From mortality of tree individuals to large-scale disturbances: structural diversity in forest reserves in Switzerland and Europe

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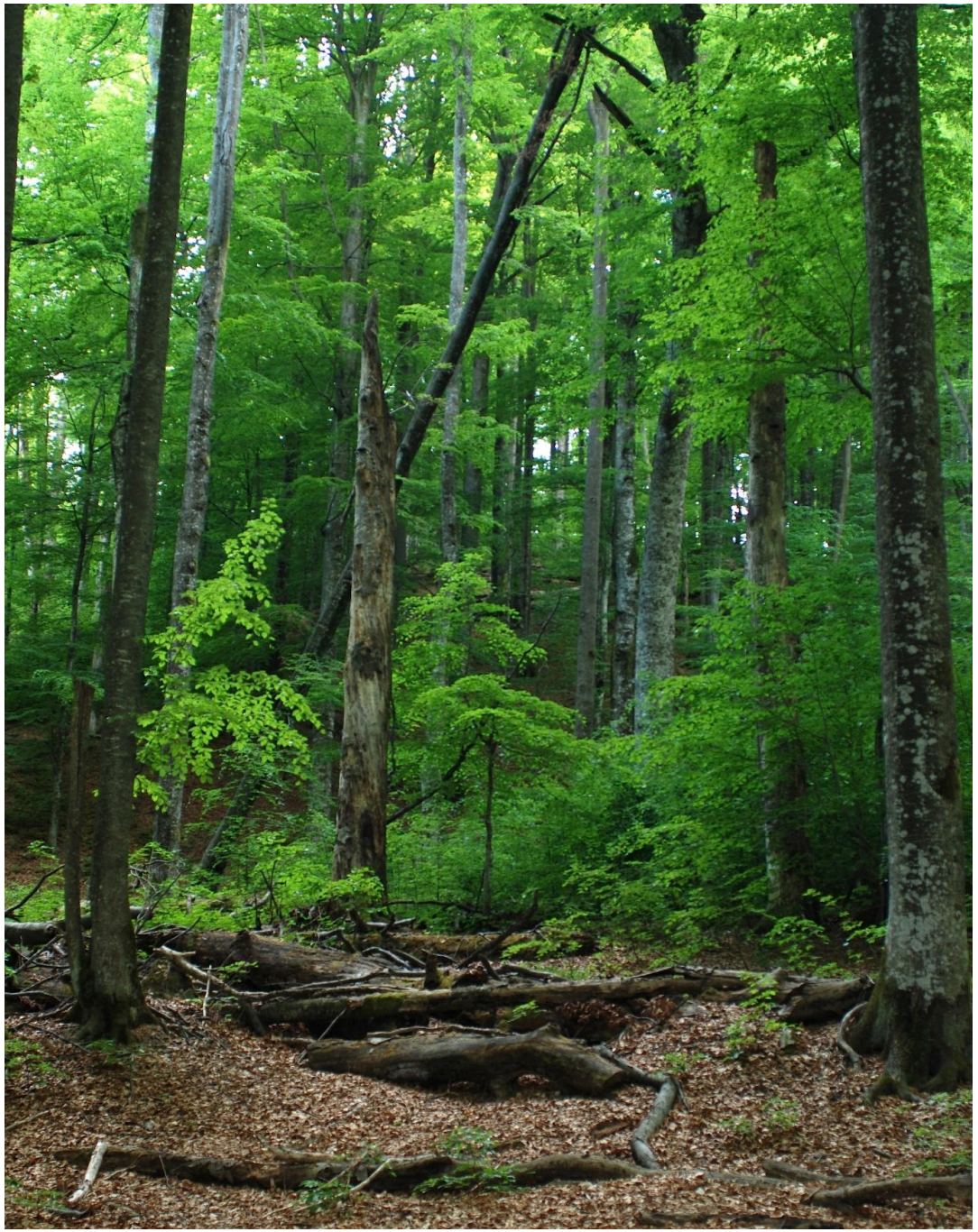
Natural dynamics

Processes in the absence of anthropogenic influence/management

- Natural development of main ***demographic processes***: recruitment, growth and mortality
- Change in ***communities and structure*** over time
- ***Disturbance*** driven dynamics



