Swedish University of Agricultural Sciences

The potential contribution of fast-growing broadleaves to biodiversity in northern Europe

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Trees For Me

What are you going to listen to?

1. • Academic background
2. • What is Trees For Me?
3. • Short-rotation broadleaves, fast-growing broadleaves… What are they?
4. • Why this project
5. • Introduction of my studies
6. • Summary / Take-home messages

1. Academic background

BSc in Biology

MSc in Conservation and Management of Wildlife

Restoration Ecology Group, SLU Umeå

Länsstyrelsen Norrbotten

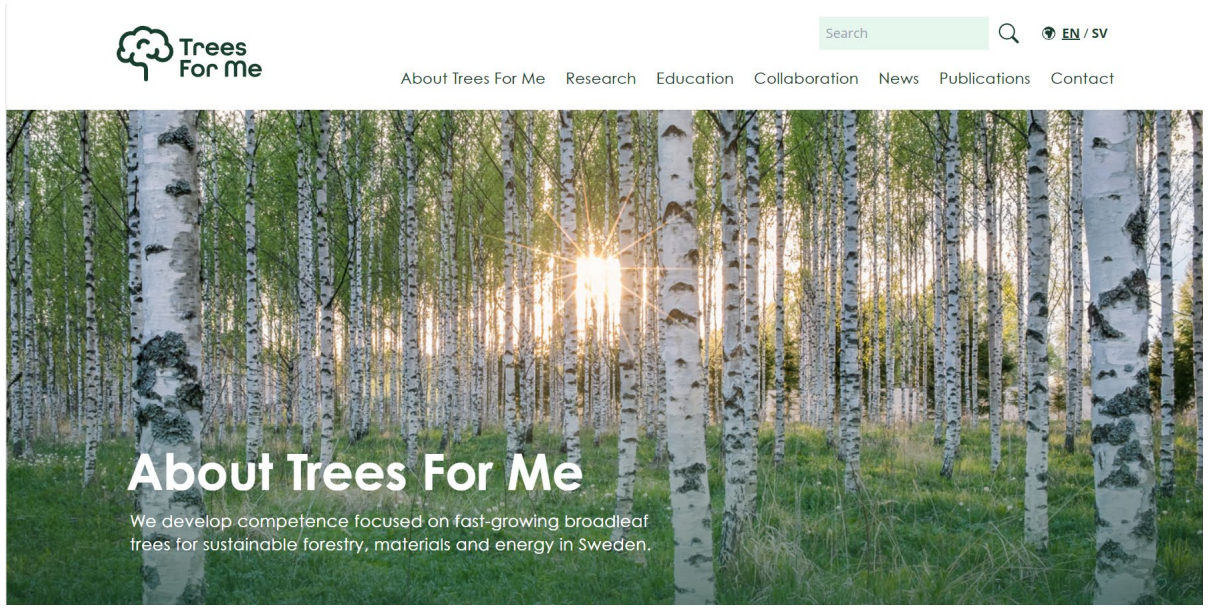
Ecology department, SLU Uppsala

Southern Swedish Forest Research Centre, SLU Alnarp

Forest Ecology and Management & Conservation

Forest Entomology

2. Trees For Me?



Home ▸ **Research**

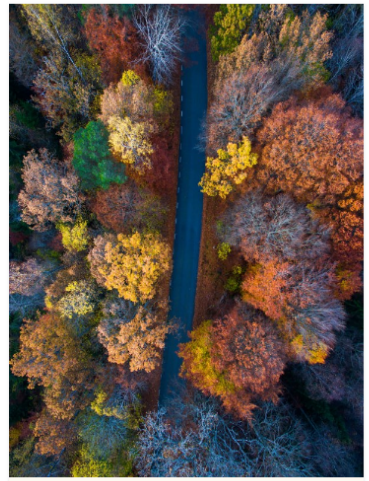
Research

Trees For Me coordinates an interdisciplinary research programme with the aim to advance the science beyond the state-of-the-art in the full chain from seed to sustainable fuels and high value-added products from fast-growing broadleaf trees. The centre brings together world-leading talent and skills to deliver high quality, innovative research.

The research is conducted within the following work packages:

- Work package 1 - Tree breeding
- Work package 2 - Silviculture
- Work package 3 - Material and energy
- Work package 4 - Societal transitions
- Work package 5 - Environmental impacts

The researchers and PhD students conducting the research are based at the Swedish University of Agricultural Sciences, Luleå University of Technology, Uppsala University, Umeå University and Skogforsk.



About the research projects →

More about the focus of the work packages and included projects.

The centre is a platform where academia, government and industry/society come together to develop science-based, innovative solutions for, and build future competence in, a new forest biomass supply system for conversion to high-value material and energy products, by combining expertise along the whole forest-based value chain.

Trees For Me is financed by the Swedish Energy Agency and 50 societal actors, ranging from academia and companies to interest organisations.

The centre is coordinated from the Swedish University of Agricultural Sciences (SLU) in Alnarp, Skåne.

3. Fast-growing broadleaves

- What are **fast-growing broadleaf trees**?
  - Broadleaves that grow faster than usual
  - Short rotation period
  - Normally planted in abandoned agricultural lands
  - Examples: poplar, hybrid aspen, salix, improved birch…

Salix plantation / Iggesund

Harvest: 3-4 years
Purpose: chips for heating and electricity

Poplar plantation/ Skåne, Sweden/ Jaime Luna

Harvest: 18-25 years
Purpose: energy wood and pulpwood

Hybrid aspen plantation / Jaime Luna

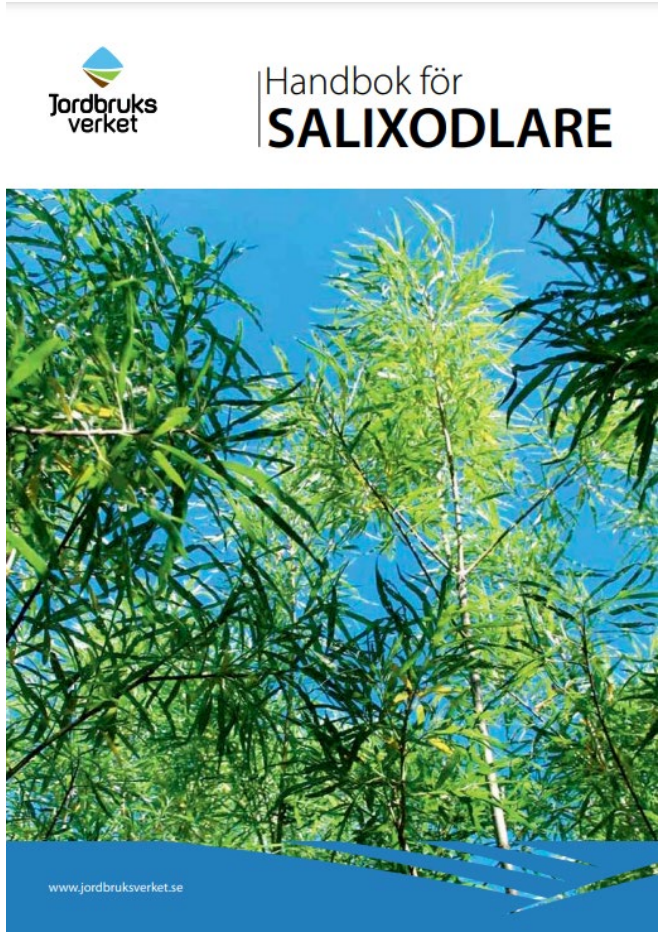
Harvest: 20-30 years
Purpose: energy wood and pulpwood & sawn logs and match wood

