

FOREST GROWTH DETERMINE CLIMATE CHANGE MITIGATION BENEFITS

- Tomas Lundmark
- SLU
- Sweden

Unit for Field-based Forest Research

- Experimental Forests
- Research Stations
- Long-term field experiments





Why do we need forest management?

Heinrich Cotta wrote in the preface of his book (*Anweisung zum Waldbau* 1817):
“There would be no forestry science without deficiency in wood supplies.”

Unmanaged

Heterogeneous structure

Old-growth

Natural disturbances

Lots of dead wood

Natural regeneration

Managed

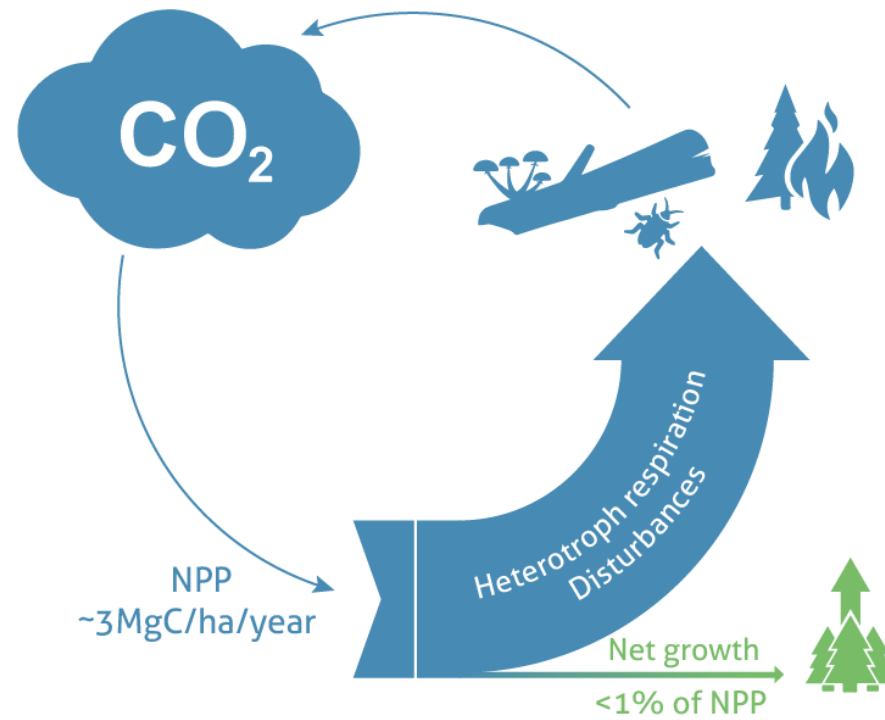
Even and sustainable flow of
timber

Even age class distribution
and/or

Controlled diameter
distribution

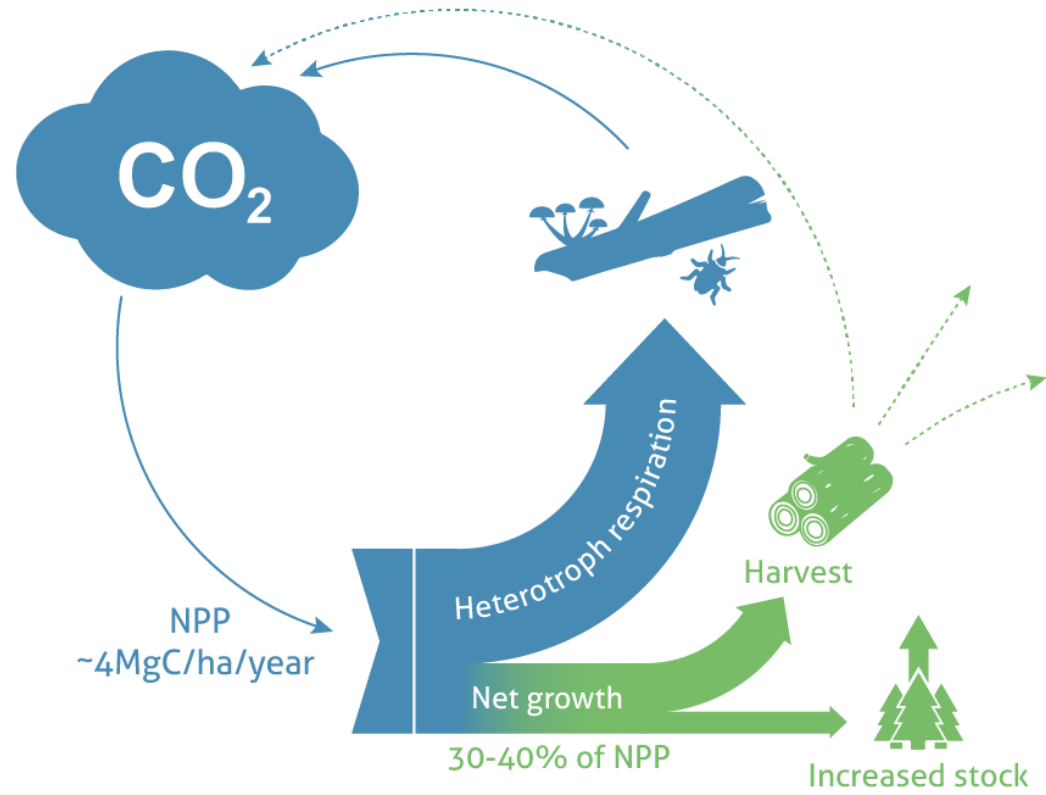
Harvest regimes adapted to
"maximize" mean annual
production (value or volume)

Silviculture



UNMANAGED FOREST LANDSCAPE

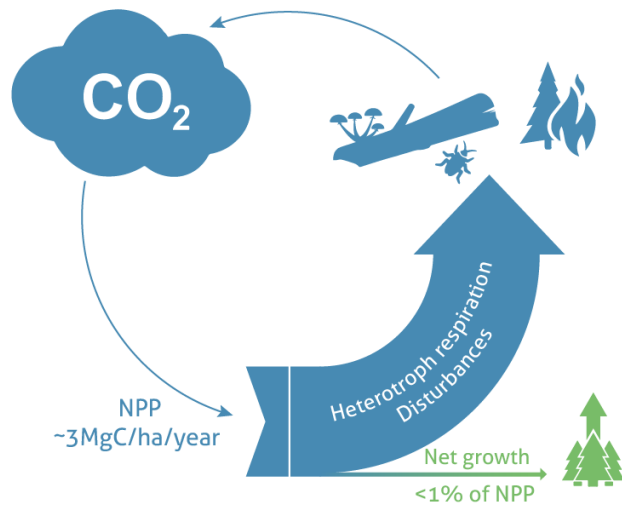
● Neutral or negative for climate ● Good for climate



MANAGED FOREST LANDSCAPE

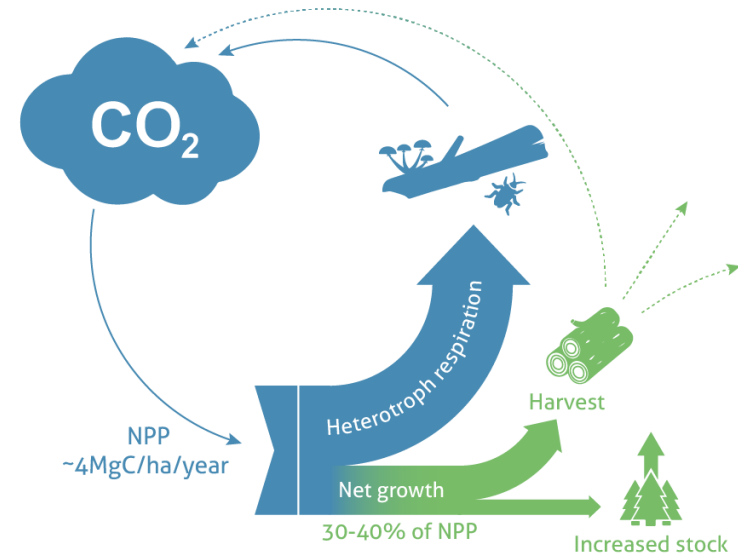
- Neutral or negative for climate
- Good for climate

