

# Effects of climate and policy changes on growth, carbon sequestration and mortality risk for 9 species within a regional natural park



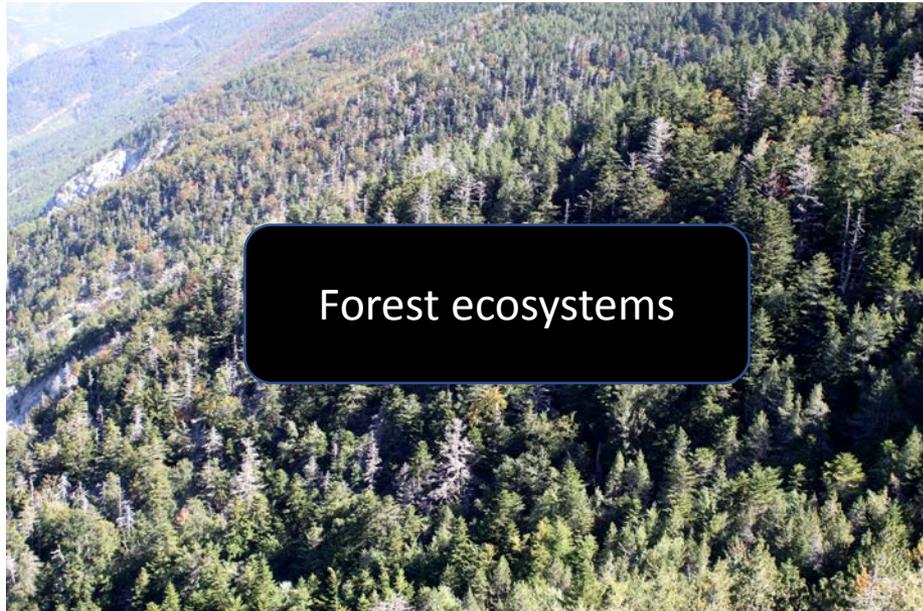
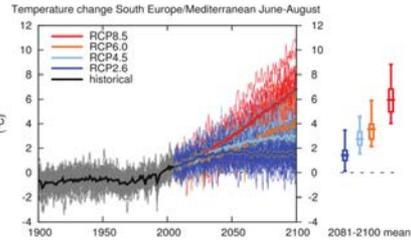
H. Davi, N López-García, N. Martin-StPaul, V. Journé, C. Petit, H. Fargeon, G. Simioni, J.M Ourcival, J.M Limousin, F. Courdier, L. Tuffery, E. Rigolot, F. Lefevre

# How global change impact ecosystem services?

Climate change

CO<sub>2</sub>, N

Policy changes



Carbon sequestration

Wood industry

Wood energy

Tourism

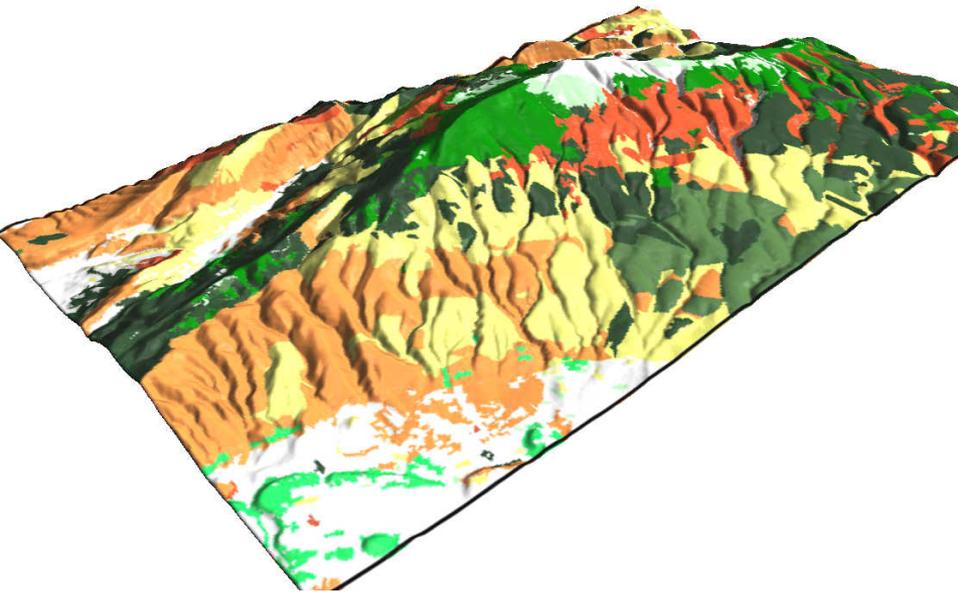
Biodiversity

Erosion

Climate change:  
RCP4.5 RCP8

**How manage forest to increase  
mitigation and adaptation ?**

BAU  
Wood Energy  
Carbon sequestration



**The Mont Ventoux Regional Natural  
Park**

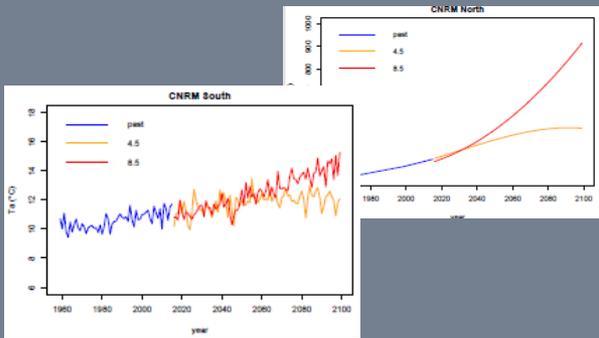
→ 91 600 ha

→ 9% of urban area, 34% of agricultural  
area, 57% of natural area.

Wood sector

Carbon price

## Climate Change



## Public policies

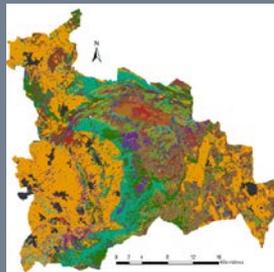


Sociological model  
Transition matrix

Ecosystem model  
CASTANEA



Land-Use/Land-Covers

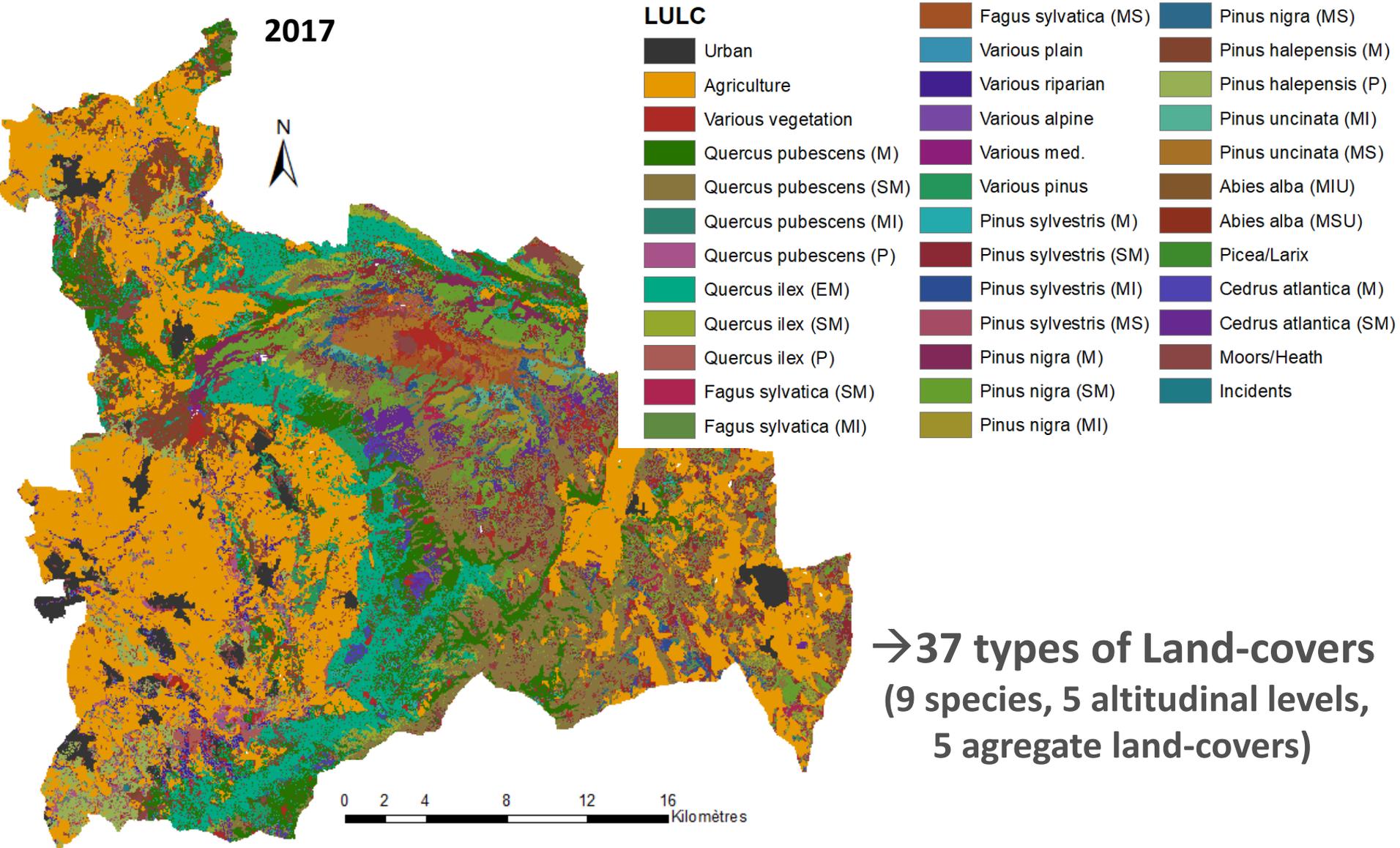


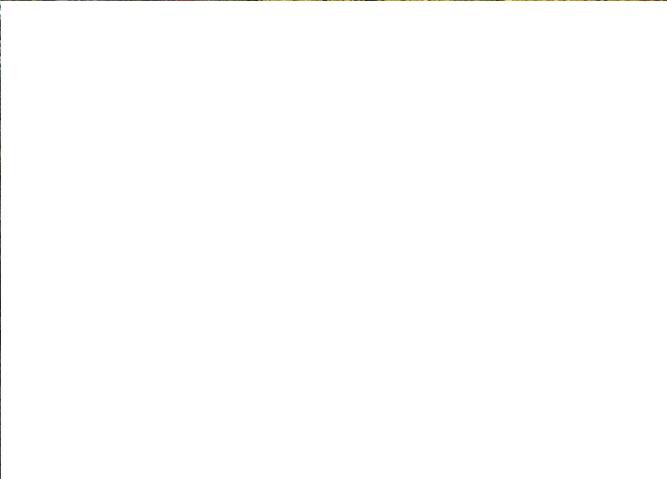
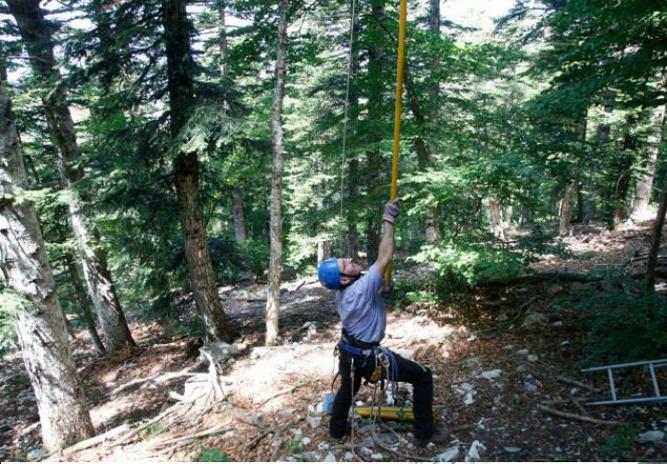
Economical model  
inVEST

State of the forest ecosystems  
-  $\Delta$  Basal area  
-  $\Delta$  Carbon Seq.

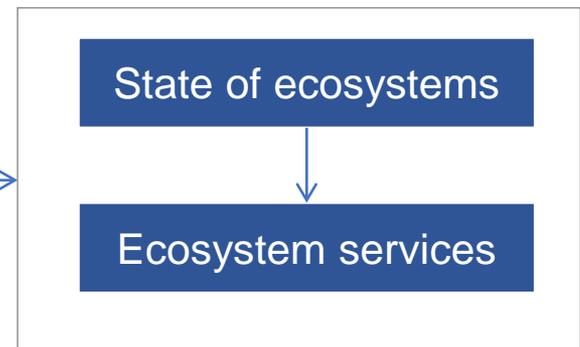
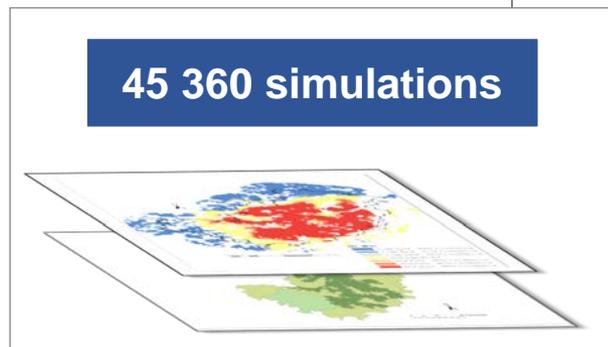
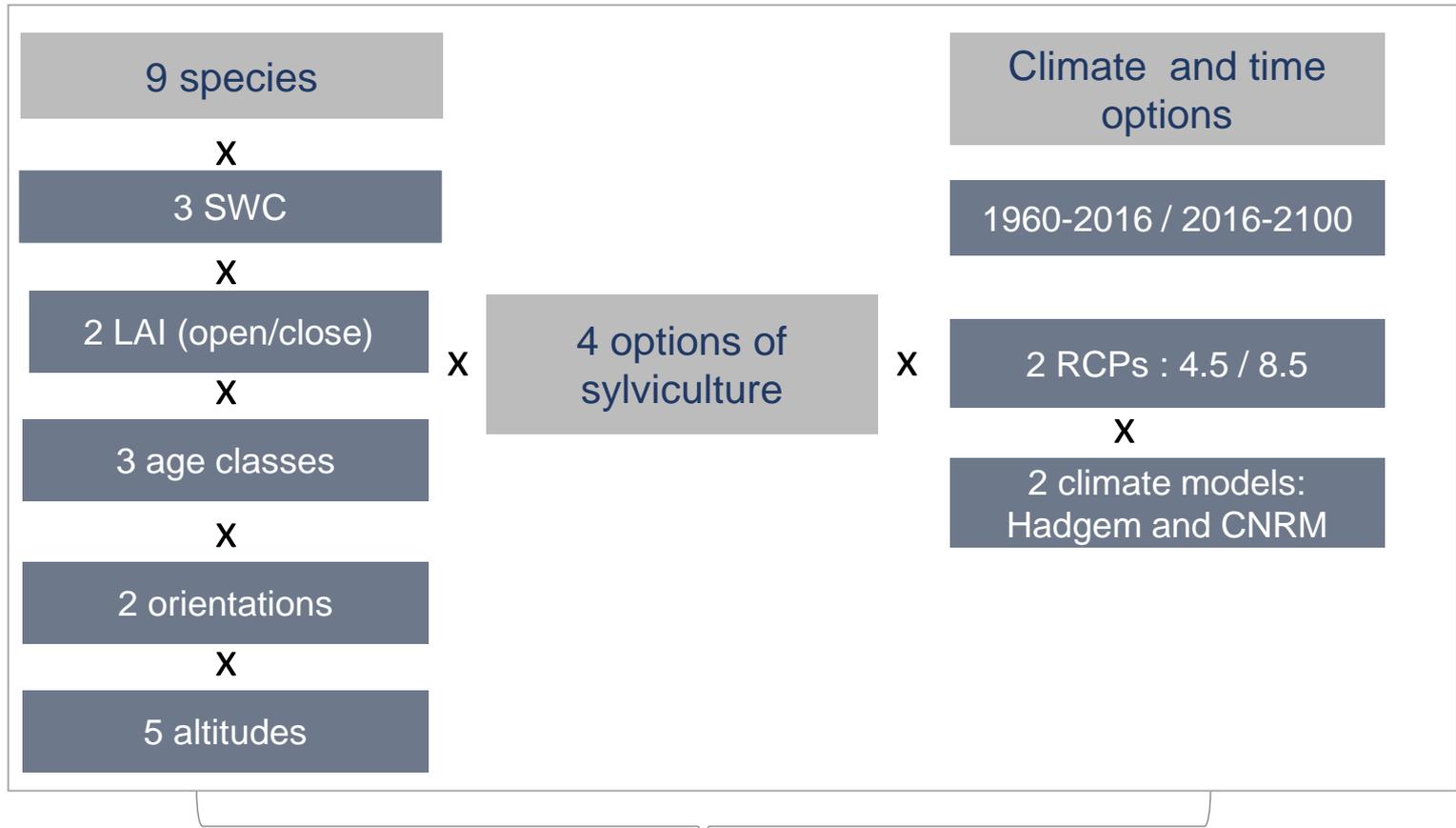
Ecosystem services  
- wood product  
- carbon price