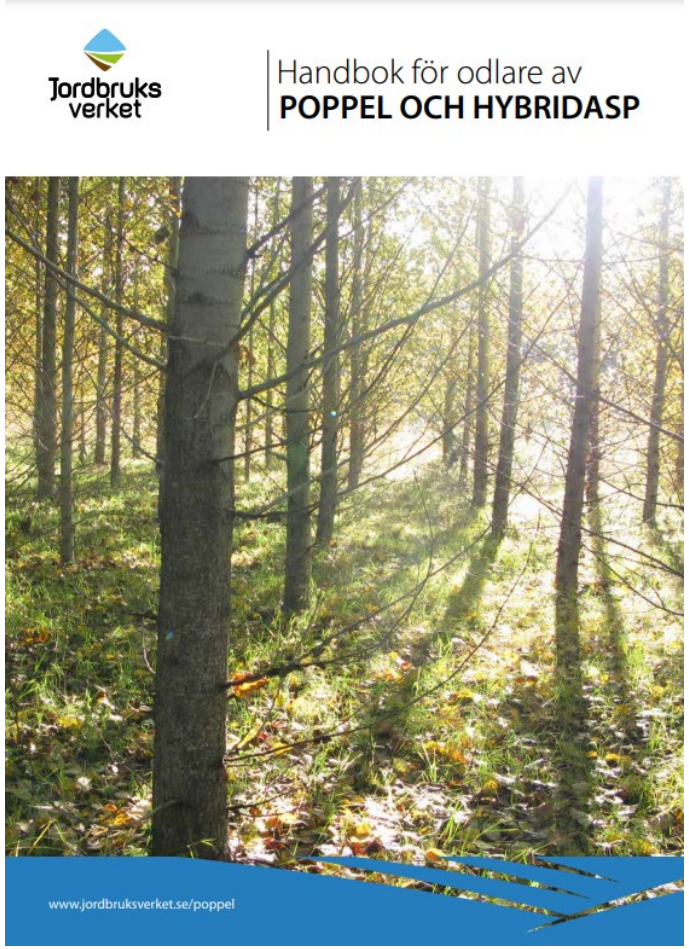
3. Fast-growing broadleaves?

- FGB in agricultural land: energy crops! Farmers entitled to agricultural subsidies (gårdsstöd) → harvest every 20 years
- Different legislation:
  - The Forestry Act (skogsvårdslagen)? → Does not apply to energy crops planted in agricultural land
  - Certifications? PEFC does not cover trees in agricultural lands the first 20 years
  - The Sustainability Act (hållbarhetslagen) → biofuels need to meet certain sustainability criteria (Renewable Energy Directive or Förnybartdirektivet; REDII (EU 2018/2001) (europa.eu))

3. Fast-growing broadleaves?

Energy crops





https://jordbruksverket.se/utveckla-foretagande-pa-landsbygden/fornybar-energi/odla-energigrodor

4. Background and why this project?

- Swedish Forestry Energy Project in 1976: willow coppices.
- Then hybrid aspen and poplar gained popularity (Southern Sweden)
- Break free from dependence on fossil fuel
- Challenges:
  - Lack of knowledge on management of fast-growing broadleaves
  - Large scale establishment: poplars on forest land? Climate resistant clones for higher latitudes?
  - Society attitude towards FGB? Non-native species?
  - Ecological trade-offs and biodiversity implications? Ecosystem services?!

4. Background and why this project?

- Diversification: from conifer dominated landscapes (more insect outbreaks and climate disturbances) to more broadleaves. Positive effects on forestry, recreation values and biodiversity.
- Short-rotation regimes need to be evaluated for sustainable forest biomass production:
  - Disadvantages: short rotation periods, even-aged and homogeneous stands
  - Advantages: diversification of conifer-dominated landscapes.
    - Increase share of native tree species like silver birch
    - Planting more Populus tree species may benefit biodiversity? Aspen hosts a great number of taxa (bryophytes, lichens, fungi, insects, etc) →

A hidden biodiversity potential on fast-growing Populus plantations?

Can fast-growing Populus plantations help us to reduce the production pressure on native aspen?

4. Background and why this project?

- Example of the poor knowledge we have:

Table 1. Number of publications concerning the implication of hybrid aspen and poplar plantations on lichens and bryophytes.

	Number of publications and countries where these were carried out	
	Sweden	Estonia
Bryophytes		1 Tullus et al., (2012b)
Bryophytes (and vascular plants)	1 Weih et al., (2003)	3 Tullus et al., (2008, 2015), Soo et al., (2009)
Lichens	1* Jastrzębska (2020)	1 Randlane *et al.*, (2017)

Notes: Weih et al., (2003) do not provide a list of the bryophytes they surveyed in their poplar plots; Tullus et al., (2008) found 19 species of bryophytes (moss layer) in hybrid aspen plantations but just mention one species; Soo et al., (2009) just mention the four most common species (moss layer) out of a total of 44 found on the surveyed hybrid aspen plots and they did not use them in their analysis; Tullus et al., (2012) provide a list of 38 species of bryophytes (moss layer) found in hybrid aspen and birch plantations (34 species and 17 species, respectively) but do not specify which species was found in which tree species plantation; Tullus et al., (2015) found 27 new bryophytes (59 bryophytes in total) a few years later in the same plantations where Tullus et al., (2012b) did their study; * Jastrzębska (2020) published this master thesis in SLU epsilon webpage dealing with lichens on poplars and other trees planted for experimental purposes in southern Sweden.

Literature review made by Jaime Luna in 2023

5. What are we doing?

Aim: identify the **biodiversity contributions**, and ways to increase the benefits to forest biodiversity, from the use of fast-growing broadleaves (FGB).

- Hybrid aspen (*Populus tremula* x *P. tremuloides*)
- Poplar (*Populus trichocarpa* x *P. maximowiczii*; OP42)
- Improved birch (*Betula pendula*; EKEBO)

Knowledge gaps?

- Determine the relative **capacity** of hybrid and exotic FGB tree species to **support species of conservation importance. Evaluate SRB habitat contribution**
- How can these FGB production stands **contribute to environmental goals?**
- **Assess the potential benefits of targeted conservation actions** such as retention trees, CWD creation, etc.

Taxonomic groups to be assessed:

- **Saproxylic beetles**
- **Lichens** & bryophytes,
- Understory vegetation, birds & deadwood-dependent fungi?

Chapters

I. **CWD – Saproxylic beetles** → *The contribution of coarse woody debris from short-rotation broadleaf stands to saproxylic beetle diversity* **(J)**

II. **Lichen Survey** → *The lichen diversity of short-rotation broadleaf production stands in Sweden* **(J)**

III. **Bryophyte transplant protocol** → *Using bryophyte transplants to assess the potential of SRB stands to host species of conservation concern* **(J)**

IV. **Systematic review** → *The biodiversity implications of short-rotation broadleaved trees in northern Europe: A synthesis* **(J)**

