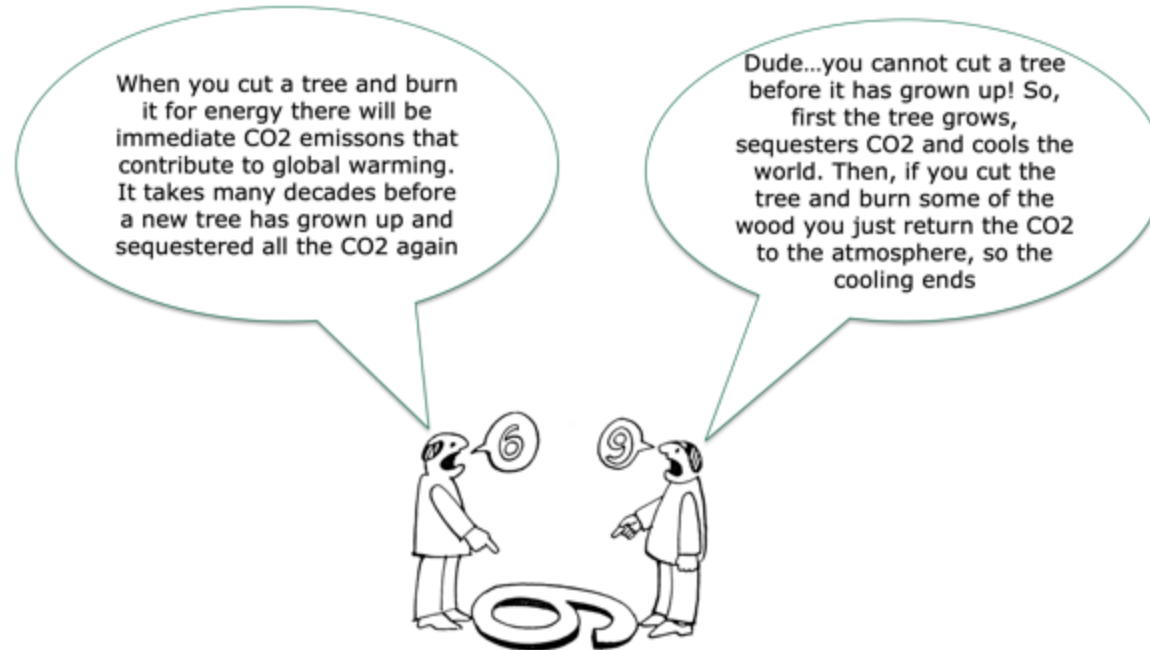


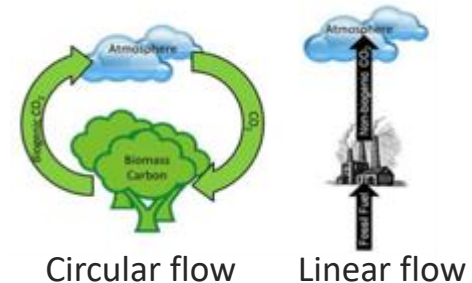
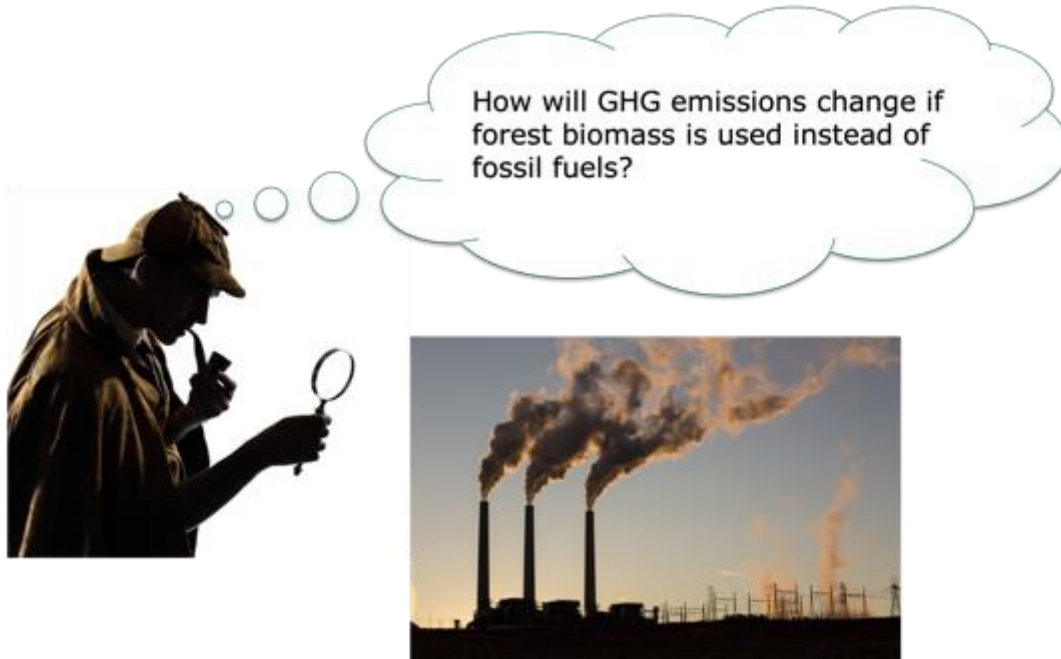
Climate effects of forest biomass and bioenergy