# Land-Cover Map: IFN map

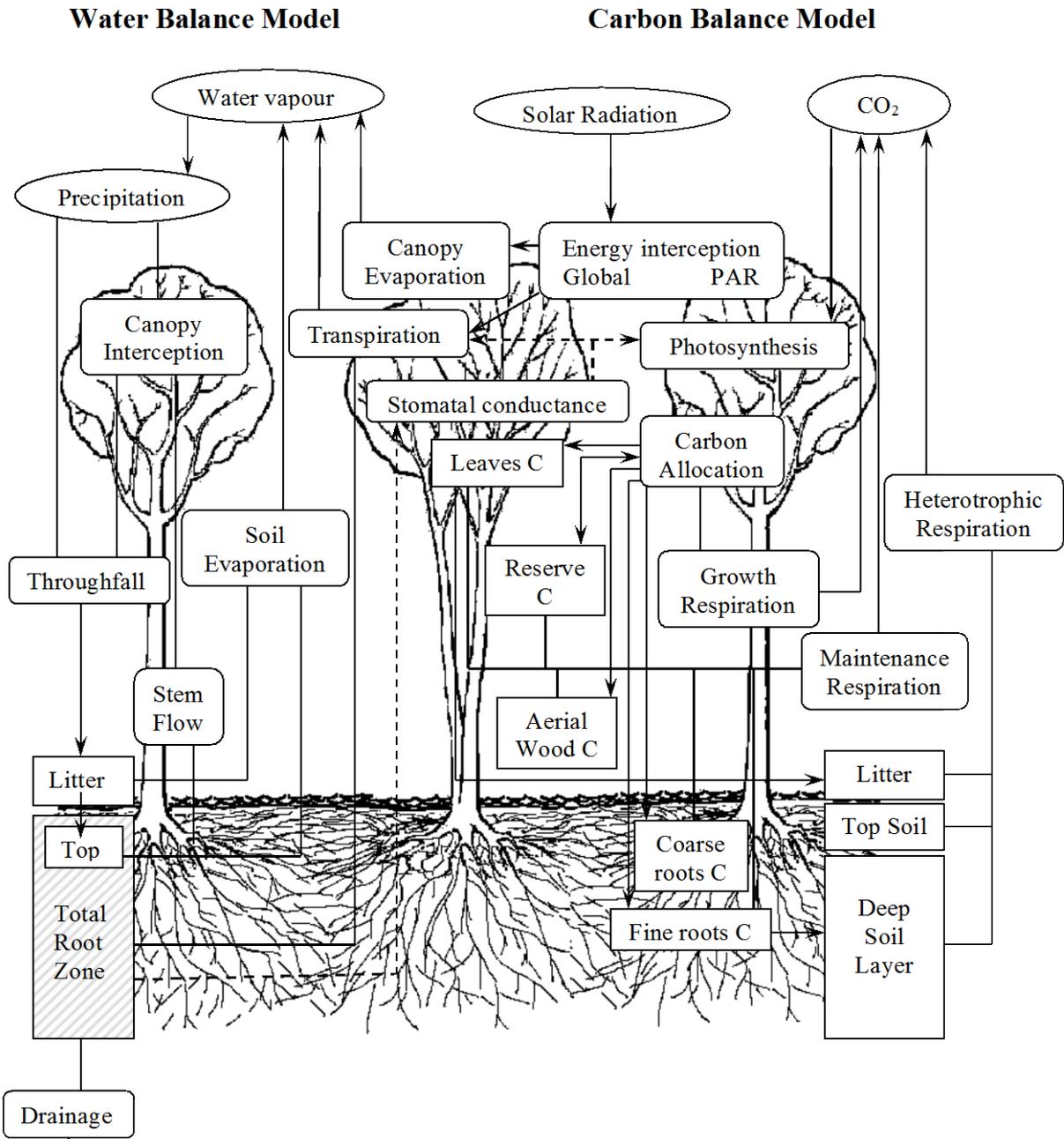




# Simulation Plan



# Description of CASTANEA model



**Canopy photosynthesis**  
Farquhar model coupled with Ball & Berry

**Leaves respiration**  
Q10, Nitrogen, Biomass

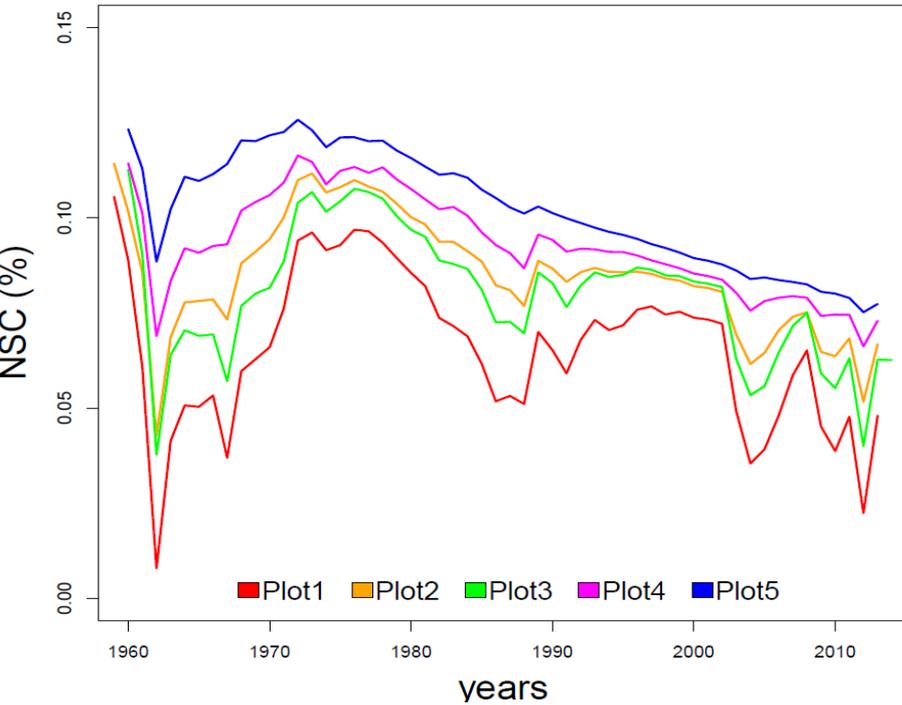
**Wood respiration**  
Q10, Nitrogen, alive biomass

**Water interception**  
LAI, clumping, leaves/needle reserves

**Transpiration**  
Penman Monteith

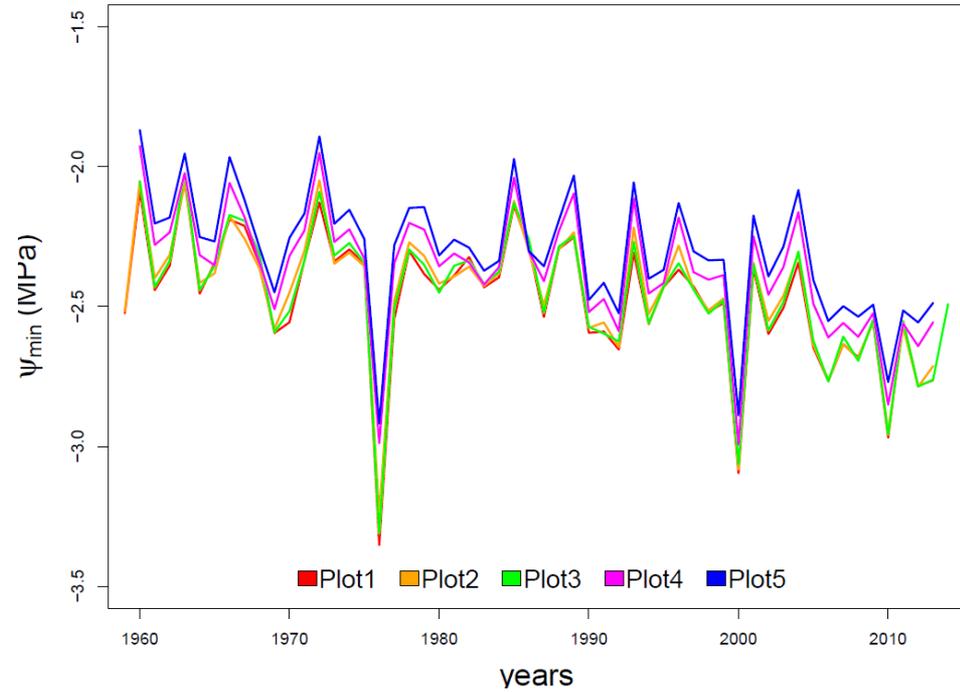
# Mortality modelling

## Non-Structural Carbohydrate (NSC) concentration



Carbon starvation: threshold obtained from IFN data

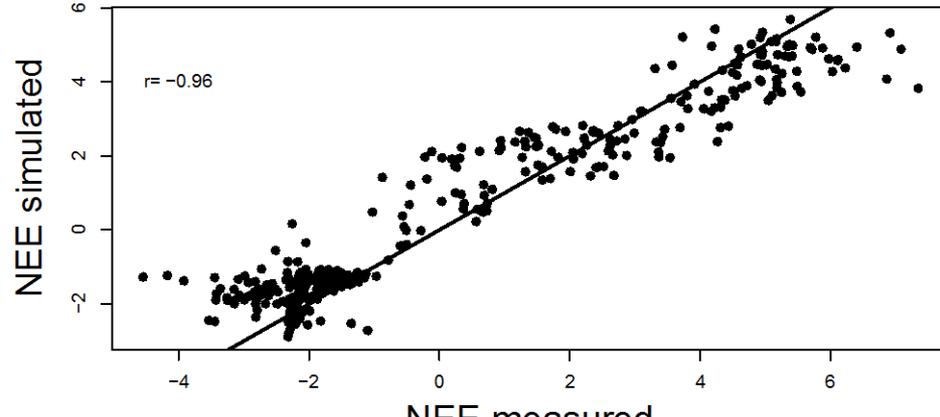
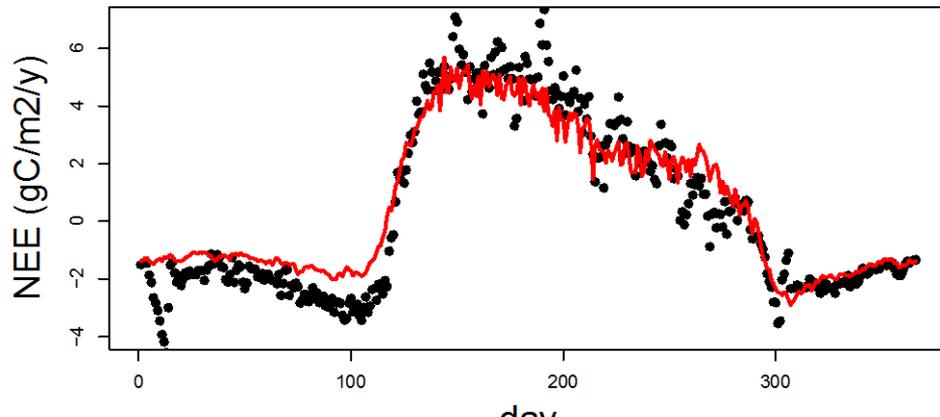
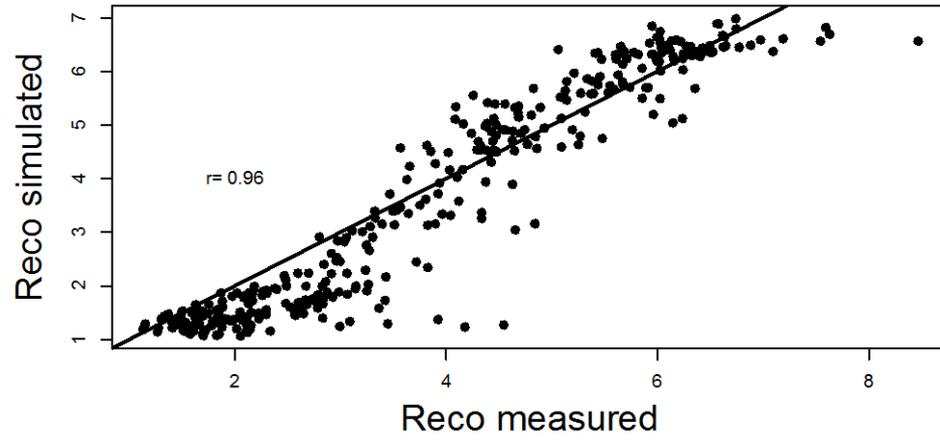
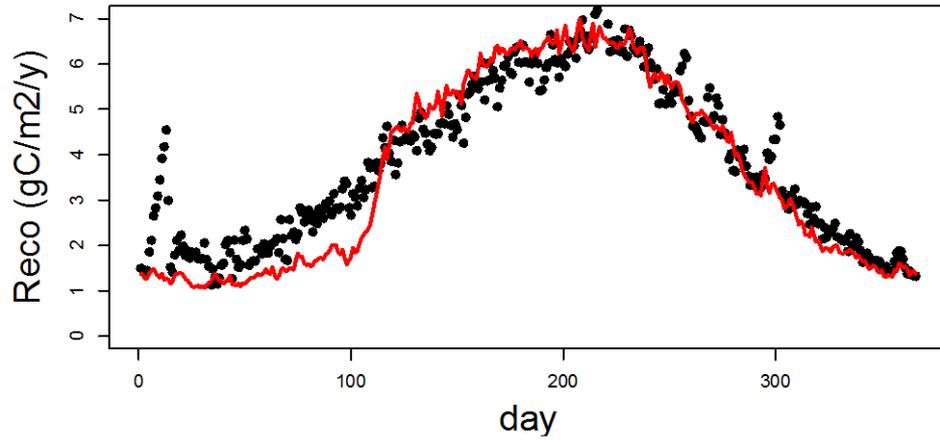
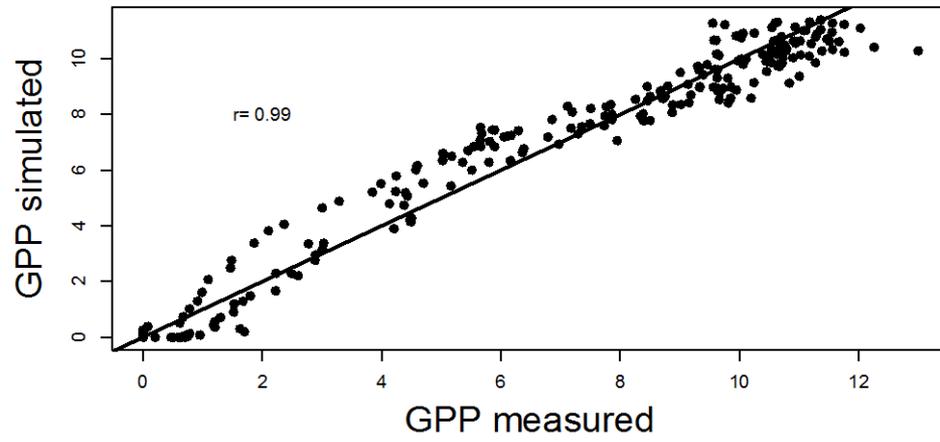
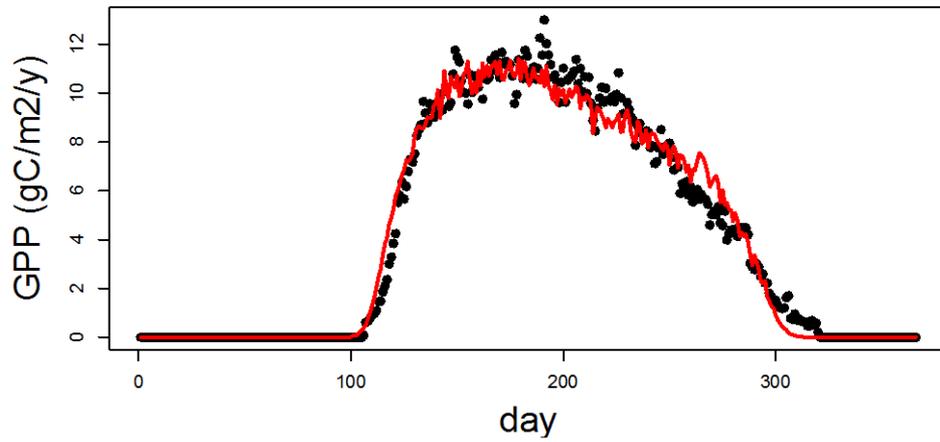
## Leaf water potential