V. **High stumps and saproxylic beetles** → pilot study: bachelor thesis (J)

VI. **Wood-dependent fungi** → *DNA assessment of wood-dependent fungi communities* **(G)**

VII. **Understory vegetation? (PO)**

VIII. **Bird communities** → master thesis (N)

IX. **Fast-growing broadleaf database creation (J, O…)**

Project 1: Saproxylic beetles and CWD

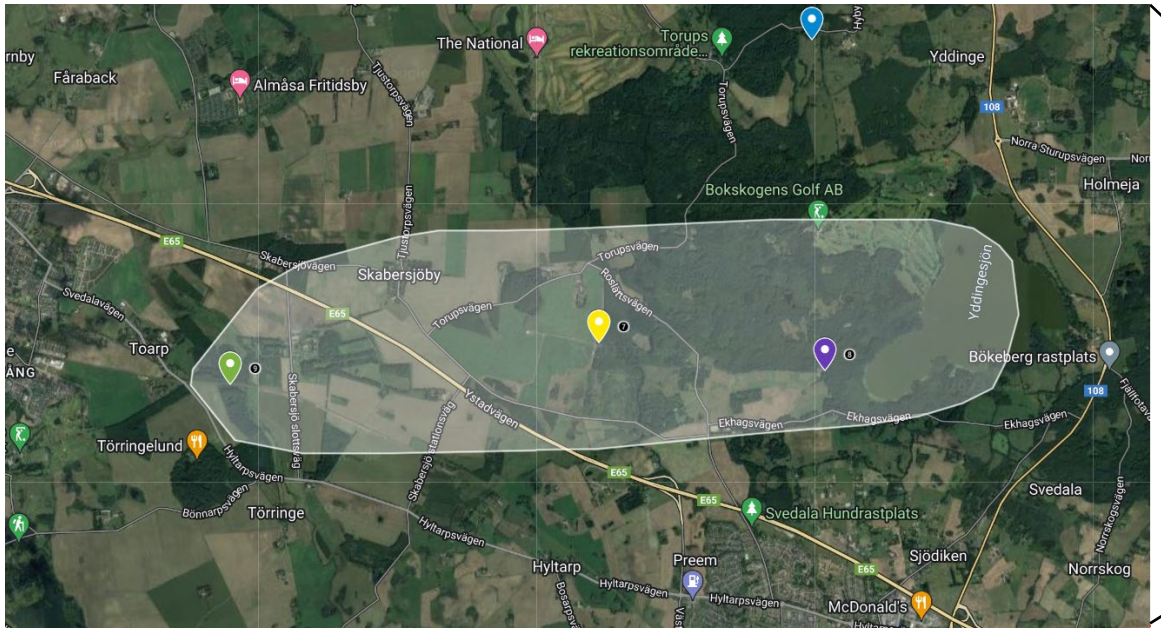
- Can FGB dead wood contribute to forest biodiversity? Relevant inputs on the potential usefulness of conservation actions (e.g., CWD retention)
- Are there any differences between the deadwood of different FGB tree species?

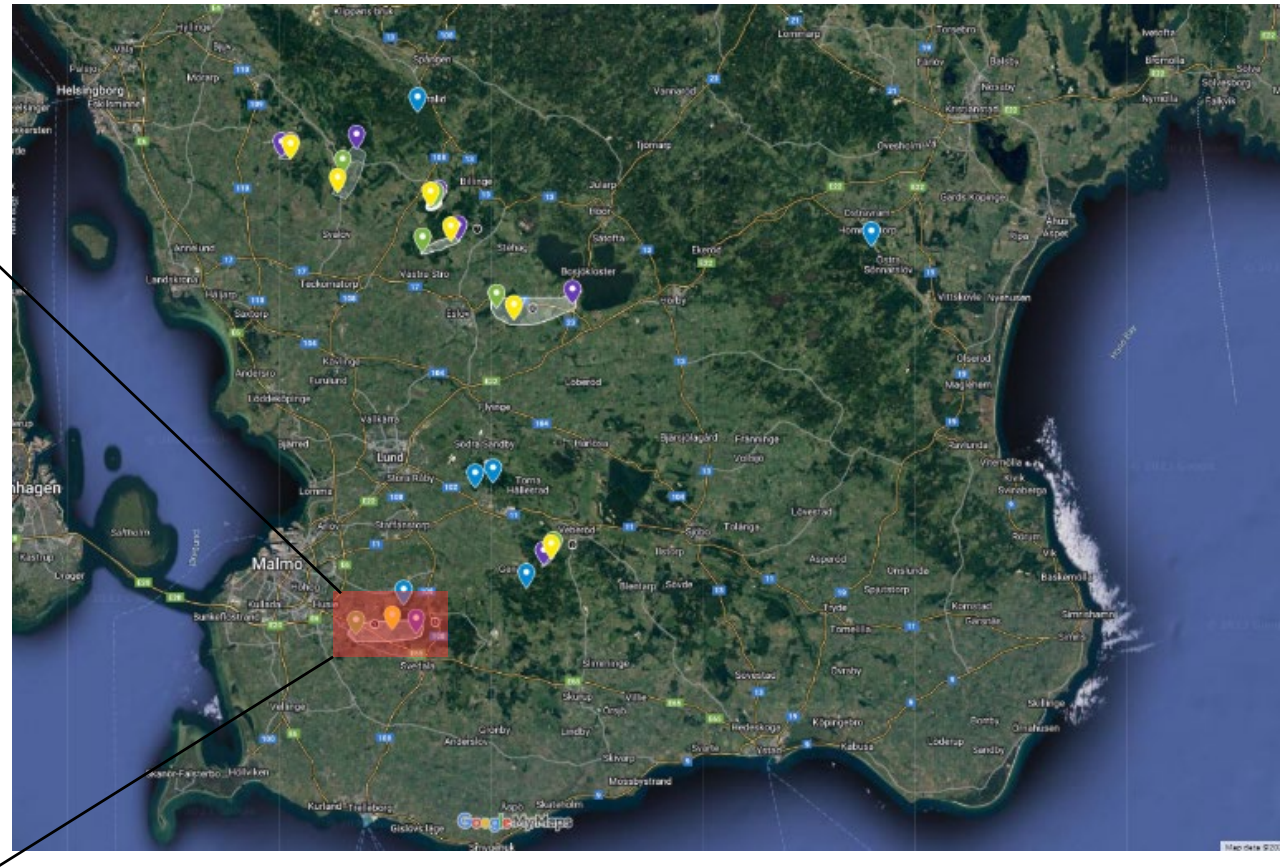
- STATUS: data collection

Project 1: Saproxylic beetles and CWD

- Can FGB dead wood contribute to forest biodiversity? Relevant inputs on the potential usefulness of conservation actions (e.g., CWD retention)
- Methodology

  1) Find, visit and select fast-growing stands & creation of database. Selection of 7 stands of each tree species (poplar, hybrid aspen and birch)



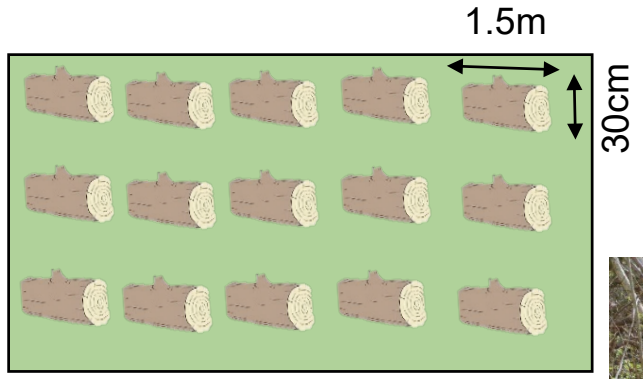


Project 1: Saproxylic beetles and CWD

- Can FGB dead wood contribute to forest biodiversity? Relevant inputs on the potential usefulness of conservation actions (e.g., CWD retention)
- Methodology

  2) Placement of 3 x 1.5 m x 20-30 cm diameter logs of hybrid aspen, aspen, birch, Ekebo birch & poplar on SW sunny spots:

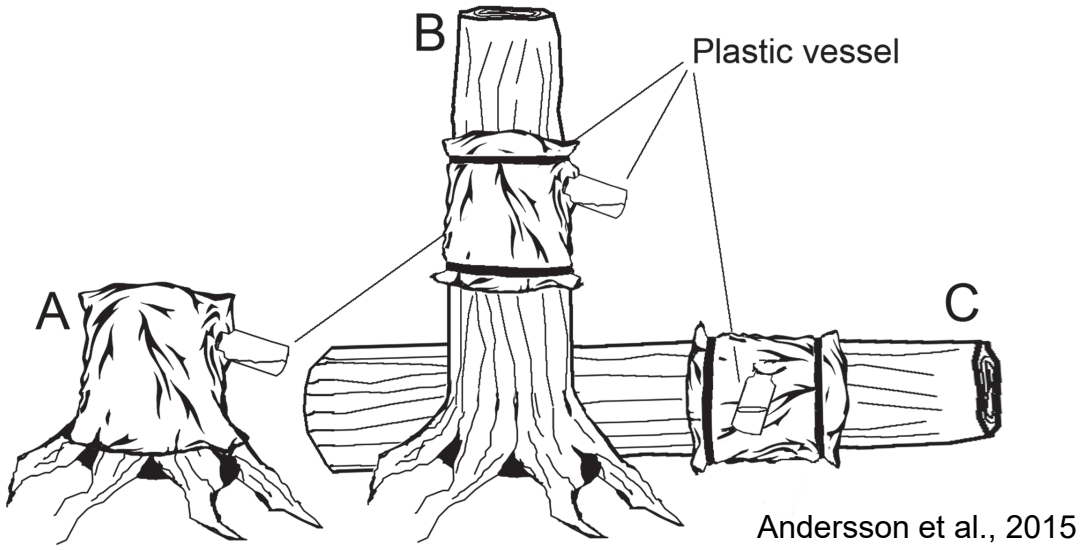
  - close to stands of x7 poplar, x7 hybrid aspen, and x7 birch
  - saproxylic beetle hotspots x 3



Project 1: Saproxylic beetles and CWD

- Can FGB dead wood contribute to forest biodiversity? Relevant inputs on the potential usefulness of conservation actions (e.g., CWD retention)

- Summary:
  - 7 clusters x 3 stands/cluster = 21 stands + 3 hotspots = 24 stands.
  - 3 logs/species in each stand = 15 logs/stand x 24 stands = 360 logs in total placed around Skåne
  - 100-120 kg each log x 360 logs = 36 tones of wood



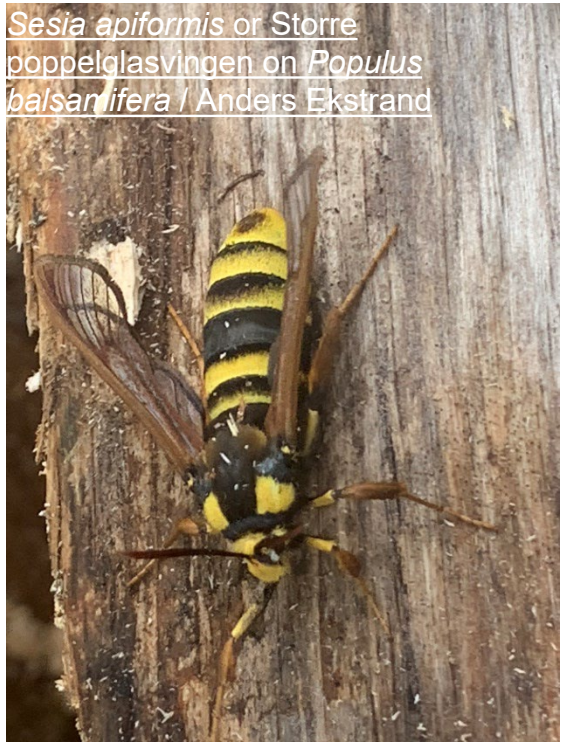
Andersson et al., 2015


Kärvemo et al., 2022

Project 1: Saproxylic beetles and CWD

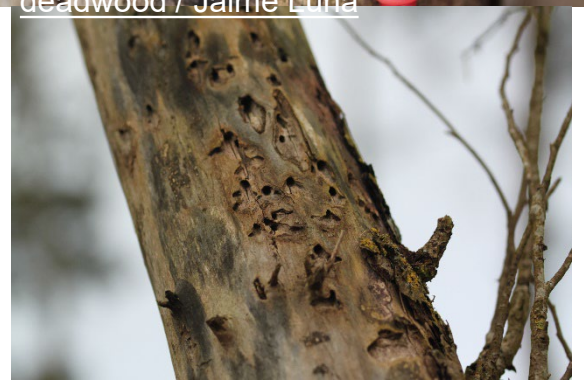
- Can FGB dead wood contribute to forest biodiversity? Relevant inputs on the potential usefulness of conservation actions (e.g., CWD retention)


Catocala sp. on hybrid aspen / Jaime Luna


Sesia apiformis or Storre poppelglasvingen on *Populus balsamifera* / Anders Ekstrand


Rhagium mordax or Lövträdlöpare. on hybrid aspen / Jaime Luna


Emergence holes on poplar deadwood / Jaime Luna

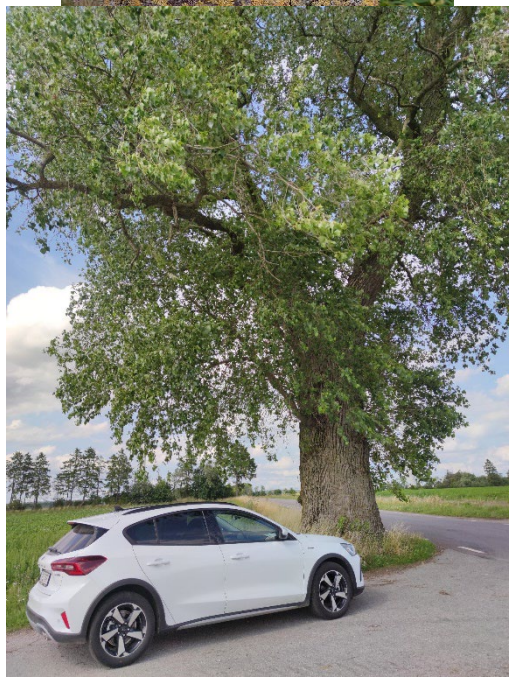


Project 1: Saproxylic beetles and CWD

- Can FGB dead wood contribute to forest biodiversity? Relevant inputs on the potential usefulness of conservation actions (e.g., CWD retention)

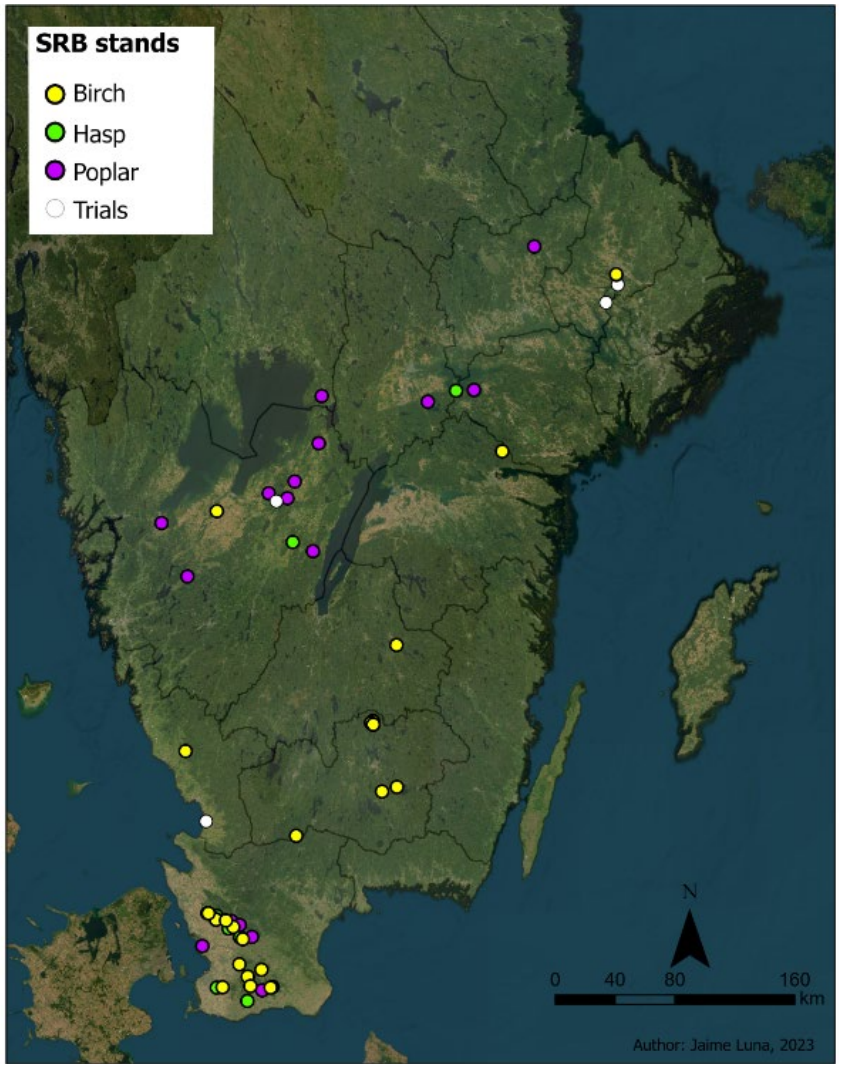
Project 2: Lichen diversity of FGB stands

