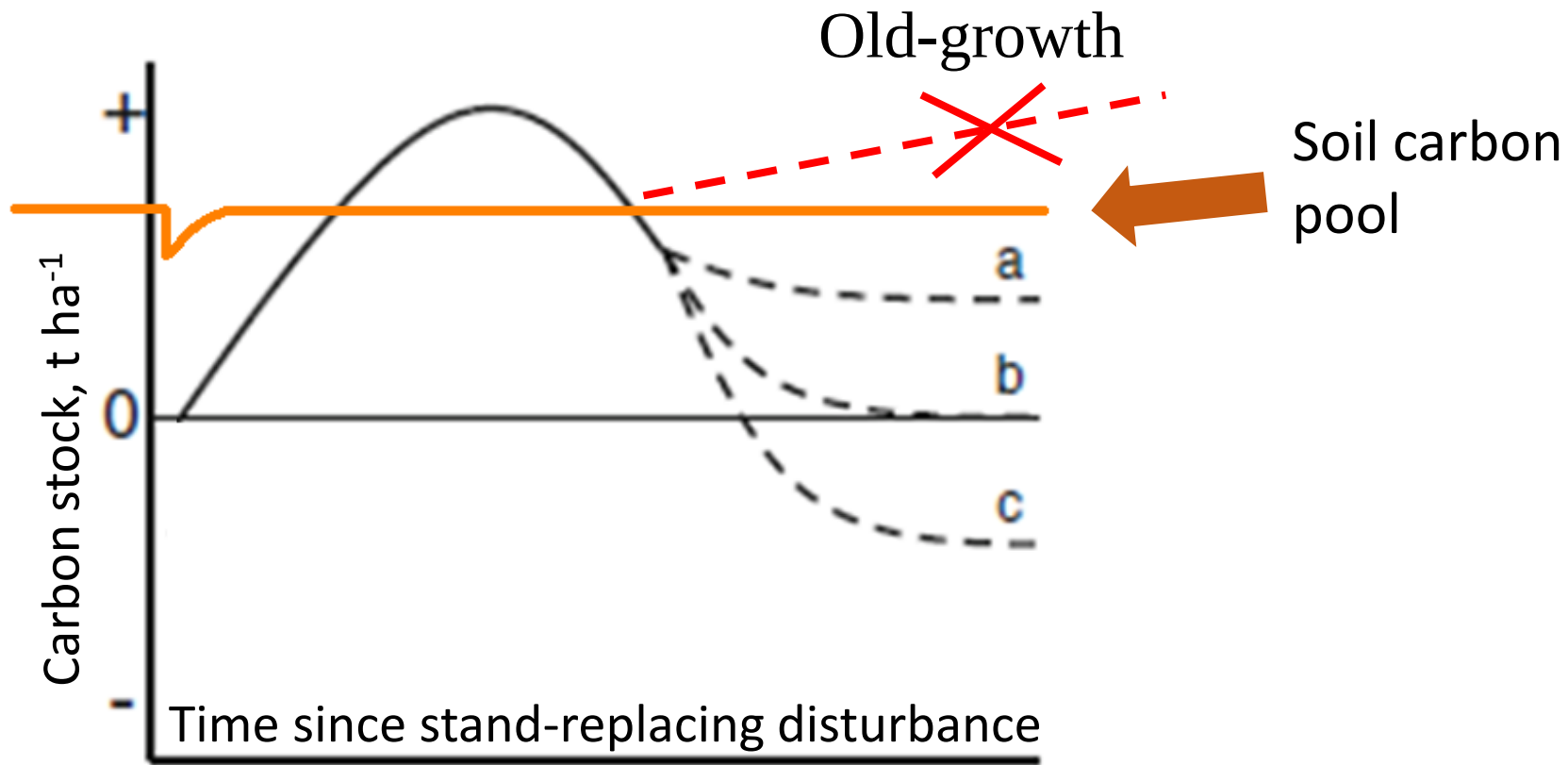
Carbon storage: soil- deciduous trees

Significant differences of soil carbon storage between control (age 58-69 years) and old-growth (112-131 years) birch and aspen stands on mineral soil were **not** detected



What have we found?

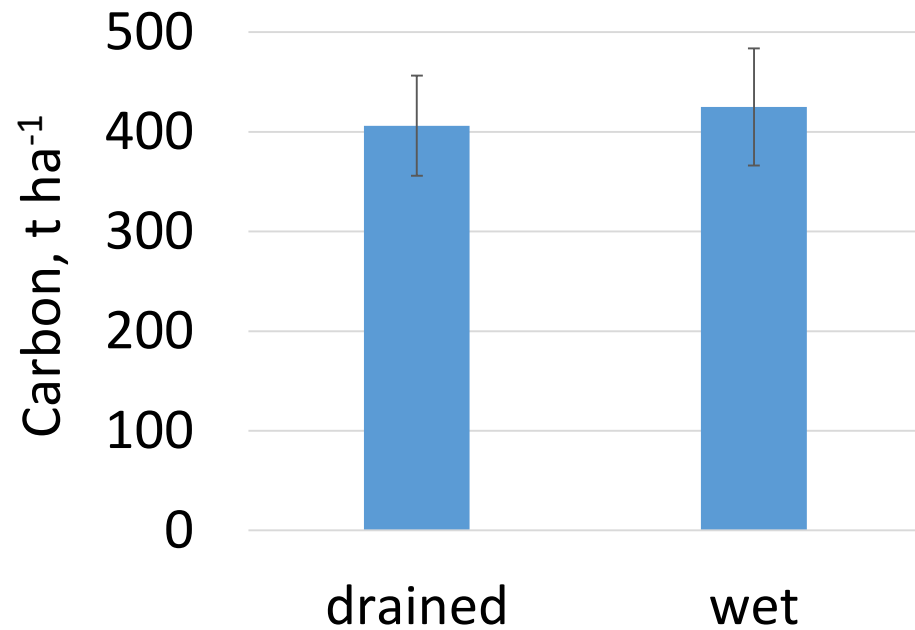
Carbon storage: soil- deciduous trees



What have we found?

Carbon storage: soil- deciduous trees

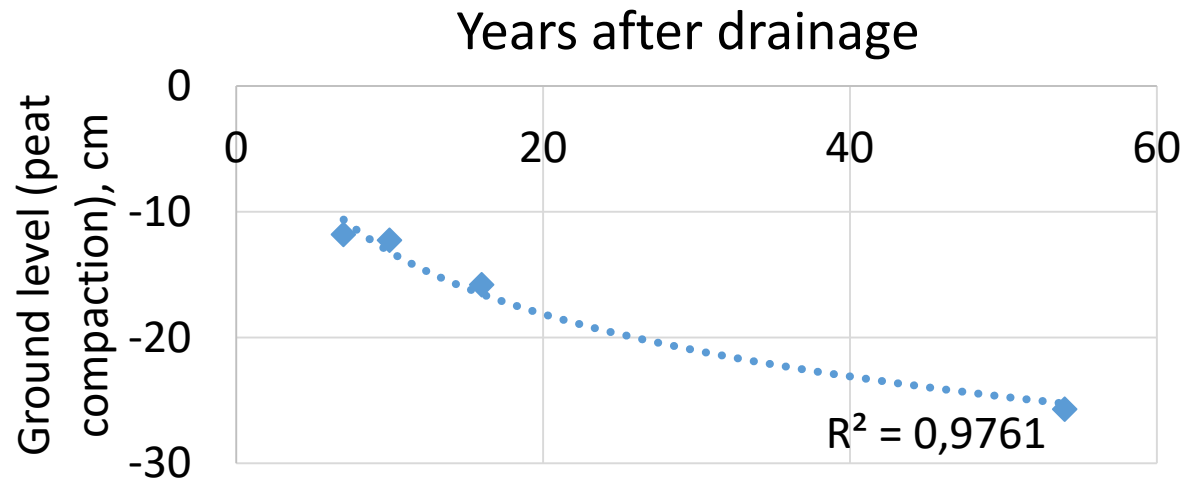
Significant differences of soil carbon storage between control (age 58-69 years) and old-growth (112-131 years) birch and aspen stands on mineral soil were **not** detected



Significant differences in carbon storage between drained and undrained old-growth birch stands on organic soil were **not** detected

What have we found?