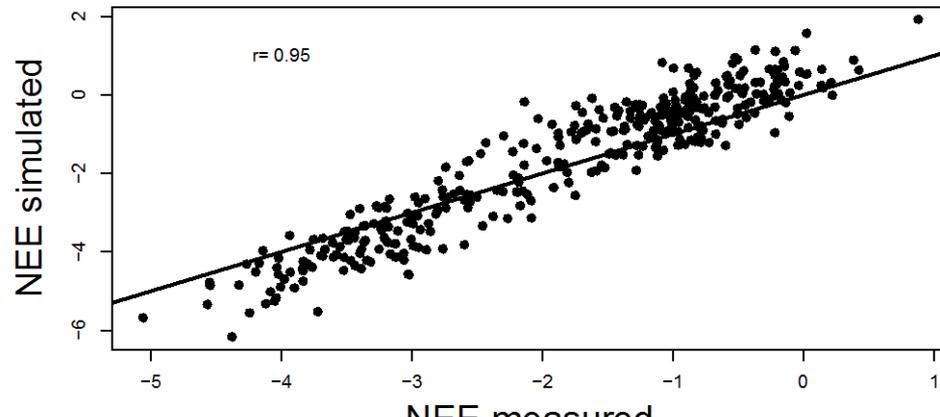
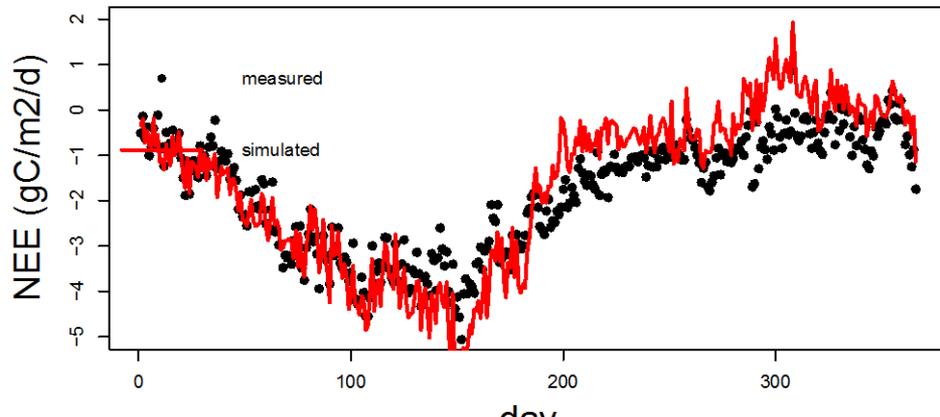
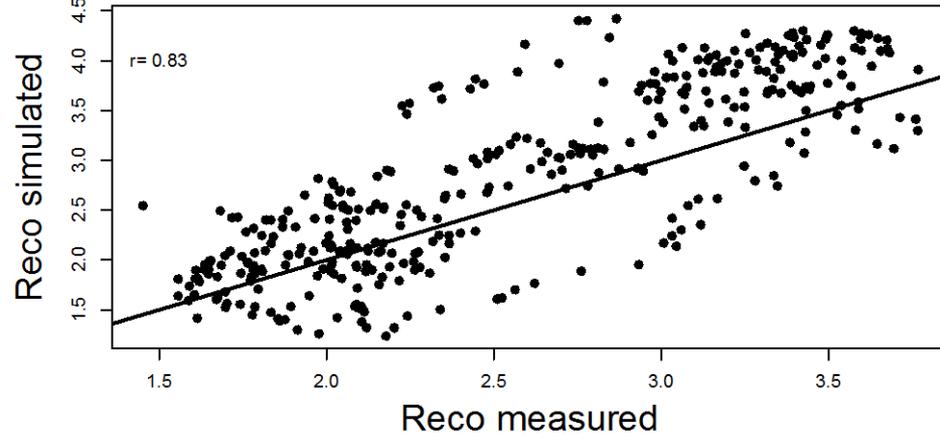
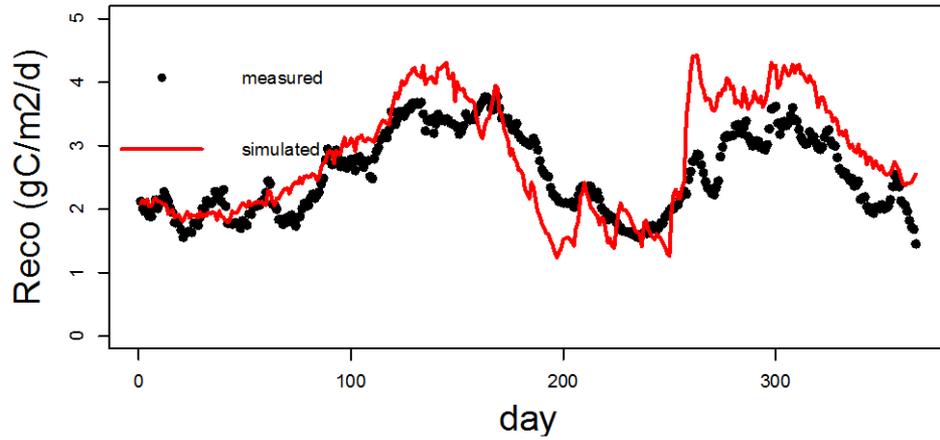
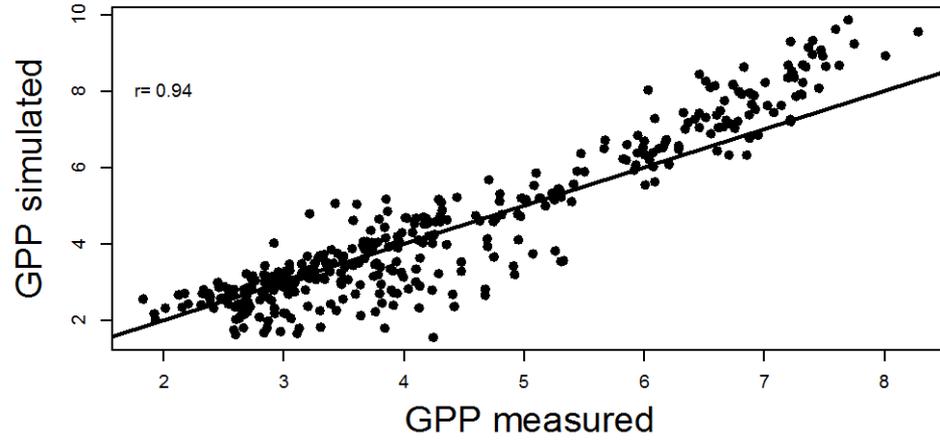
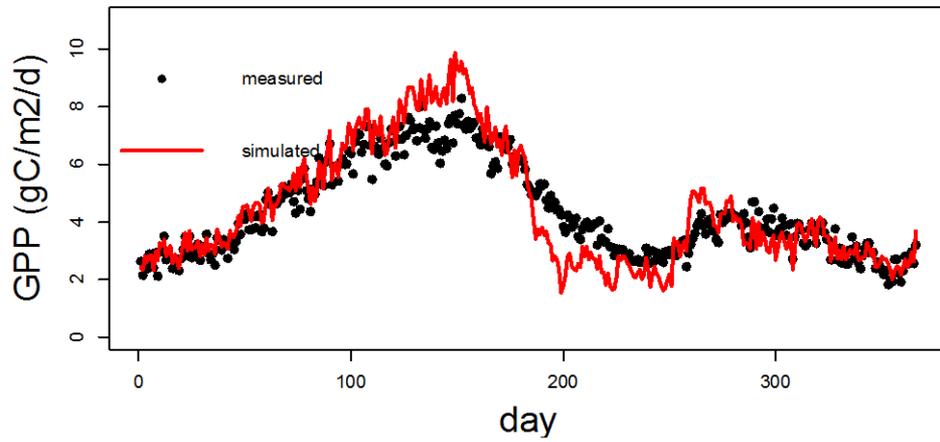
Hydraulic failure: threshold obtained from Xylem database



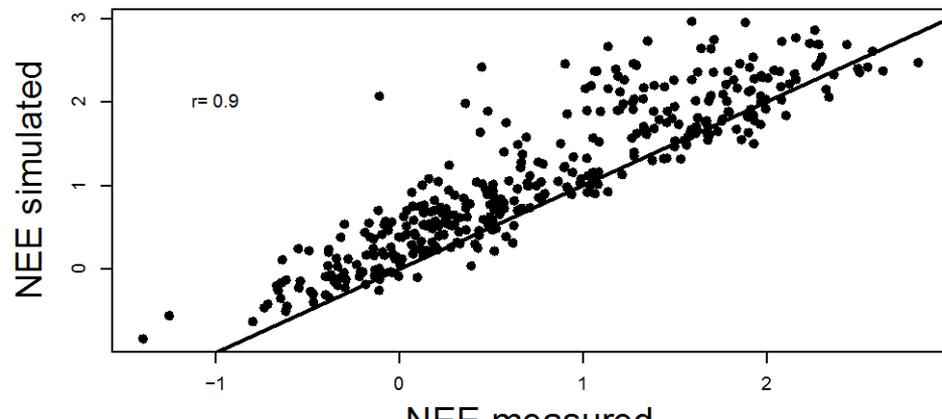
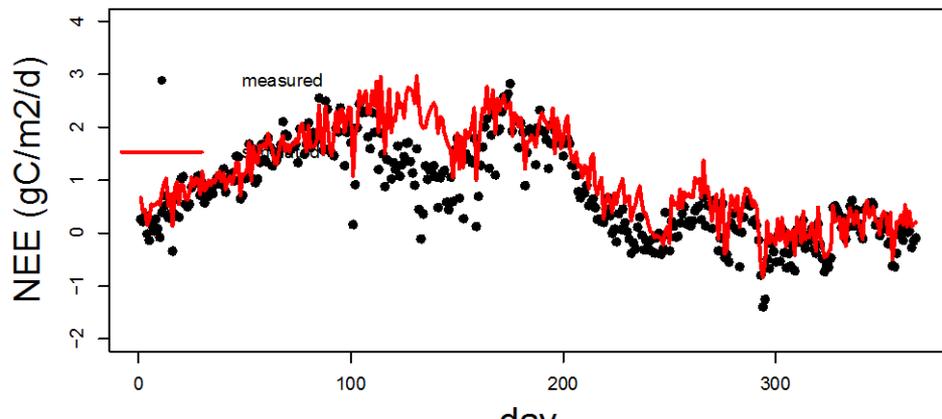
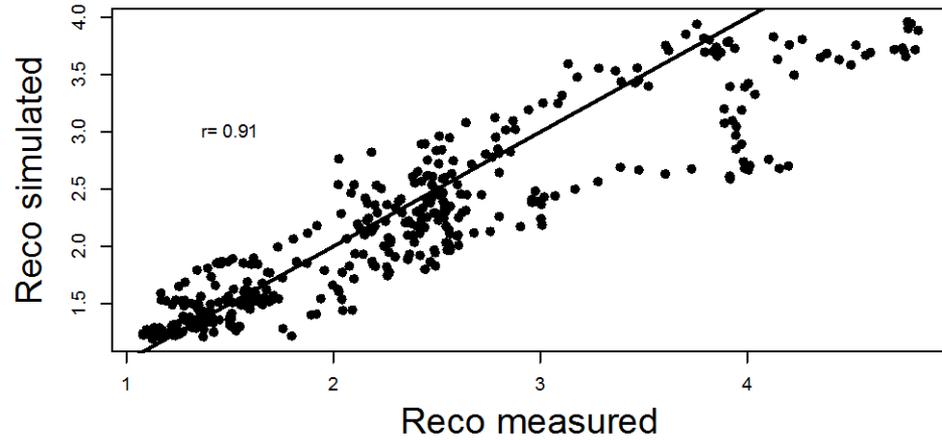
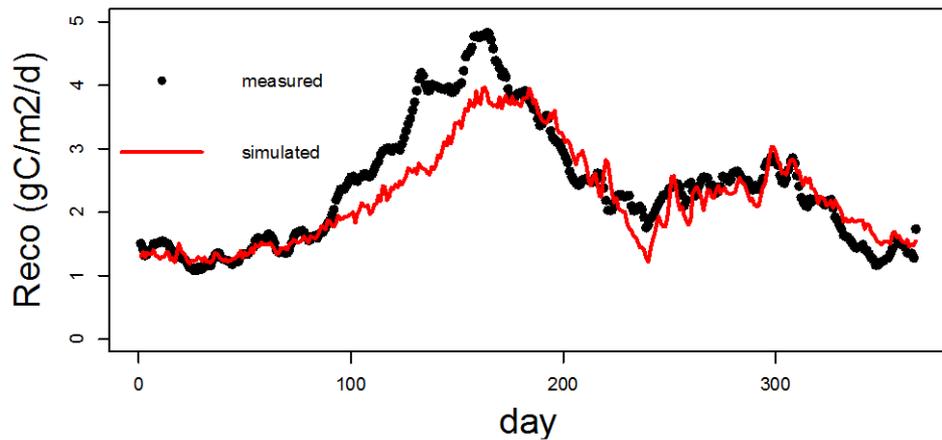
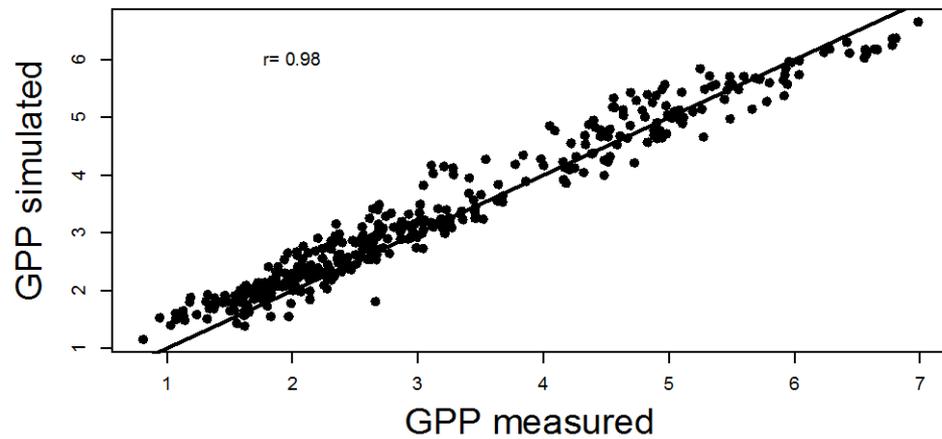
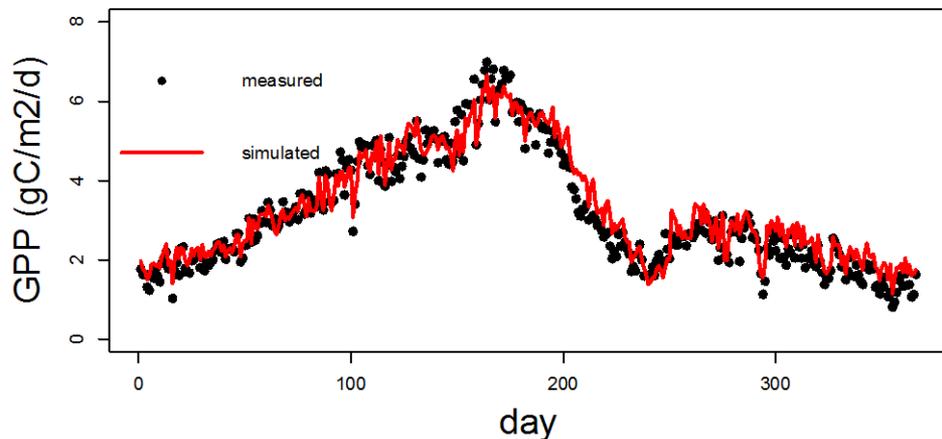
# Model validation: *Fagus sylvatica* (Hesse 1997 to 2013)