- What is the relative contribution of SRB stands to lichen biodiversity, and how can this contribution be enhanced?
- **Address the extent to which hybrid, exotic and native broadleaf tree species grown under short rotations provide lichen habitat**, and the potential contribution to habitat suitability from altered light environments and **retention trees**
- **STATUS: data analysis**



Project 2: Lichen diversity of FGB stands

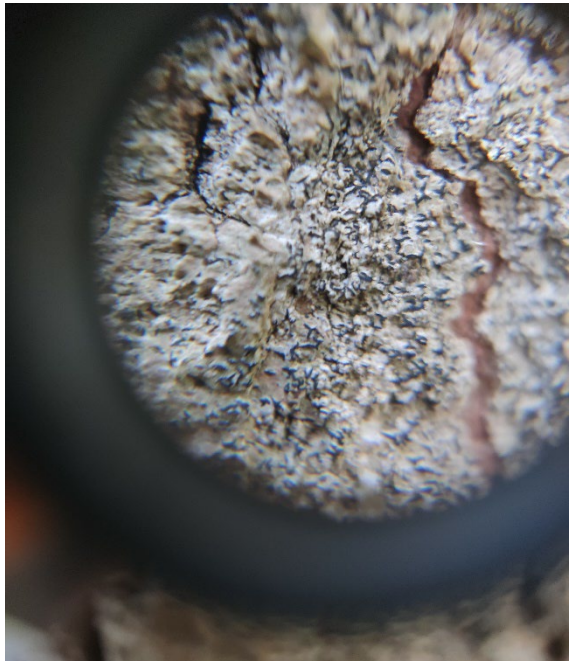
- How beneficial can green retention be for lichen diversity?
- Methodology
  1) Find, visit and select **mature** fast-growing stands
  2) Lichen inventory (20 trees/stand) in ca. 14 stands/tree species
  3) Environmental and stand variables



Project 2: Lichen diversity of FGB stands

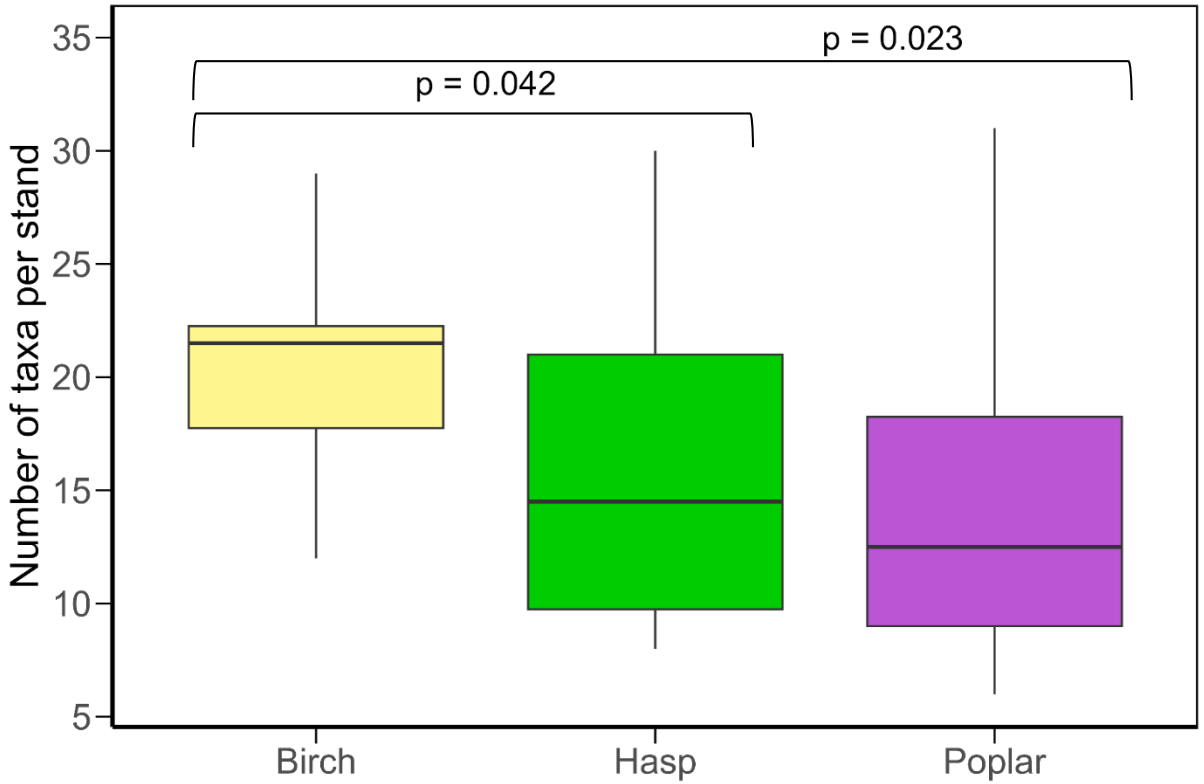
- Address the extent to which hybrid, exotic and native broadleaf tree species grown under short rotations provide lichen habitat. Retention trees!

