



EUROPEAN FOREST INSTITUTE

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# Forestry in Europe under changing climate and land use: the ATEAM project

[www.efi.int](http://www.efi.int)





# Assessment of the effects of changes in climate, land use and atmospheric CO<sub>2</sub> concentration on tree growth, wood supply and carbon sequestration in European forests



- 95 mill. ha of forest available for wood supply





# Models and scenarios

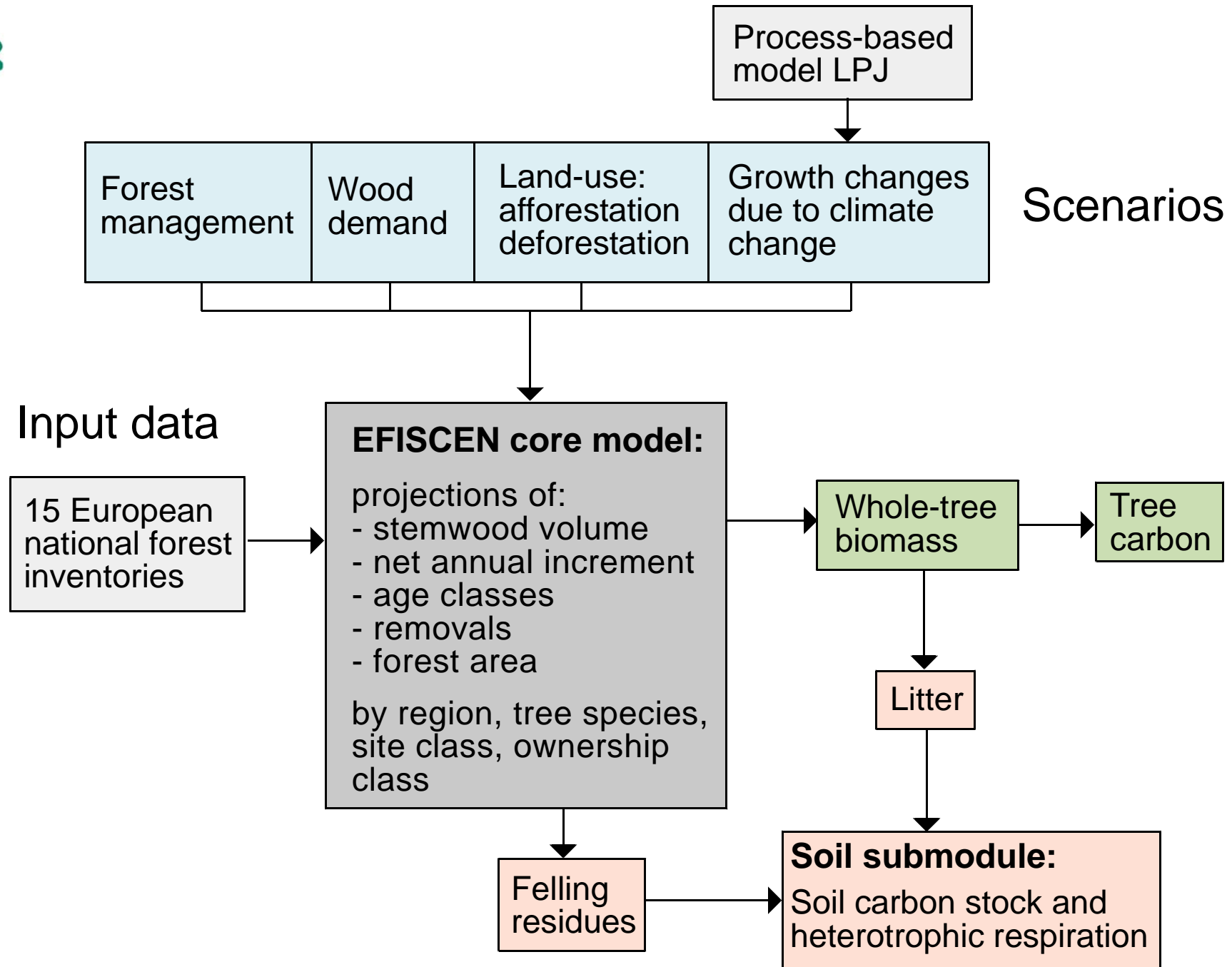
European Forest Information Scenario Model (EFISCEN)

- Projections of stemwood volume, fellings, net annual increment and carbon stocks under different scenarios

Dynamic global vegetation model LPJ (Lund-Potsdam-Jena)

