Seeing trees and forests for the future

Assess4EST: assessment of trade-offs and potentials to breed and manage forests to meet sustainability goals

Breeding and forest management for the future pile of logs: the users must tell us what quality that is needed!

International Workshop in WP5 (25.Jan.2023) arranged by WoodWorks! Cluster

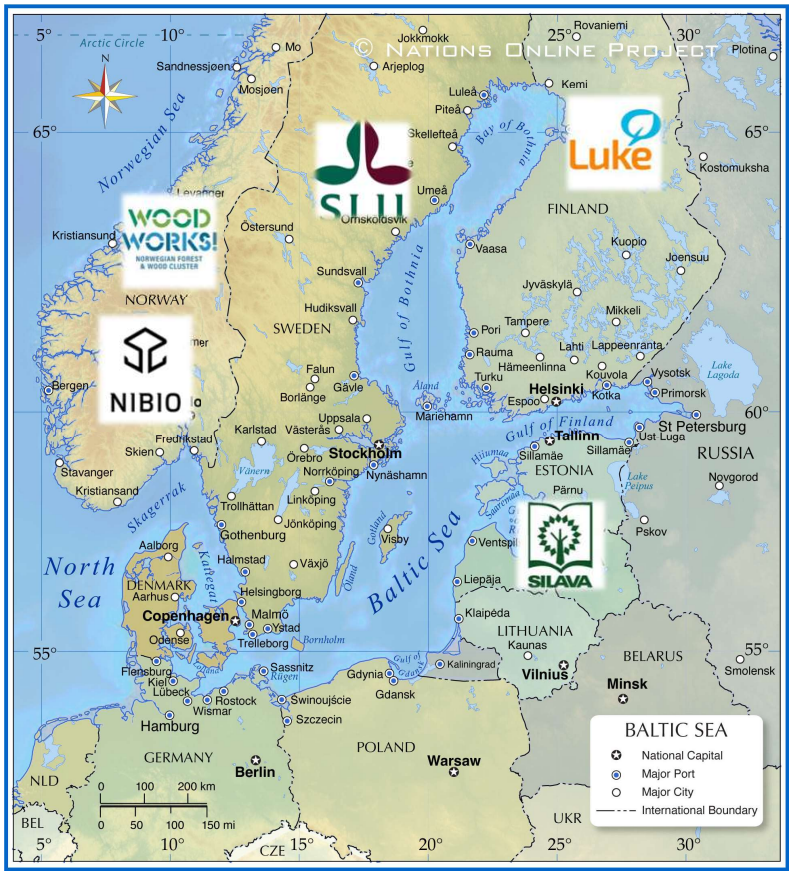
Arne Steffenrem (NIBIO/Skogfrøverket)