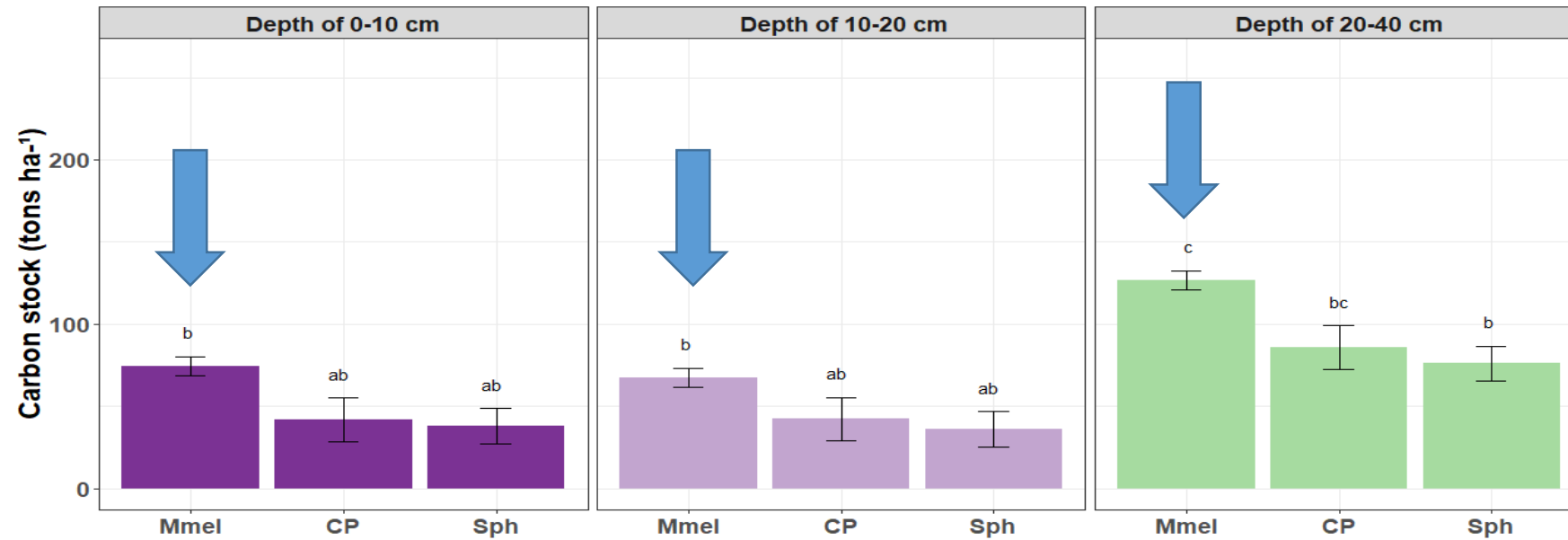
Carbon storage: soil- coniferous trees



Vesetnieki study site

What have we found?

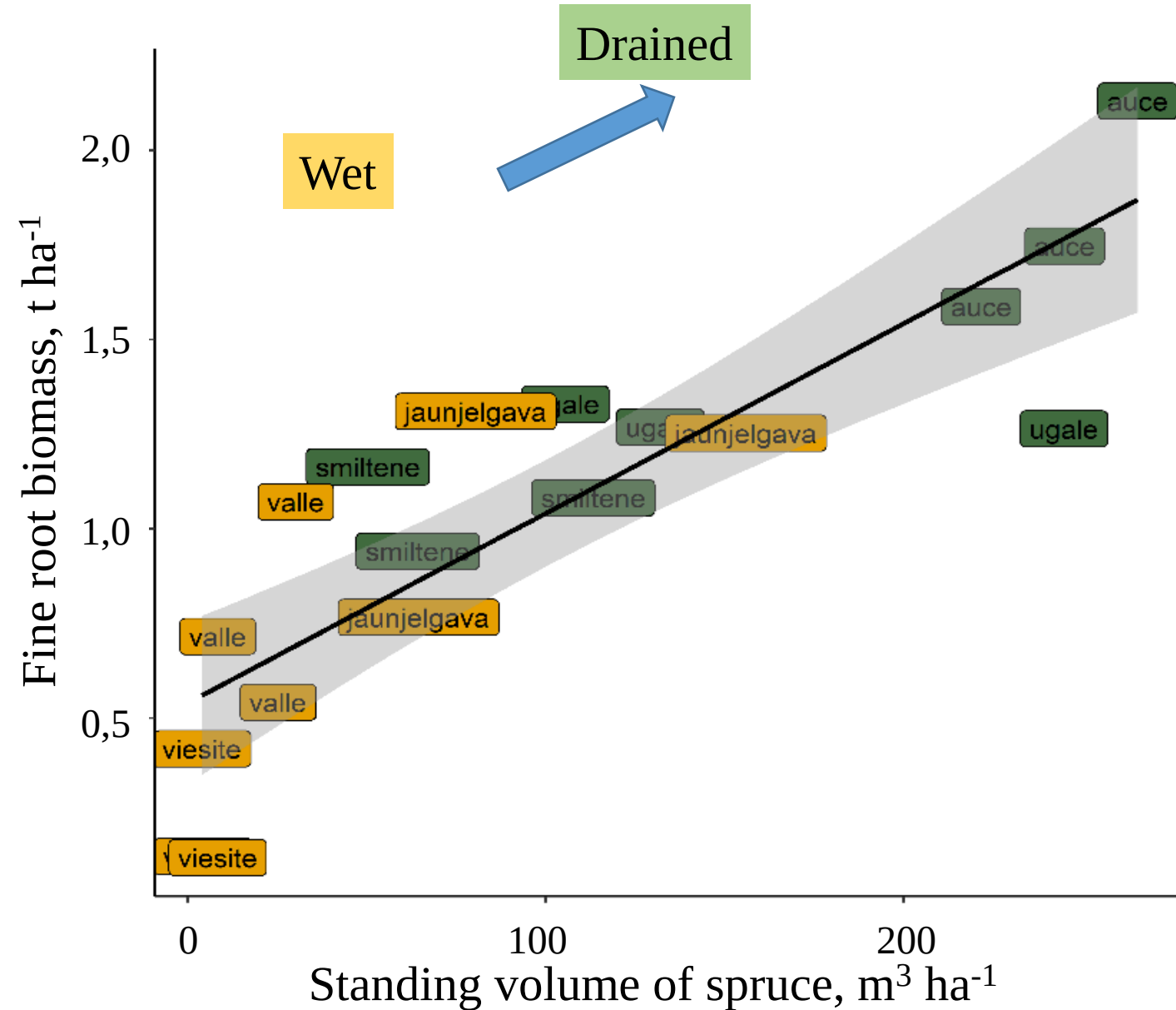
Carbon storage: soil- coniferous trees



Drainage in long-term has not depleted soil carbon stock

What have we found?

