

Regional vs continental climate envelopes

RESEARCH INSTITUTE
NATURE AND FOREST

Dirk Maes (INBO, Belgium)

Nicolas Titeux & Lluís Brotons (CTFC, Spain)

Miska Luoto (University of Helsinki, Finland)

Toon Van Daele, Thierry Onkelinx (INBO)

Risto Heikkinen (SYKE, Finland)

Helena Romo, Enrique Garcia-Barros,

Miguel Munguira (University of Madrid, Spain)

Wilfried Thuiller (University of Grenoble, Switzerland)

Chris van Swaay (Dutch Butterfly Conservation, The Netherlands)

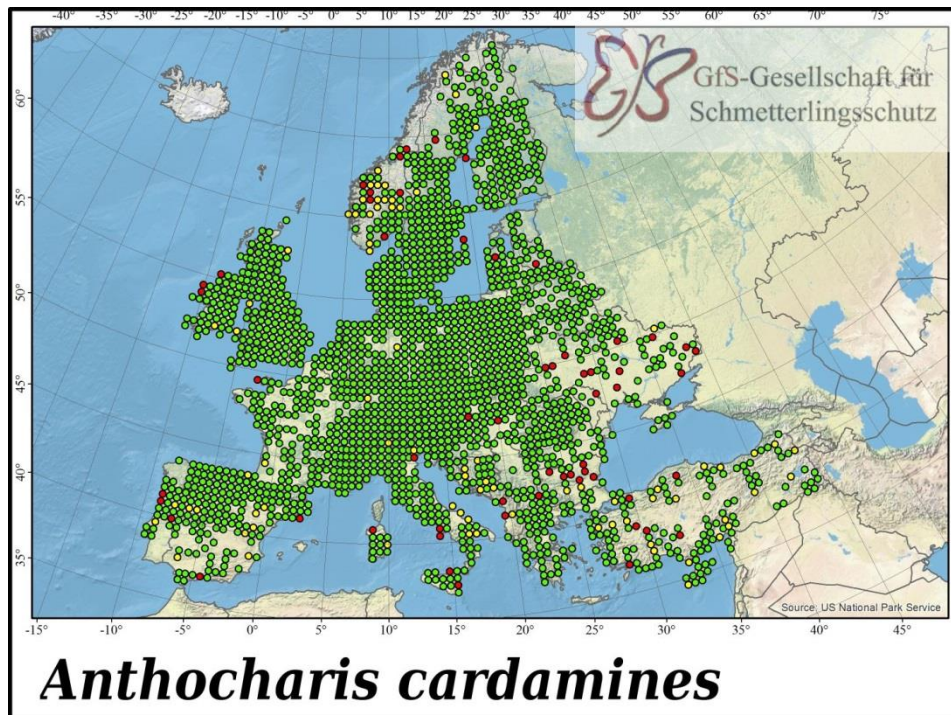
Oliver Schweiger, Josef Settele, Alexander Harpke,

Martin Wiemers (UFZ, Germany)



Hypothesis

- ▶ Can we use local climate envelopes to predict species distributions under climate change?
- ▶ Are there differences among regions in Europe?



Methods



► Local data bases

- Finland
- Belgium/Netherlands
- Spain

► European data base

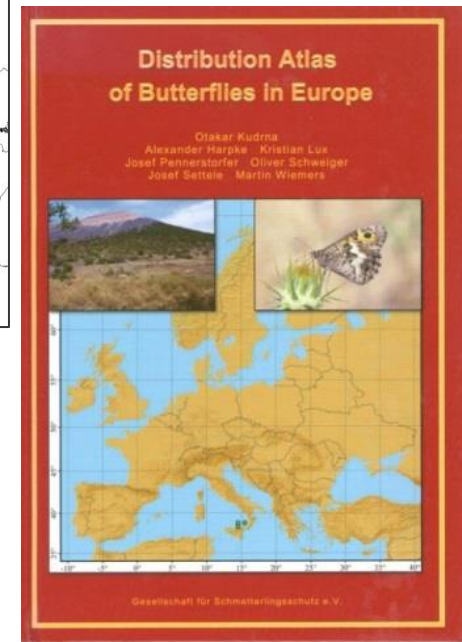
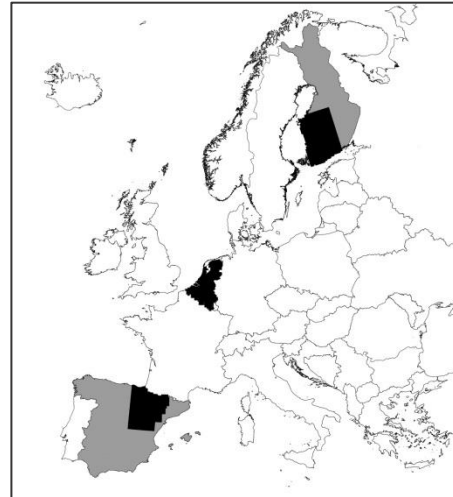
- Kudrna et al. (2012)

► Resolution

- 10 x 10 km

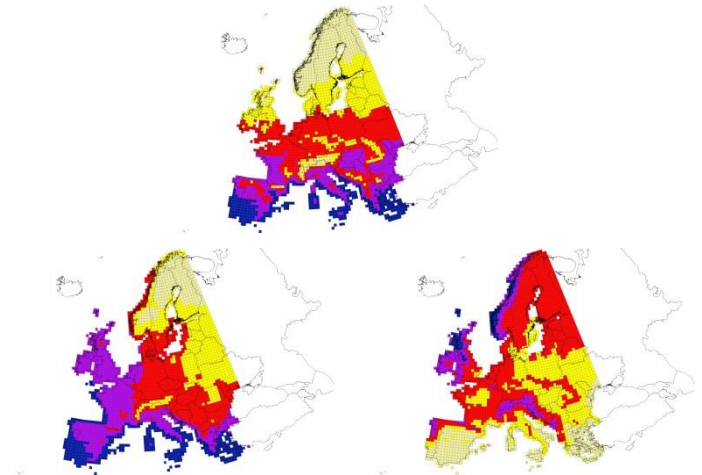
► Species distribution modelling

- Generalised Additive Models (GAMs)
- Well-surveyed grid cells
- Biomod2 package in R (Thuiller et al. 2016)