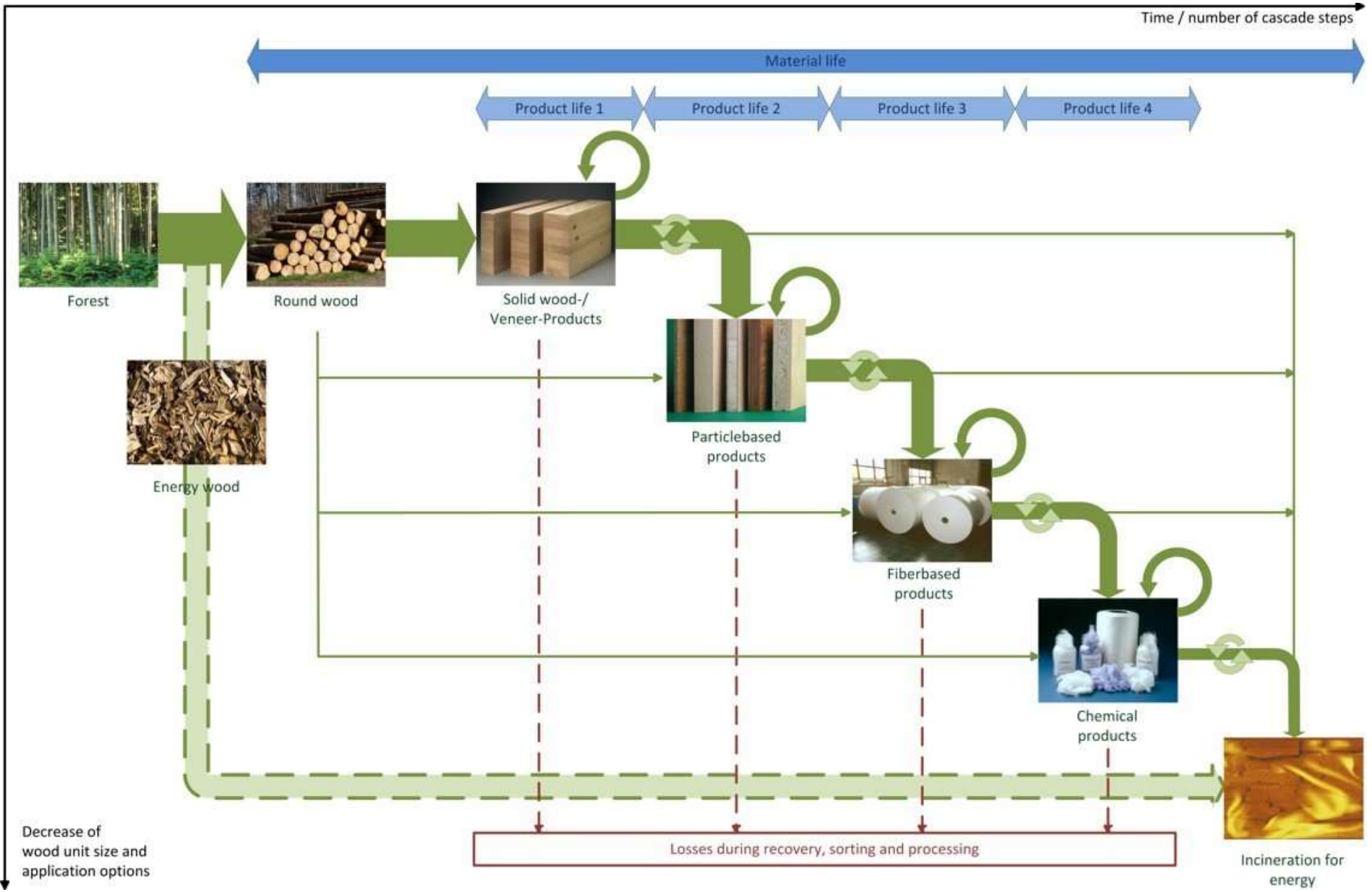
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773324