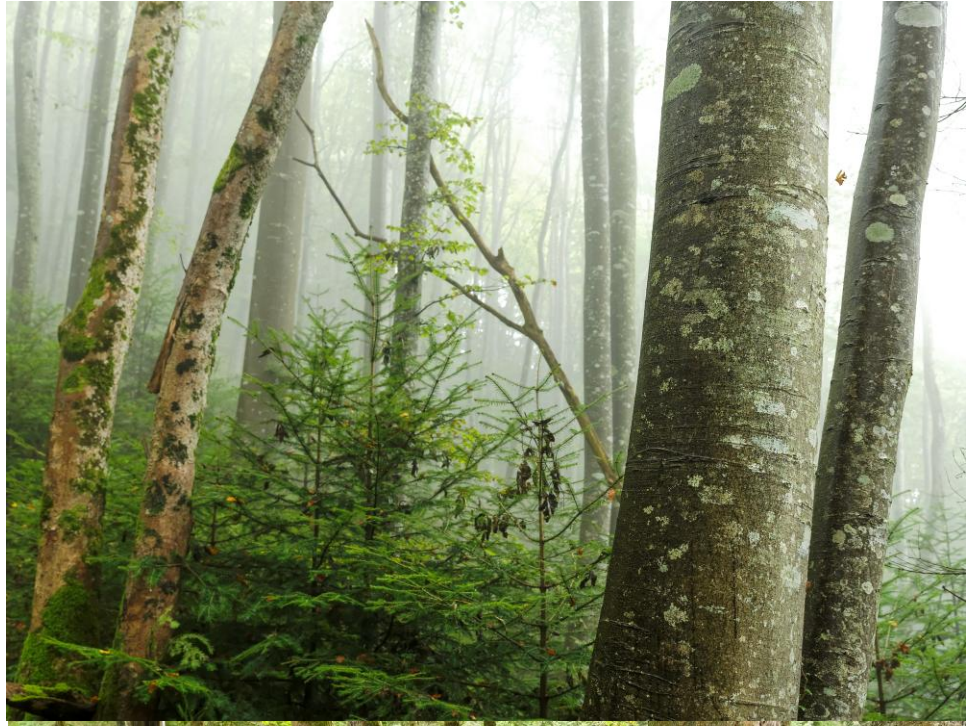
Structural diversity

Vertical structure:
- Multiple layers

Horizontal structure:
- Spatial aggregation
- Denser and less dense patches

Size diversity:
- Wide range of tree sizes

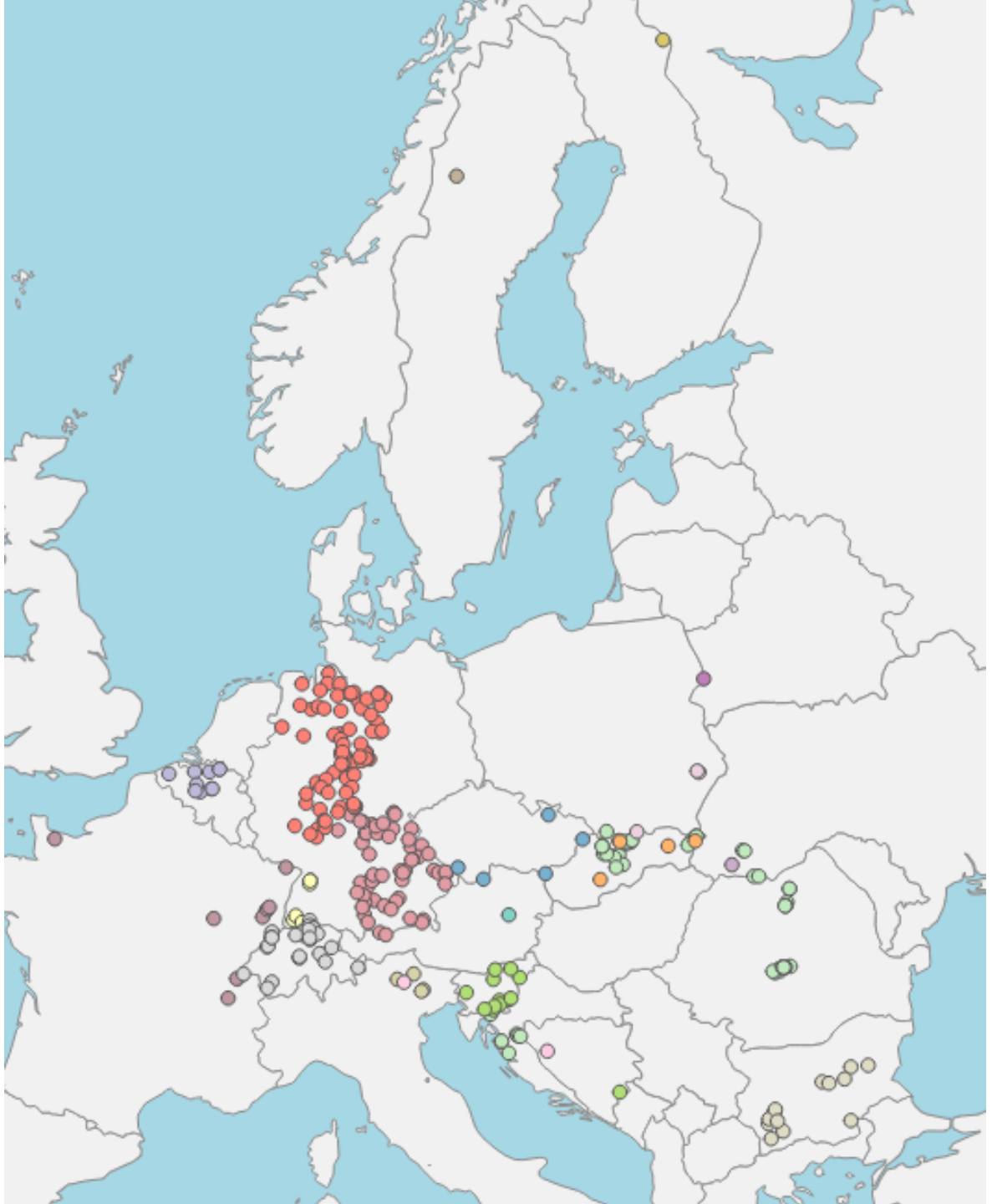
Diversity of structural elements:
- Lying dead trees and CWD
- Dead standing trees



Fotos: M. Bolliger

Forest reserves as a reference for structural diversity

- Processes in the absence of management
- Increasing ecological importance with time since cessation of management
- Research networks provide insight into dynamics across climatic gradients



Natural dynamics in unmanaged forests

Development of coppice with standards forests after cessation of management

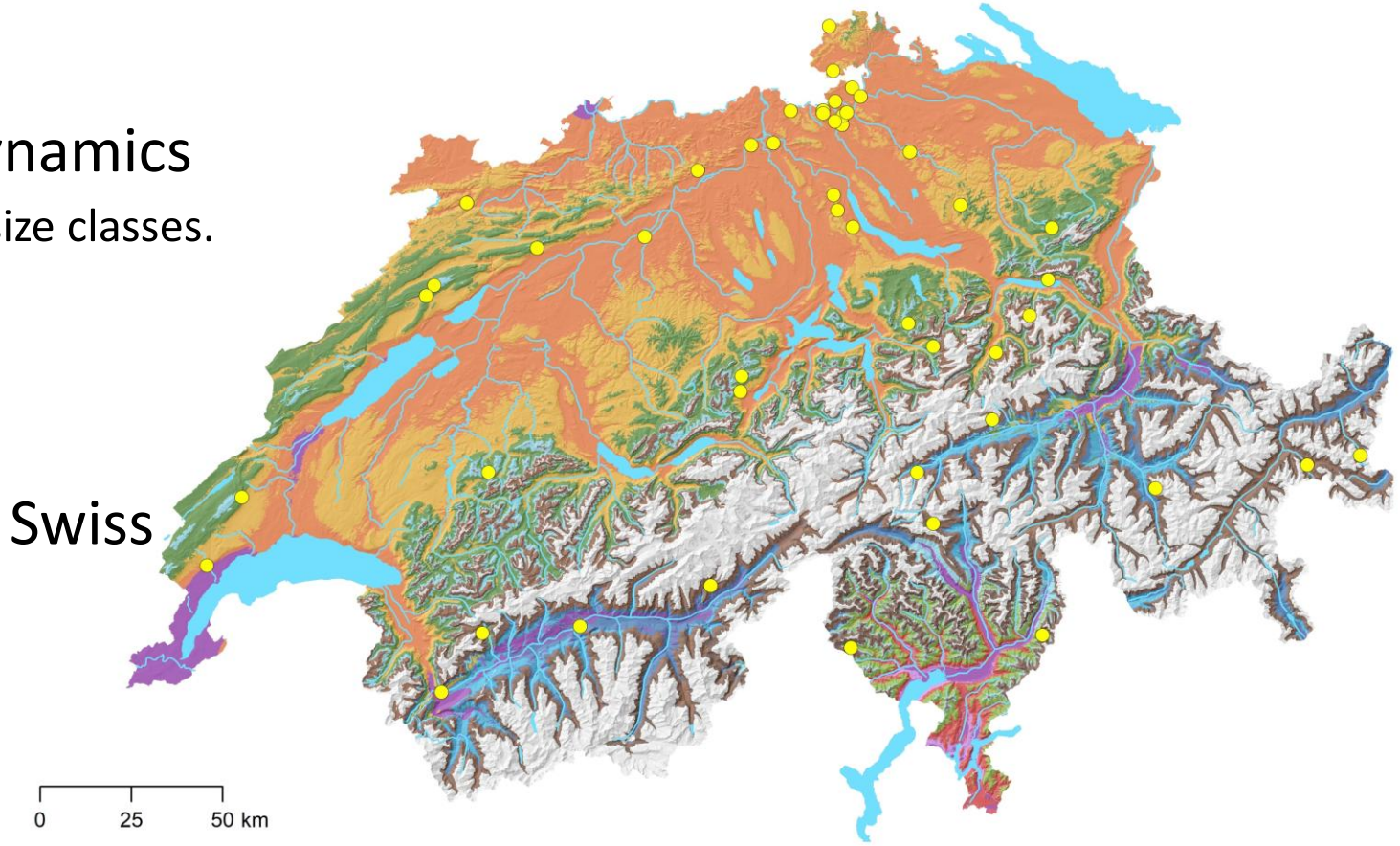
- Succession after intensive management
- Change in species and structure?