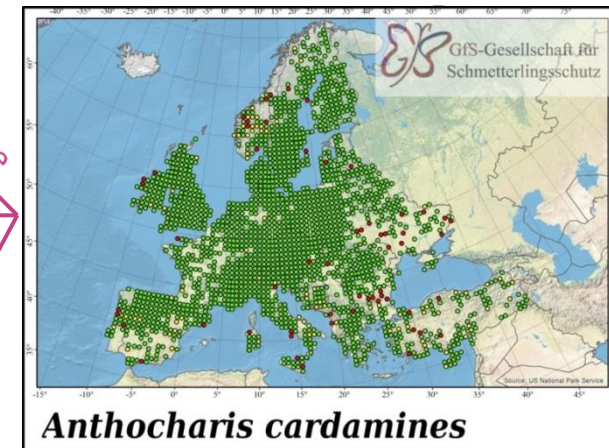
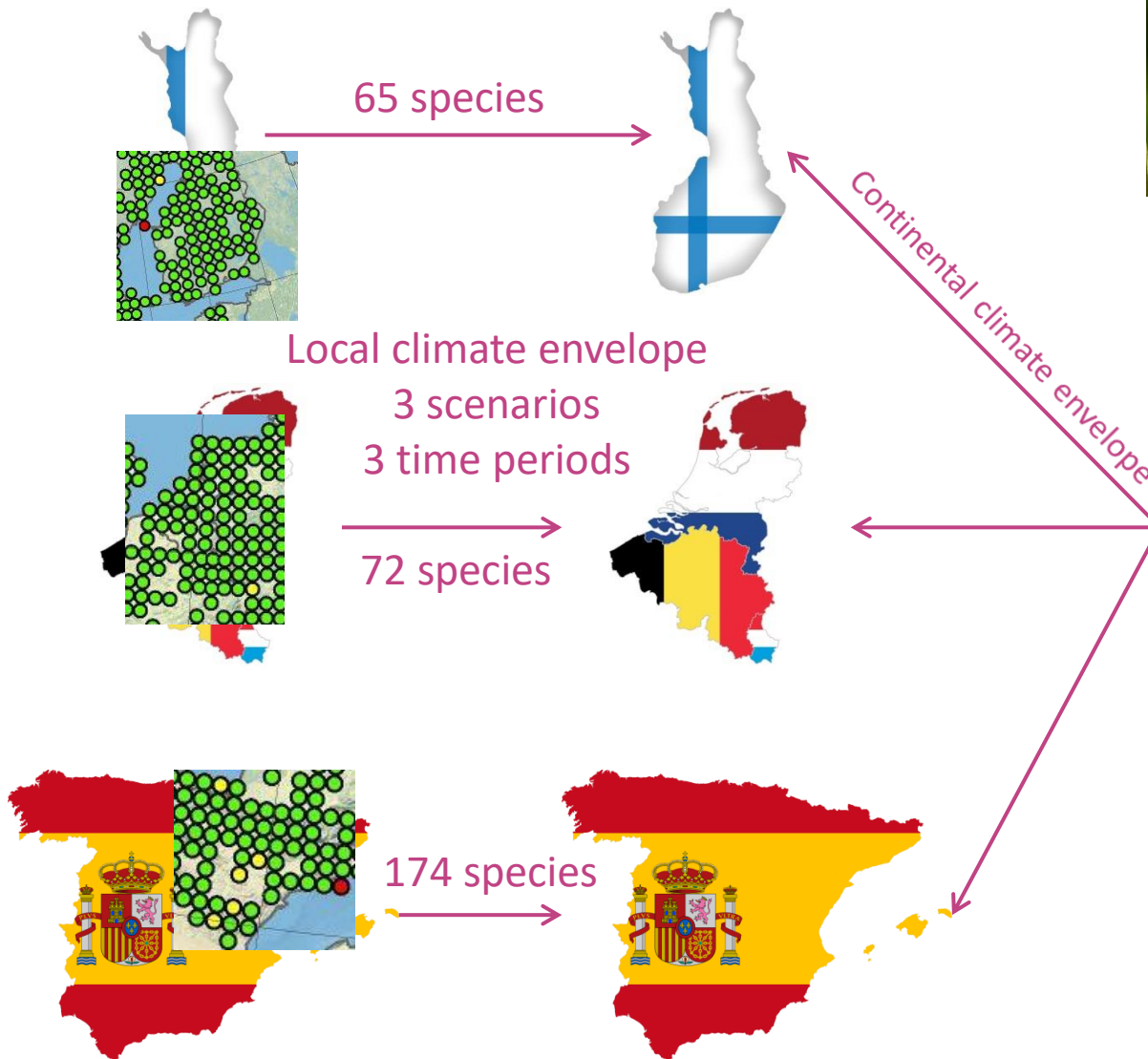