Project partners

Luke
SLU
NIBIO
SILAVA
Woodworks! Cluster

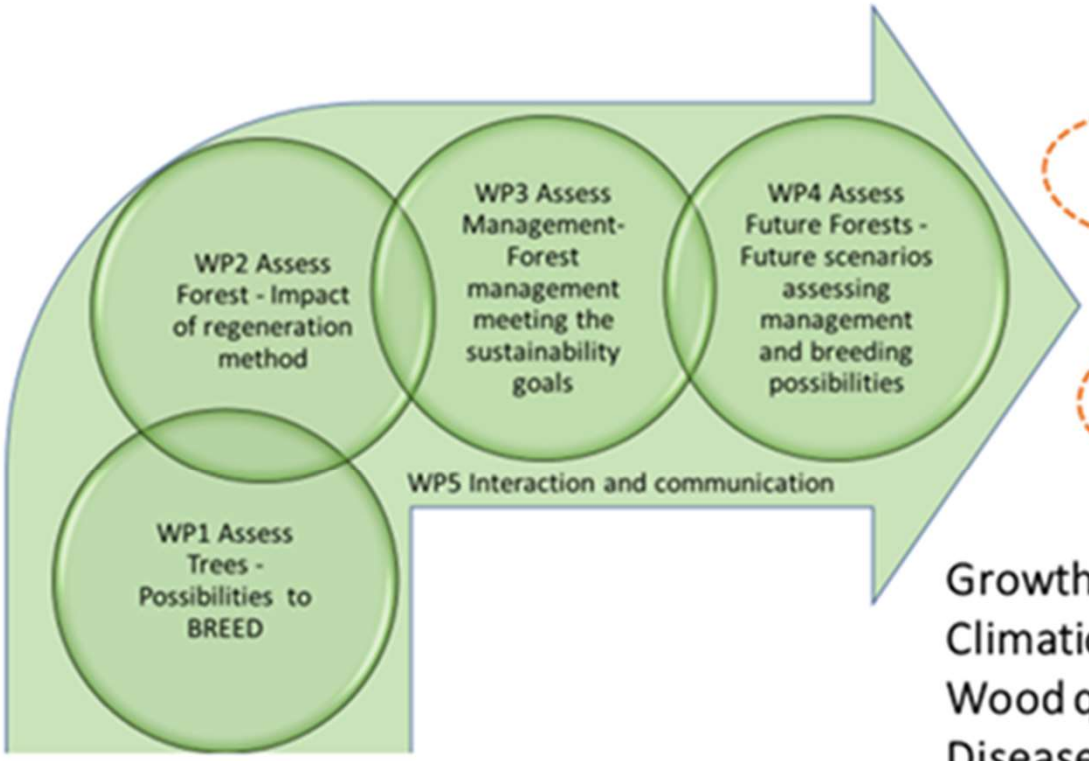
2022 - 2025




Time / number of cascade steps
Material life
Product life 1
Product life 2
Product life 3
Product life 4
Forest
Round wood
Solid wood-/
Veneer-Products
Particlebased
products
Energy wood
Fiberbased
products
Chemical
products
Incineration for
energy
Losses during recovery, sorting and processing
Decrease of
wood unit size and
application options
Recove
process
Cascadi
flows
Wood f
cascadi
Re-use
sorting,

Assess4EST (ForestValue 2021)

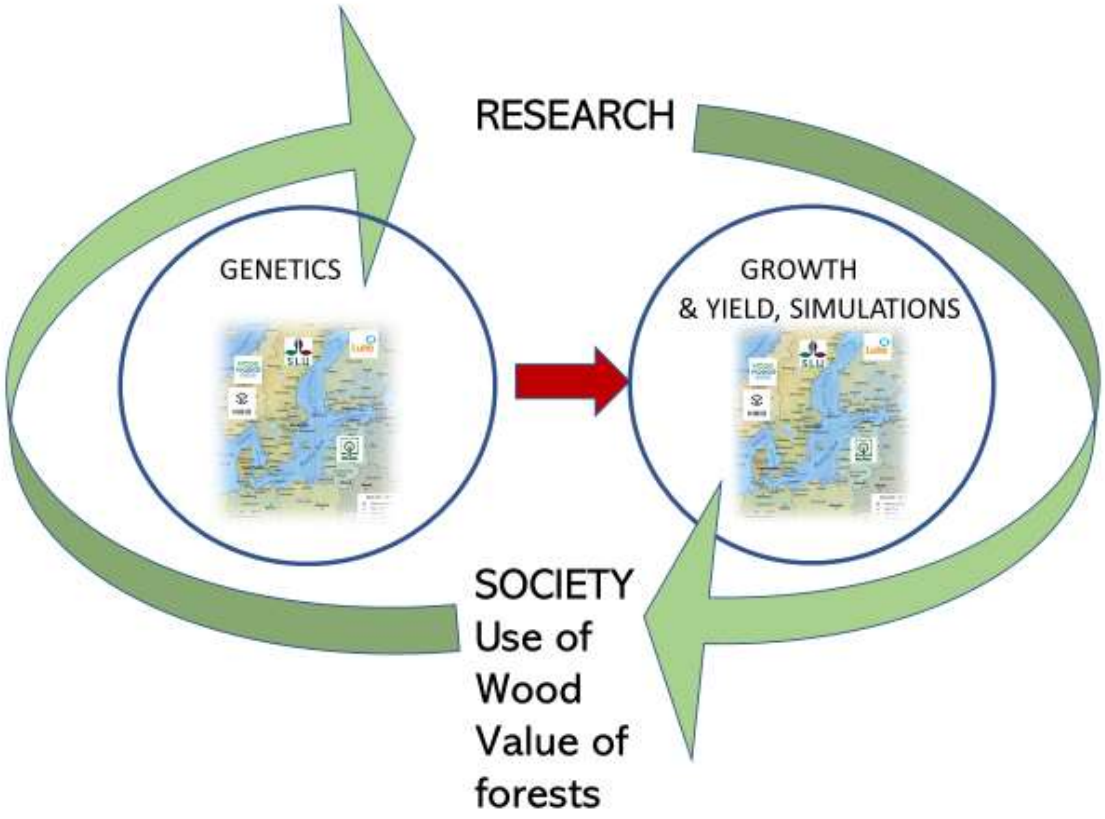
- Adaptation of forest production to satisfy UNs sustainability goals



Growth & yield
Climatic adaptation
Wood quality
Disease resistance
Biodiversity

How to get there?