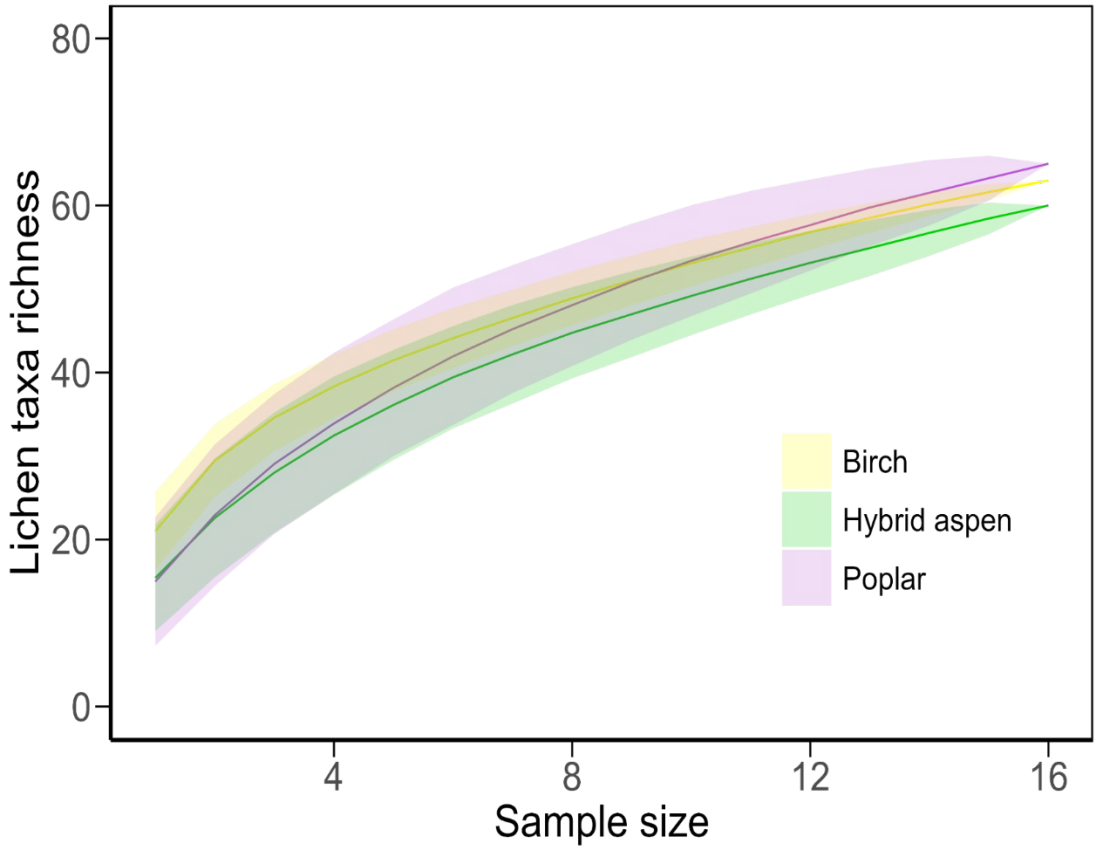
- Preliminary results (observations) from the inventories:
  - Lichen communities differ from tree species. *Populus* lichen communities more related to each other than to *Betula* communities. Lichen flora on hybrid aspen is not that different from aspen flora.
  - Every single stand seems to have a particular lichen flora (close environment is playing a role here?)
  - Betula stands host the richest lichen flora.



Project 2: Lichen diversity of FGB stands

- Preliminary exploratory results:





Project 2: Lichen diversity of FGB stands

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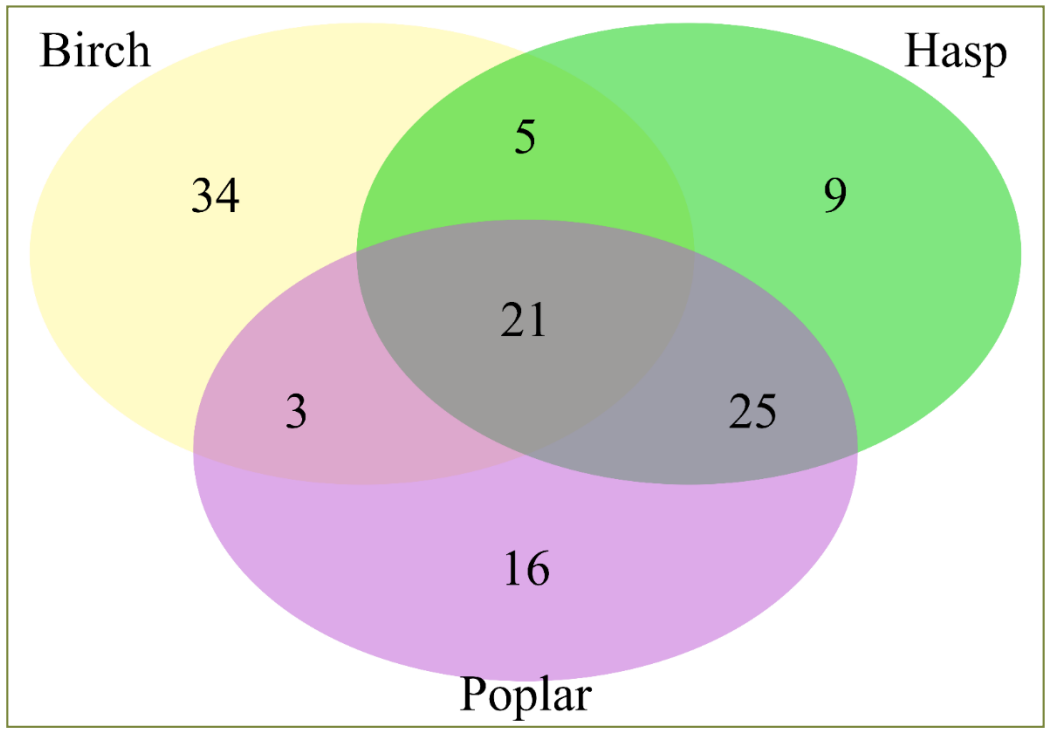