Changes in litter dynamics



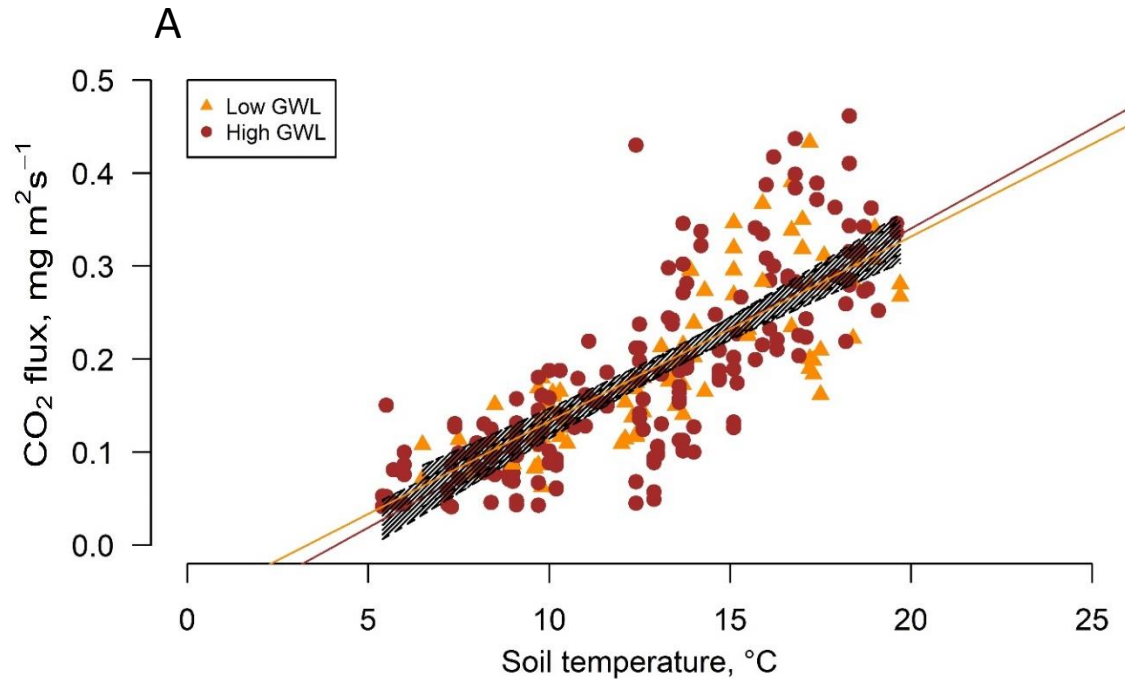
What have we found?

Emissions: soil- coniferous trees

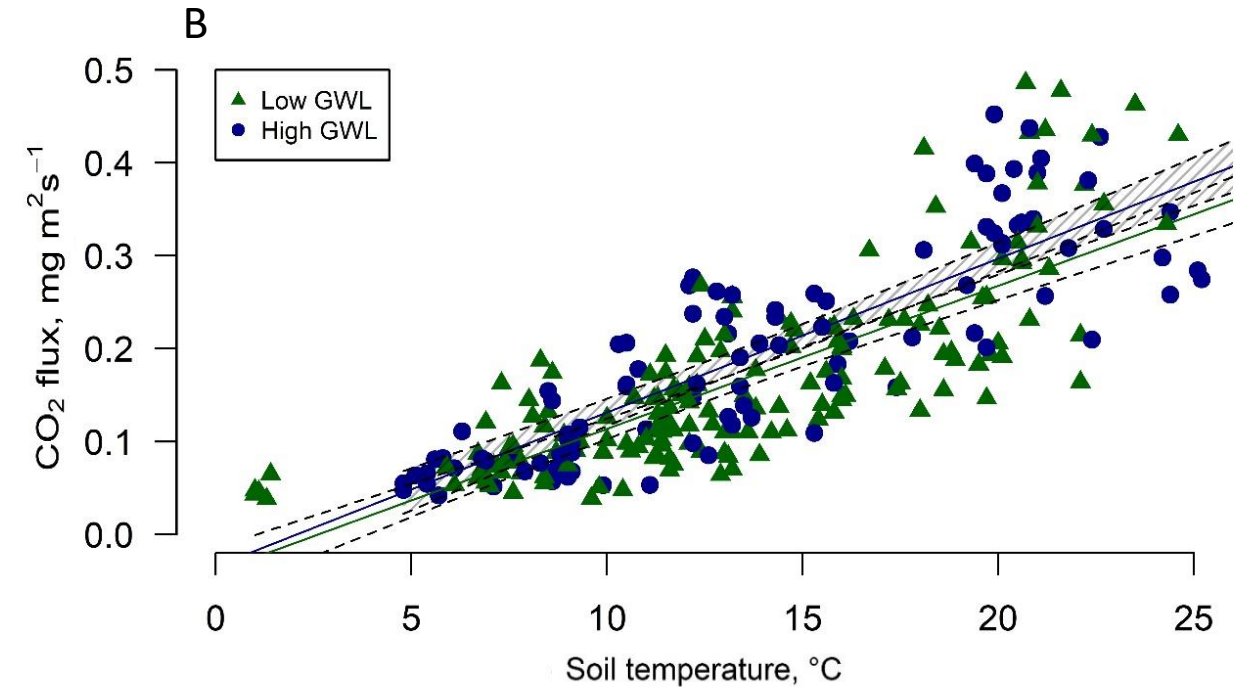
CO₂



Scots pine



Norway spruce

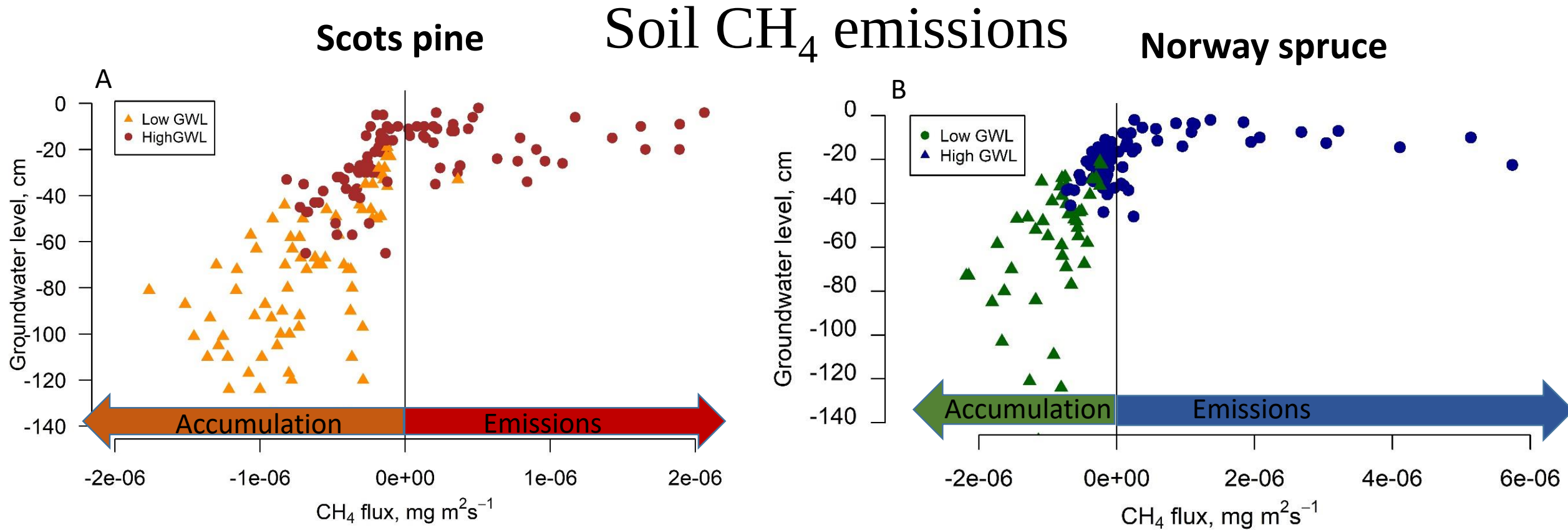


Soil total CO₂ emissions and soil temperature relationship in old-growth Scots pine (A) and Norway spruce (B) stands per groundwater level category. Grey area denotes 95% confidence interval.