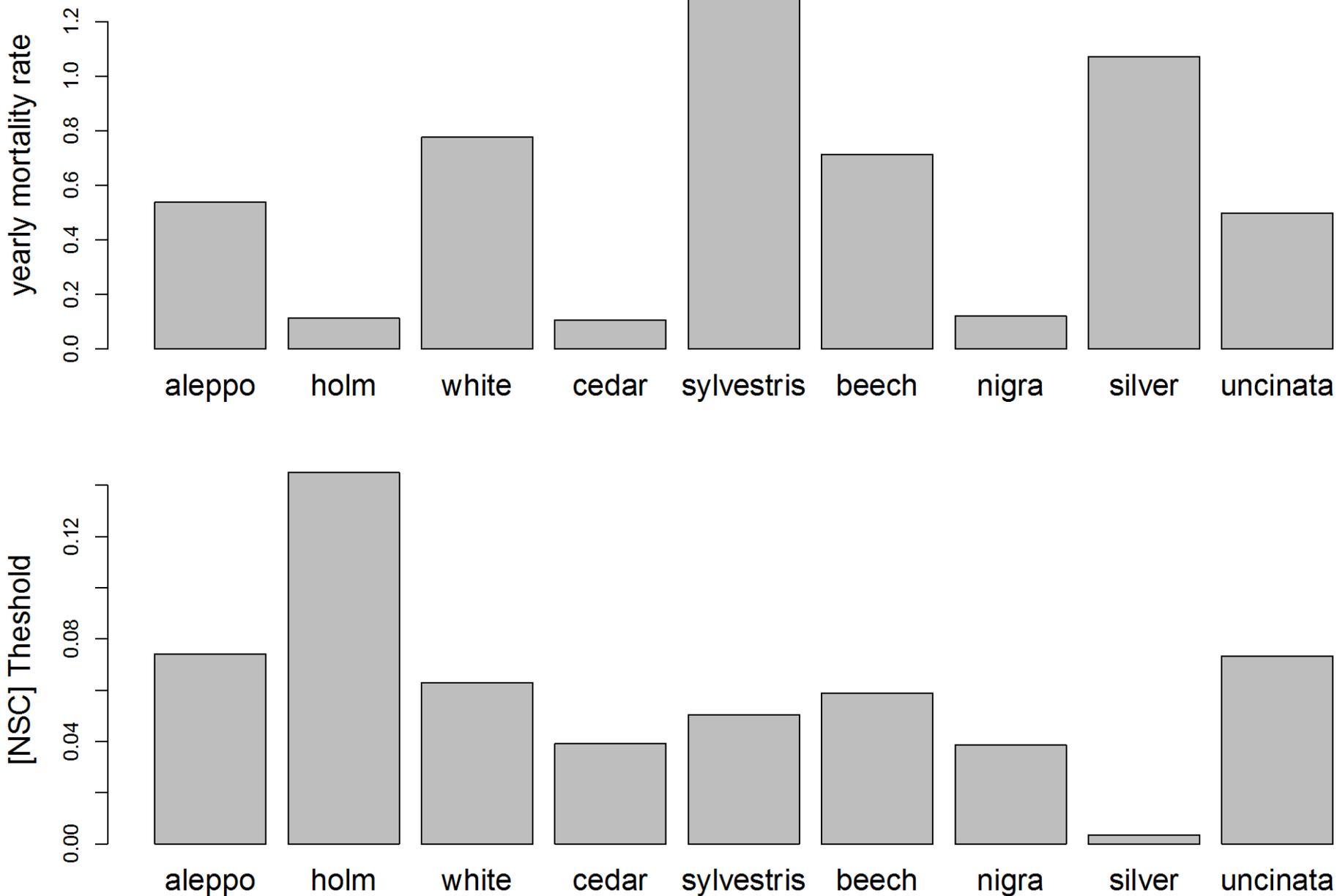
# Model validation: Pinus halepensis (Fontblanche 2009-2017)



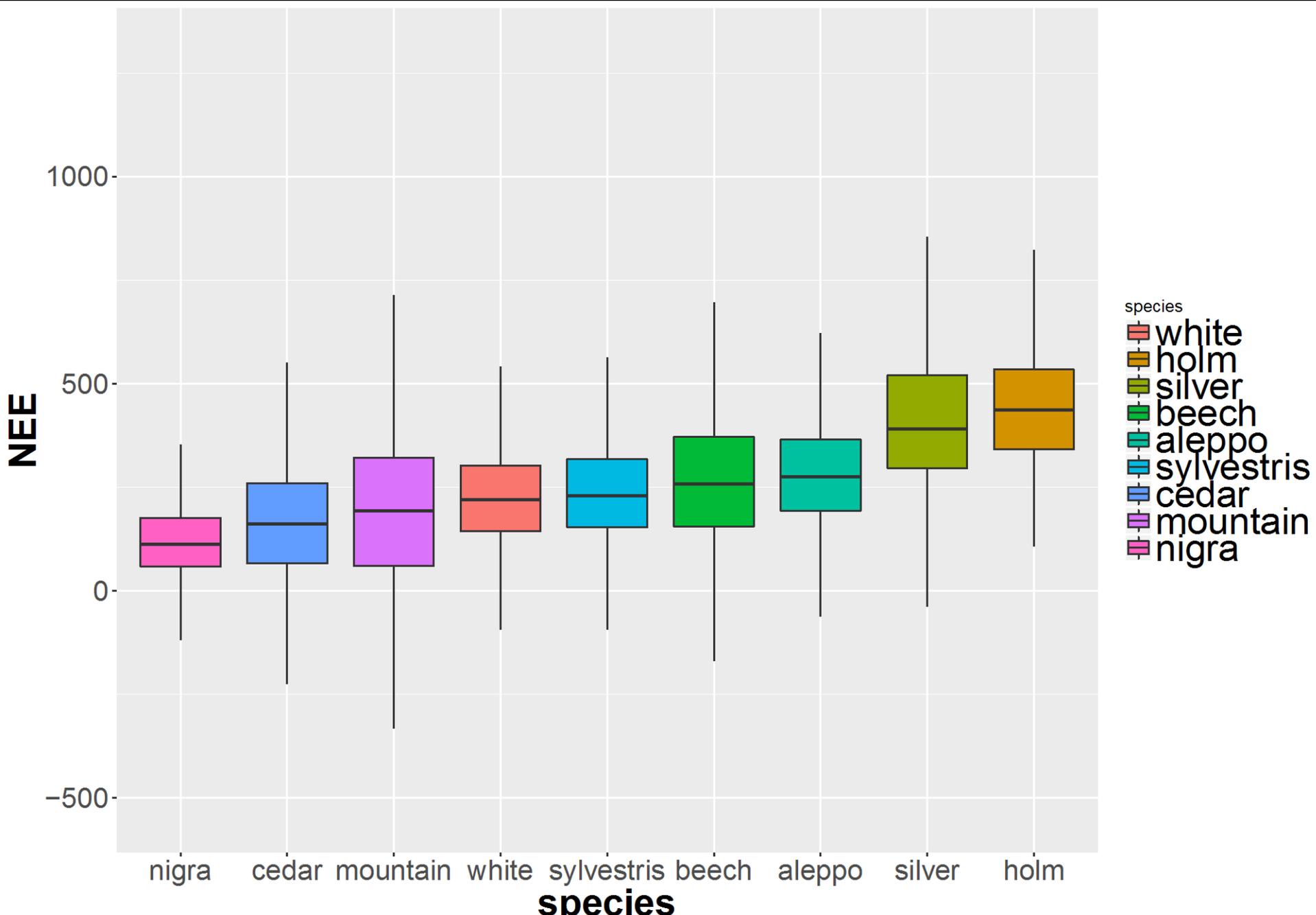
# Model validation: Quercus ilex



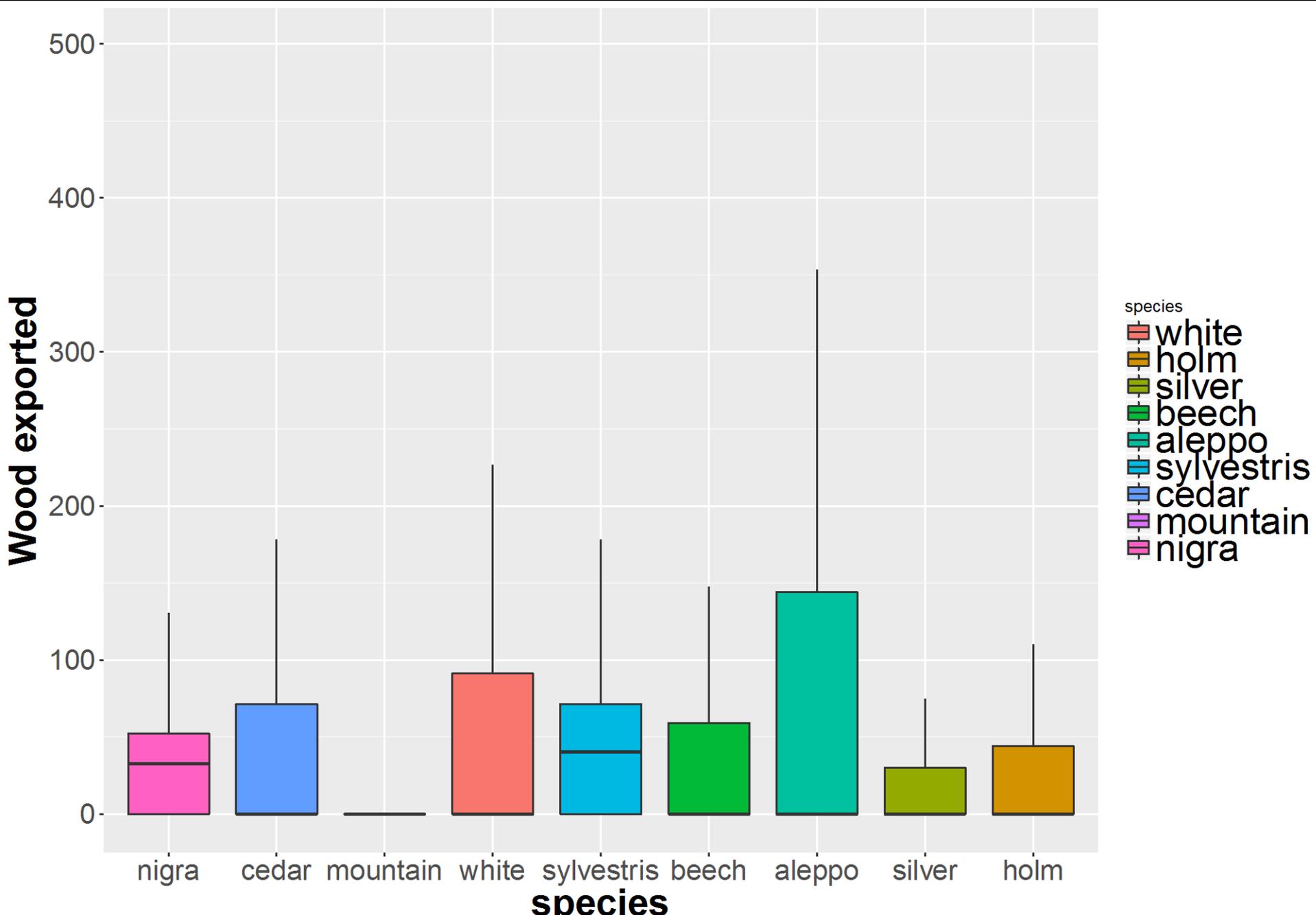
# Model results: mortality



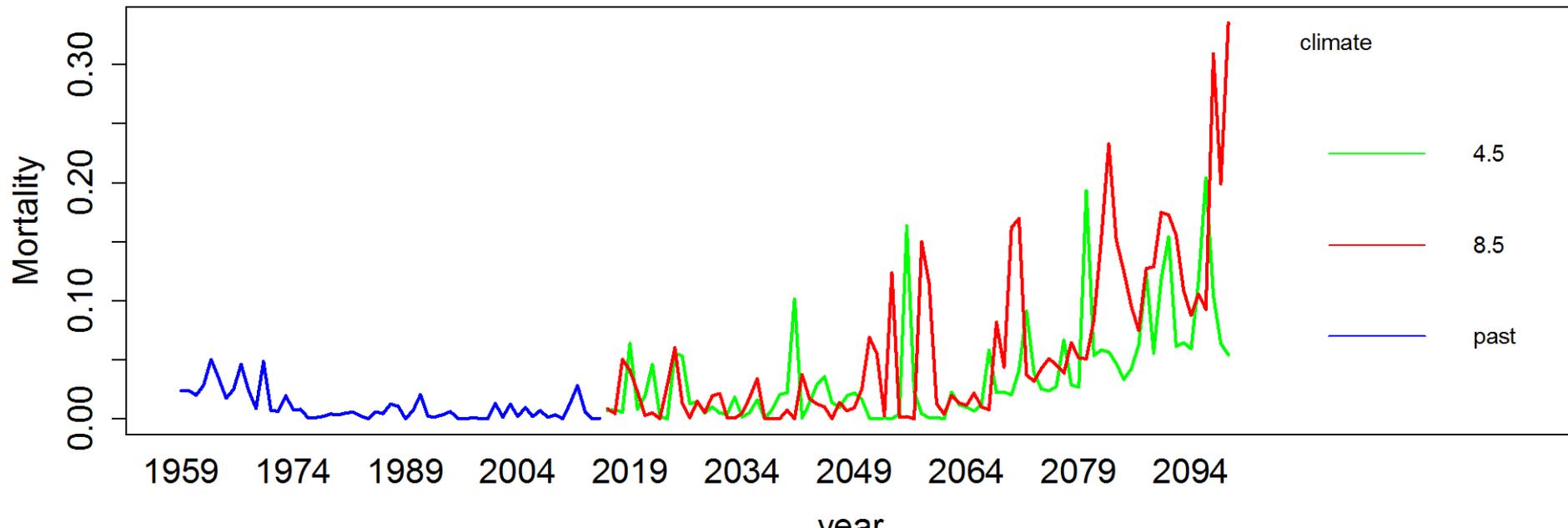
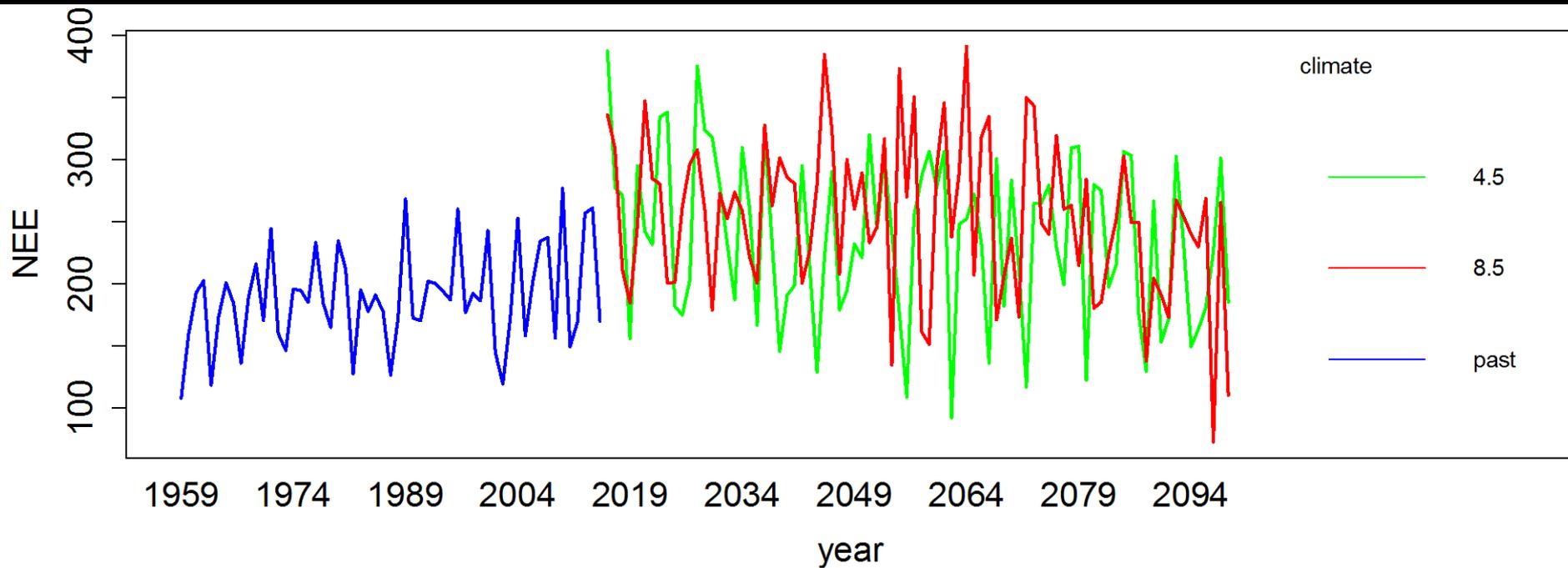
# Model results: species effect