The value of your input to the scientific cooperation



What will be the use and requirement of timber in the long run?
40 – 60 years

Foto: Peder Gjerdrum

Foto: Moelven

Foto: Adressavisen

- The large volume across the whole landscape
- Conifers and bradleaves
- CO_2 construction pulp/fiber>

NIBIO

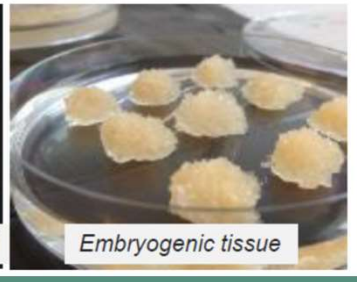
The timber resource from «cultivated forests»

- Quality and dimensions will depend on decisions we make in forest breeding and management
- 70 – 90 % of FRM is improved in a breeding program
  - Volume and/or quality ??
- Forest management - silviculture
  - Choise of species, mixture, site prep. and stand density
- Age of harvest and next generation planning
  - Clearcut, shelterwood, seed trees, CCF

Tree breeding: Breeding goals

Large potential across the whole landscape - decicions must have a strong fundament

- Seed orchards – seed from selected parents
  - 70 – 100 % of seed used in conifer regenerations in Nordic and Baltic countries
  - Also important for broadleaves
  - Long breeding cycle – decisions have impact for yield after 70-80 years
  - **Potential: 20 – 35 % increase of productivity /area**
  - *General* breeding goals: balance between growth and quality
  - Adaptation is always fundamental
- Vegetative reproduction by somatic embryogenesis (SE-plants)
  - Super-families from crosses between the best parents
  - Short breeding cycle – decisions have impact for yield sooner (50-60 years)
  - **Potential: 30 – 40 % increase of productivity /area, possibly more**
  - *General* or *specific* breeding goals: wood properties, resistance or adaptation?
  - Higher cost of seedlings, most relevant at high site indexes



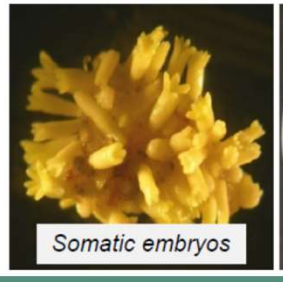


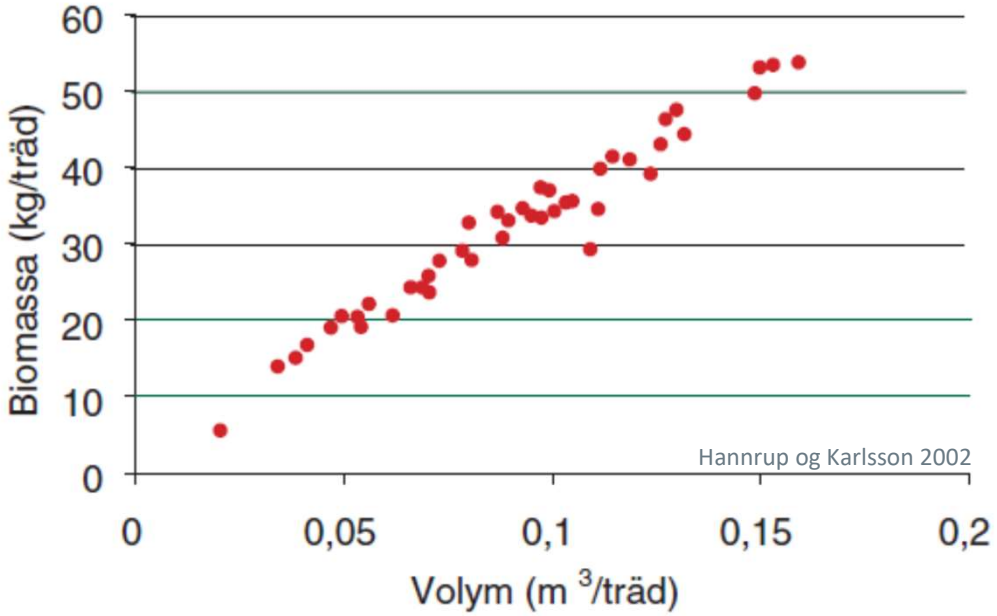
Figure: SweeTree Techn.