Unmanaged vs. managed



UNMANAGED FOREST LANDSCAPE

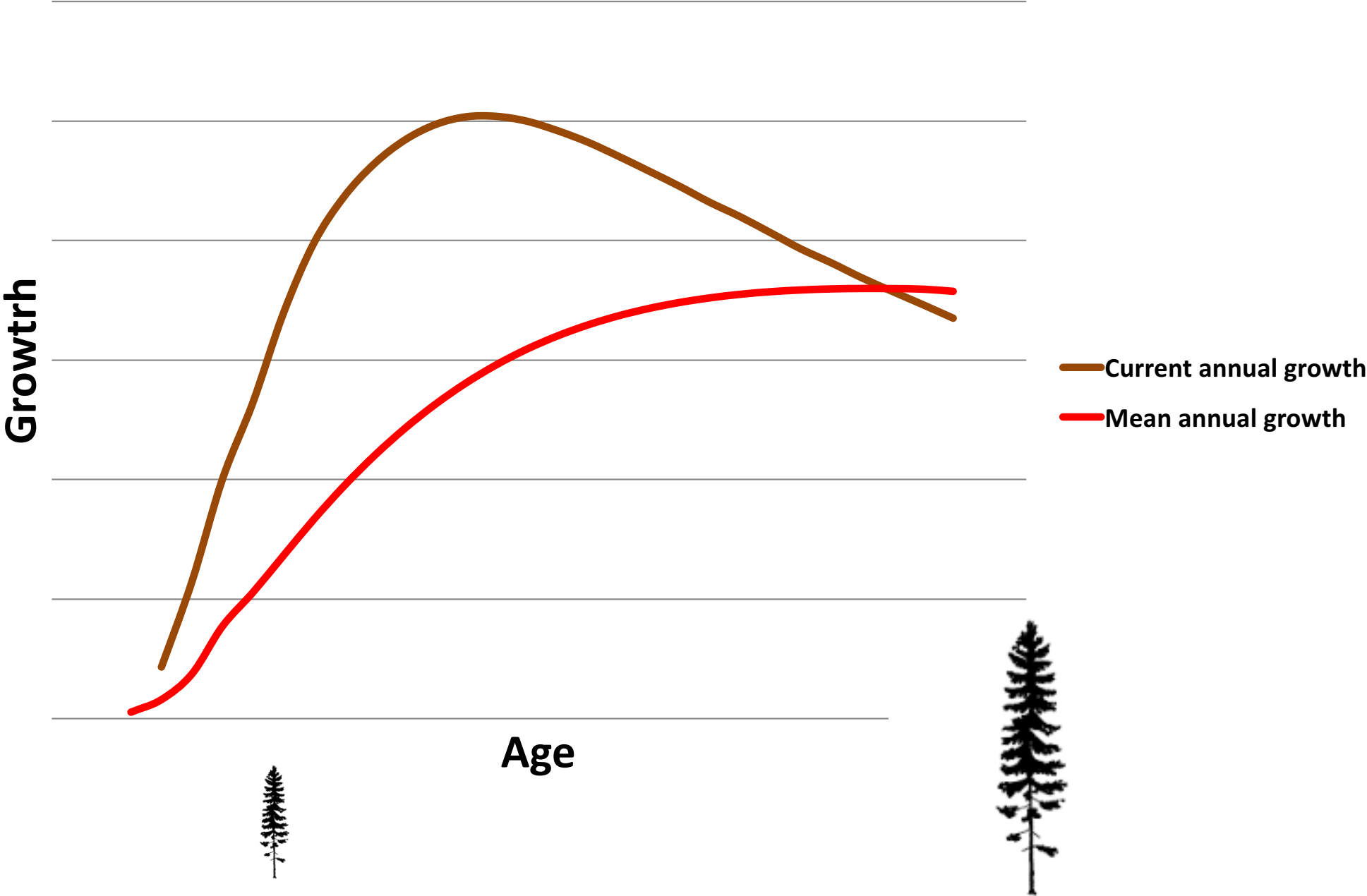
● Neutral or negative for climate ● Good for climate