Scale dependency of diversity and dynamics

- Primeval forest with high structural diversity in size classes.
- Dominated by beech
- Stability at large, dynamic at small scale.

Development of vegetation height in Swiss forest reserves

- Saturation?
- Diversity in vegetation height models

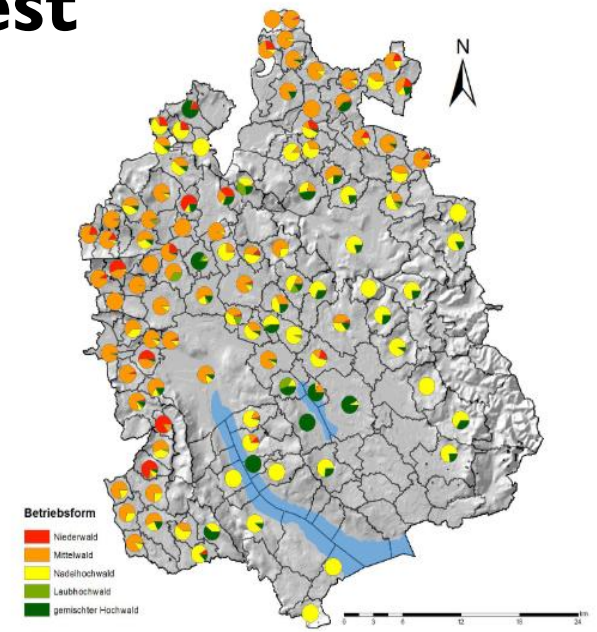


Coppicing has for a long time been the main forest management system

Coppicing **widespread** in Northern part of Canton of Zurich for centuries

Highly artificial management system, changing both structure and species composition.

What pathway does secondary succession take?



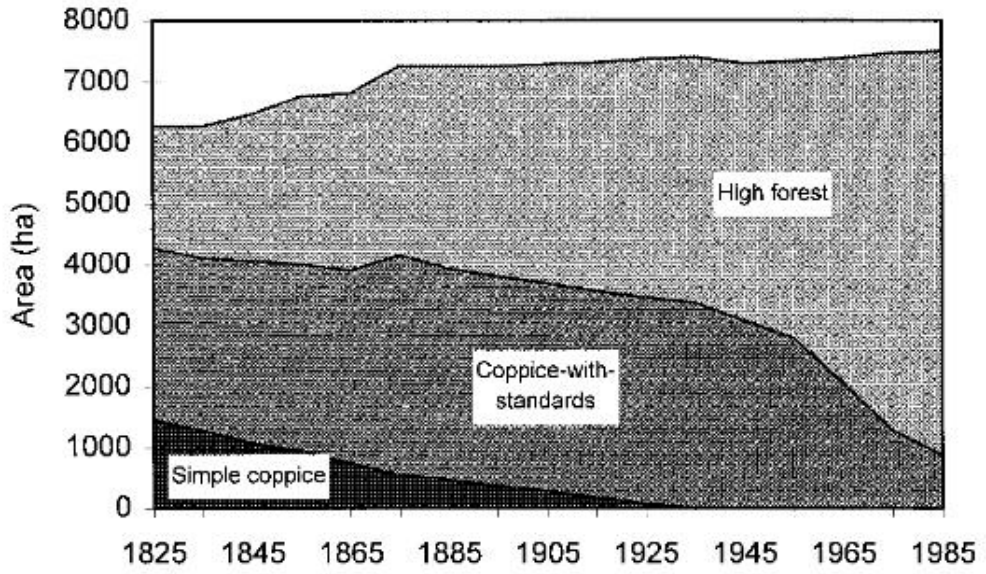
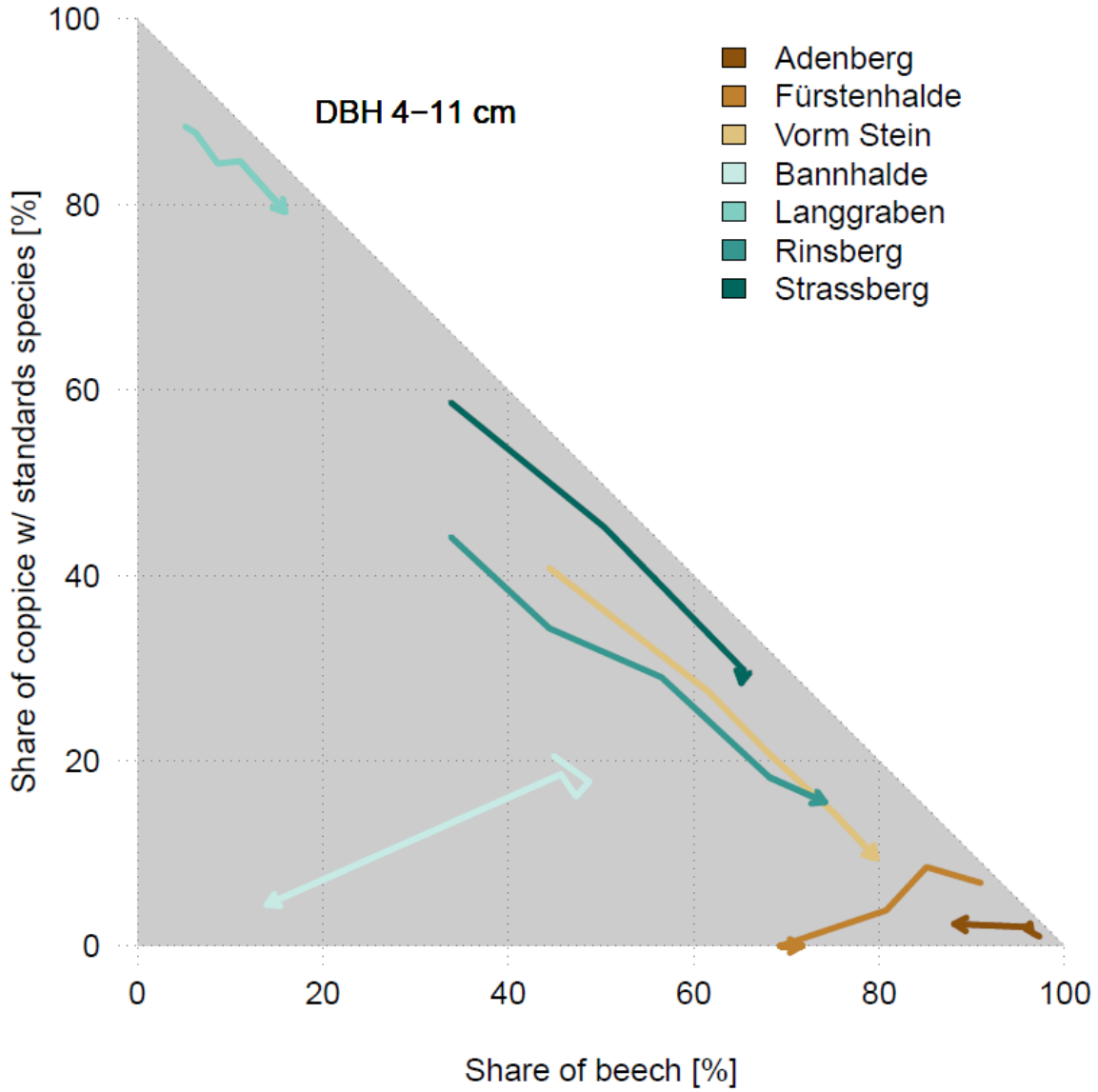