Decicions in tree breeding? Breeding goals

1. Maximise productivity: + 30 % m^3
   - **Frequency of stem defects as in cultivated forests today** (crook, bends, spike knots)
   - 5 % lower wood density (-20 kg/m^3)
   - 5 % increased branch diameter
   - Silviculture determines volume and quality, most important!
2. Balance productivity and quality: + 15-20 % m^3
   - Less defects (crook, bends, spike knots)
   - No change in wood density
   - No change in branch diameter
   - Silviculture determines quality at the most fertile sites
3. Improved quality at the cost of productivity: + 10 % m^3
   - Less defects (crook, bends, spike knots)
   - Increased wood density
   - Reduced branch diameter
   - Silviculture still determines quality at the most fertile sites

Optimization of CO_2 stored in productive forests: Breeding goal 1

Optimization of CO_2 in the whole system: Breeding goal ???



Figur 3. Klonmedelvärden i Hermanstorpförsöket. För gran ger samma kloner som ger högst volymproduktion också högst biomassaproduktion d.v.s. det är tillräckligt att göra urval för volym då biomassaproduktionen skall maximeras.

NIBIO

Spruce and pine is simple

- High quality – high demand
- Simple silviculture
- High utilization of area for m3
- Vi have strong knowledge
- Strong genetic variability and robustness

Great potential in broadleaves; more demanding silvics.

- Variable timber market
- More competence in stand management
- Highly productive when appropriately managed, otherwise….
- Narrow markets?
- High genetic variation, large potentials in breeding
- Which species??

Genetics is only the start – then forest management
Biomass – quality – risks

- Regeneration
- Spacing and species composition (pre. comm.)
- Thinning (none, free, from below or above)
- Rotation age
- Breeding and forest management must go hand-in-hand
- Maximation of biomass trough breeding and rigid stand management might be optimal

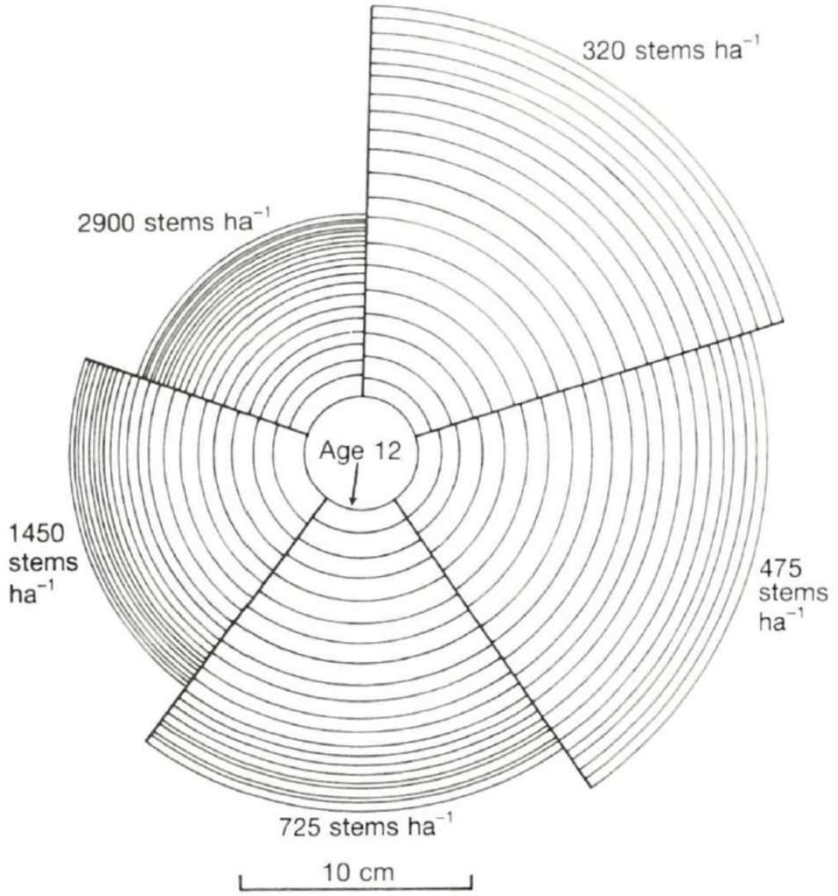


Fig. 10.3 Effect of spacing on mean tree diameter at breast height and annual ring widths of Sitka spruce (*Picea sitchensis*) 32 years after planting. (From Savill and Sandels 1983.)

With your well known timber resource that you utilize today in mind;

Is the raw material good enough?

More of the same, or change?

- Strength of structural wood
- Dimensional stability
- Fibre yield, mass yield
- Juvenile wood
- Loss at construction site…


Arne Steffenrem © Skogfrøverket / NIBIO


Arne Steffenrem Skogfrøverket / NIBIO

NIBIO

Breeding strategies are being revised, maybe also management strategies are …

- Your input will have effect the next 100 years!