MANAGED FOREST LANDSCAPE

● Neutral or negative for climate ● Good for climate

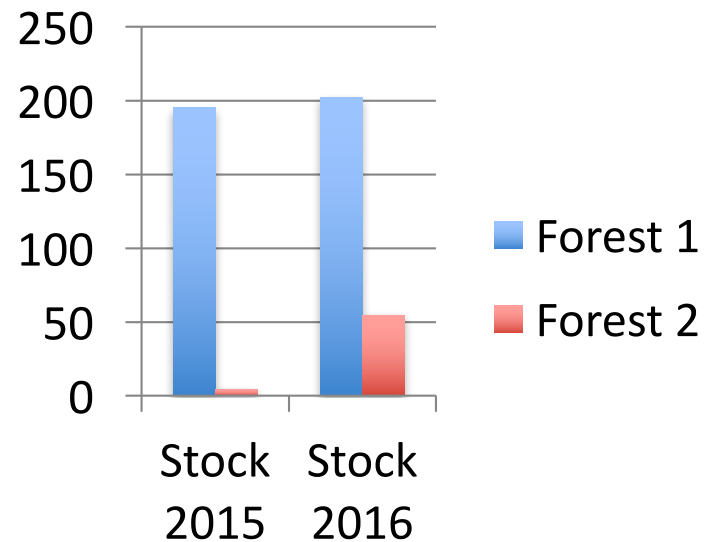
Forest growth is age-related



So what is climate benefit?

- Carbon stocks

- It is the annual stock change that matters, not the size of the stock
- No more change - no further benefit



So what is climate benefit?

- Reduce or avoid fossil emissions through product substitution and through bioenergy use
 - Additive, burning fossils is a permanent transfer of fossil carbon to the atmosphere
 - Depends on when you “start the clock”
 - If you grow trees first and then harvest (no carbon debt)
 - Or if you harvest first and then regrow the trees (carbon debt)
 - Depends on your spatial perspective
 - Suppose we manage an entire estate of forests. At any one time harvesting and growing occur simultaneously, when growth > larger than harvest there is no carbon debt. Carbon goes into the forest at the same, or higher, rate than it goes out. Bioenergy is far better than coal.
 - In a natural stand harvests that lead to reduced stock create a carbon debt