Figure 2. Forest types in the public forests of the Unterland and Weinland, 1825–1985.

Bader 2015
Bürgi 1999*a*
Vollmuth 2022

Rates of change in species composition differ between reserves but trajectories (mostly) don't



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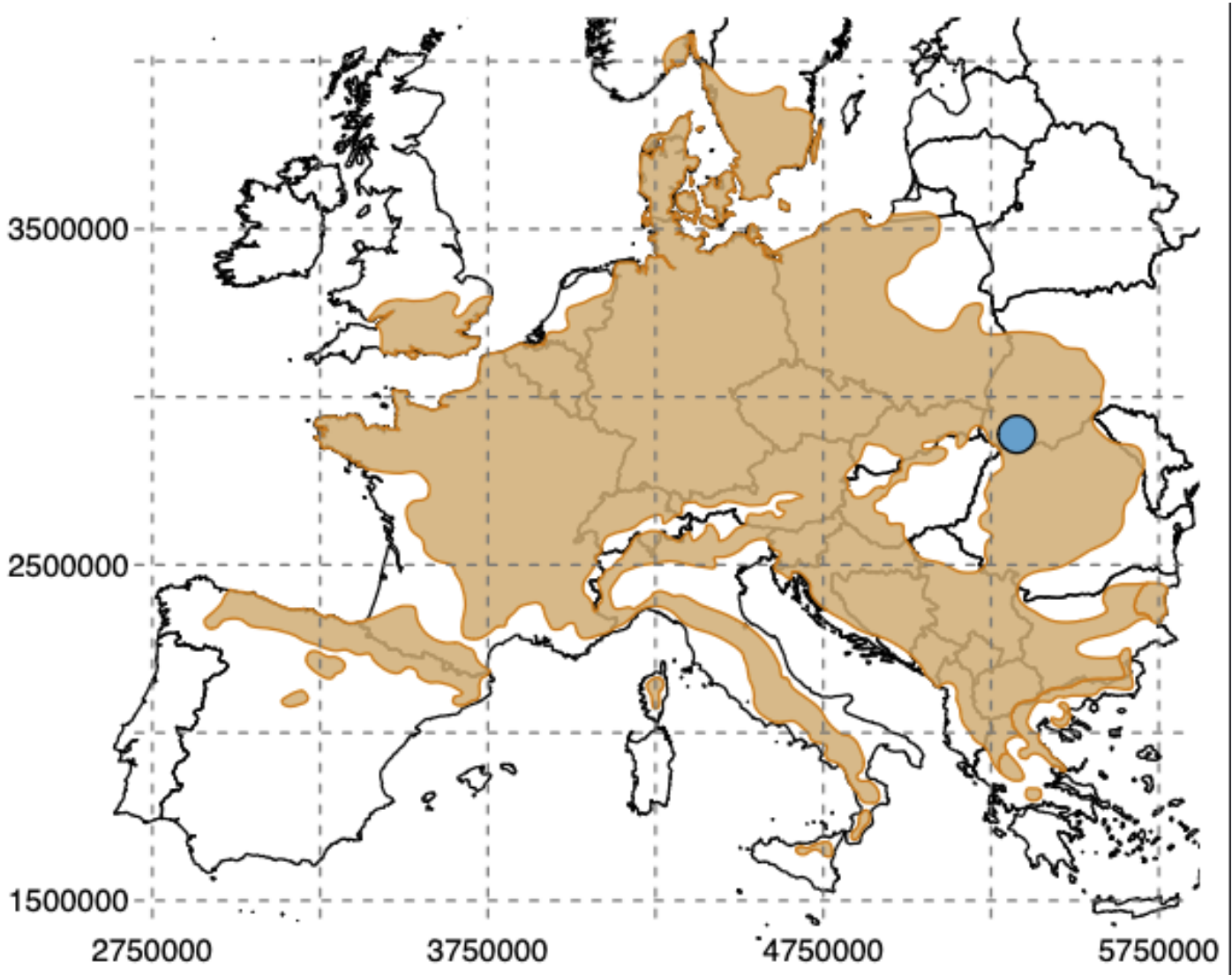
Dynamics across scales in the primeval beech forest of Uholka-Shyrokyi Luh

Beech important species throughout Europe

Highly competitive on fertile sites

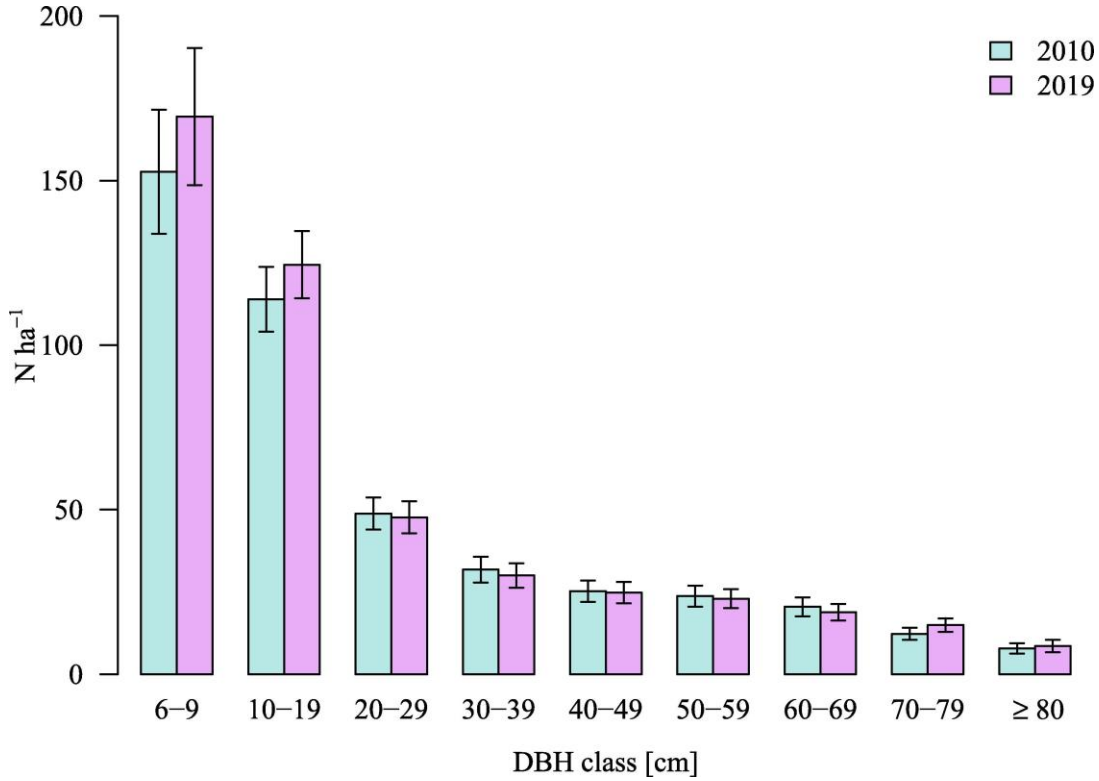
Beech dominated forests **heavily altered by humans**