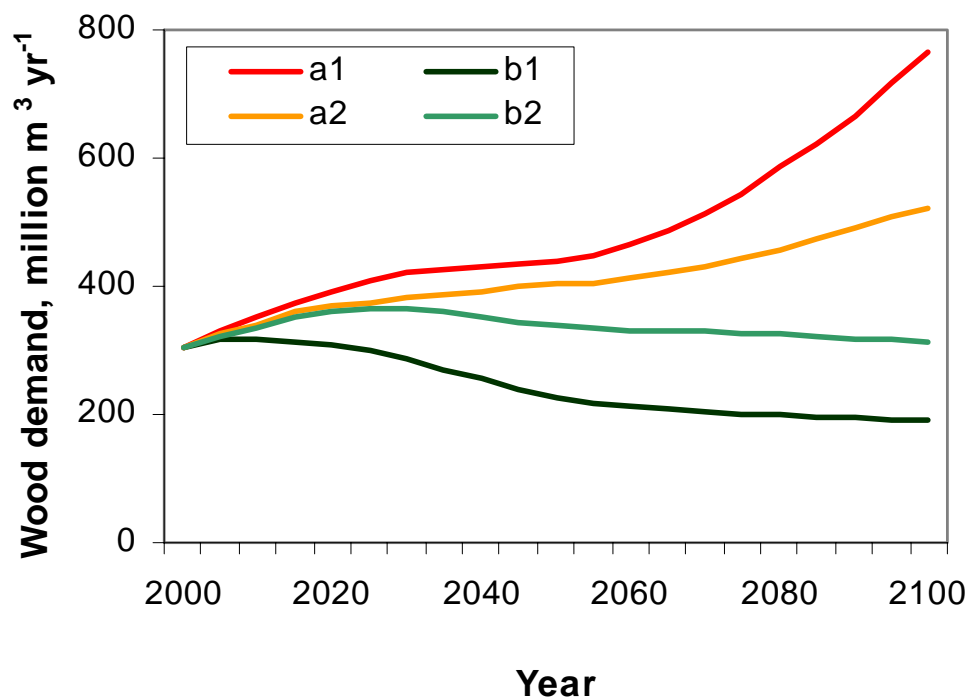
- Growth changes due to climate change as input for EFISCEN







# Demand scenarios



Demand projections from  
IMAGE 2.2

Total wood demand in  
EFISCEN for the four SRES  
scenarios in 15 European  
countries



# Land-use scenarios

Afforestation/deforestation per EFISCEN region

Afforestation:

- Mostly coniferous species in a1 and a2
- More broadleaved species in b1 and b2

Deforestation

- Uniformly from all species



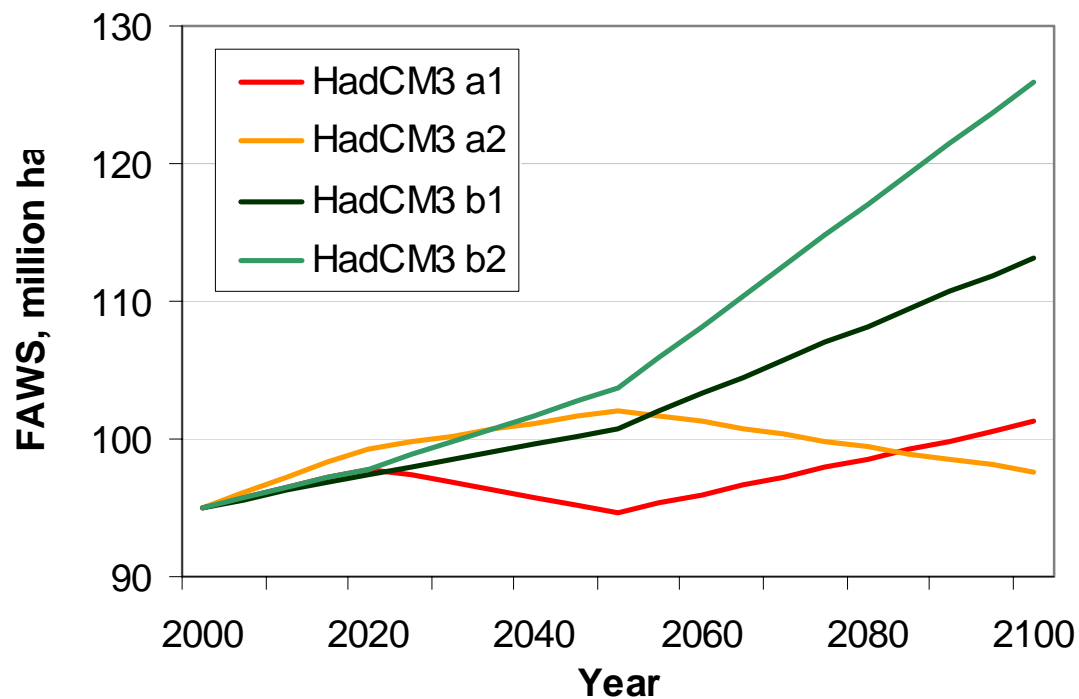


# Results





# Forest area

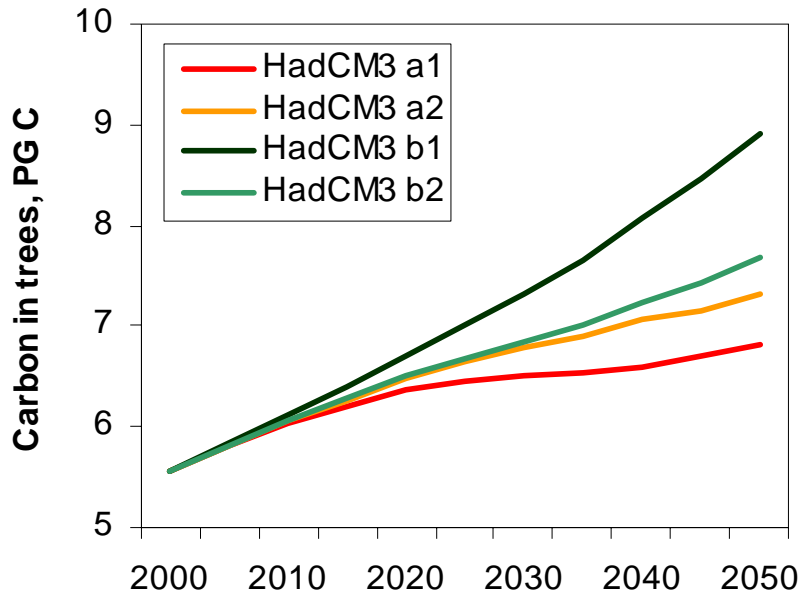


Forest available for wood supply in 15 European countries

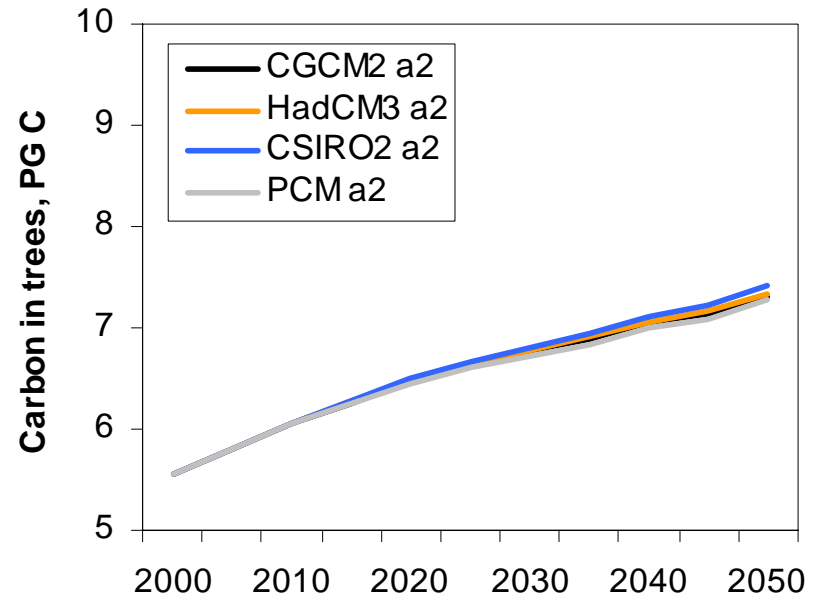




# Carbon stocks in trees



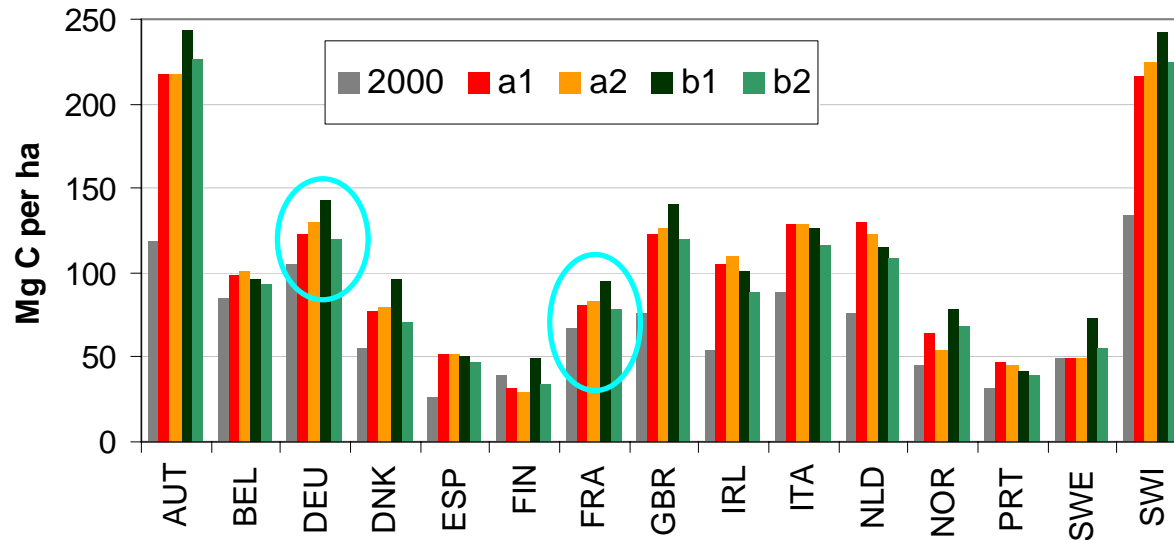