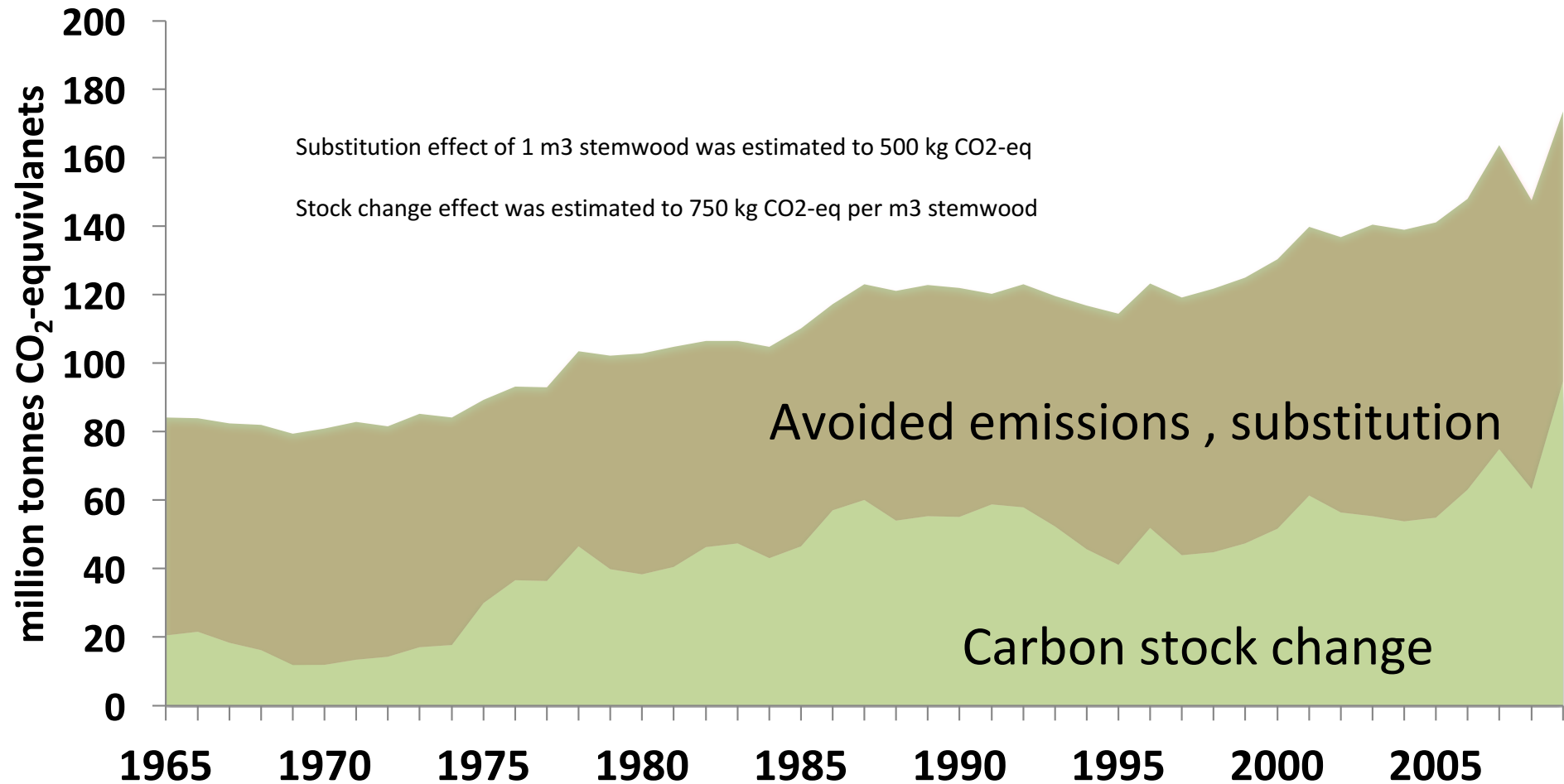
So what is climate benefit?

- You must define your reference
- You can't fool the atmosphere

Climate mitigation potential of 1 m³ of wood

- Substitution 500-800 kg of CO₂
 - Depend on product use strategy and emission related to forest management and processing of wood
 - Lundmark et al. 2014, Braun et al. 2016
- As carbon stock \approx 750 kg of CO₂
 - stock change is of a temporary character
 - Wood density 0.4, carbon content 50% of dw

Annual climate benefit, Norway, Sweden, Finland



Conclusions

- Design of climate change mitigation portfolios in the forest sector should account for changes in C in **forest ecosystems**, in **harvested wood products**, and for **substitution benefits**, relative to a base case.
- Climate change mitigation efficiency varies among silvicultural activities, product use strategies and by region, and no single strategy is best everywhere.
- Time perspective is crucial.
- A forest that is not **growing more than today** can not make further climate benefit.



Conclusions

- Forest growth and the use of forest biomass is more important than carbon storage in the forest in the long term
- The “mitigation” effect can increase significantly in Europe if measures are taken to increase sustainable forest growth
- The “mitigation” effect can increase significantly in Europe if measures are taken to improve forest product use strategies

- 
- Forest management matters !!

Some final remarks

- increased forest growth = increased climate benefit
- increased forest growth means opportunities for increased sustainable yields
- increased sustainable yields mean increased opportunities for the bio-economy to develop
- there is much to be gained by a more active forestry