In absence of management, tendency to **form monospecific forests**



Forest in steady state

Only minor changes over time at landscape scale - forest in steady state.



Stillhard et al. 2022

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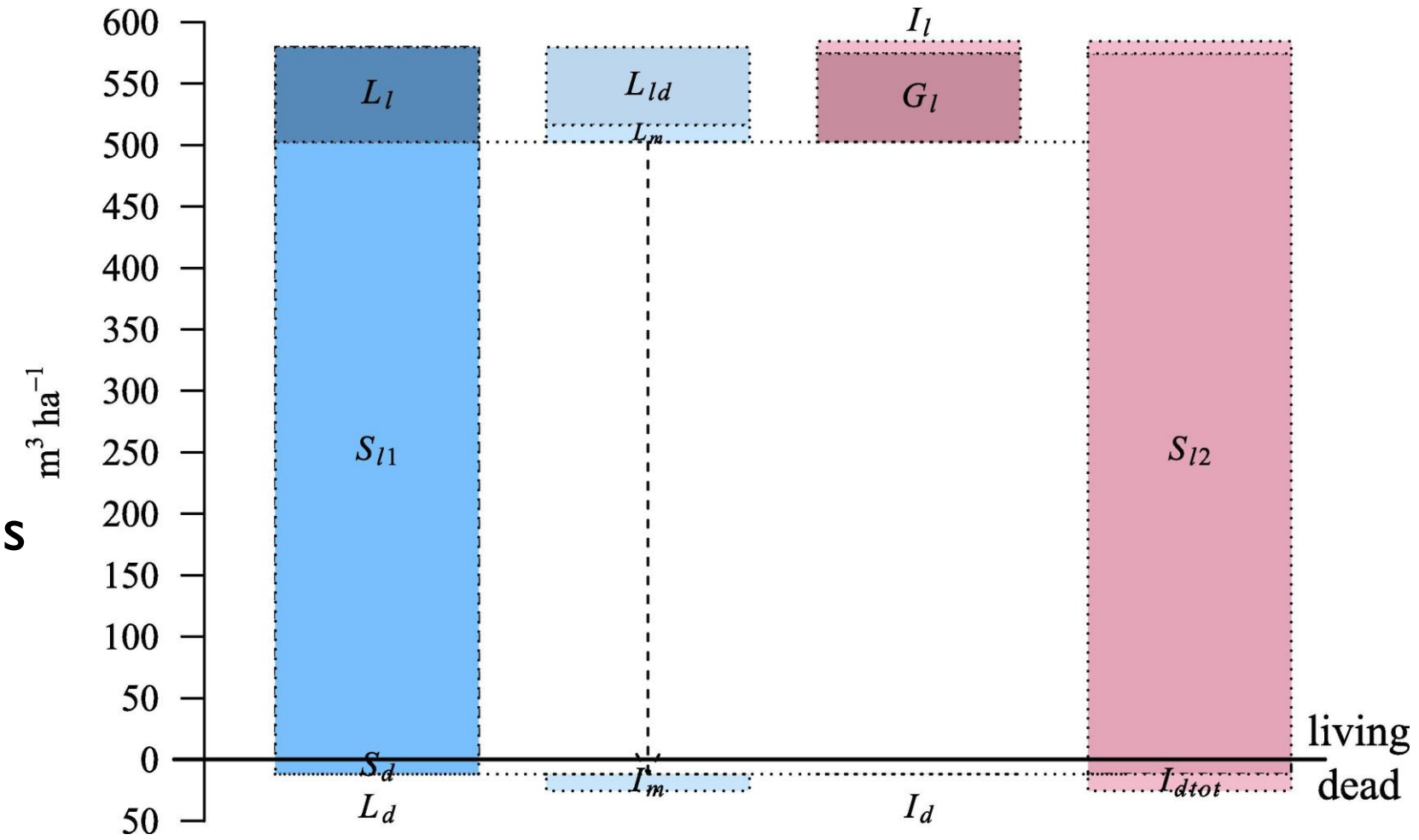