Göran Berndes, Division of Physical Resource Theory, Dept. of Space, Earth and Environment

This is not a relevant debate

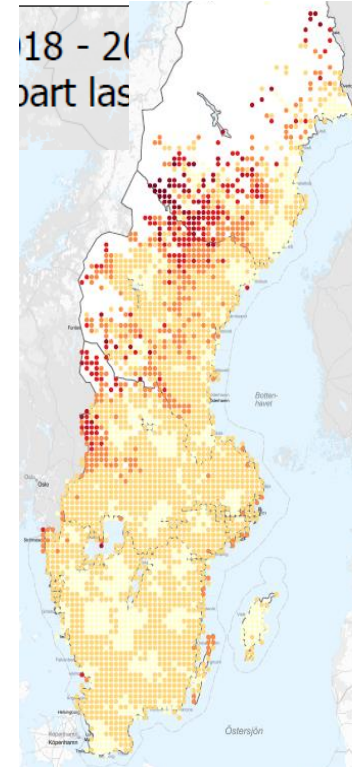


This is a relevant question but wrong approach to find the answer

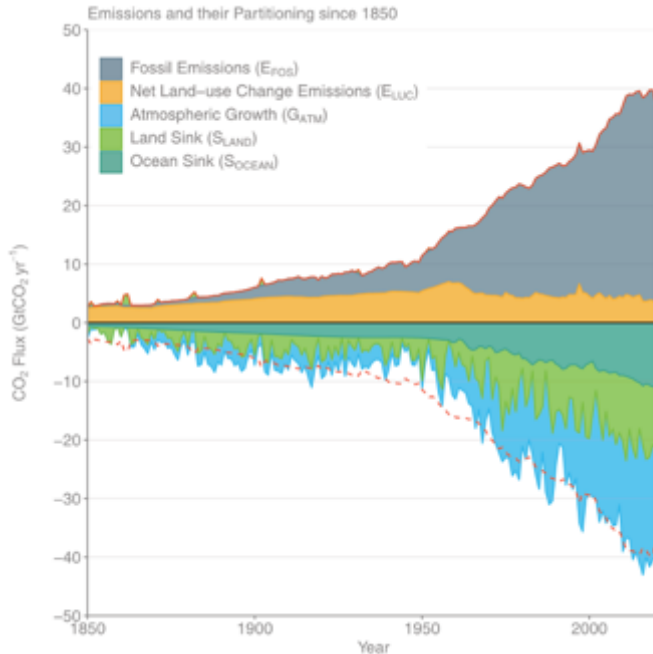


This is how you ask the question and look for answers

How will **atmospheric GHG concentrations** change if forest biomass is used instead of fossil fuels, **cement, steel, plastics, and other materials**?