What have we found?

Emissions: soil- coniferous trees

CH₄



Soil CH₄ emissions and soil temperature relationship in old-growth Scots pine (A) and Norway spruce (B) stands per groundwater level category

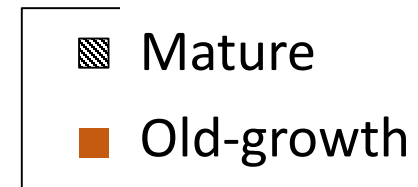
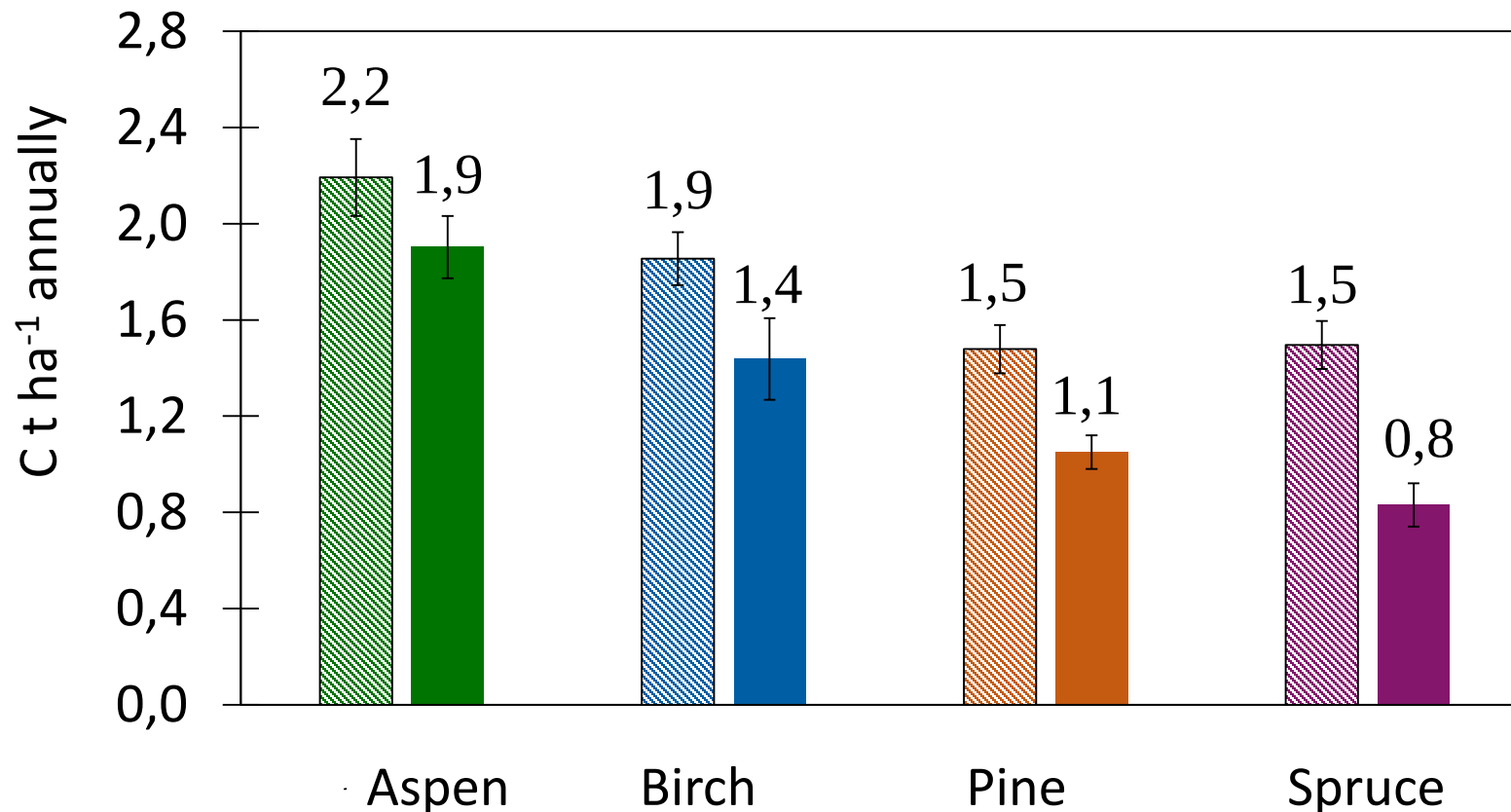
Drainage in **long-term** has no negative effect on soil emissions

Samariks, Jansons et al.,
2022, submitted¹⁰

The story about the forest carbon storage is the story about trees



- Dominant tree species ($p < 0.001$) had a significant impact on the carbon stock.
- In the old-growth stands (104 to 218 years), in which old target-species trees still formed the dominant cohort, the total carbon stock was, on average, 20% larger than in the younger (than 54 to 103 years) control stands, the difference depending on the dominant tree species



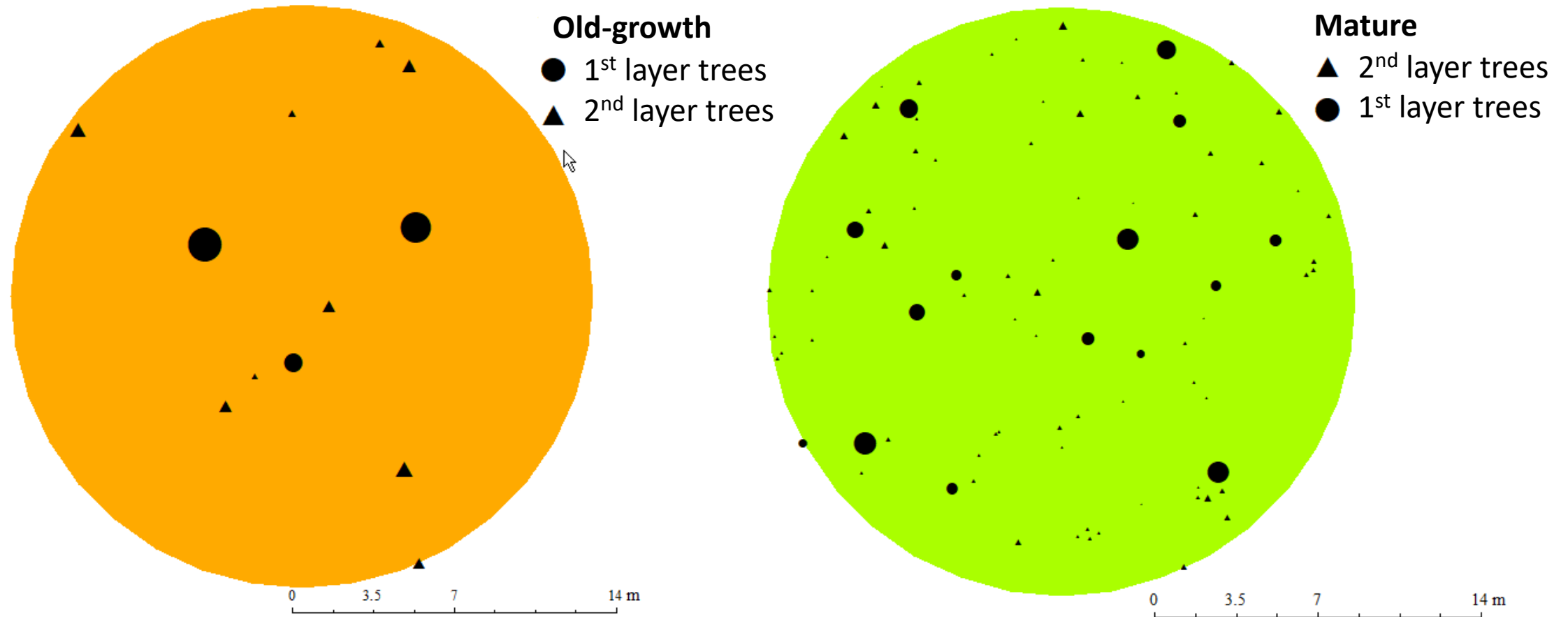
Average annual C sequestration is significantly lower compared to mature Stands:

Aspen: -13 %

Birch: -23 %

Pine: -29 %

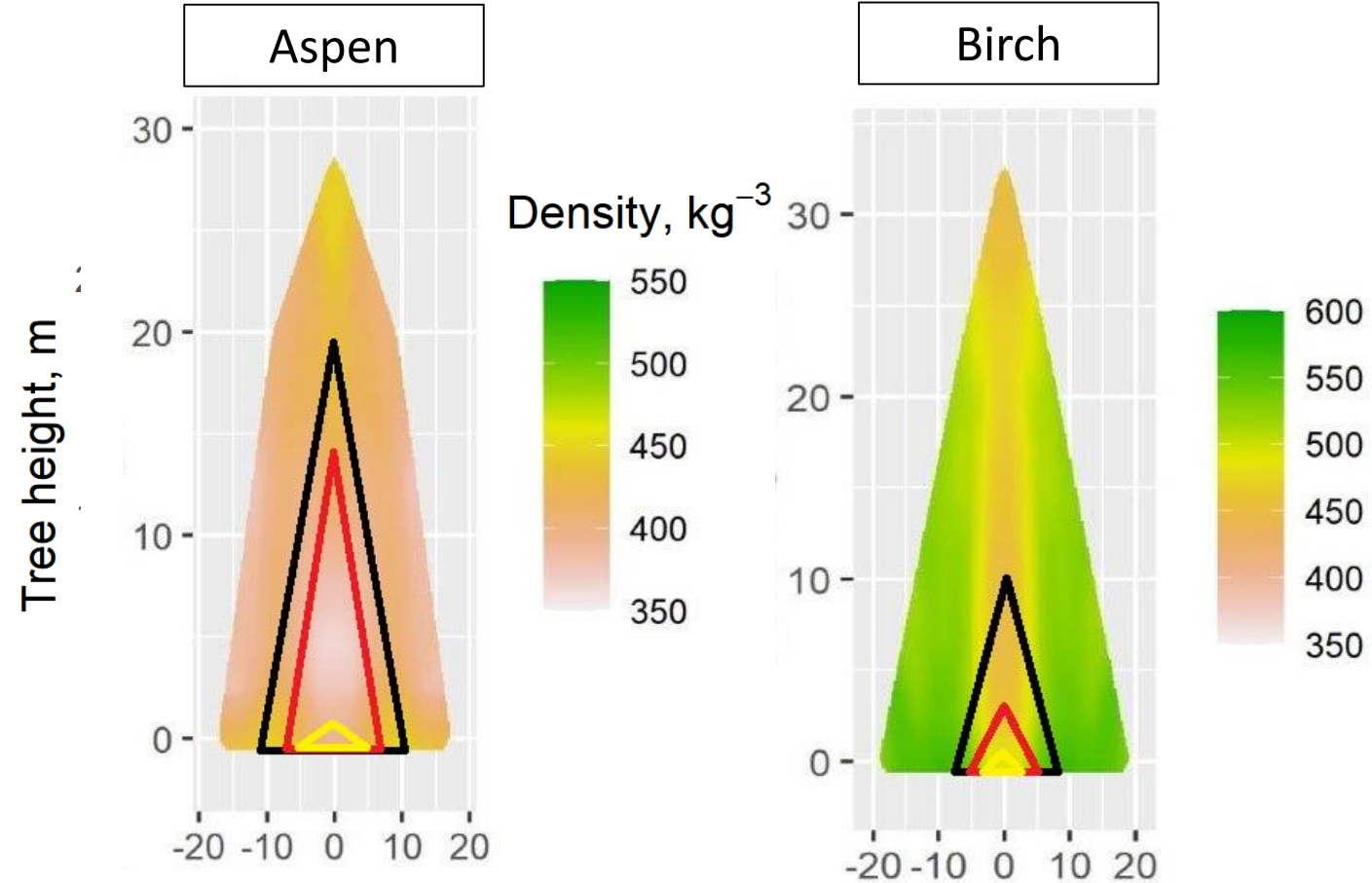
The story about the forest carbon storage is the story about trees



Old forest stands in our study corresponds to FAO classification n6 category – *old-growth forest* (Buchwald 2005).

Tool for assessment of carbon turnover and greenhouse gas fluxes in broadleaved tree stands with consideration of internal stem decay (ERDF No 1.1.1.1/21/A/063)

Foto: A. Šmits





Old growth forest are not effective for climate change mitigation.
So what's the point?

Old-growth forests: what's the point?

- Maintenance of biodiversity (certain aspects)
- Reference for comparison with managed forest in order to shape (adjust) management system (climate smart forestry / closer to nature forestry approaches)