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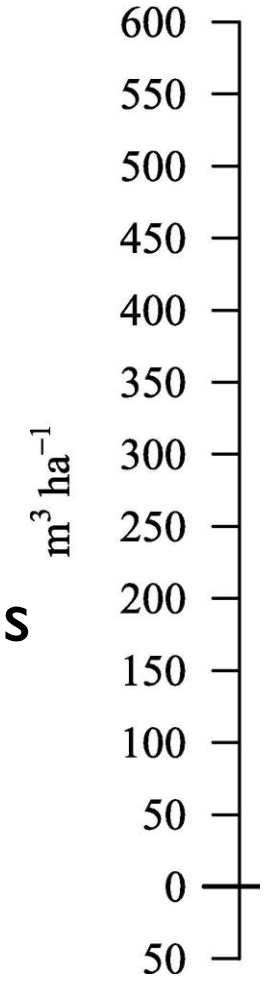
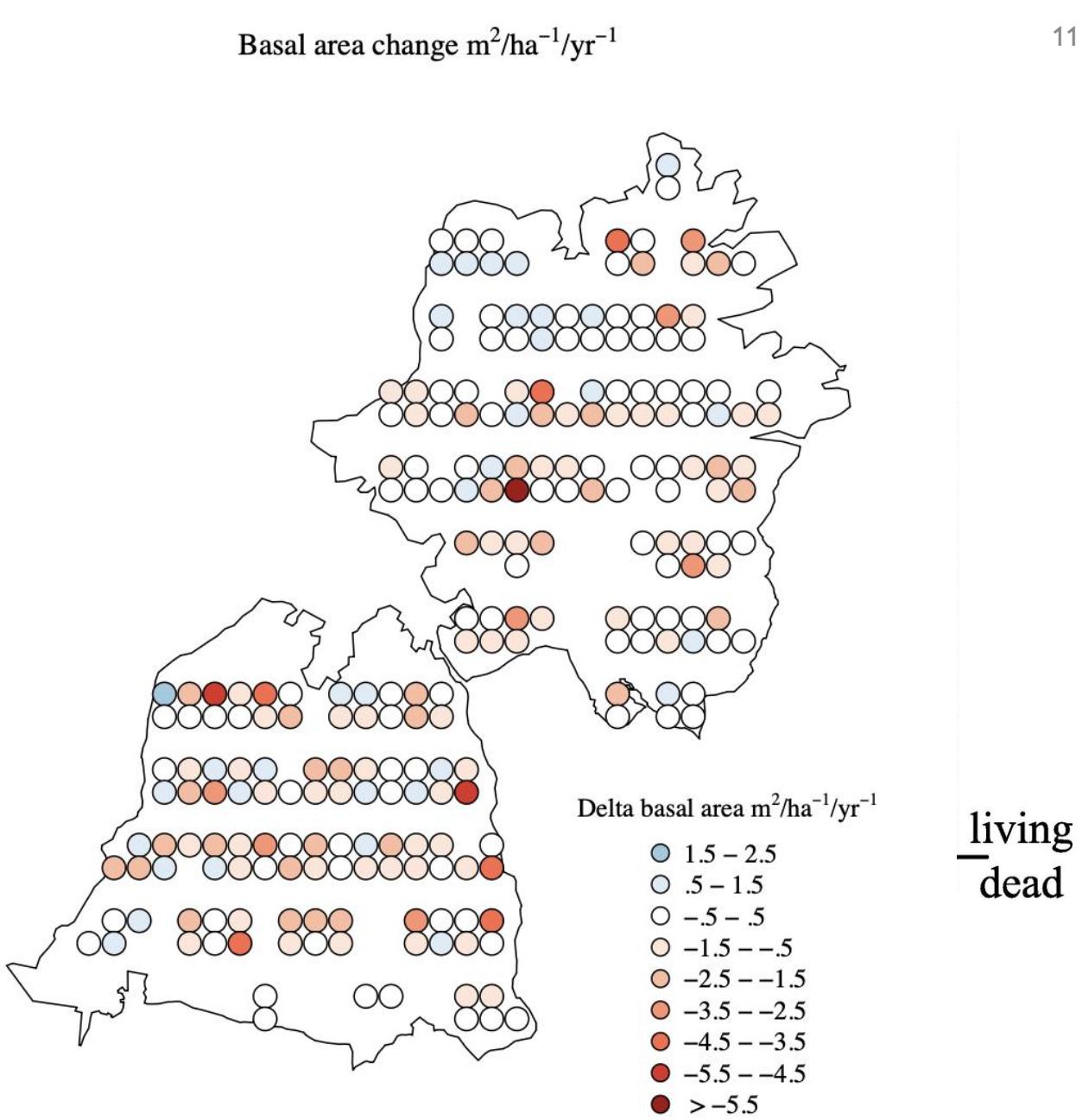




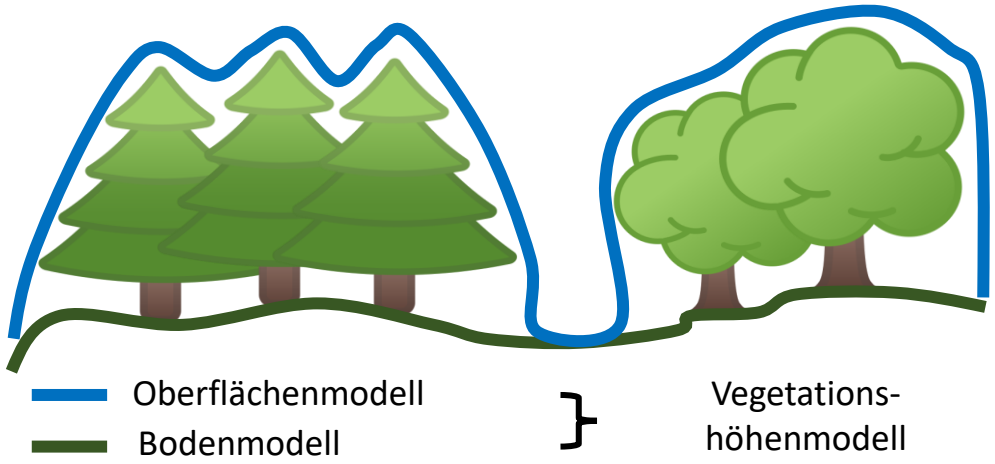
Development of Canopy Height in Swiss Forest Reserves

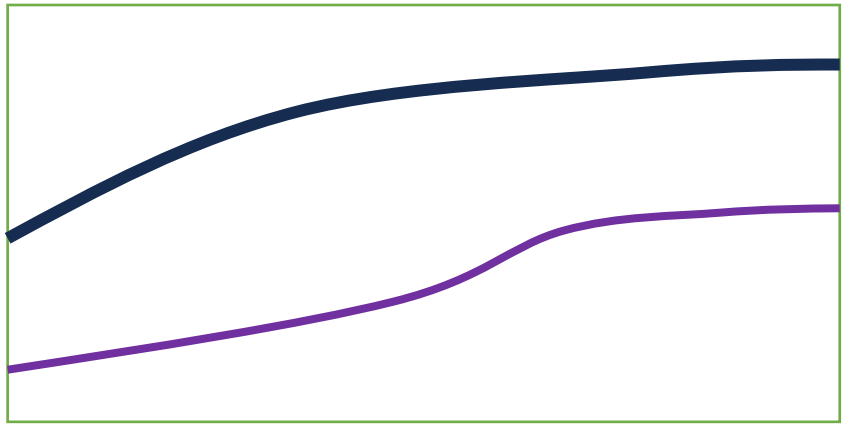
Canopy height models as a good indicator for growing stock / basal area

Based on aerial orthoimagery

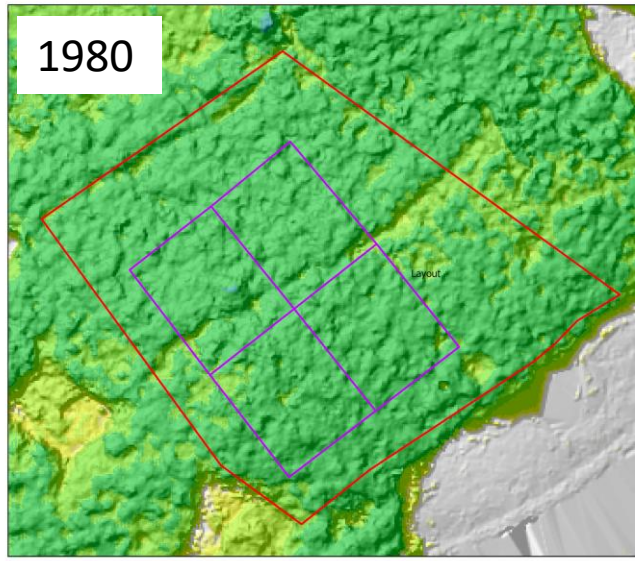
Mean height of permanent plots

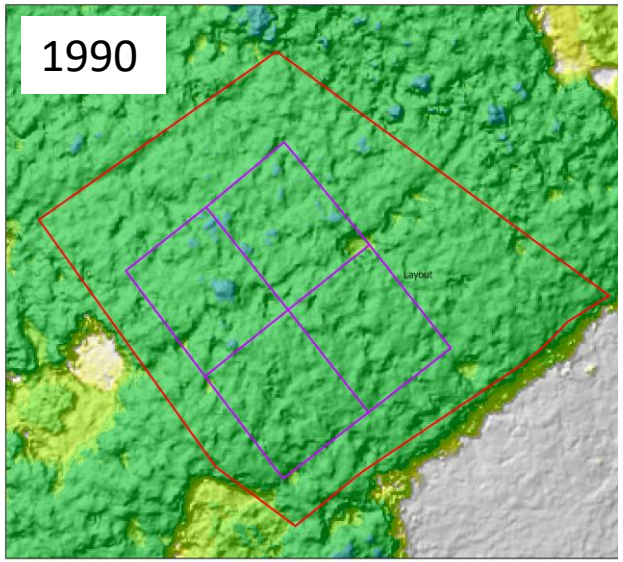
Standard Deviation of mean height as diversity measure?