Forest management & wood use influence both carbon stocks & flows

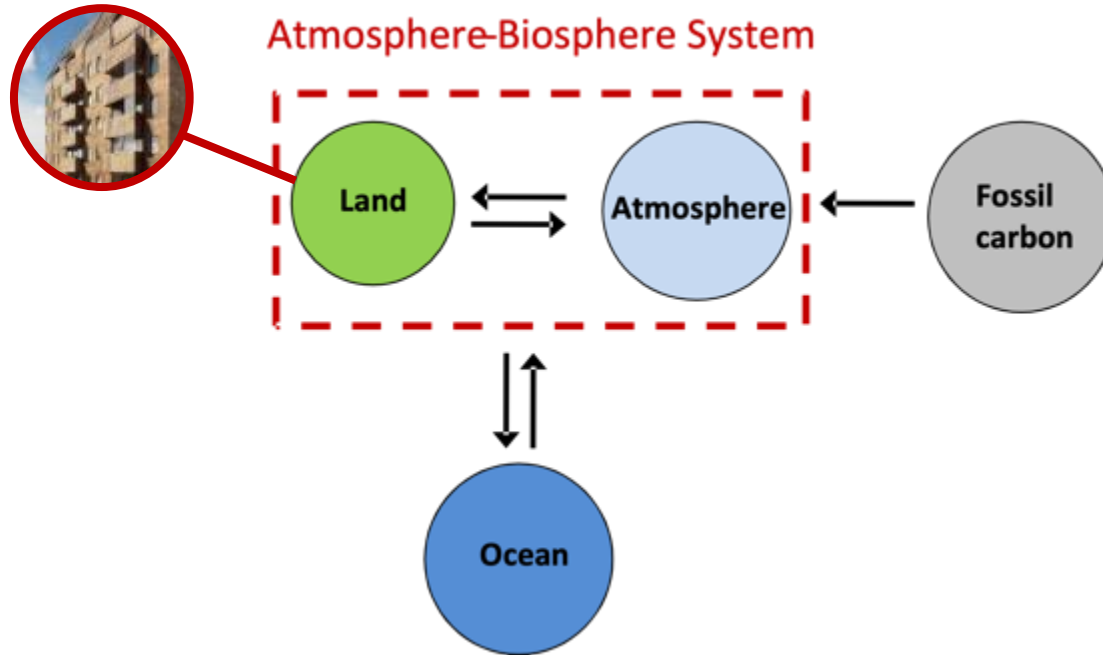


← Substitute fossil fuels, cement, steel, etc

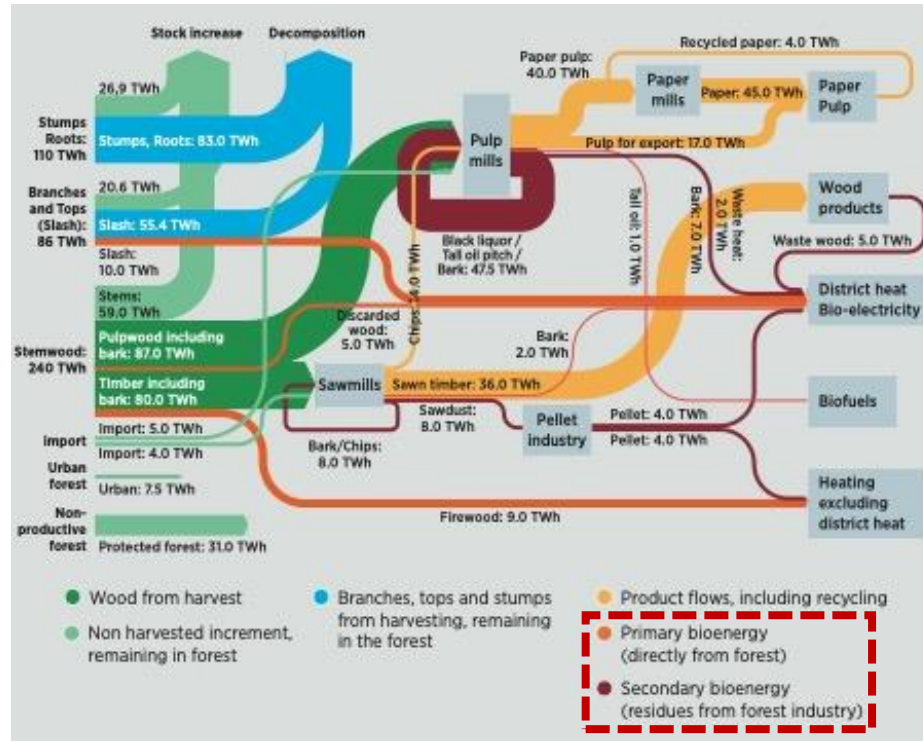
← Carbon losses from forests

← Carbon sequestration into forests

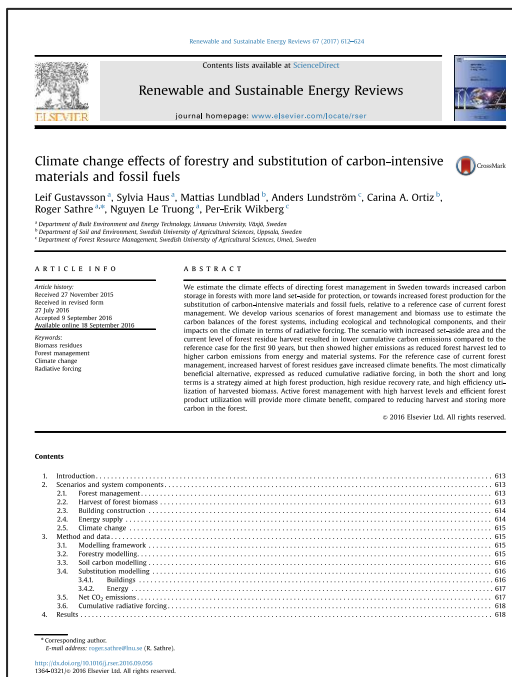
Forest management & wood use influence both carbon stocks & flows



Forest bioenergy is an integrated part of the forest product system