SRES Scenarios



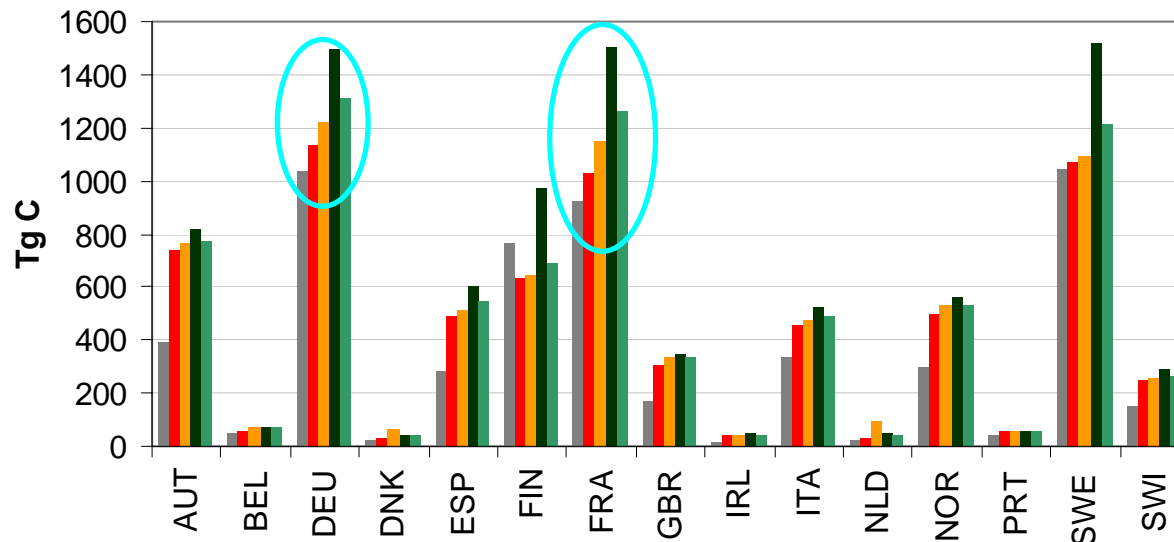
Climate Models



# Carbon stocks in trees per country



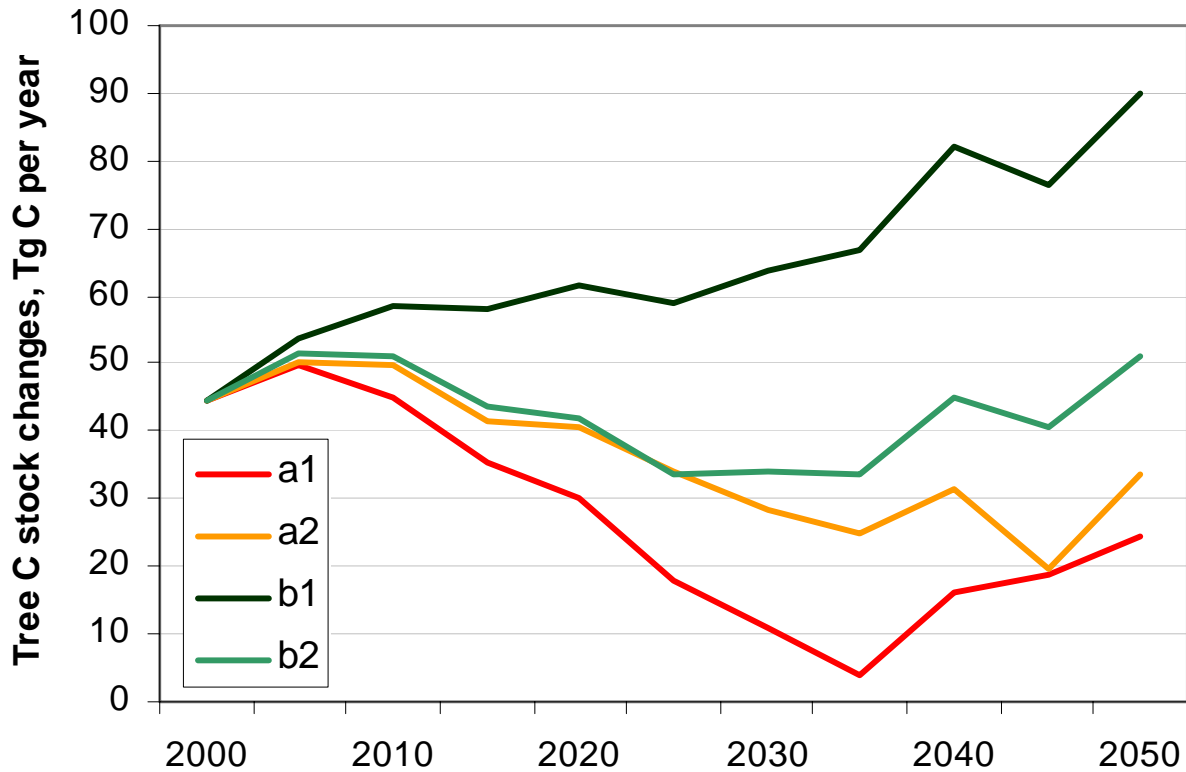
Tree carbon  
per ha  
2000 & 2050



Tree carbon  
total  
2000 & 2050



# Tree carbon stock changes



Climate model:  
HadCM3



# Impact analysis

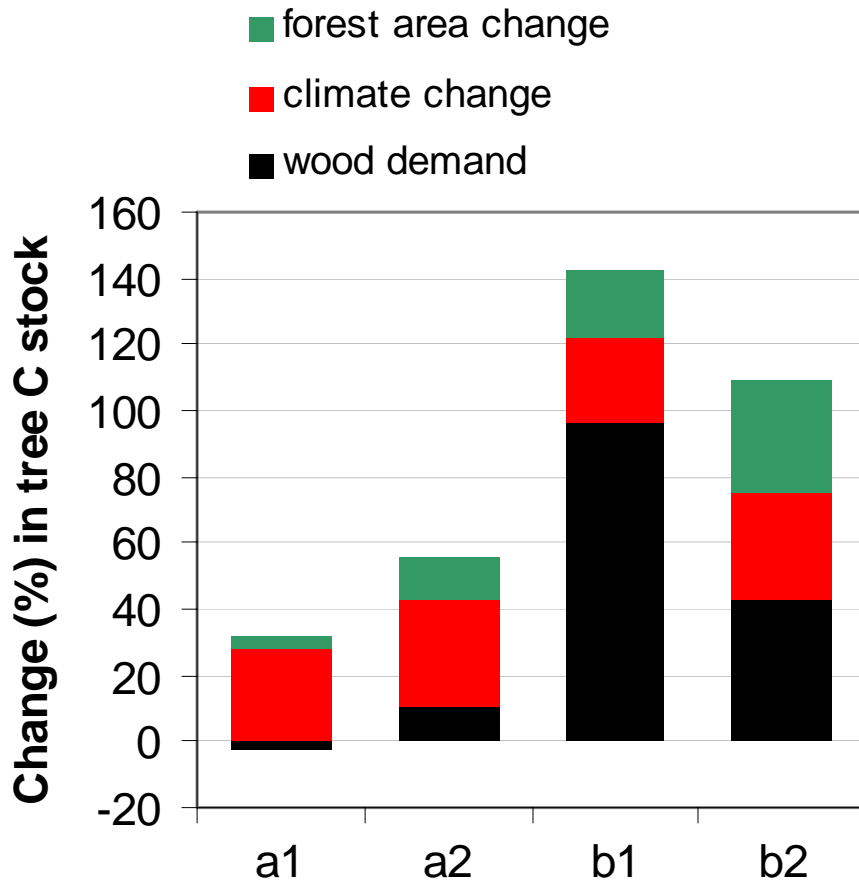
Goal: quantify the impact of changes in wood demand (and thus forest management), climate and land-use on the development of tree carbon stocks **separately** separate model runs with:

- changing demand (current climate)
- changing demand & climate
- changing demand & climate & land-use





# Carbon stocks: Ratio between 2100 and 2000



Relative importance of changes in wood demand, climate and forest area for the increase in tree carbon stocks between 2000 and 2100:

Wood demand: -2 - 96%

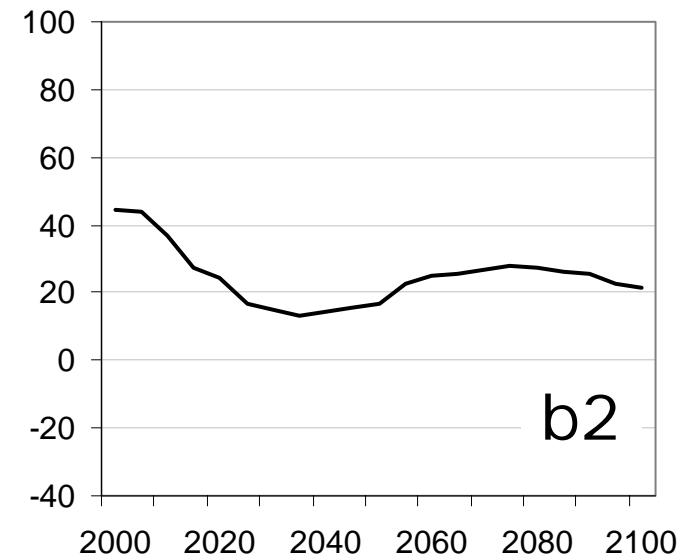
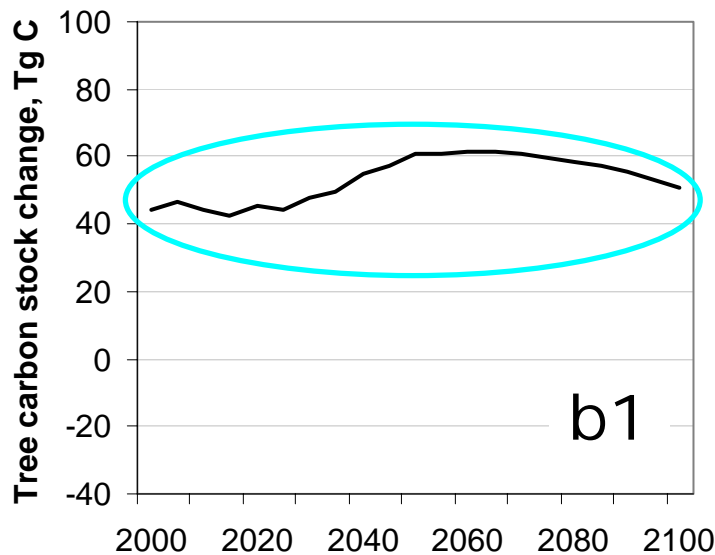
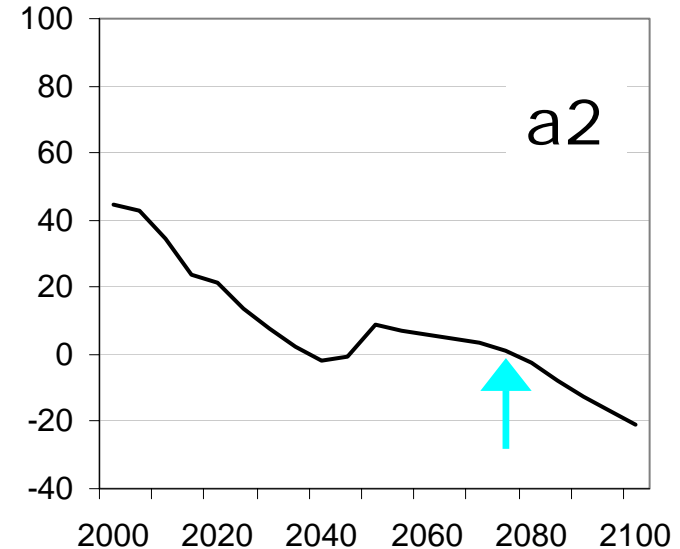
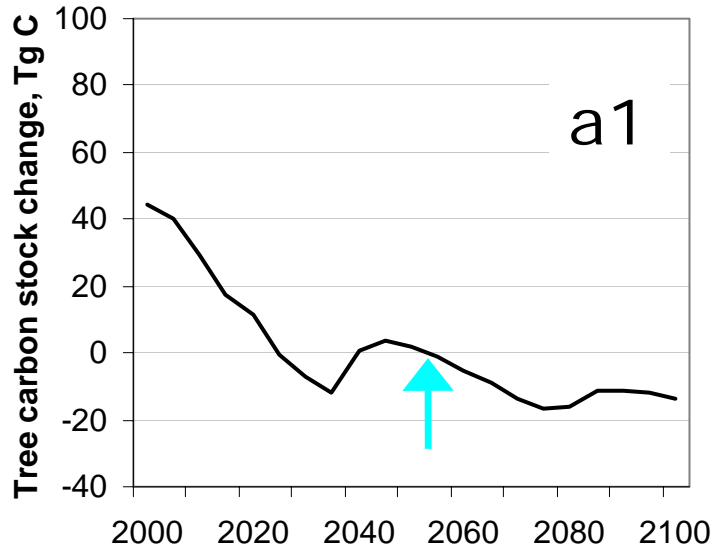
Climate change: 25 - 32%