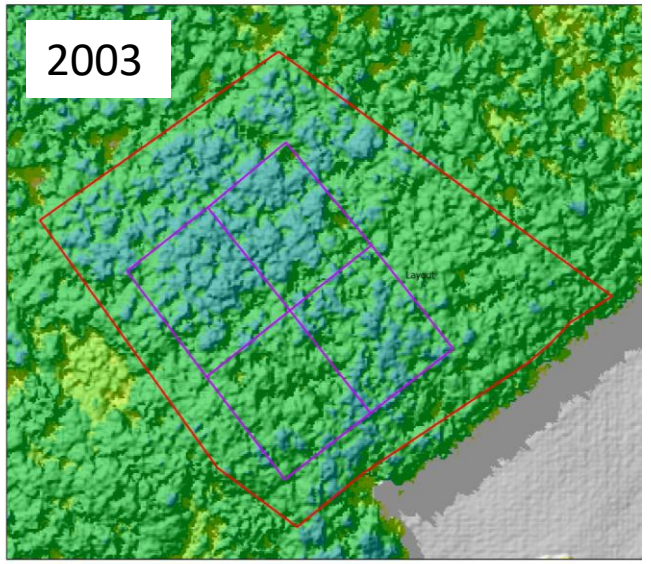


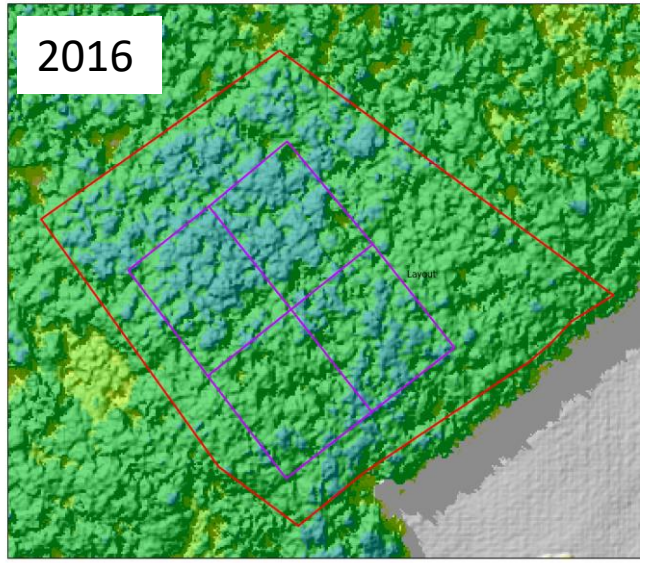


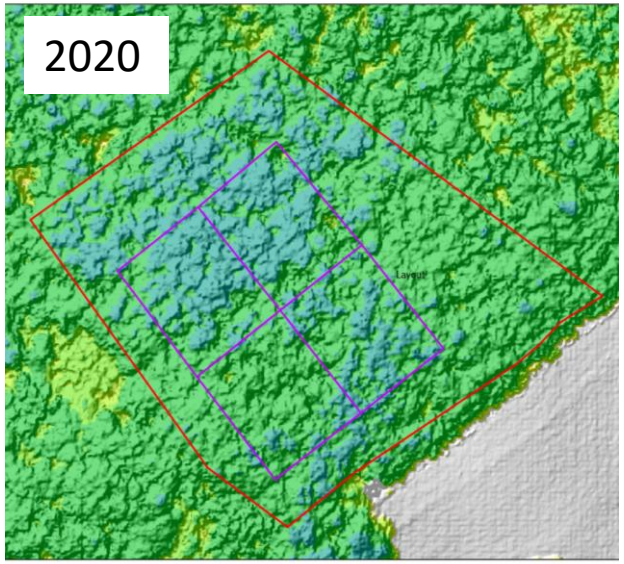
Adenberg – Zeitreihe VHM

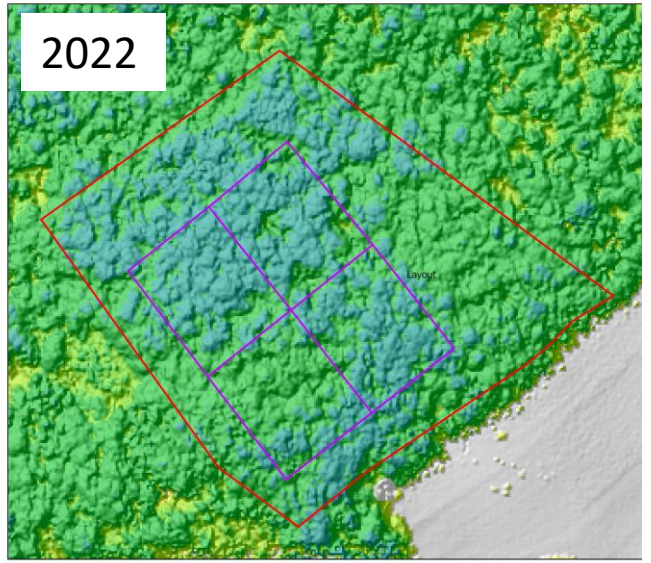












VHM

Bestandeshöhe [m]