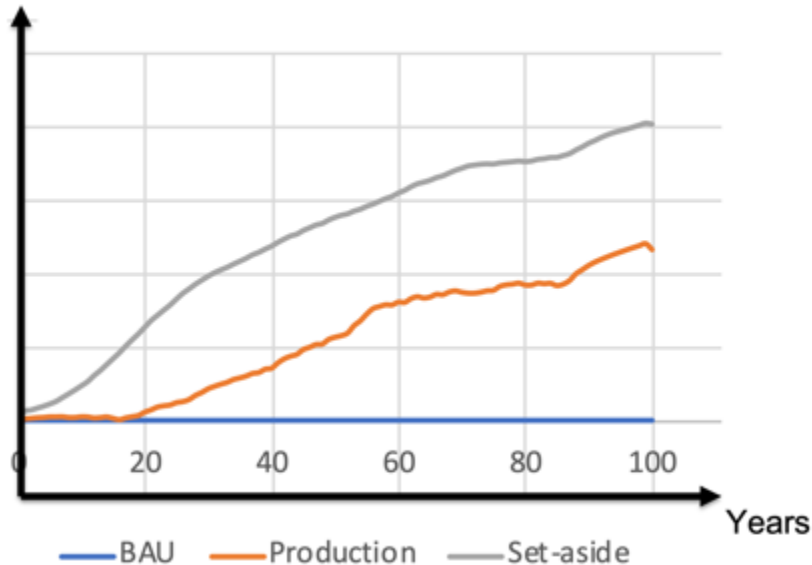
Forest management and carbon balances in Sweden



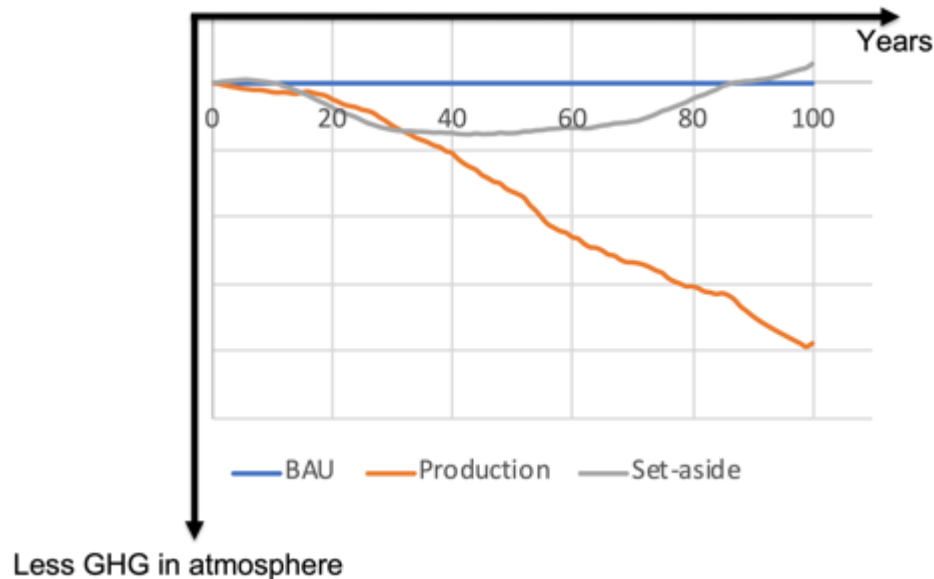
- **Three forest management scenarios**
 - Continue as before (BAU)
 - Doubled nature conservation area
 - Measures to enhance forest growth
- **Forest products**
 - Wood construction materials
 - Paper products
 - Bioenergy (CHP & liquid biofuels)