Forest area change: 4 - 34%



# Carbon stock changes

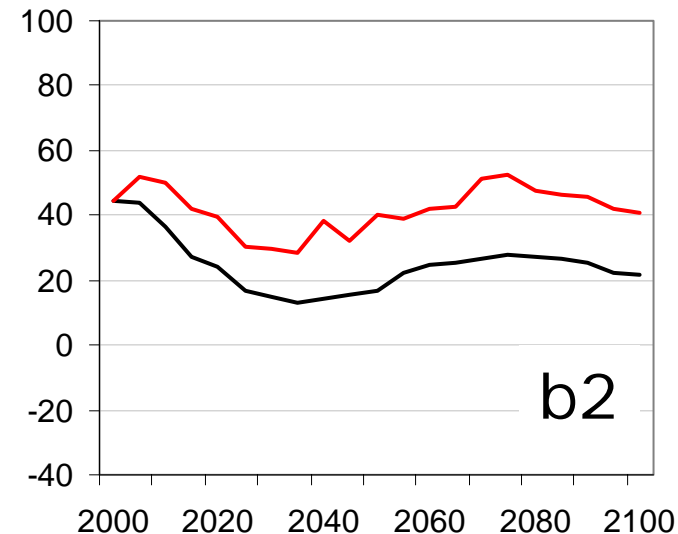
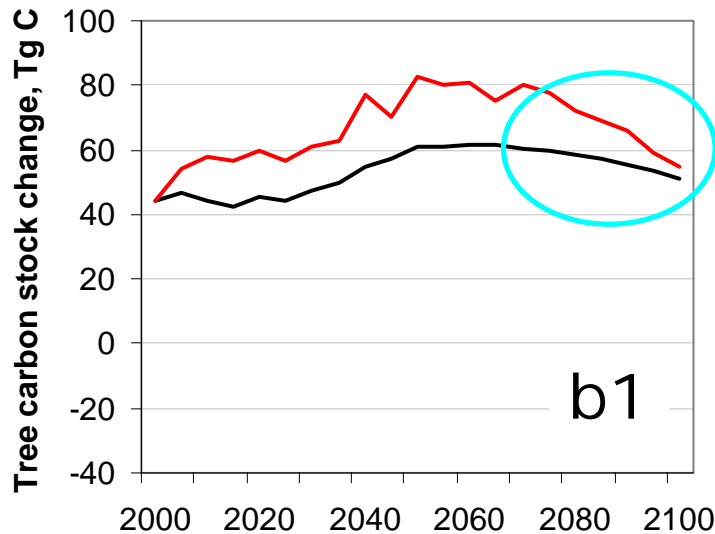
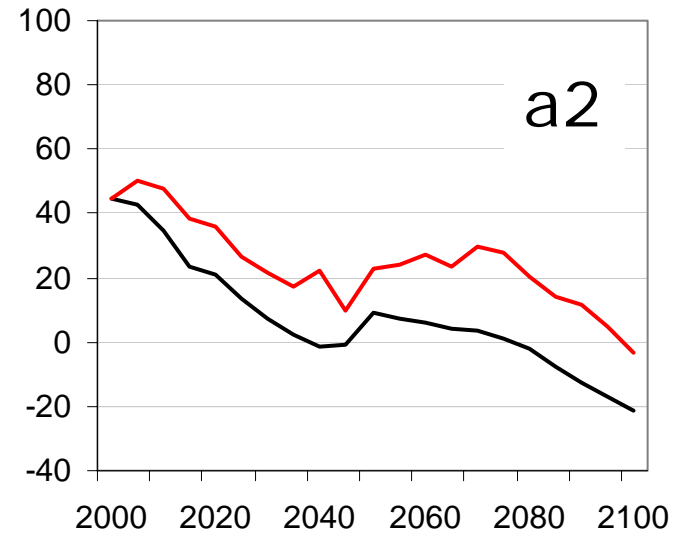
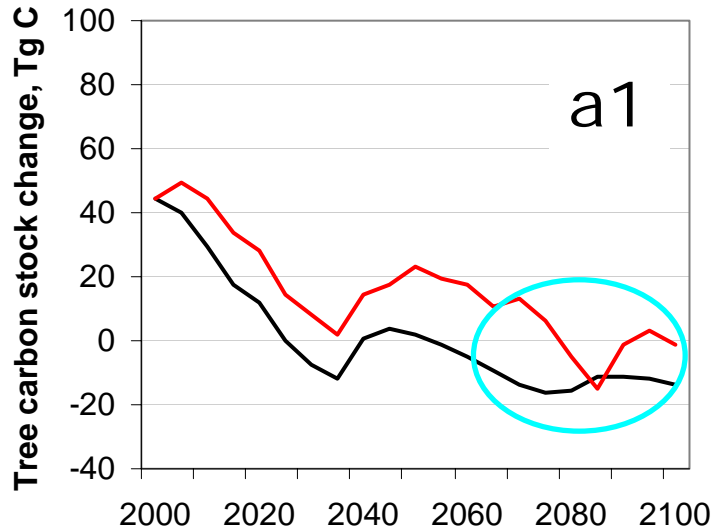
— current climate