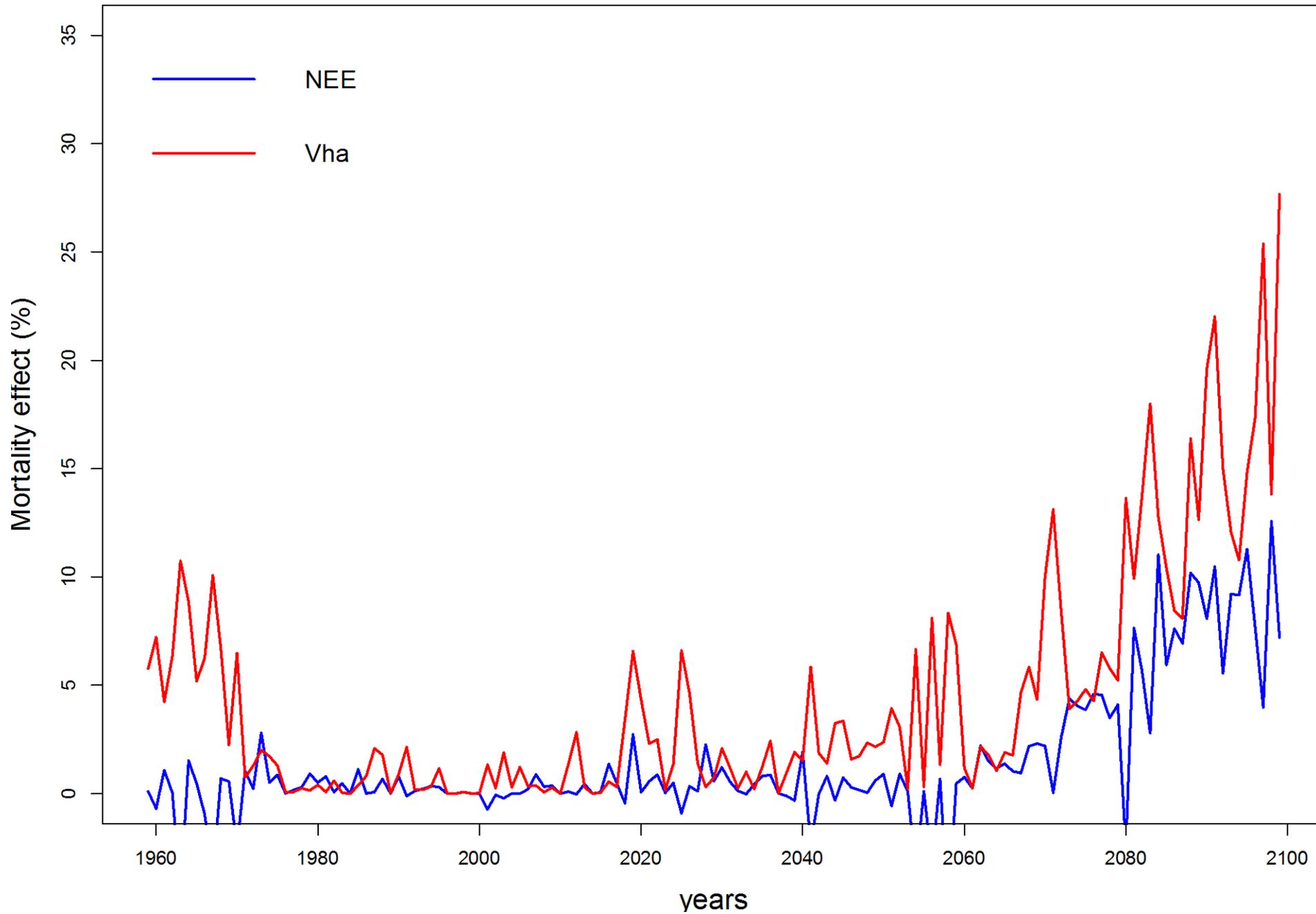
# Model results: species effect



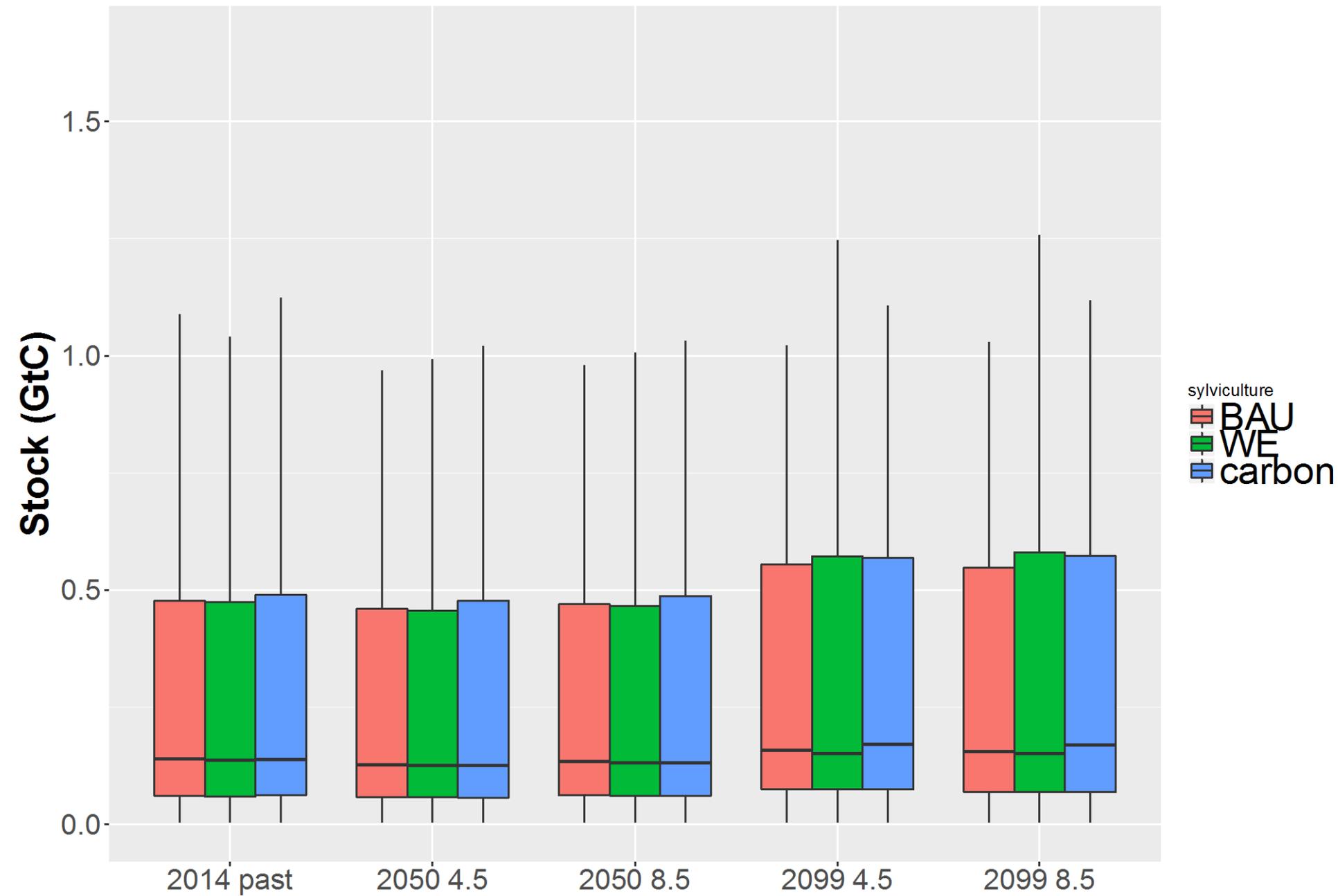
# Model results: climate change effect



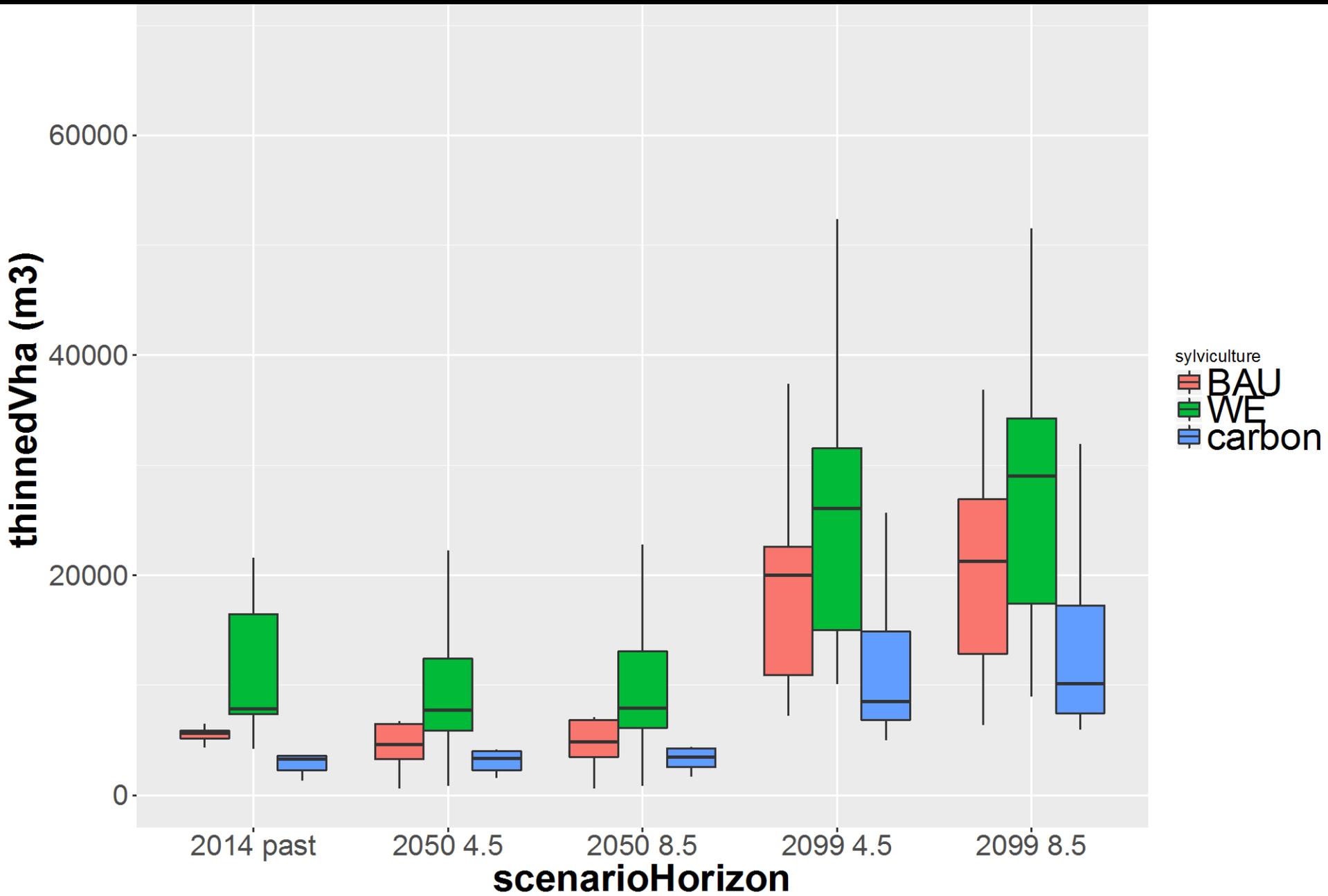
# Model results: mortality effect



# Model results: sylviculture effect

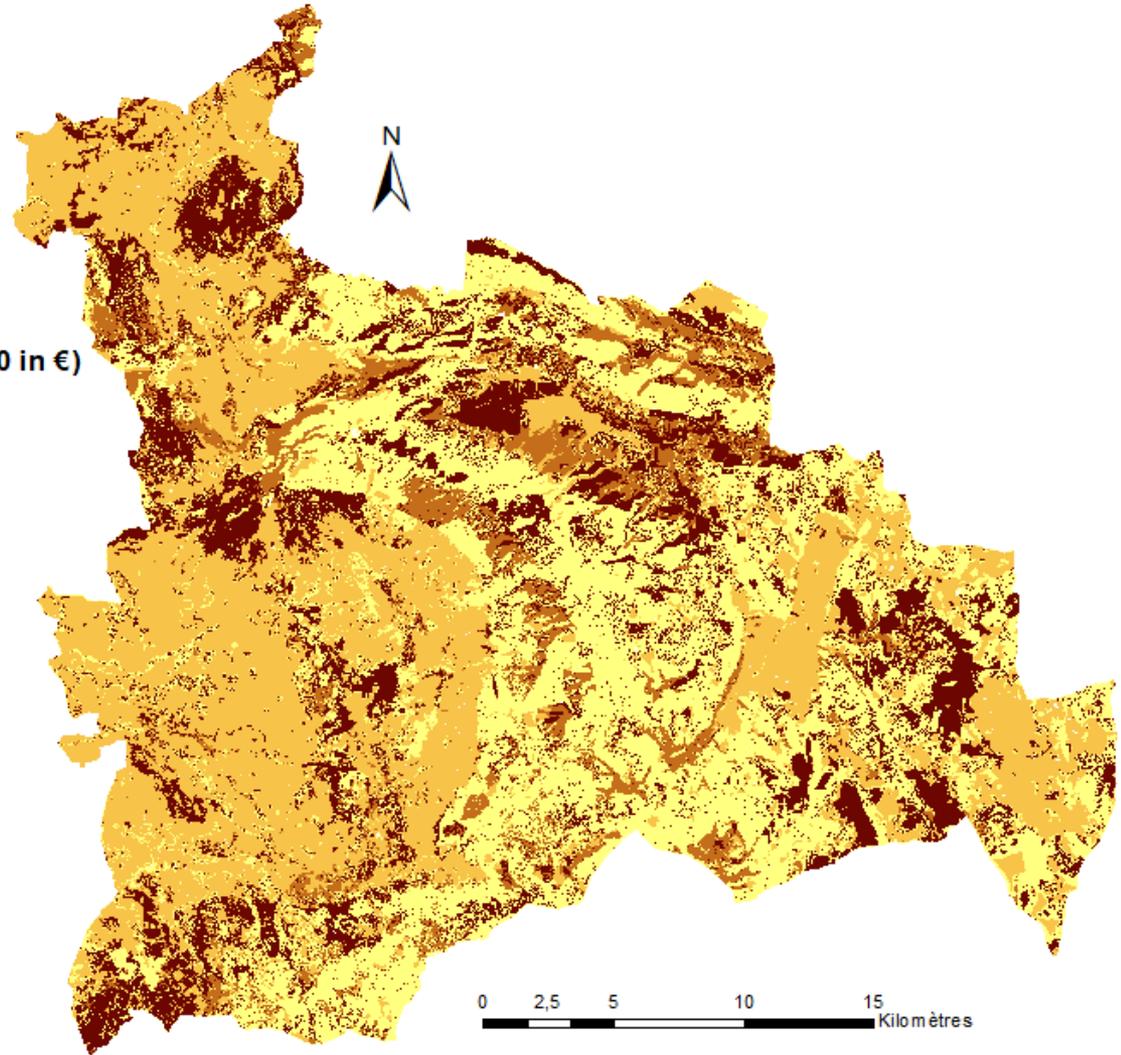
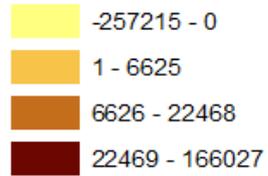


# Model results: silviculture effect



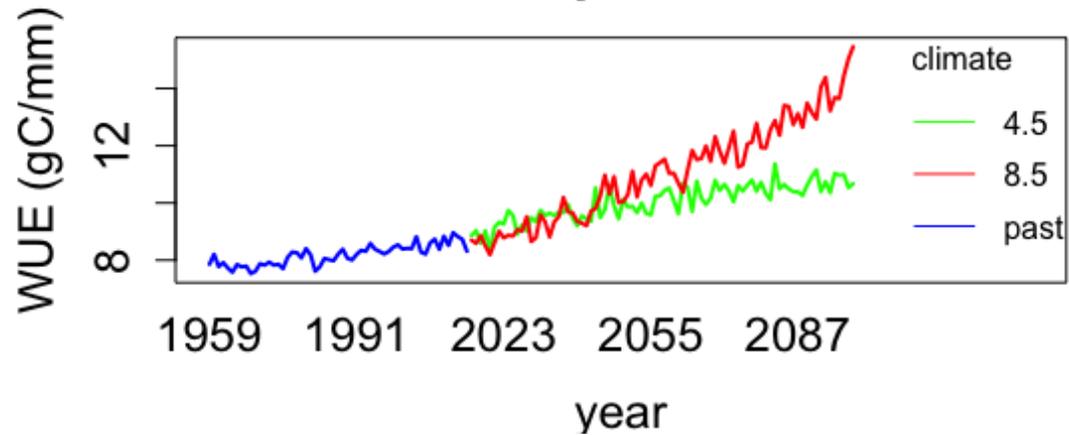
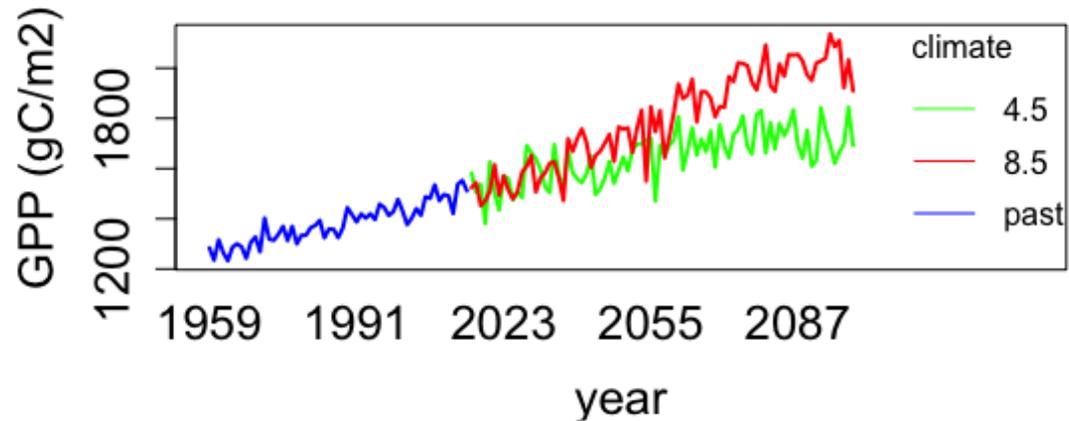
# Model results: economy