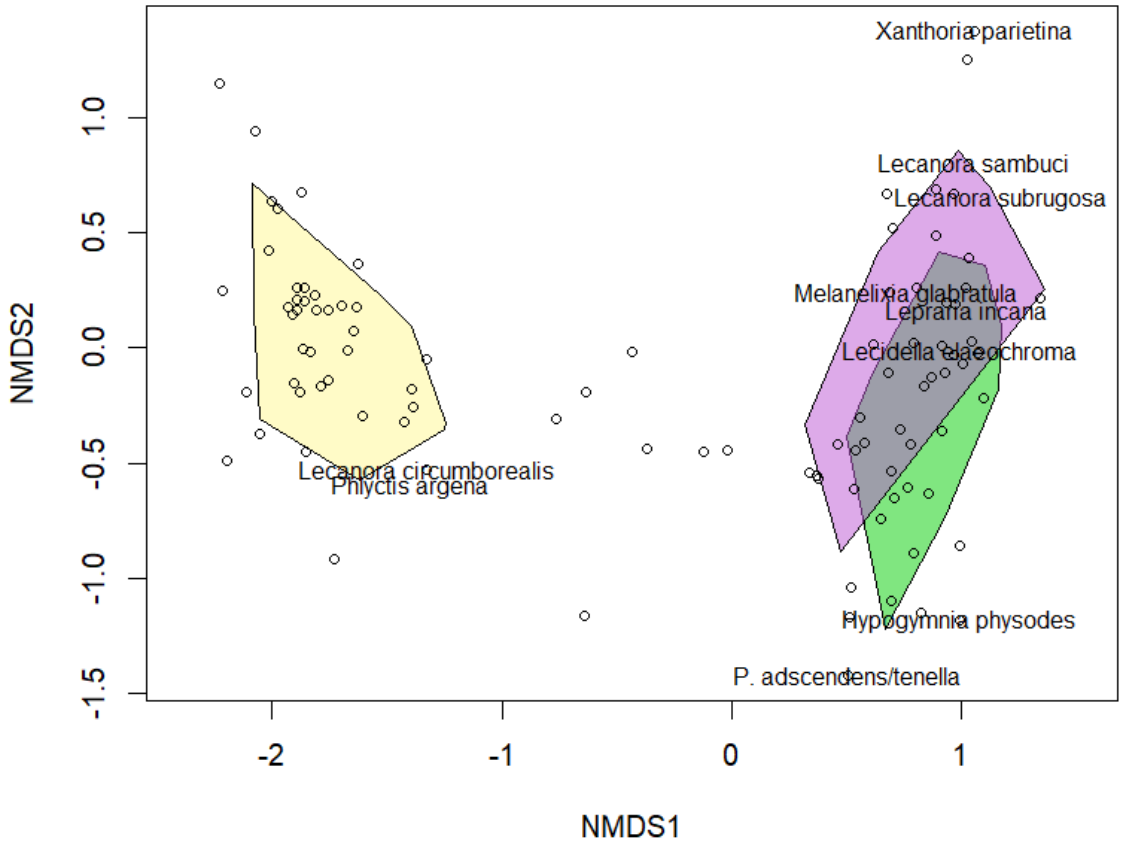

Project 2: Lichen diversity of FGB stands

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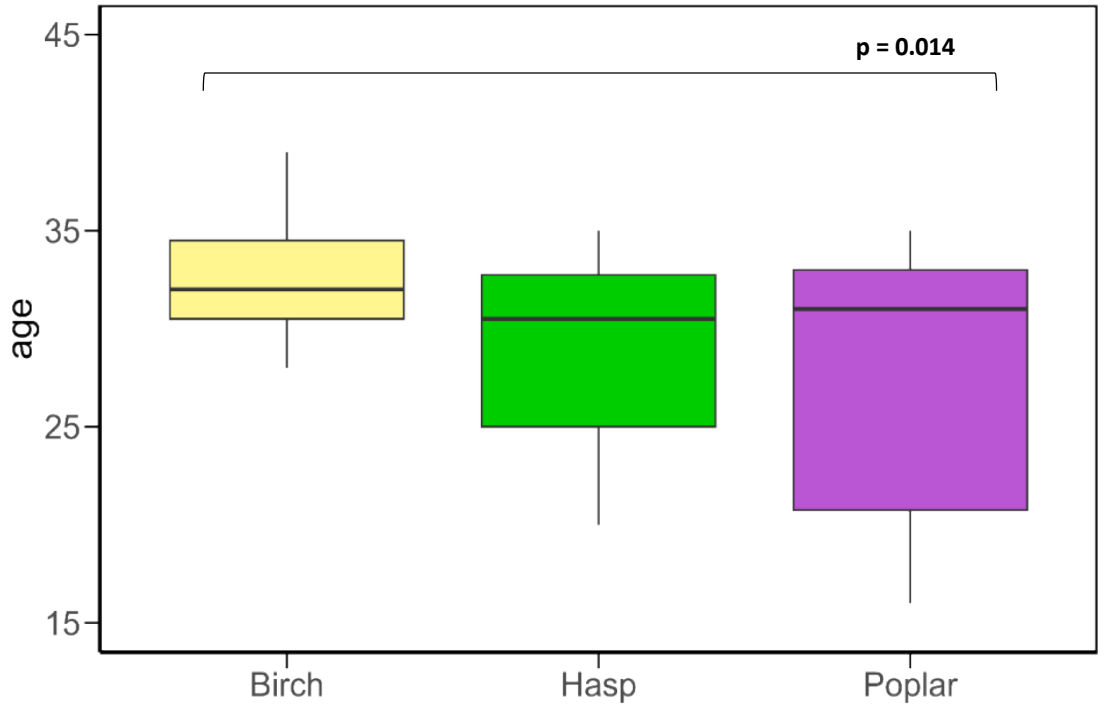
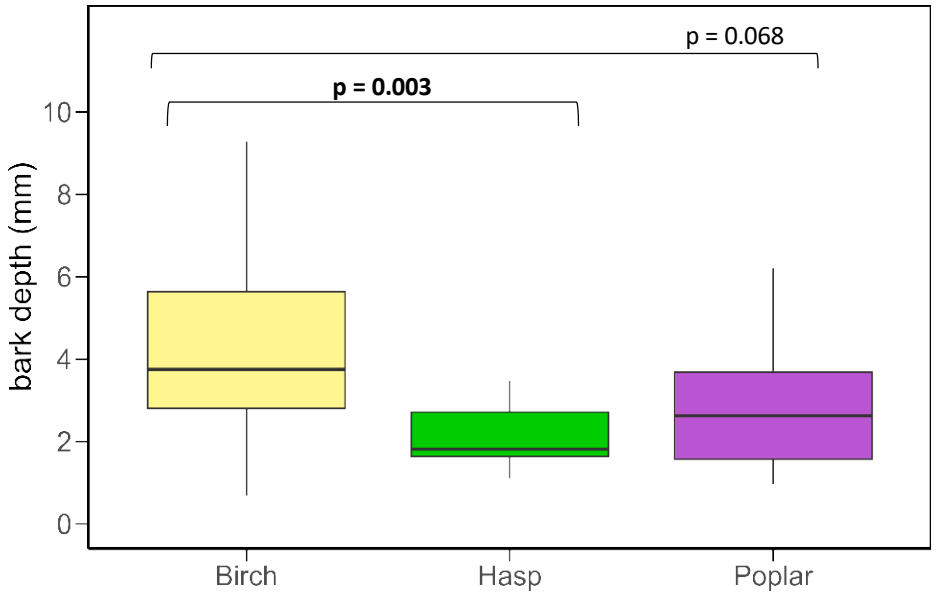
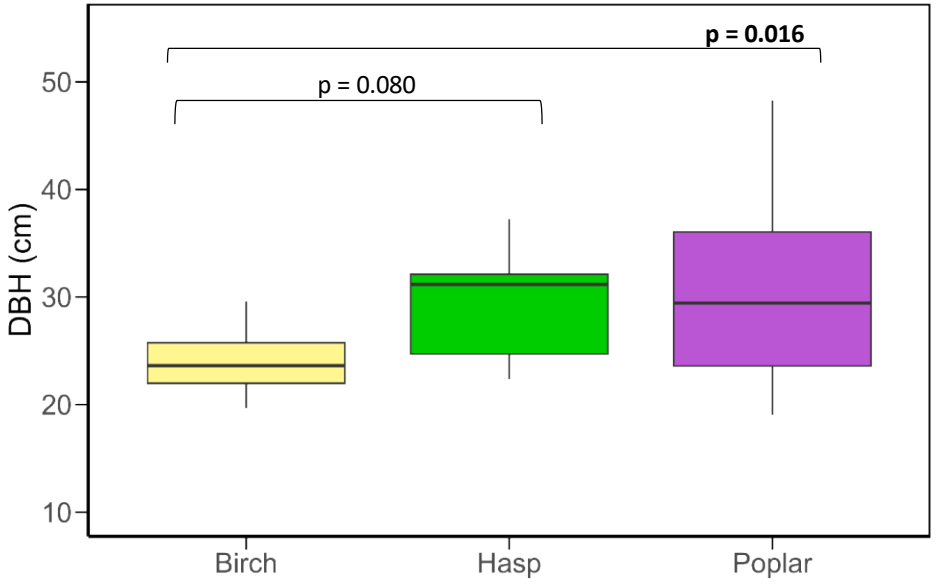