Predictions under climate change

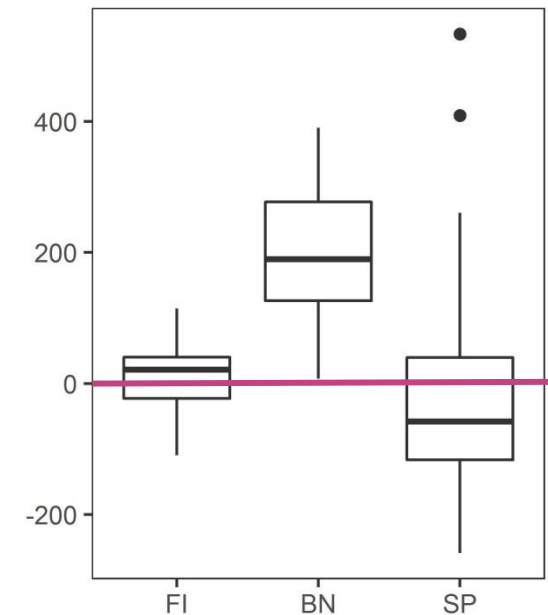
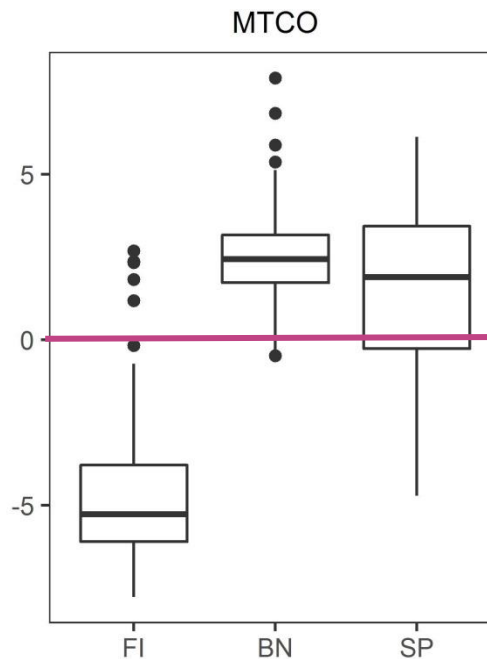
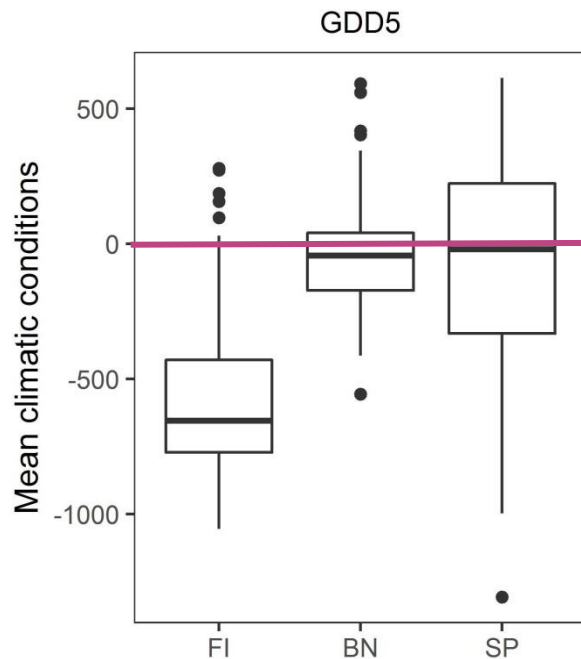
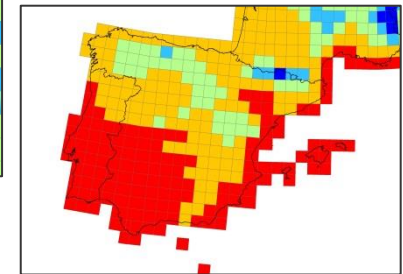
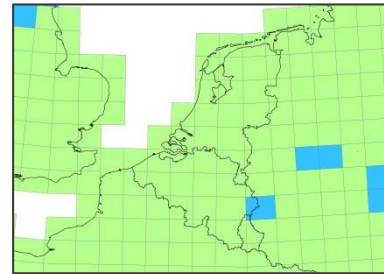
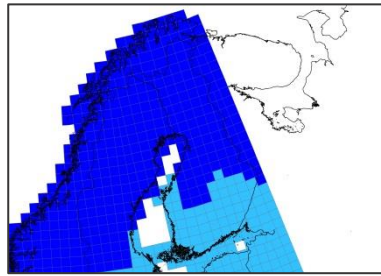
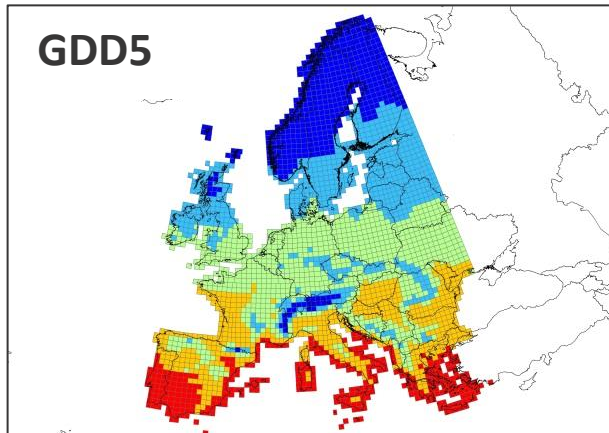
- ▶ 3 climate variables
 - Growing Degree Days (GDD5)
 - T° coldest month (MTCO)
 - Water balance (WB)
- ▶ 3 periods
 - 2000, 2050 & 2080
- ▶ 3 scenarios (ALARM – Settele et al. 2005)
 - T° + 2.4°C (SEDG)
 - T° + 3.1°C (BAMBU)
 - T° + 4.1°C (GRAS)
- ▶ Only species that are present today!