BAU\_RCP8.5\_2050 (Delta 2017-2050 in €)

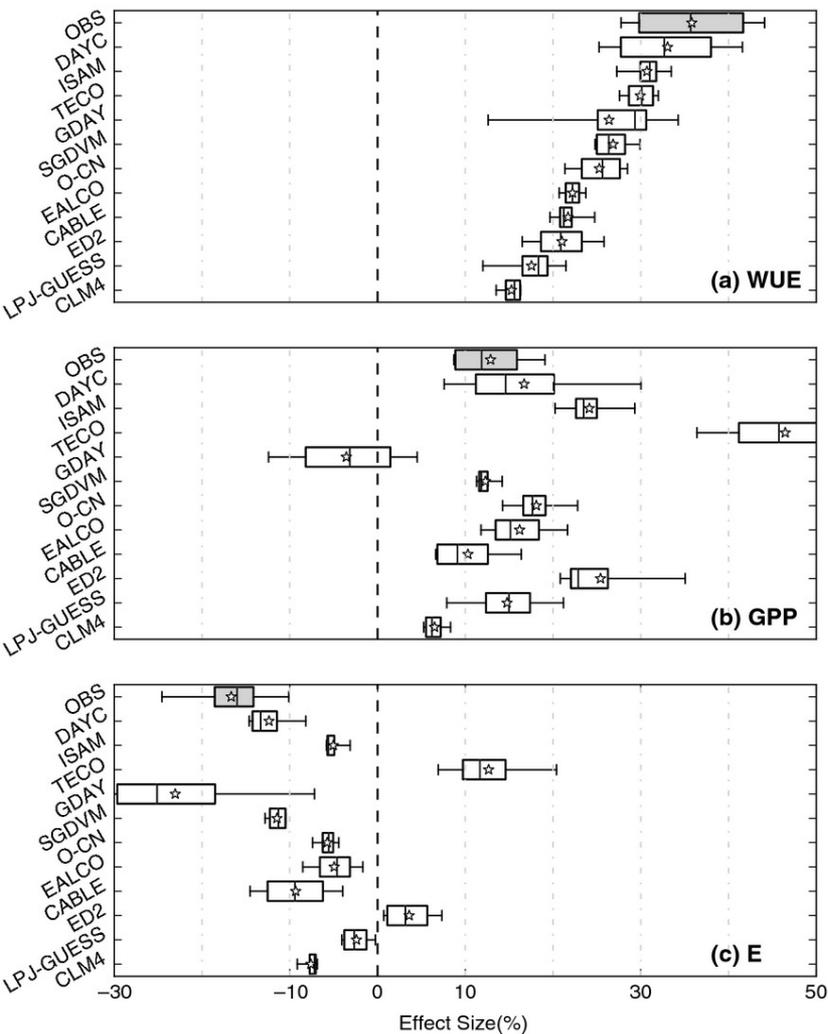


# Discussion

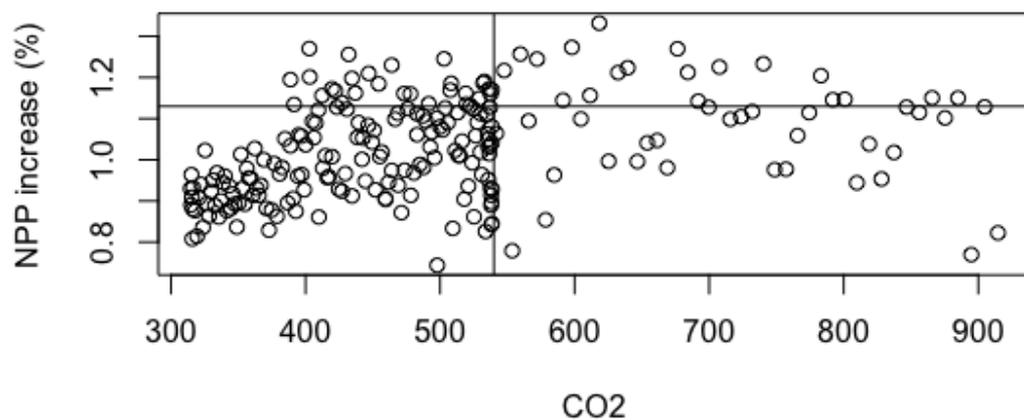
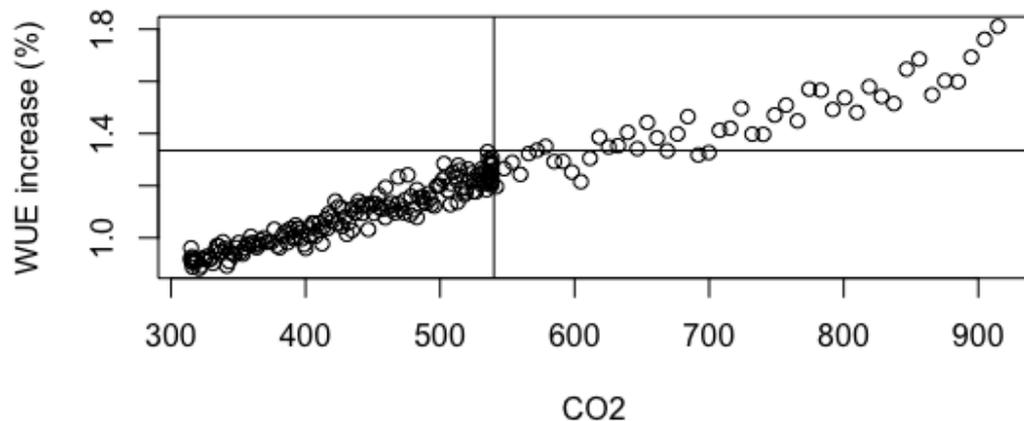
1. Validation against growth data
2. Hydraulics Failure vs carbon starvation
3. Uncertainty concerning soil carbon stocks
4. CO<sub>2</sub> fertilization effect



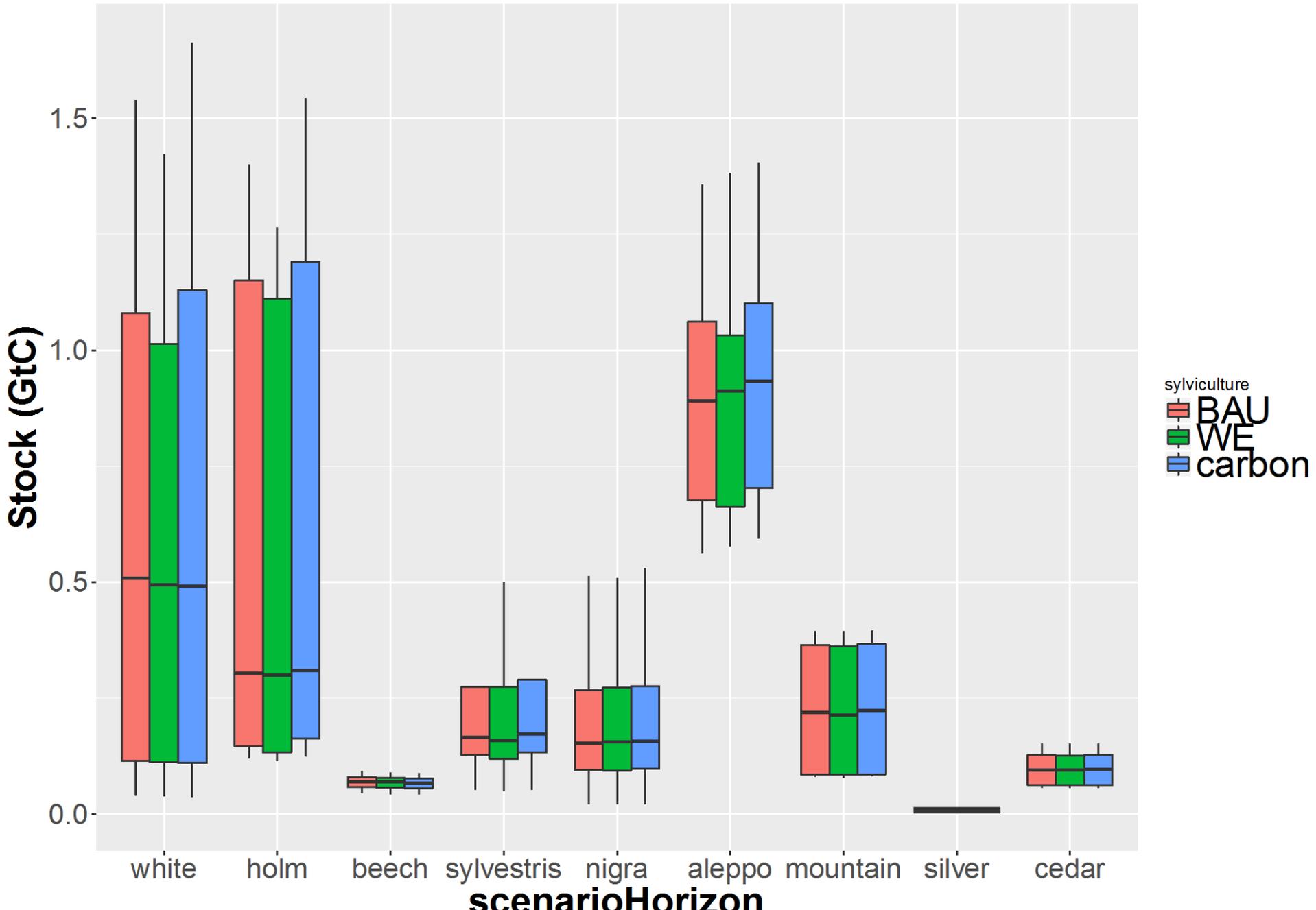
# Discussion



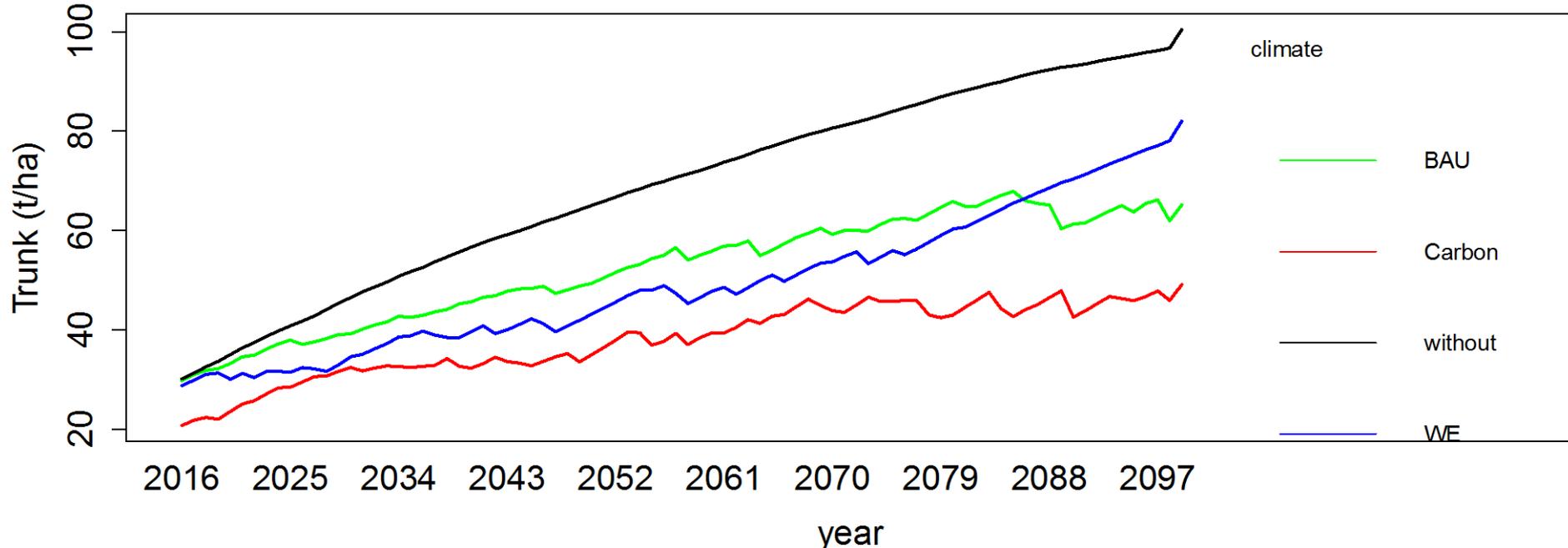
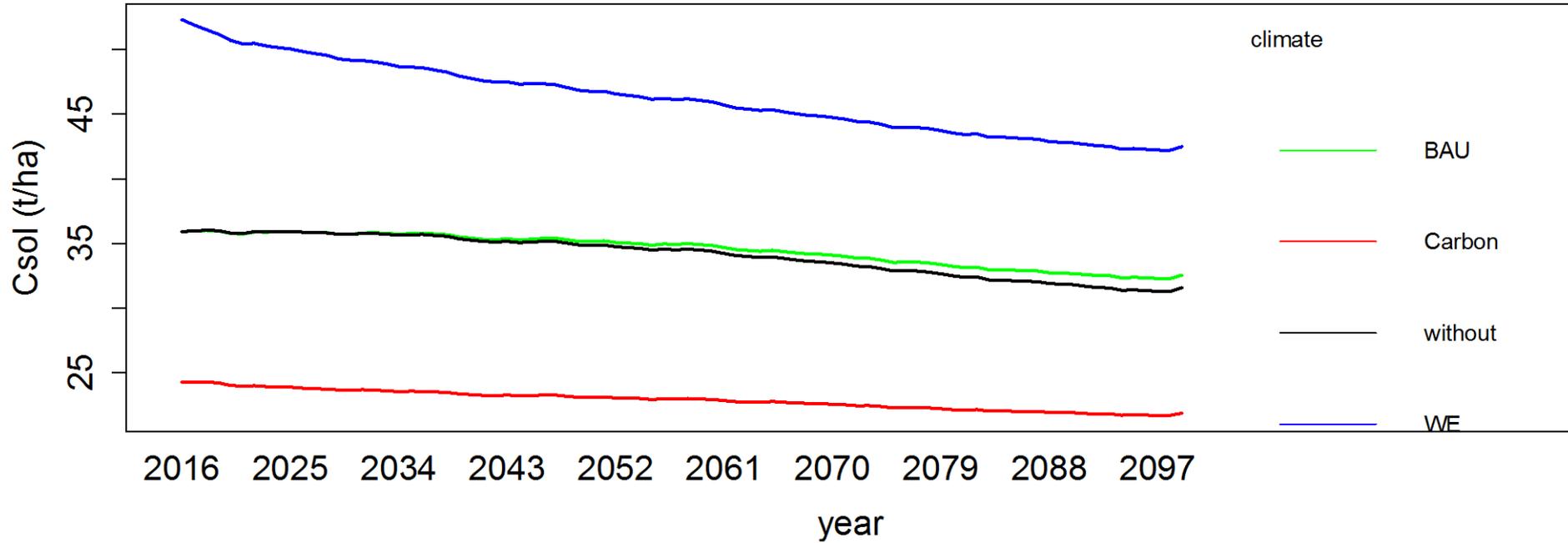
Observations in two FACE (Oak Ridge & Duke Face)