Climate smart forestry

Maintenance of biological diversity

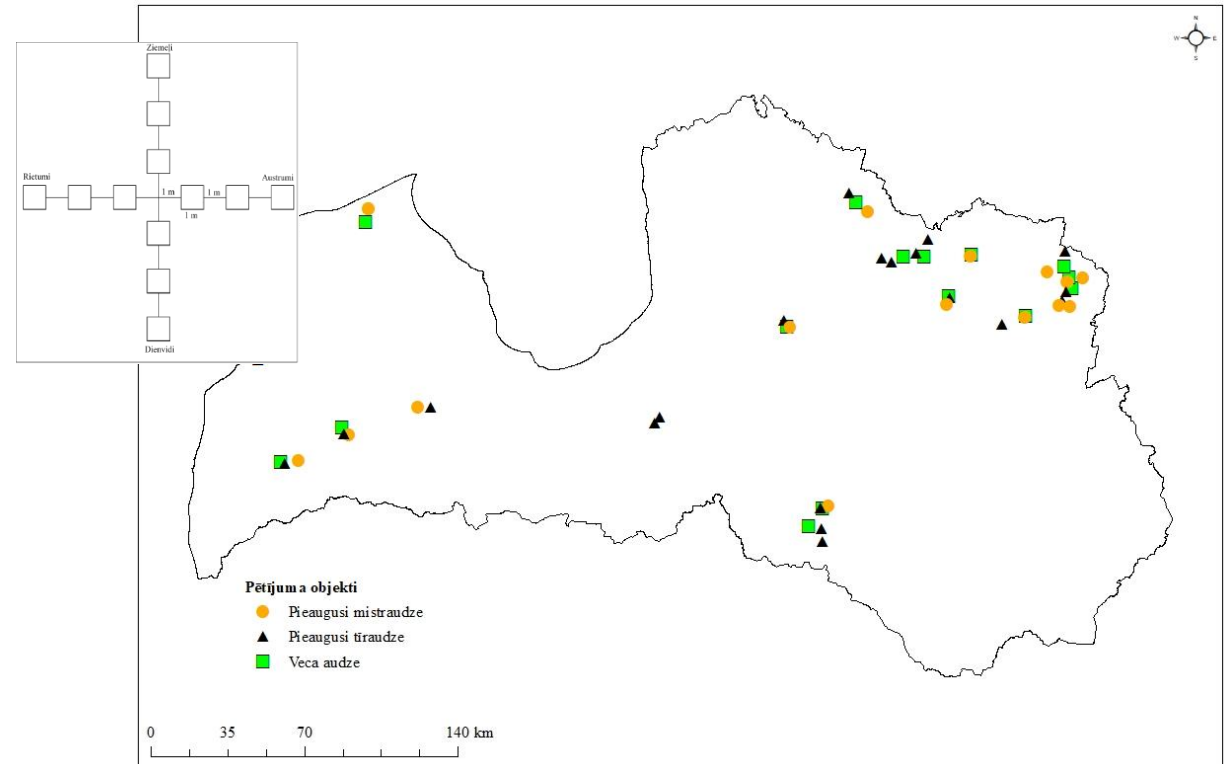
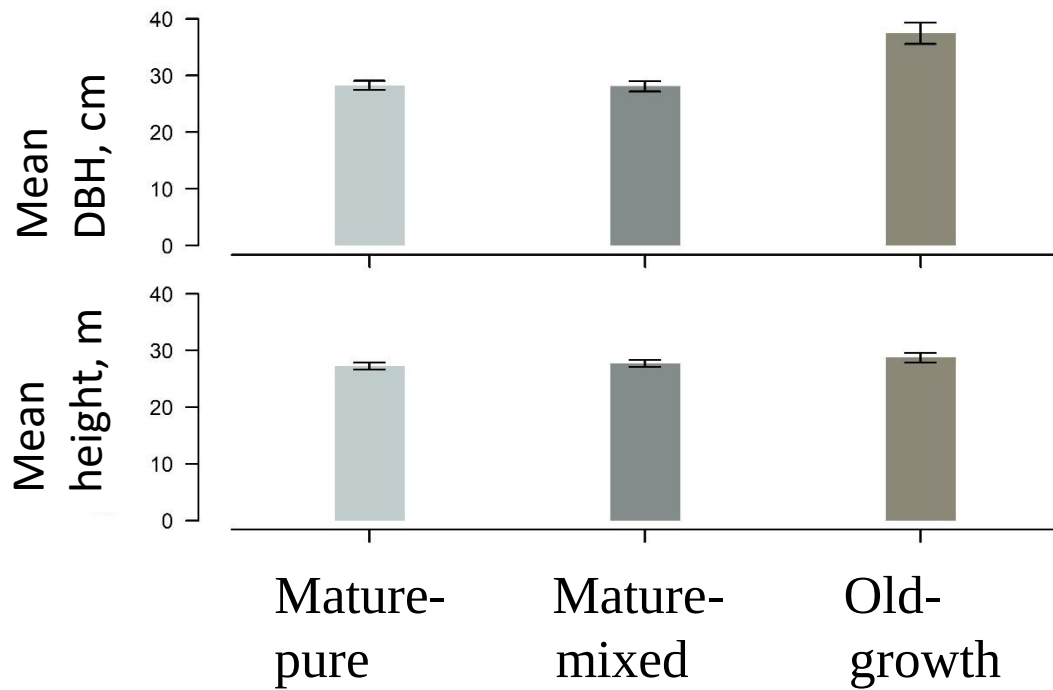
Mitigation of Climate Change and its negative effects on biodiversity and society

Adaptation to Climate Change

Foundation of bioeconomy

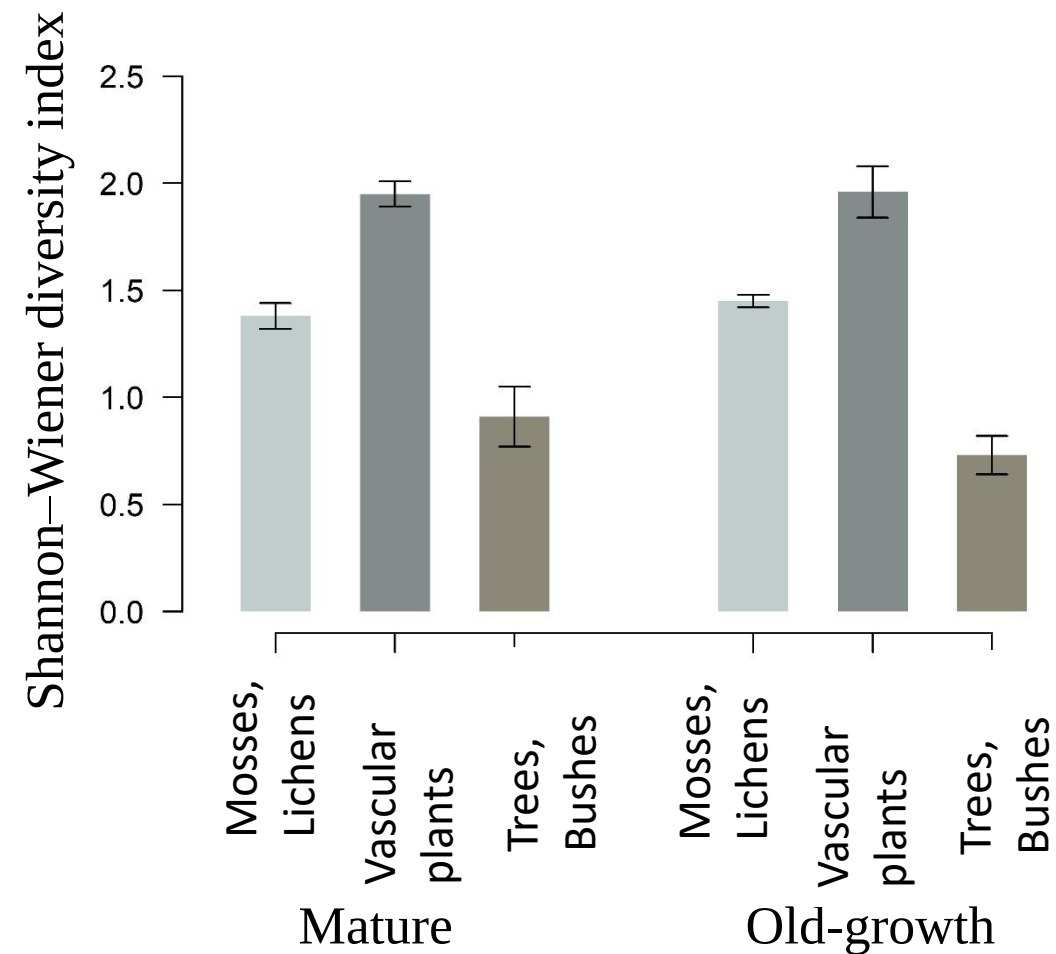
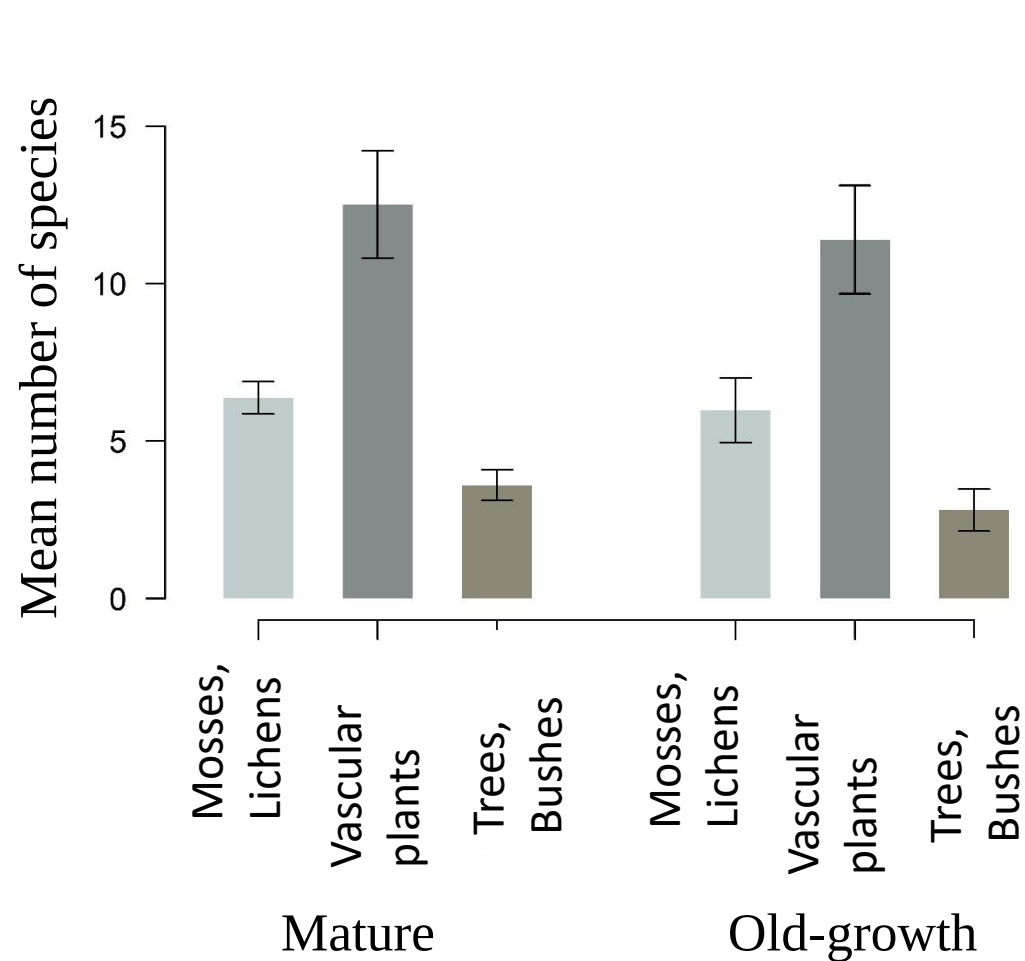