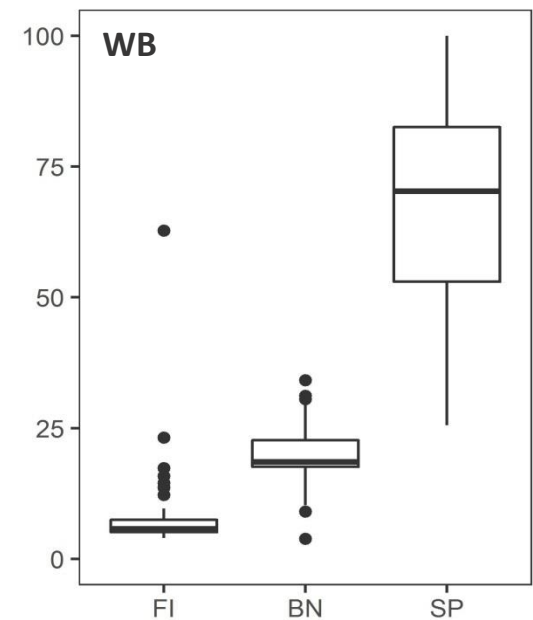
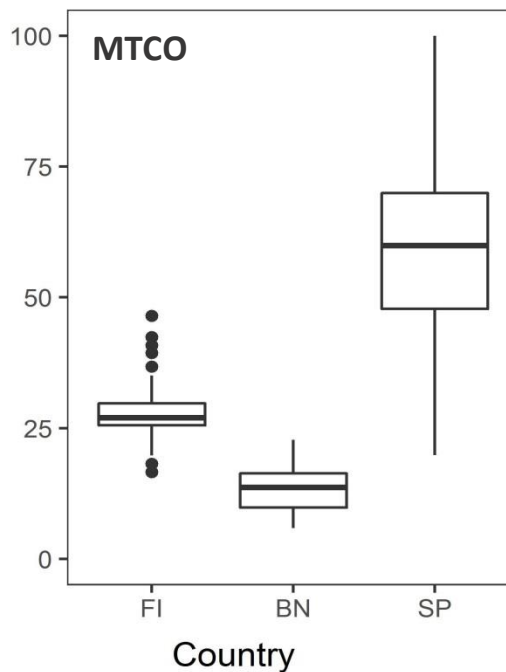
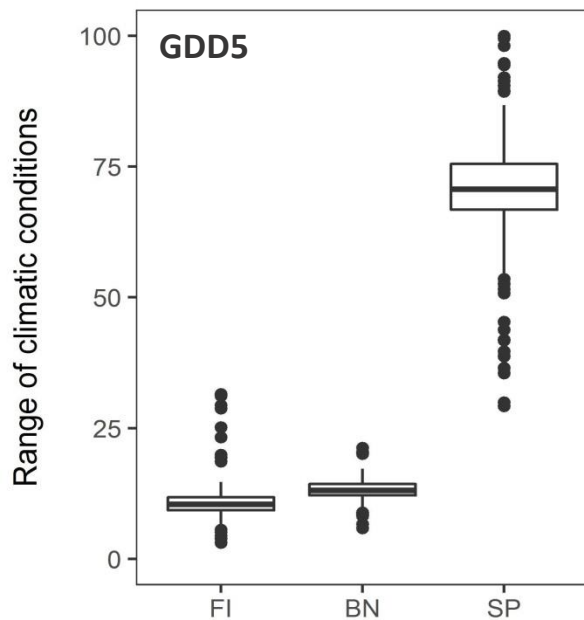
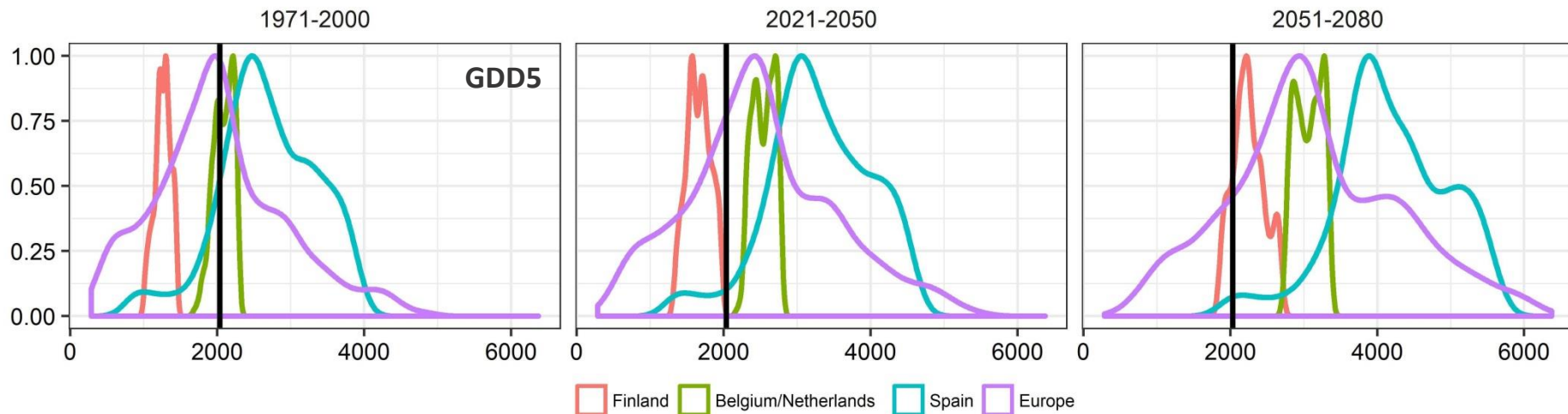
How?