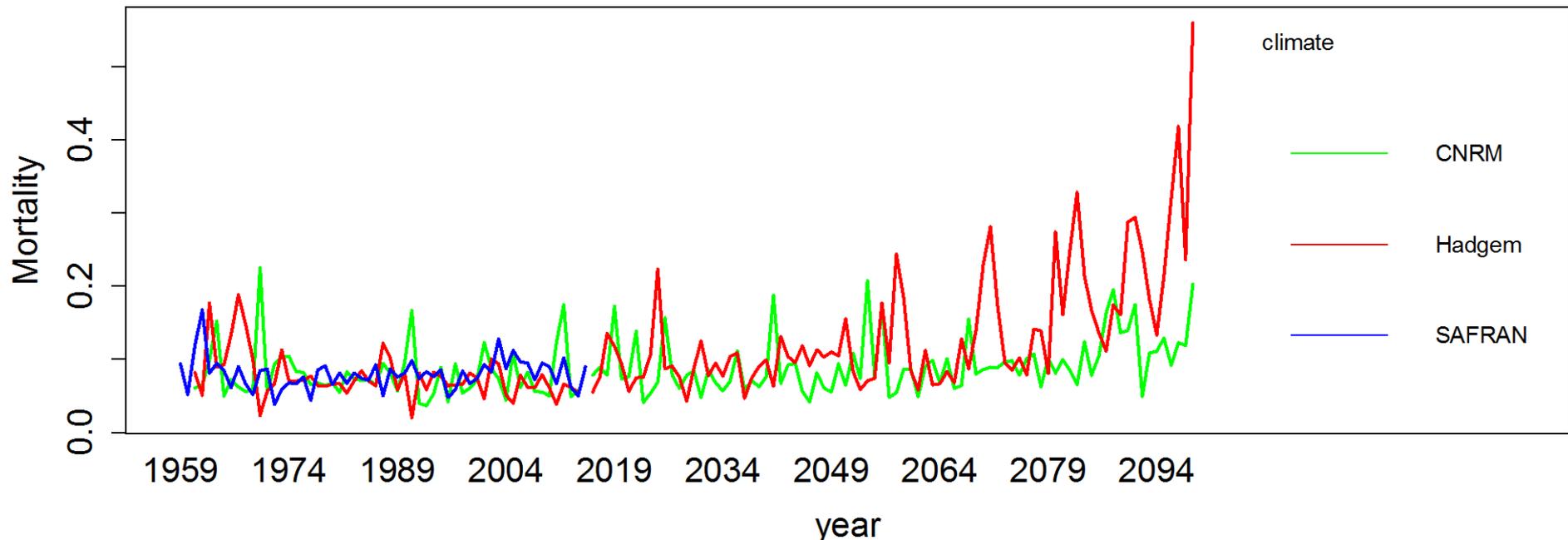
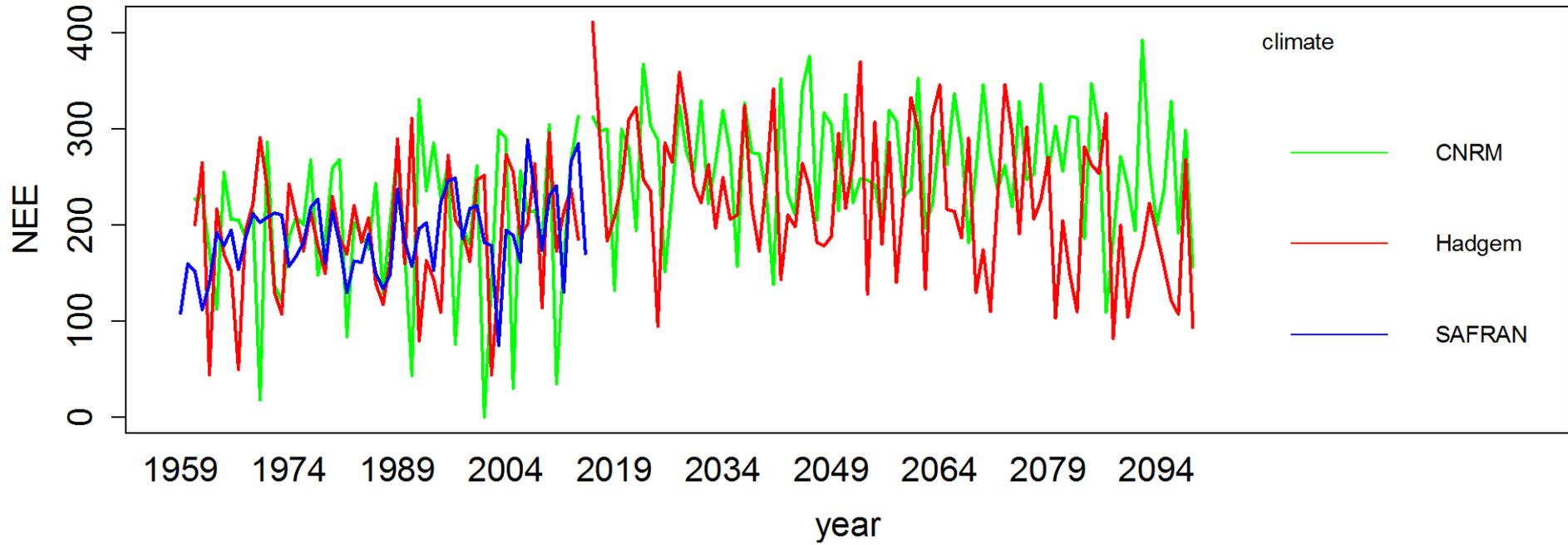
# Supplement figures



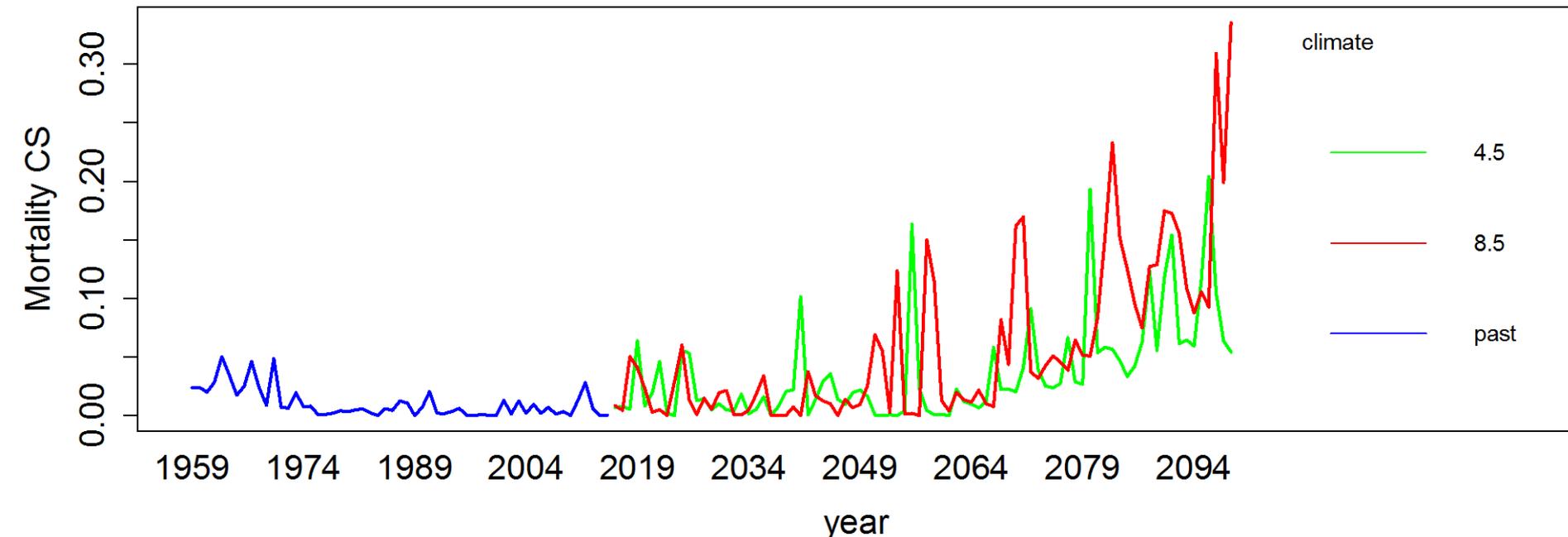
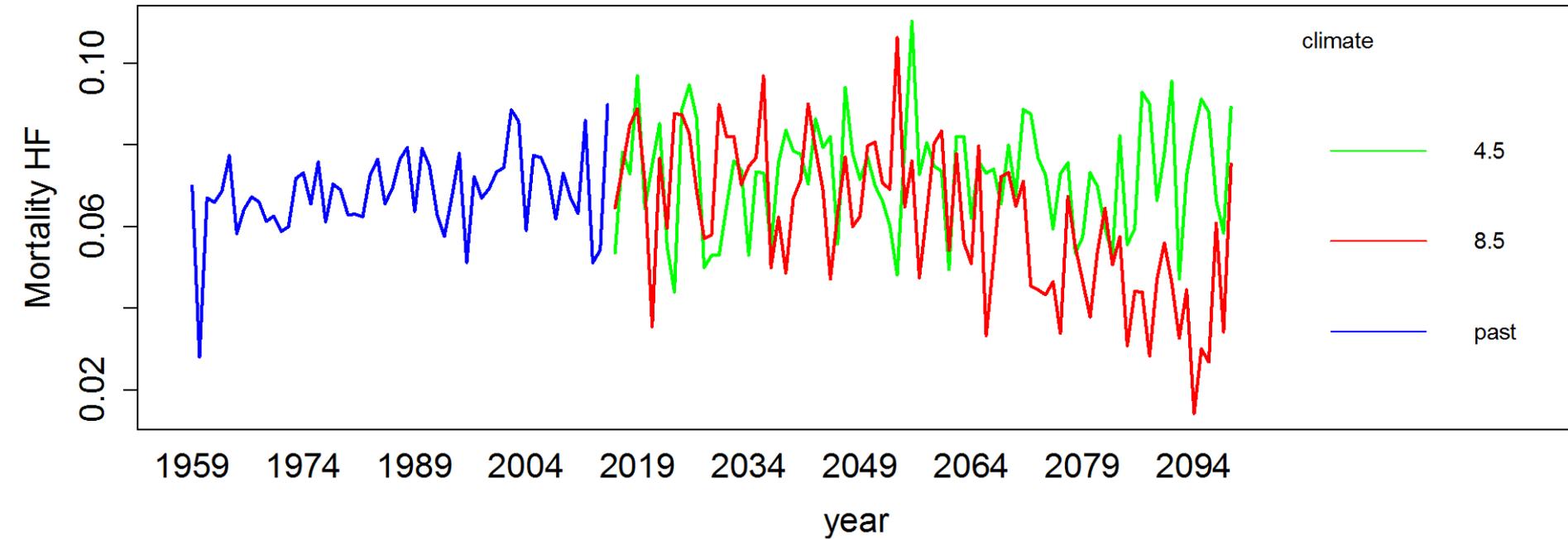
# Supplement figures



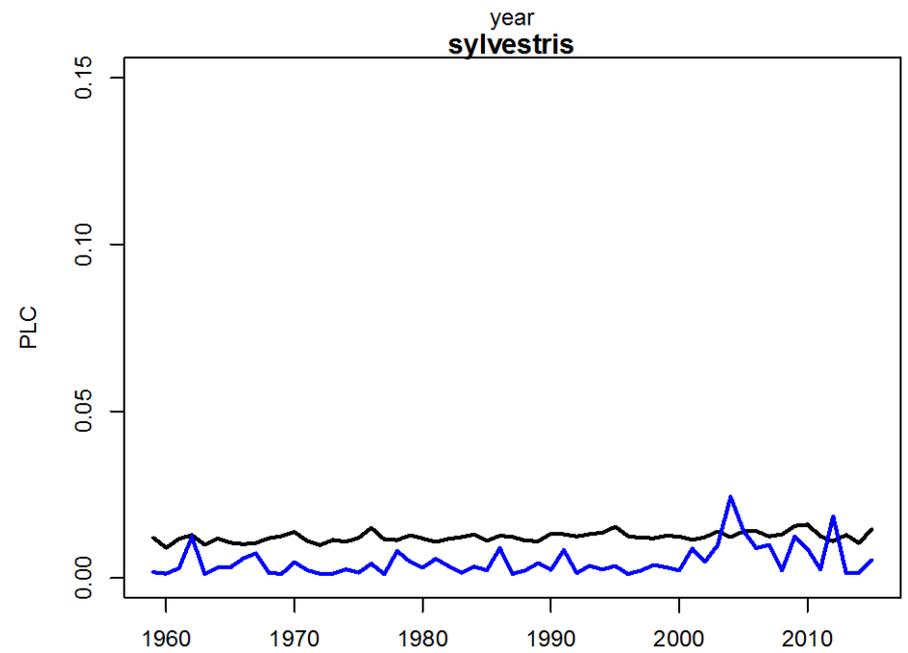
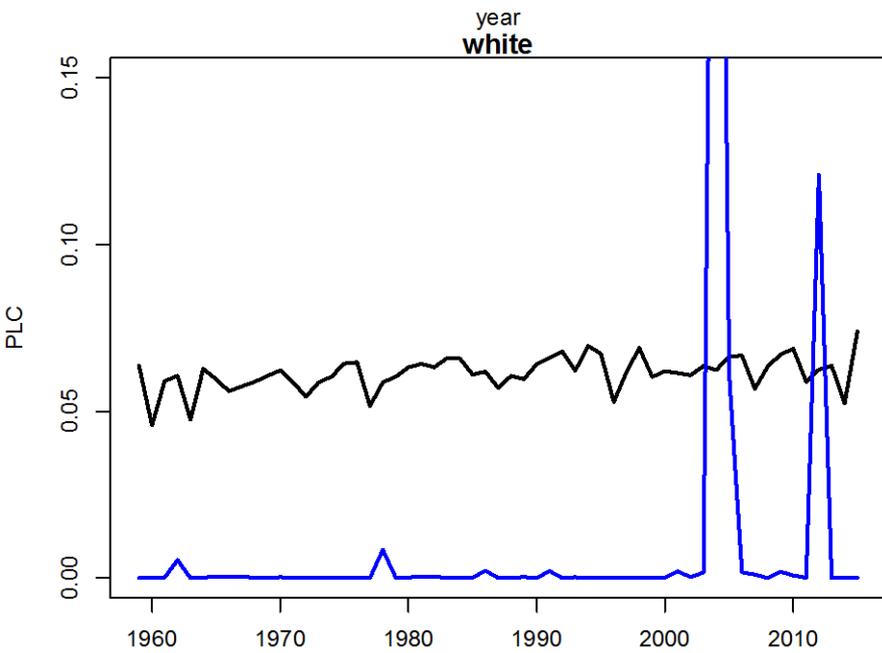
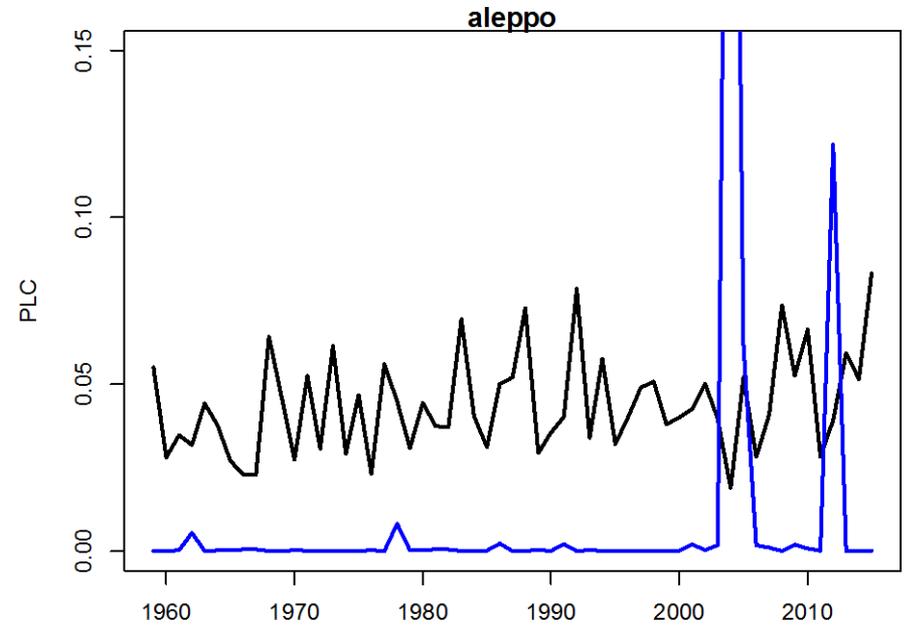
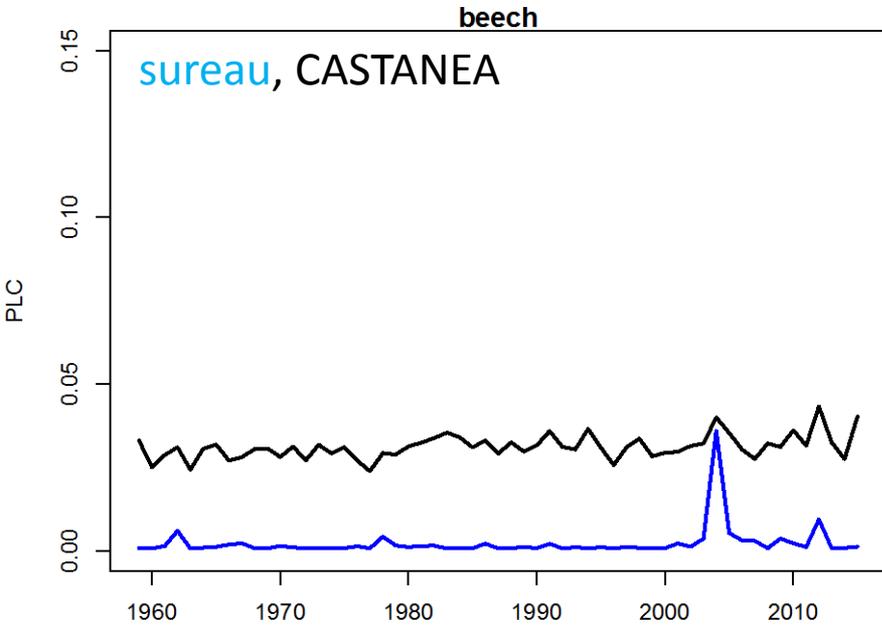
# Supplement figures