Forest management and carbon balances in Sweden

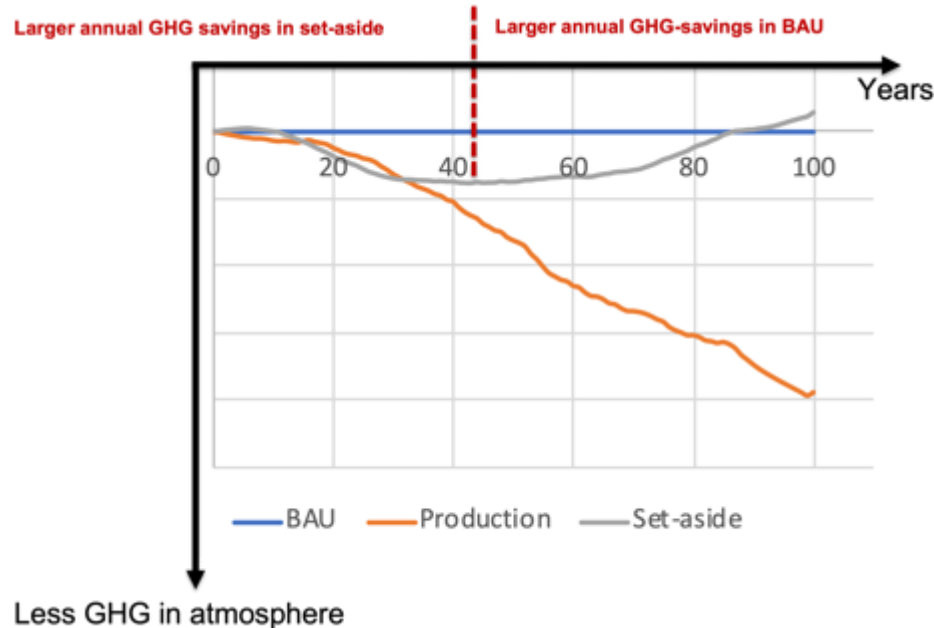
Increased carbon storage
compared to BAU



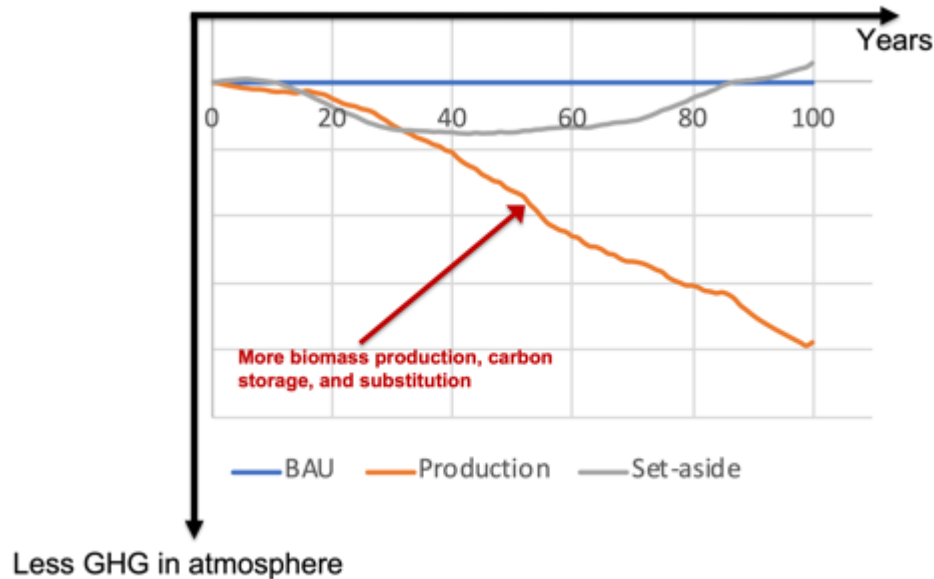
Forest management and carbon balances in Sweden