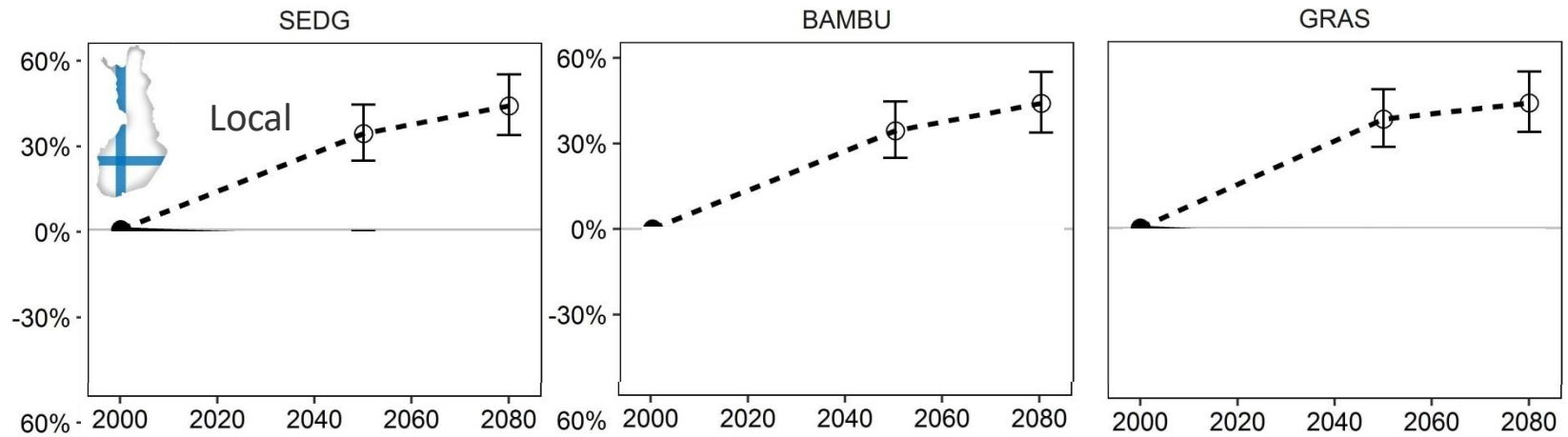
Local envelopes vs continental range



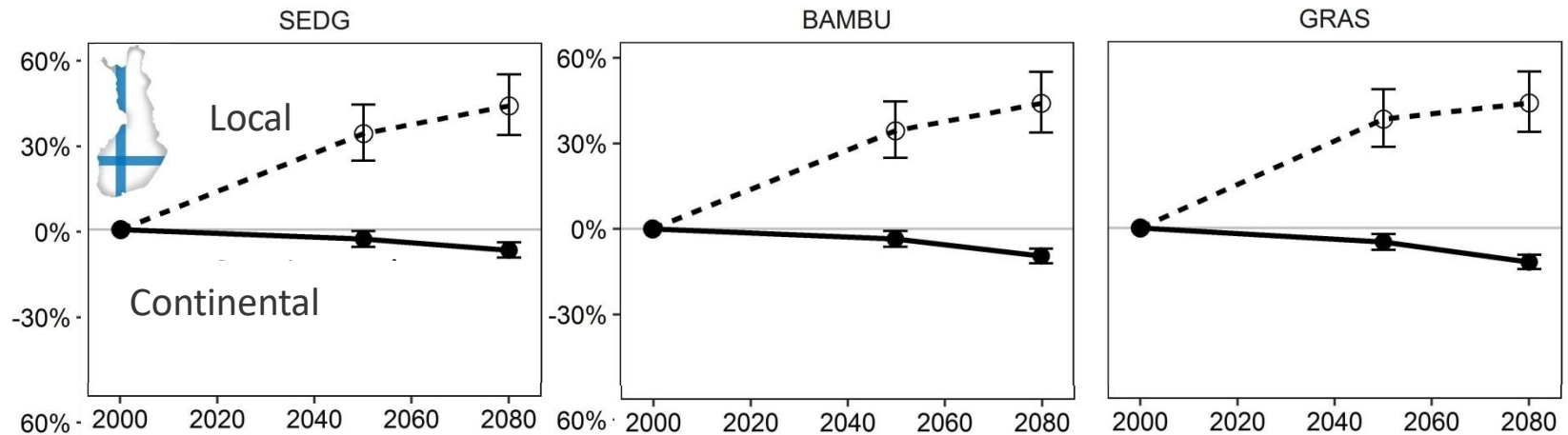
Overlap local – continental envelope



Predicted changes in species richness

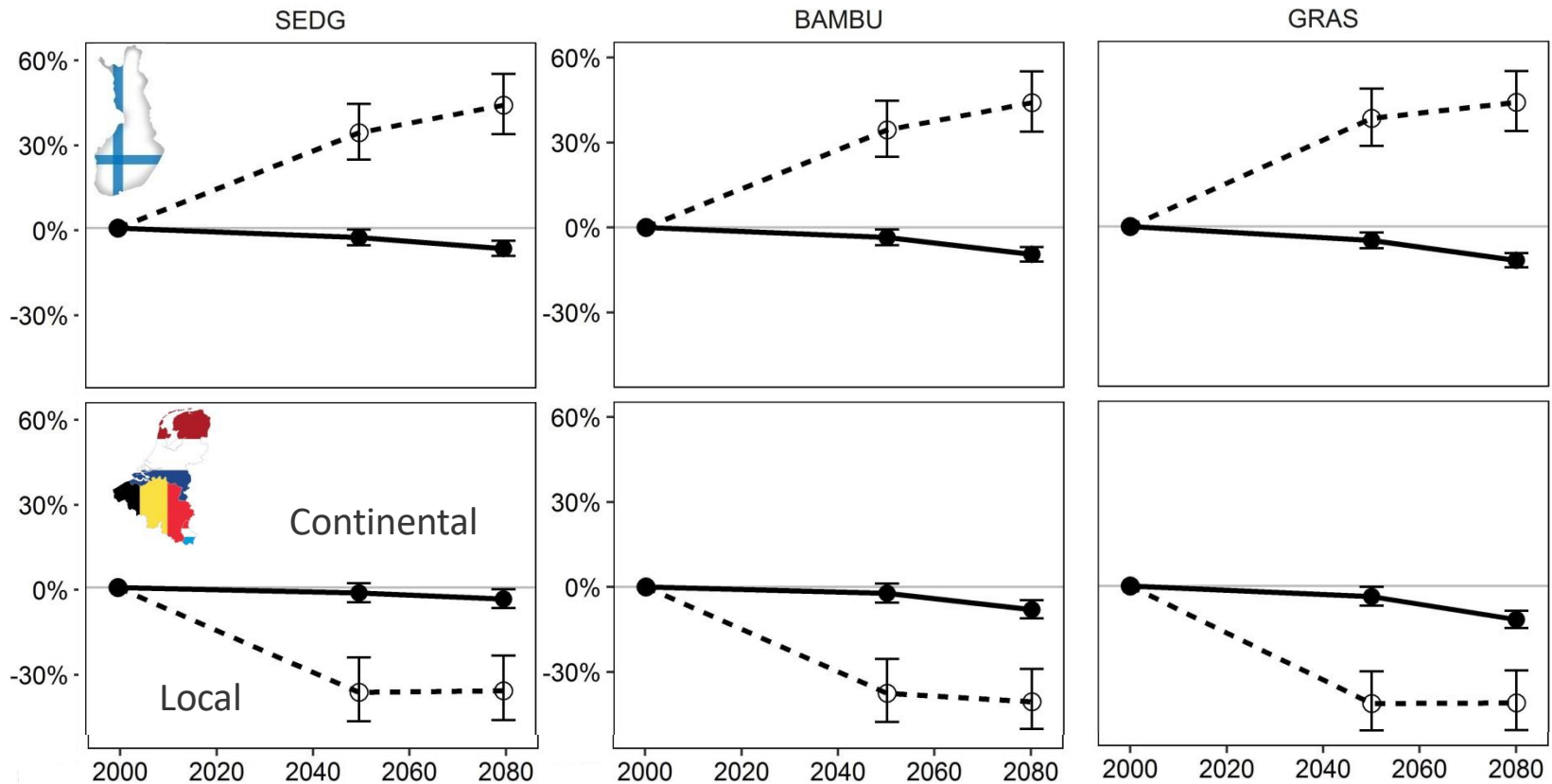


Predicted changes in species richness



Year

Predicted changes in species richness



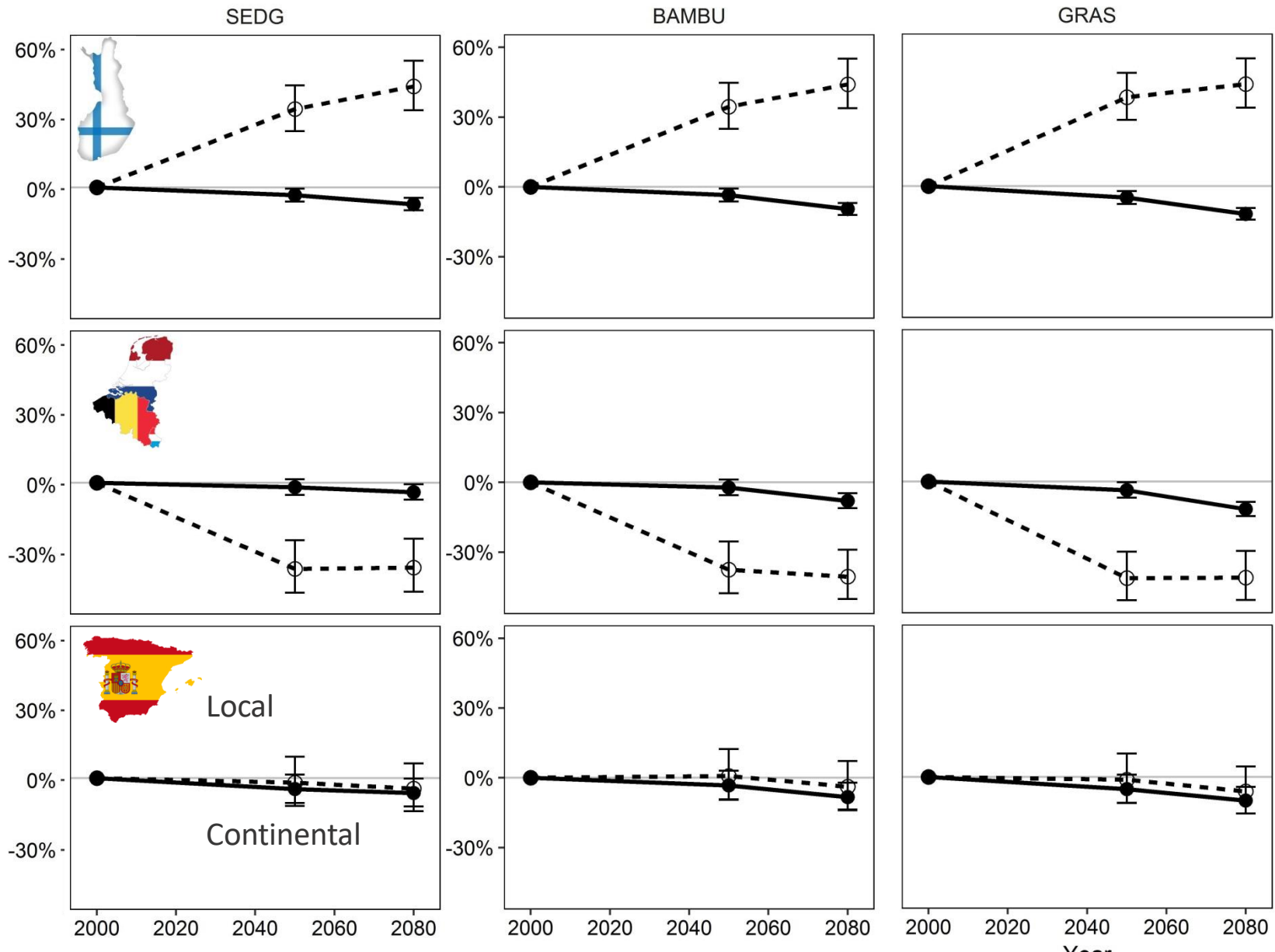
2000 2020 2040 2060 2080

2000 2020 2040 2060 2080