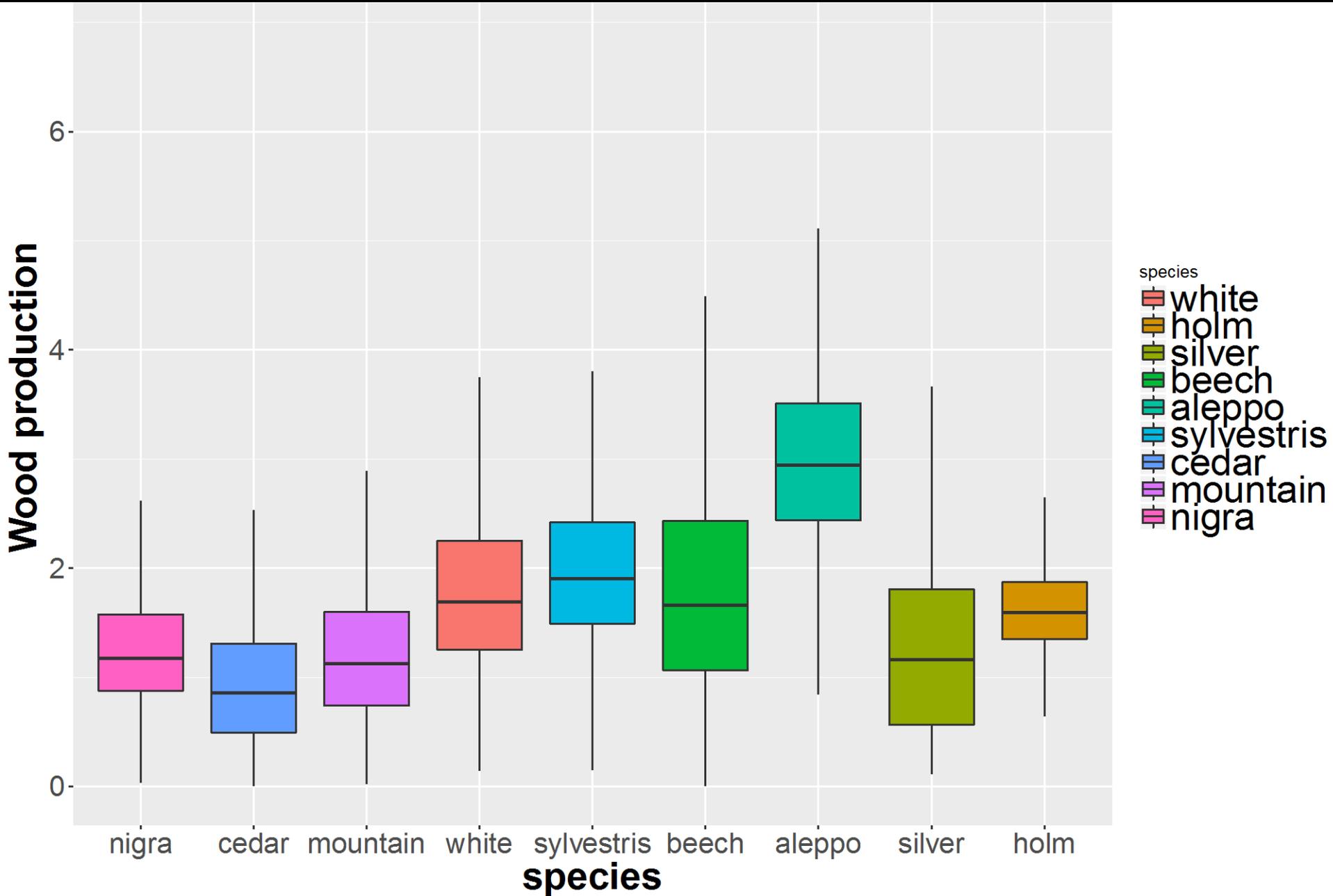
# Supplement figures



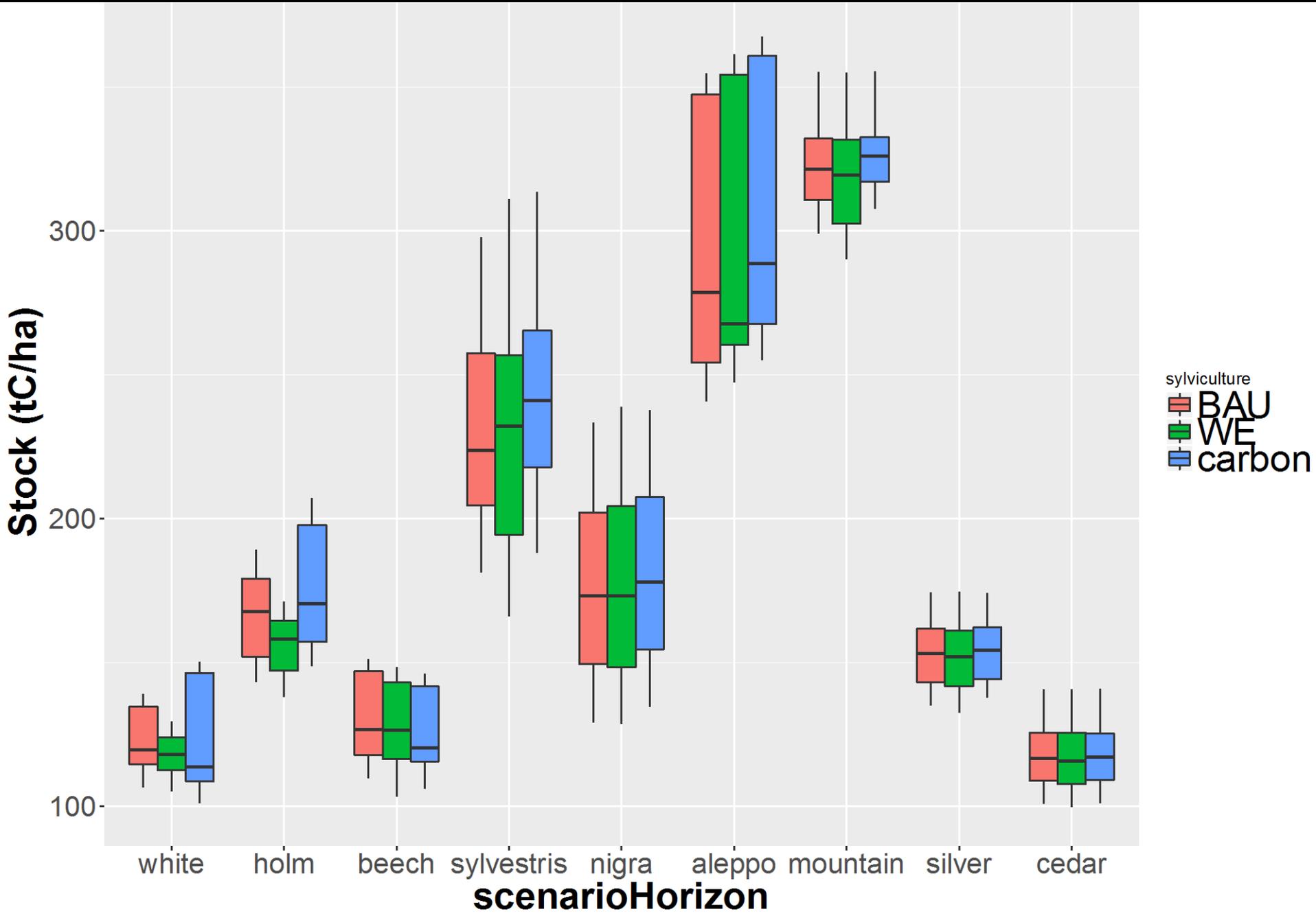
# Supplement figures



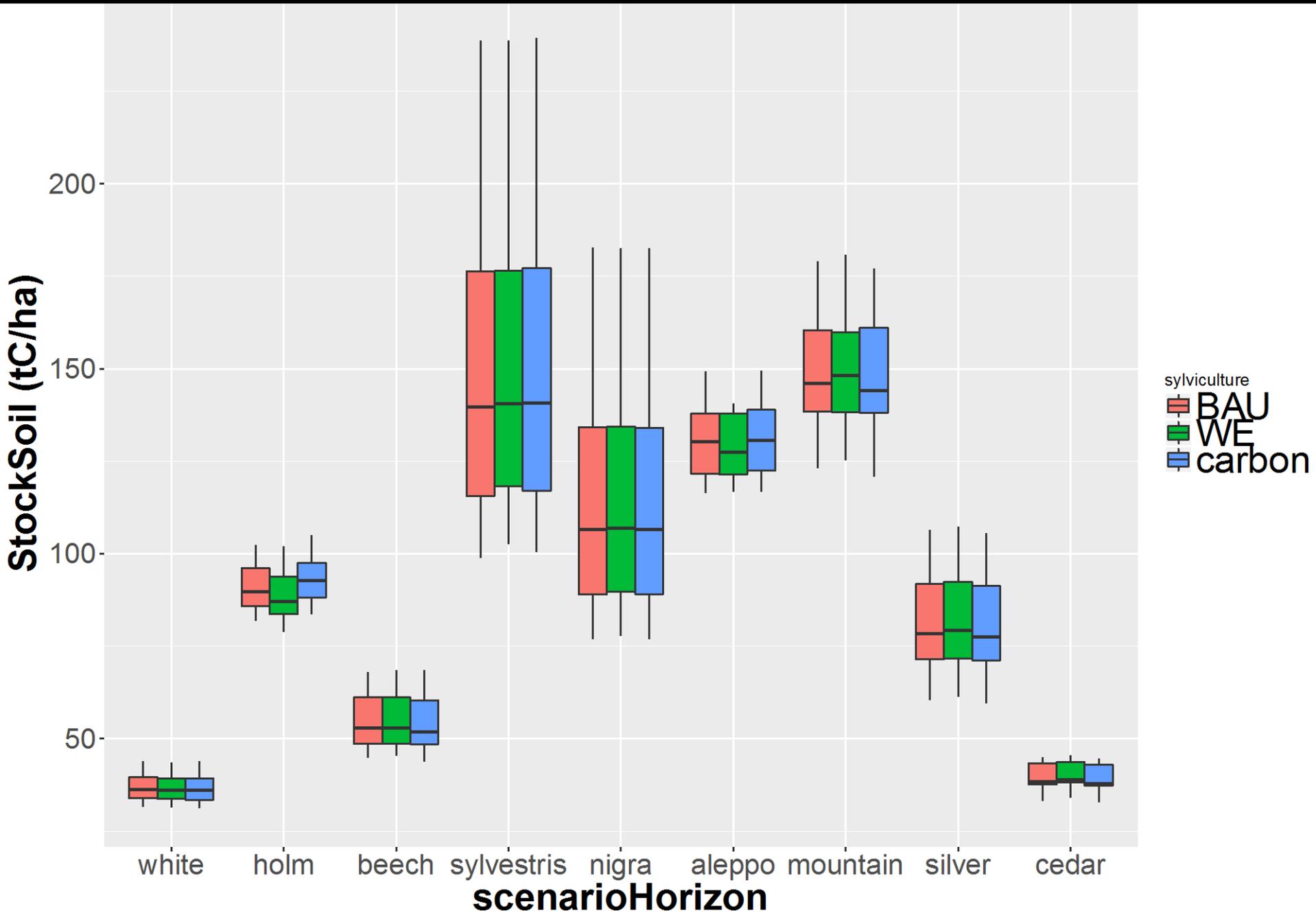
# Supplement figures



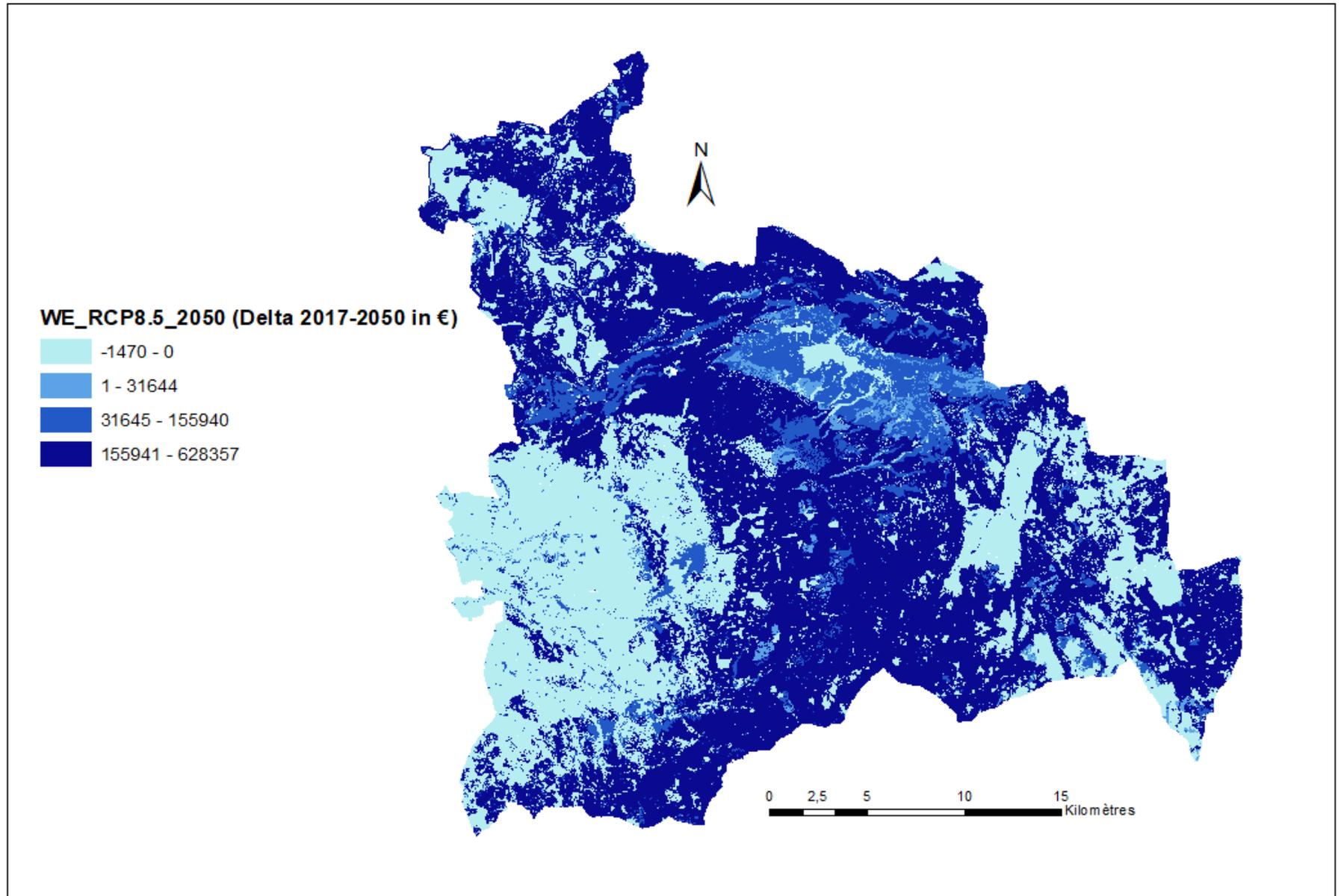
# Supplement figures



# Supplement figures



# Supplement figures



# Supplement figures