# Carbon stock changes

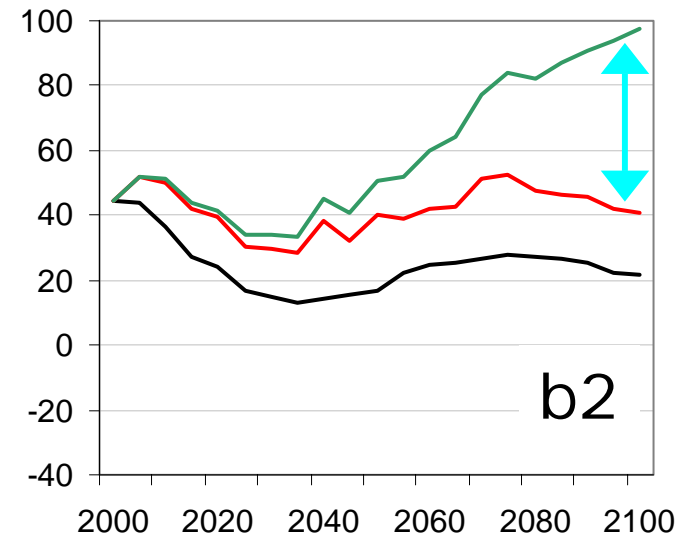
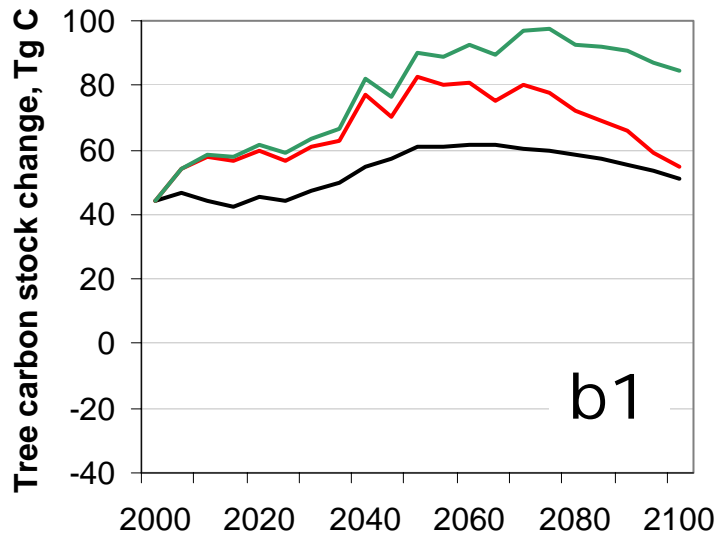
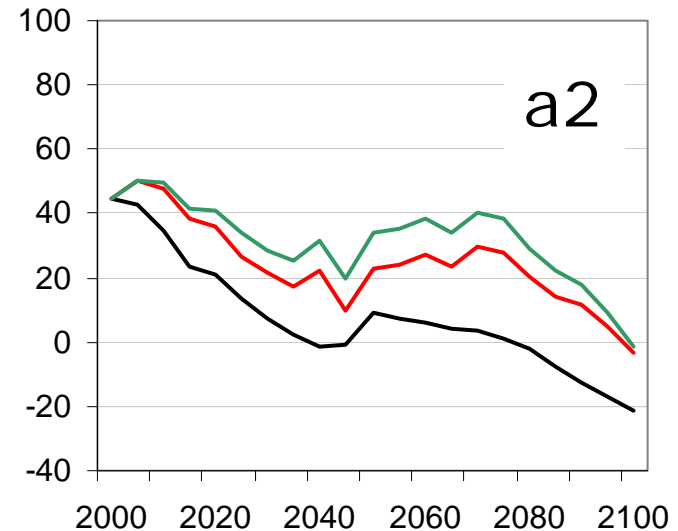
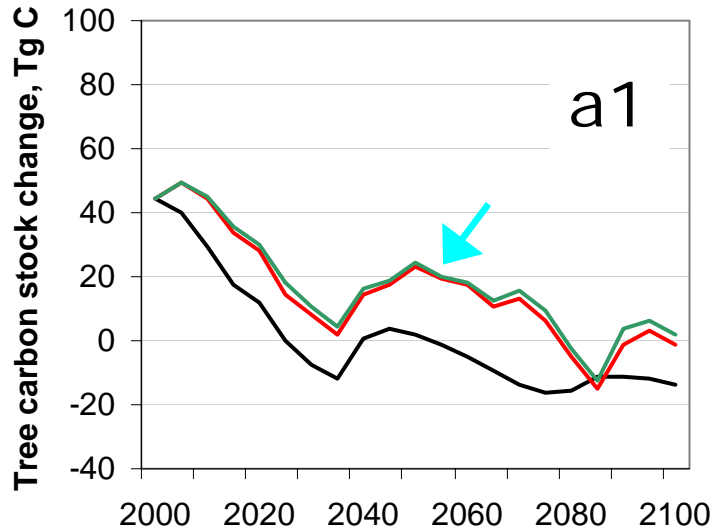
— current climate  
— climate change





# Carbon stock changes

- current climate
- climate change
- climate & land-use change







# Conclusions

Increased forest growth due to climate change throughout Europe, especially in Northern Europe

**But:**

Implementation of climate change effects on tree growth involves many uncertainties

- Depending on forest growth model used
- Averaging across regions/countries and species is simplifying and ignores local differences
- NPP versus NAI: allocation of NPP might change





## Conclusions (cont.)

Wood demand and forest management are key drivers in forest resource development

- Modelled impact of forest management (via changes in wood demand) is potentially higher than impact of climate and land-use change together





## Conclusions (cont.)

Enhanced tree growth could lead to a faster increase in the proportion of mature and unproductive forests

- Higher susceptibility to abiotic and biotic damages
- Adverse effects on forest health and wood quality
- Management needs to respond to changing conditions