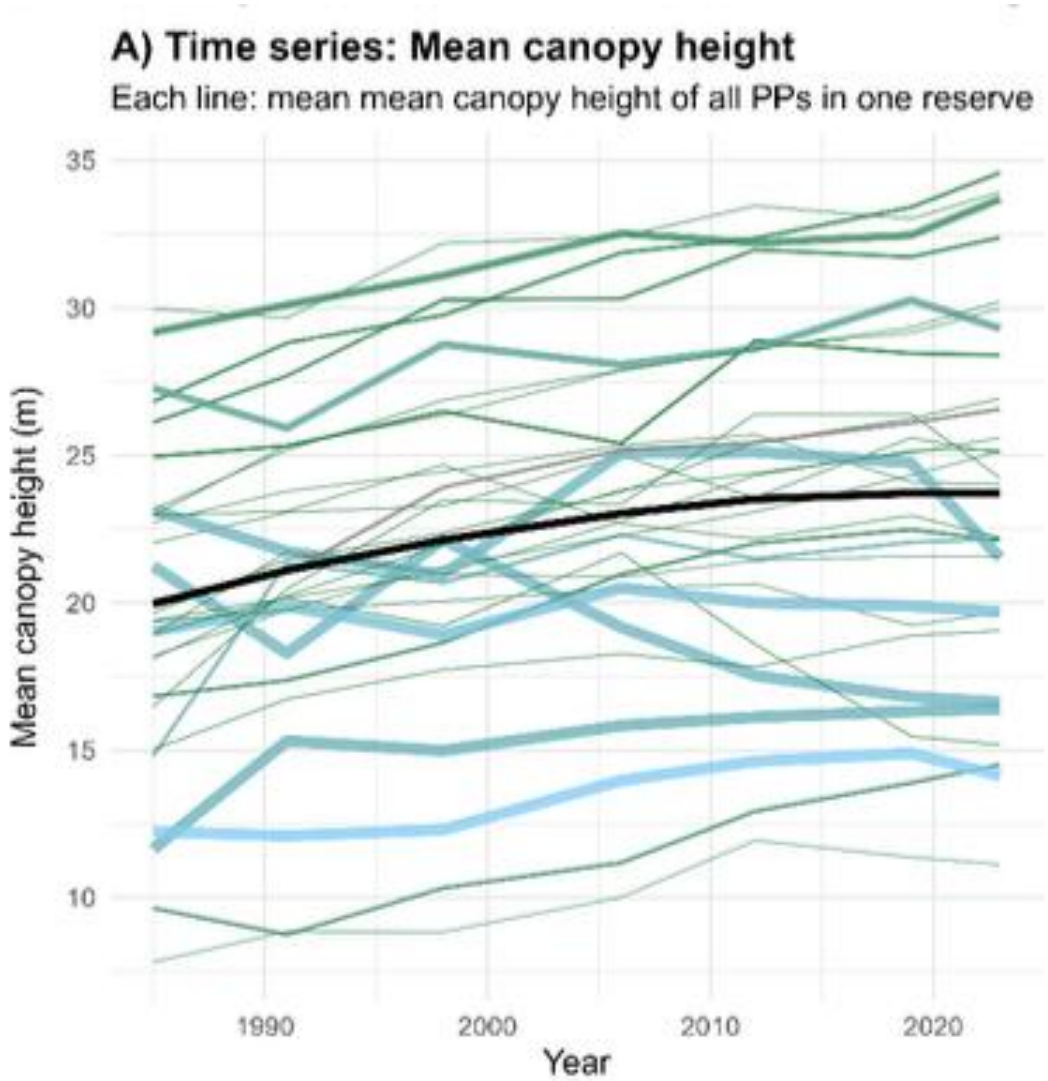
- 0 - 1
- 1 - 2
- 2 - 3
- 3 - 5
- 5 - 15
- 15 - 20
- 20 - 30
- 30 - 40
- 40 - 60

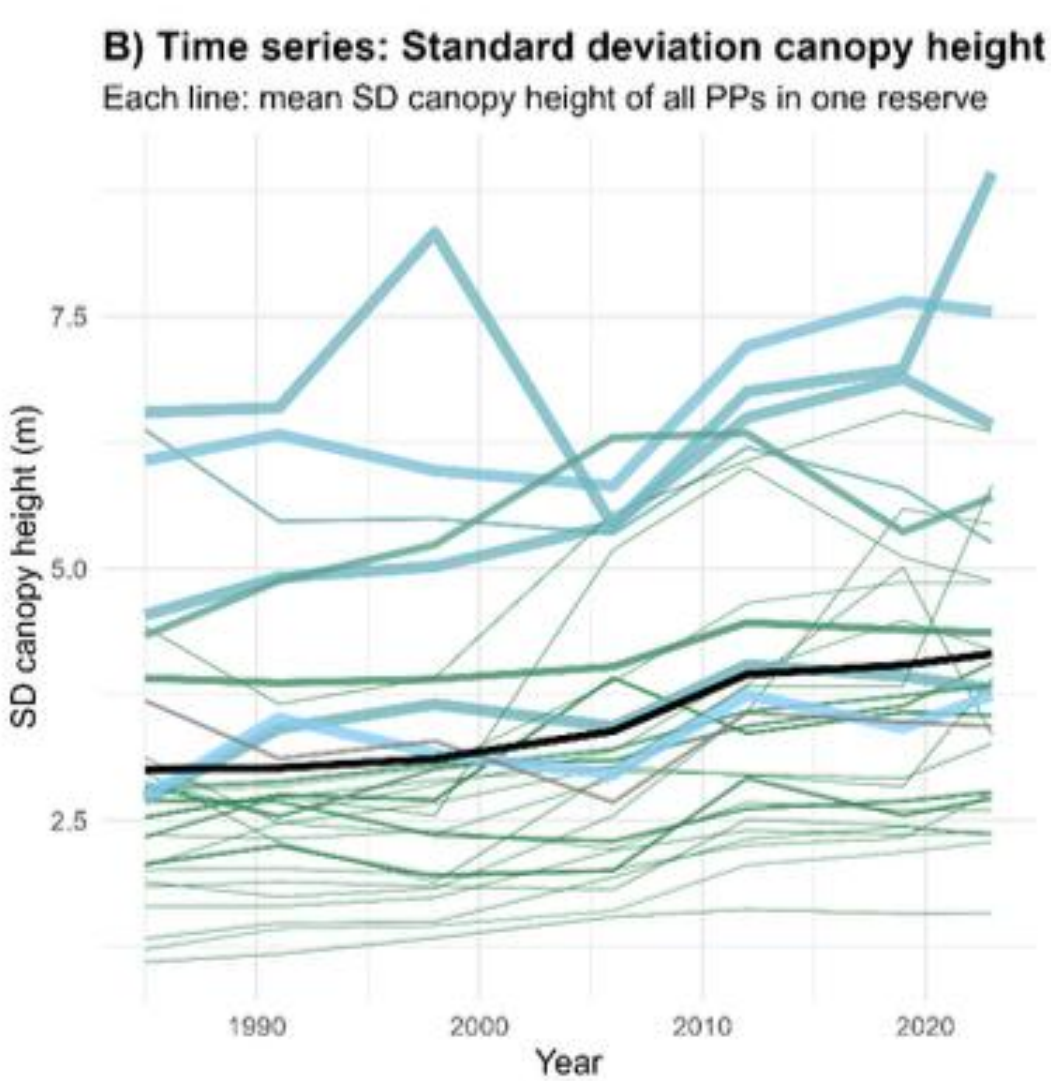
Waldreservat

Kernfläche

4 Kernflächen
Reservat 4.35 ha

Biomass development in Swiss forest reserves





Conclusions

Natural dynamics may be influenced by a variety of drivers

Scale matters.

May appear slow/subtle on human timescale

In (previously) managed forests, management history matters.

Management legacies influence dynamics over long time periods

Abb. 5.17. Alp Tamangur Dadaint. Oben: Walter Trepp, AWN, Graubünden, ungefähr 1950. Unten: Susan Lock, WSL, 2023.


Fragen?