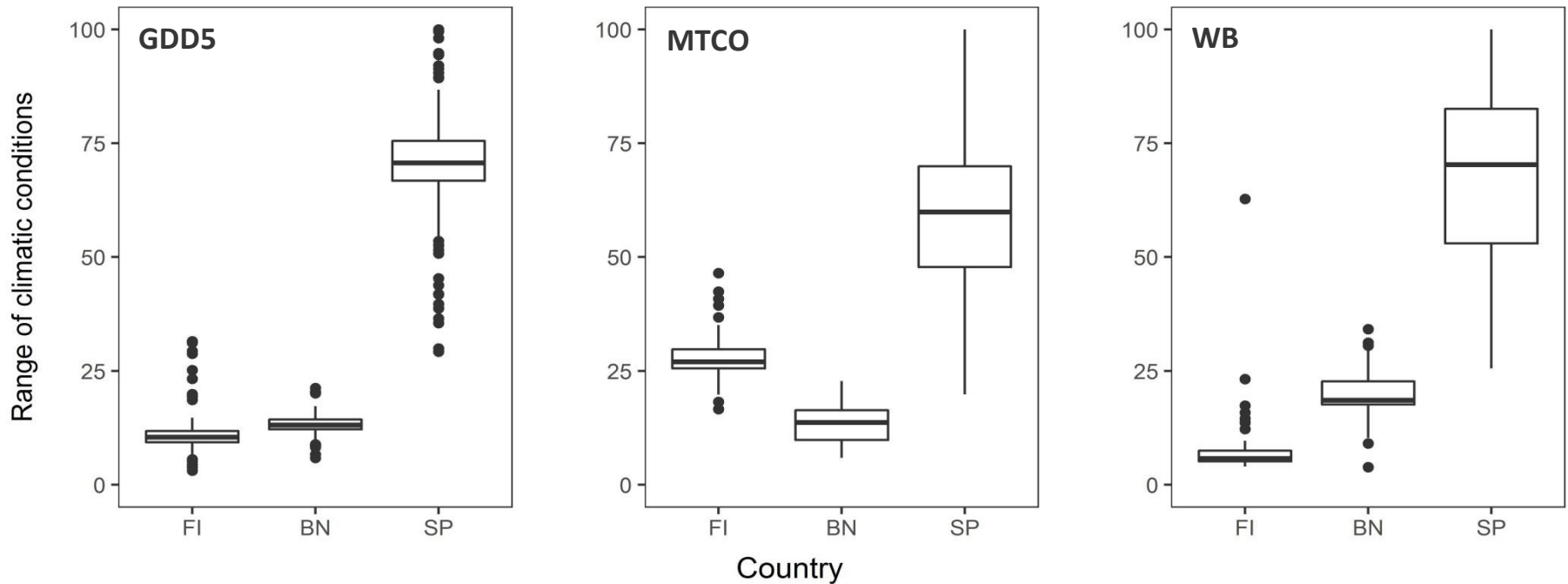
2000 2020 2040 2060 2080

Year

Predicted changes in species richness

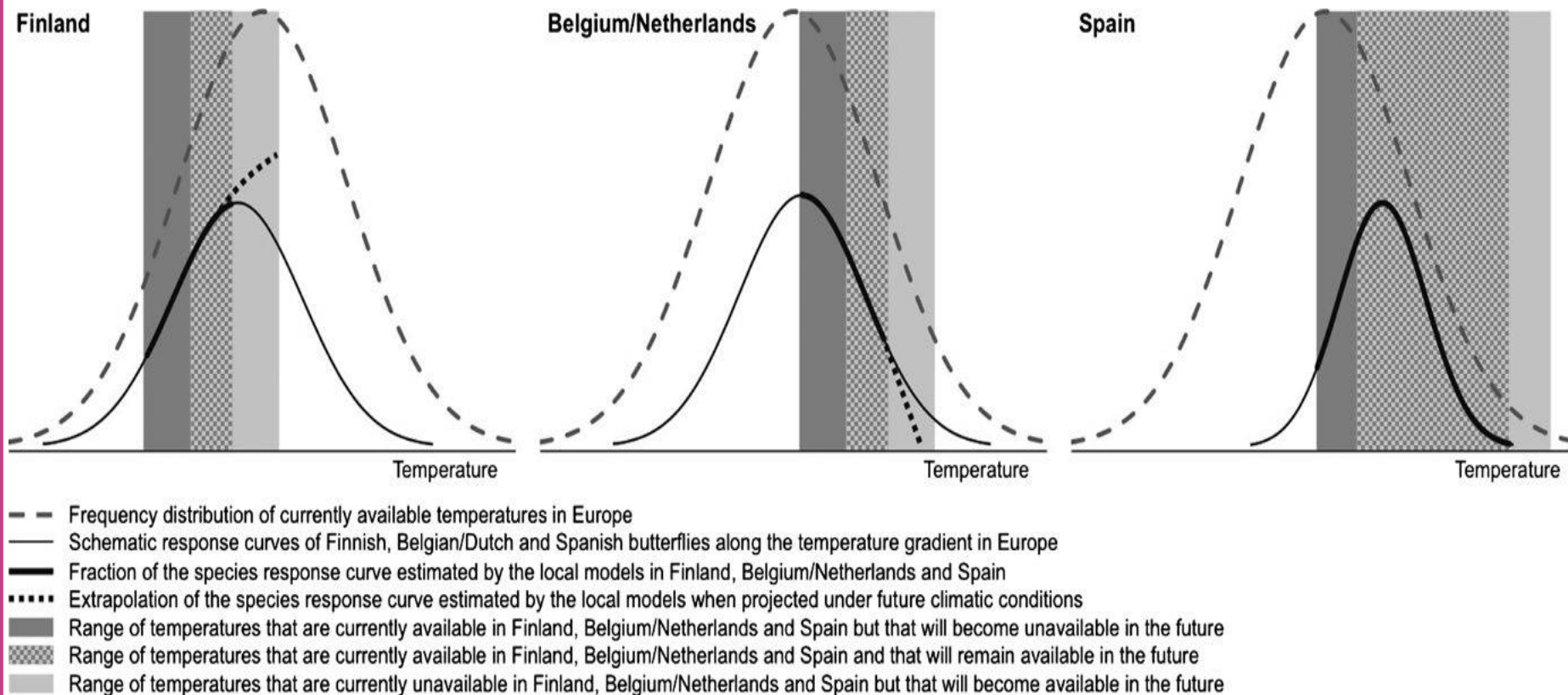


Overlap local – continental envelope



Where do we go wrong ...?

► Modelling outside the range using local envelopes



Take-home messages

- ▶ Predicting distributions under climate change
 - Check the range of climate variables in your region