Old-growth stands and biodiversity: ground vegetation



Direct comparison between mature and old-growth
Norway spruce stands

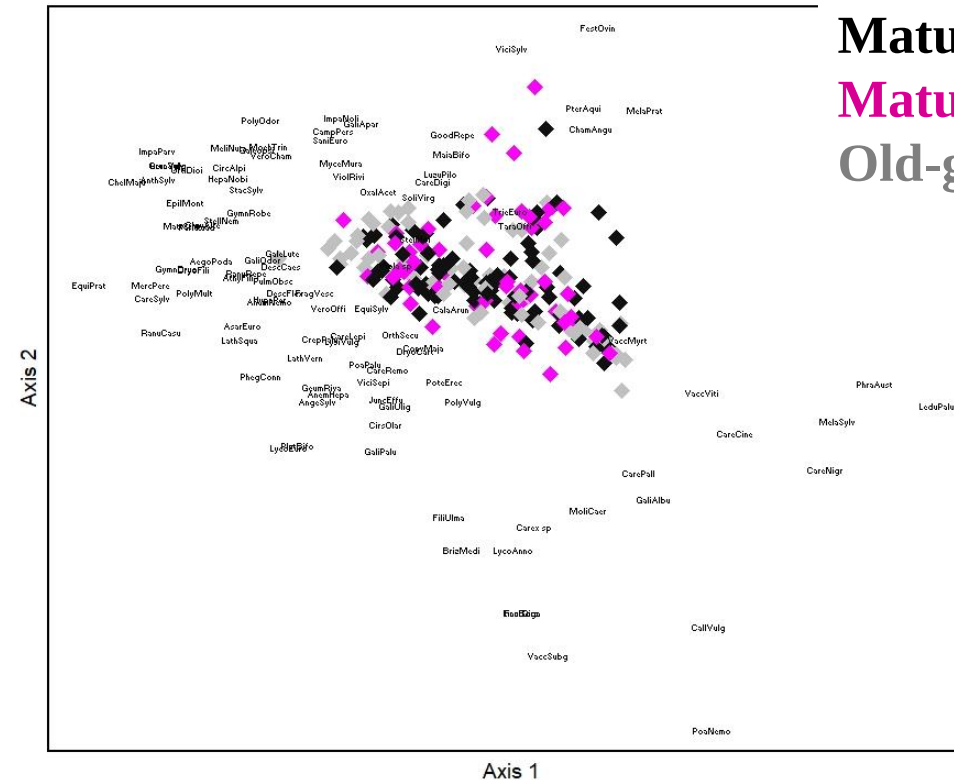
Old-growth stands and biodiversity: ground vegetation



Old-growth stands and biodiversity: ground vegetation

- The principal gradients of ground cover vegetation were related to light, site fertility, and structural diversity, as well as the degree of deciduous (particularly *Betula* spp.) admixture in a tree stand.
- Stand age (differing two time between assessed groups) did not affect ground cover vegetation, implying the principal effects of stand structure, which is manageable characteristics.