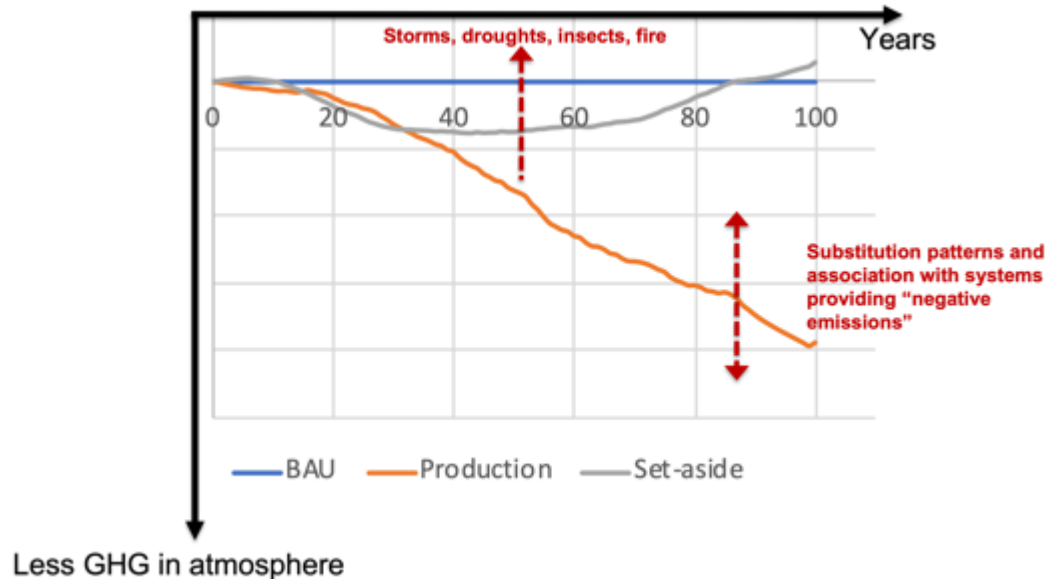
Forest management and carbon balances in Sweden



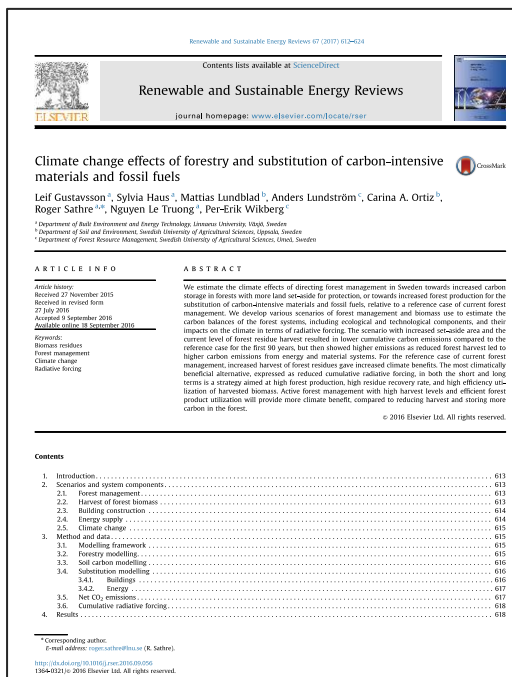
Forest management and carbon balances in Sweden



Forest management and carbon balances in Sweden



Forest management and carbon balances in Sweden



- Mitigation achieved through:
 - Carbon storage in forests and products
 - Substitution of fossil fuels, cement, etc
- Mitigation increases as more biomass is used for bioenergy (other uses may be even better)
- Set-asides can increase mitigation but measures to enhance growth even more so
- Finding optimum is not a matter of maximizing mitigation but balancing multiple objectives
- Biodiversity protection and other objectives can motivate measures causing foregone mitigation



CHALMERS