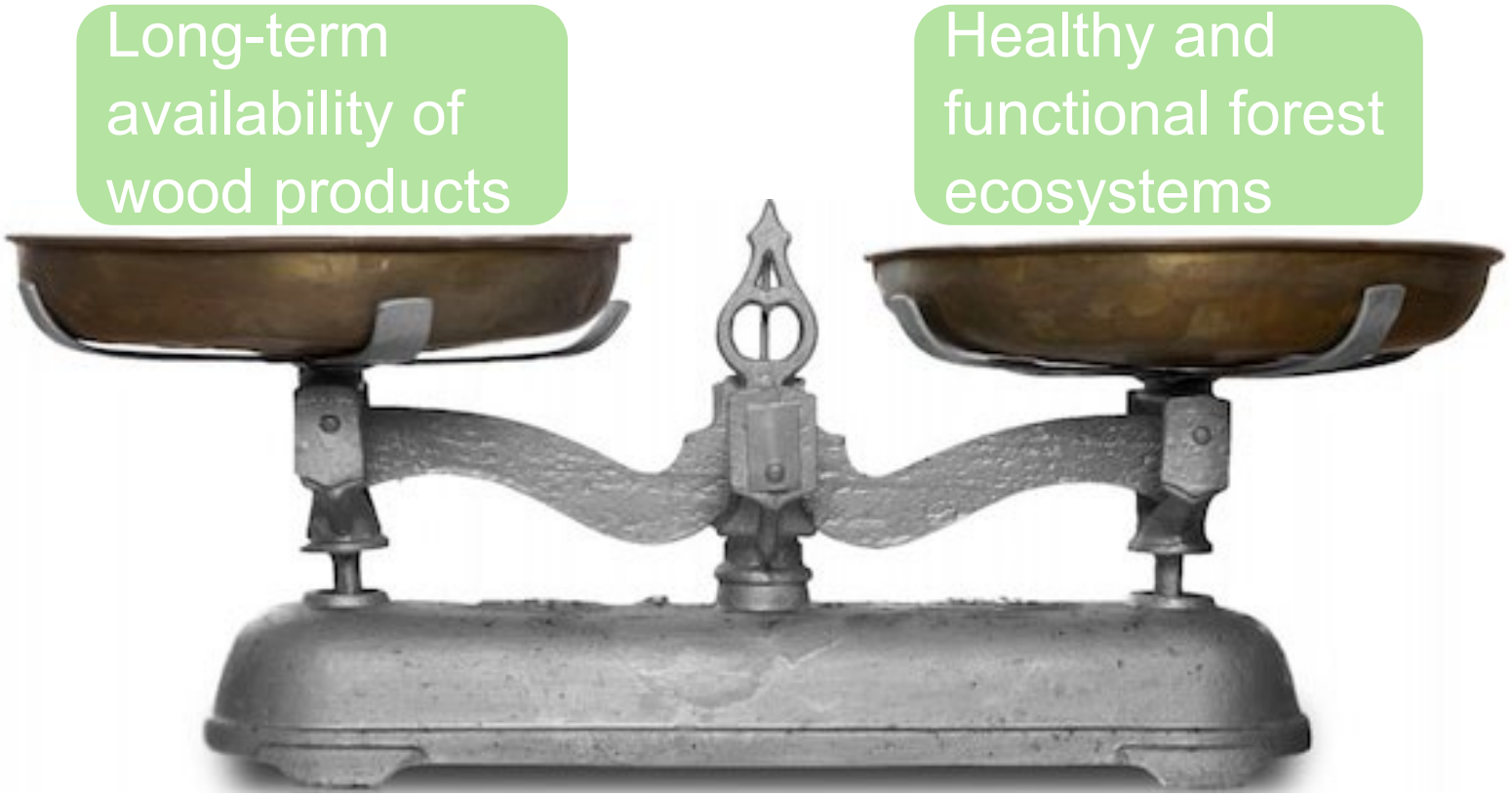


5. Summary / Take-home messages

- What we plant now & forest management → future forests.
- Potential of FGB to provide ecosystem services (e.g. risk reduction of insect outbreaks, creation of suitable habitats for different taxa – well-functioning of the forest landscape…).
- Native tree species may be the best when it comes to hosting higher lichen diversity.
- Non-native tree species have a hidden potential to provide habitat to different taxa (more research is needed). Red-listed lichen taxa!
- Sustainable forestry needs active biodiversity management plans.

5. Summary / Take-home messages

- Fulfil materials and energy demands & contribute to the environmental goals



Thanks for listening!

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Questions, comments, suggestions?

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Please, feel free to contact me! ☺

Trees For Me

Who will find the results from these studies useful?

Climate and societal benefits

- Stakeholders and people interested in making a sustainable use of our forests
- General public
- Future generations

3. Why should we study this?

- According to the **Swedish environmental goal "Living Forests"** the objective is to "protect the value of forests and forest land for biological production while preserving biodiversity and safeguarding cultural and social values."
- New **Restoration Law** (2023):
  - Protect and restore biodiversity
  - Foster knowledge, awareness, education, and dialogues on environment, climate change, energy use, and sustainability.

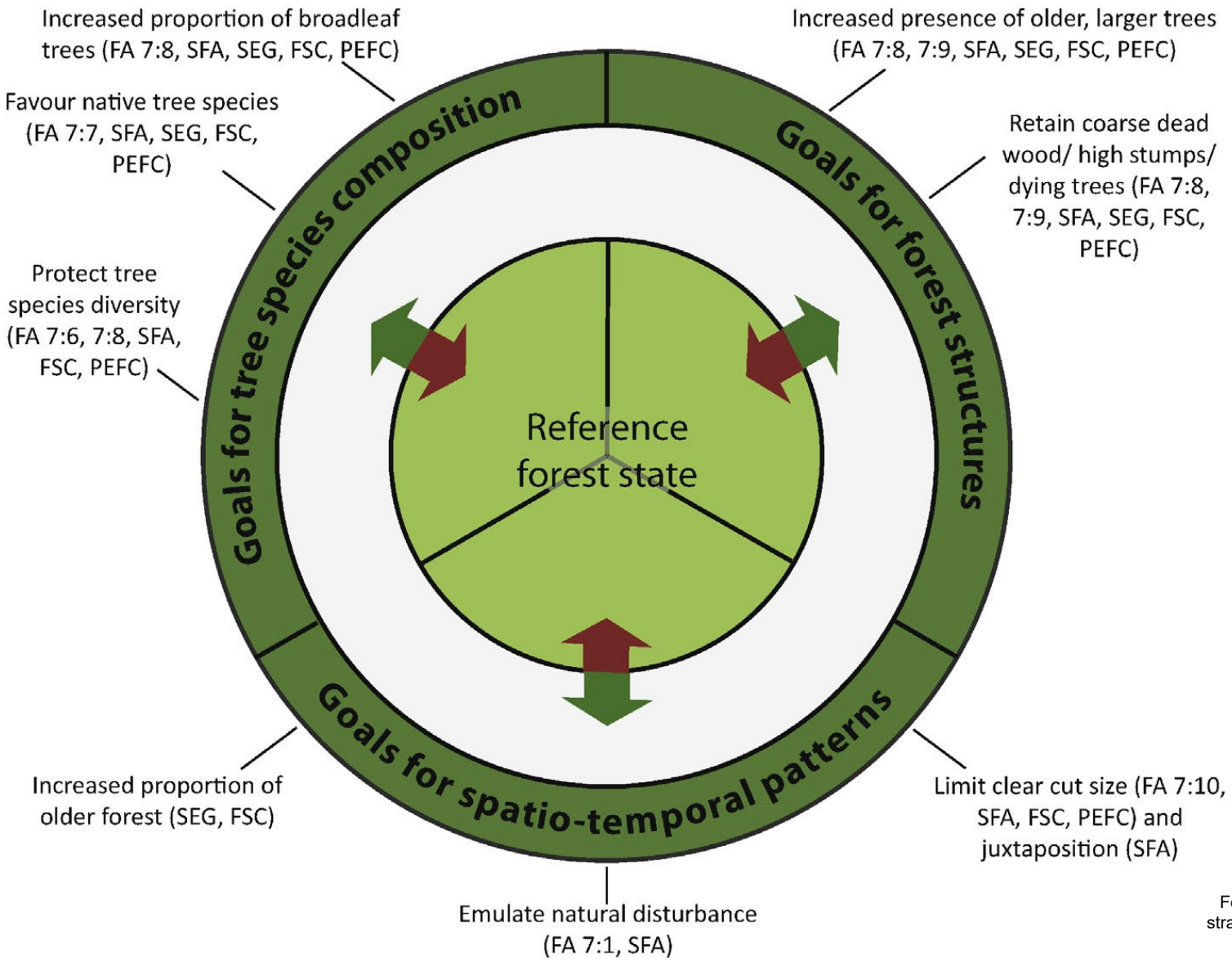
Question for the audience?

What would happen if a small landowner ask you for some evidence-based advice on how to **manage their fast-growing stands towards promoting biodiversity instead of production**?

Time goes, attitudes change and we have to adapt.

According to the Swedish environmental goal "**Living Forests**" the objective is to "**protect the value of forests and forest land for biological production while preserving biodiversity and safeguarding cultural and social values**."

Are short-rotation broadleaf stands good for forest biodiversity?



Felton, A. et al., 2016. How climate change adaptation and mitigation strategies can threaten or enhance the biodiversity of production forests: Insights from Sweden. Biological Conservation 194:11-20.