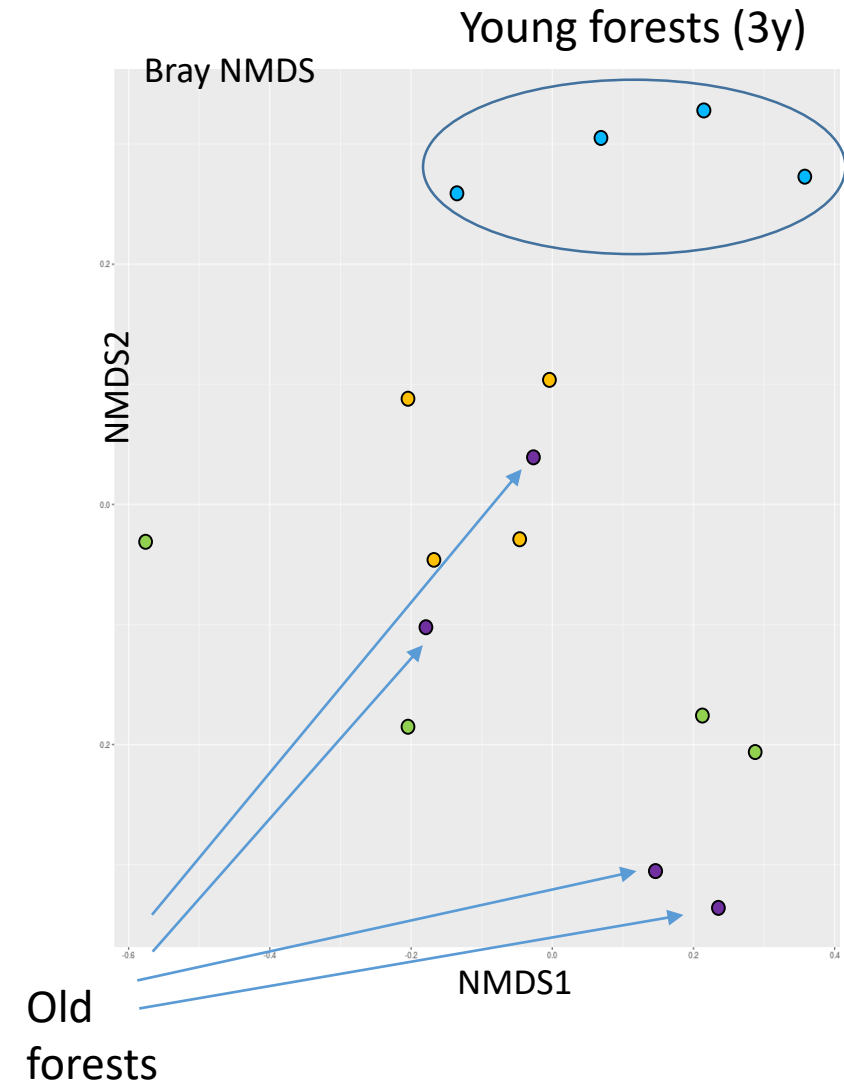
PCA of ground vegetation



Platanthera bifolia
Lycopodium annotinum

Old-growth stands and biodiversity: fungal diversity

- 7,7 million reads were obtained in two sequencing sessions, of which only 1,6 million were left after quality filtering. 523848 sequences were detected as ITS by ITSx. CD-HIT clustered these sequences in 2564 OTUs.
- Preliminary results showed high operational taxonomic unit (OUT) richness in the samples, but community composition in general was significantly different between plots in each of the sites. Soil variables did not explain differences in fungal communities.
- Bray-Curtis ordination showed that only the clearcut samples formed a distinct OTU cluster.



Biodiversity maintenance and production

Plantation of birch



Plantation of Norway spruce



(Potential) negative effect of plantations on biodiversity mostly is the result of :

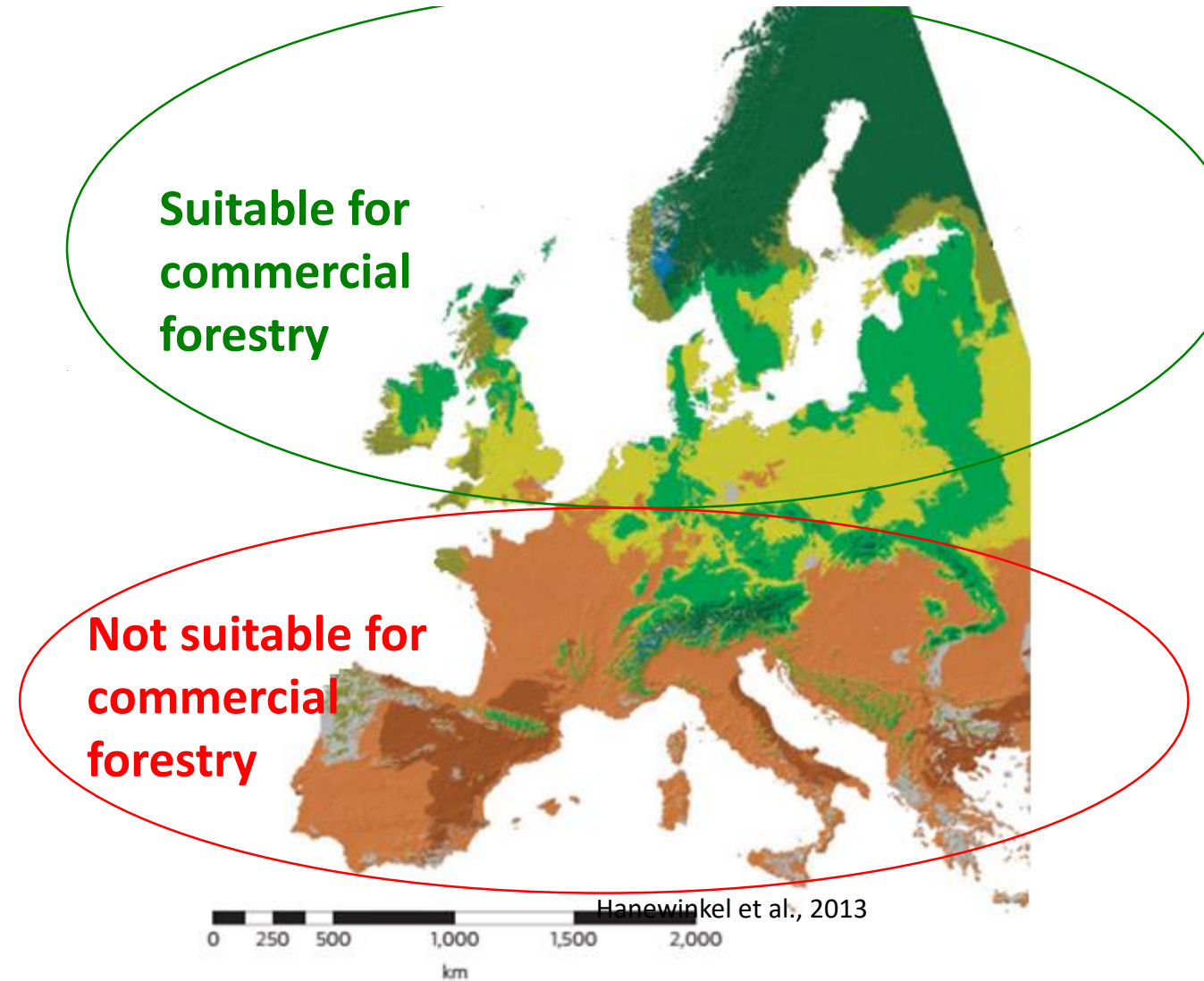
- 1) their management approach;
- 2) Their scale and allocation in landscape

Effective management can be combined with maintenance of elements of biodiversity at stand or landscape scale (triada principle)

Why does it all matter?

Effect of Climate Change by the end of the century

To ensure the best aggregate outcome of the society from the limited land resource



Take-home messages



- In recognizing that tree biomass is the largest and most dynamic carbon pool in old-growth stands, it is recommended that in forest areas where climate change mitigation is the main management objective, a forest model be used that ensures stands that are the most productive and highly resistant to natural disturbances.
- In forest areas where the primary management objective is the maintenance and protection of biodiversity, it should be taken into consideration, that the carbon storage efficiency (mean annual difference in carbon stock) in tree biomass and deadwood decreases significantly between the younger (control) and old-growth stands. Old-growth forests continue to accumulate carbon in old age, but their uptake decreases over time, until the dominant forest element changes due to tree aging and/or the impact of the natural disturbance.
- Drainage does not deplete the soil carbon pool over a long term

Tool for assessment of carbon turnover and greenhouse gas fluxes in broadleaved tree stands with consideration of internal stem decay (ERDF No 1.1.1.1/21/A/063)



Thank you!

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