 - × Comparable to species distribution range 
 - × Narrower than species distribution range 
- ▶ **The need for large-scale distribution data to estimate regional changes in species richness under future climate change**
 - GBIF
 - Observado.org
 - Other open data platforms
 - ...



Observation.org



Thank you!



Dirk Maes

RESEARCH INSTITUTE
NATURE AND FOREST

dirk.maes@inbo.be

Titeux N., Maes D., Van Daele T.,
Onkelinx T., Heikkinen R.K., Romo
H., García-Barros E., Munguira M.L.,
Thuiller W., van Swaay C.A.M.,
Schweiger O., Settele J., Brotons L.
& Luoto M. 2017

The need for large-scale
distribution data to estimate
regional changes in species richness
under future climate change

Diversity and Distributions 23:
1393-1407

doi: [10.1111/ddi.12634](https://doi.org/10.1111/ddi.12634)



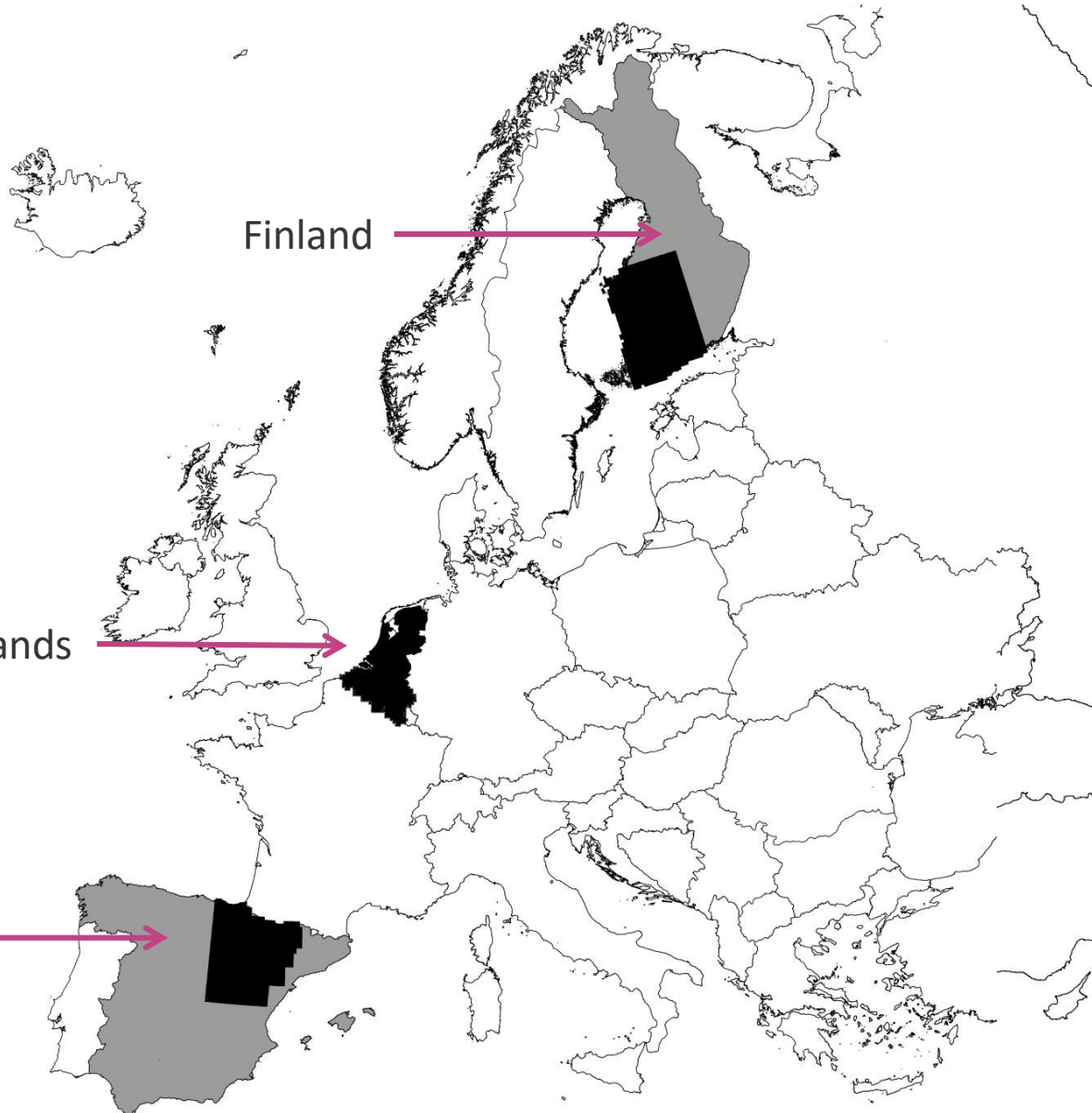
Where



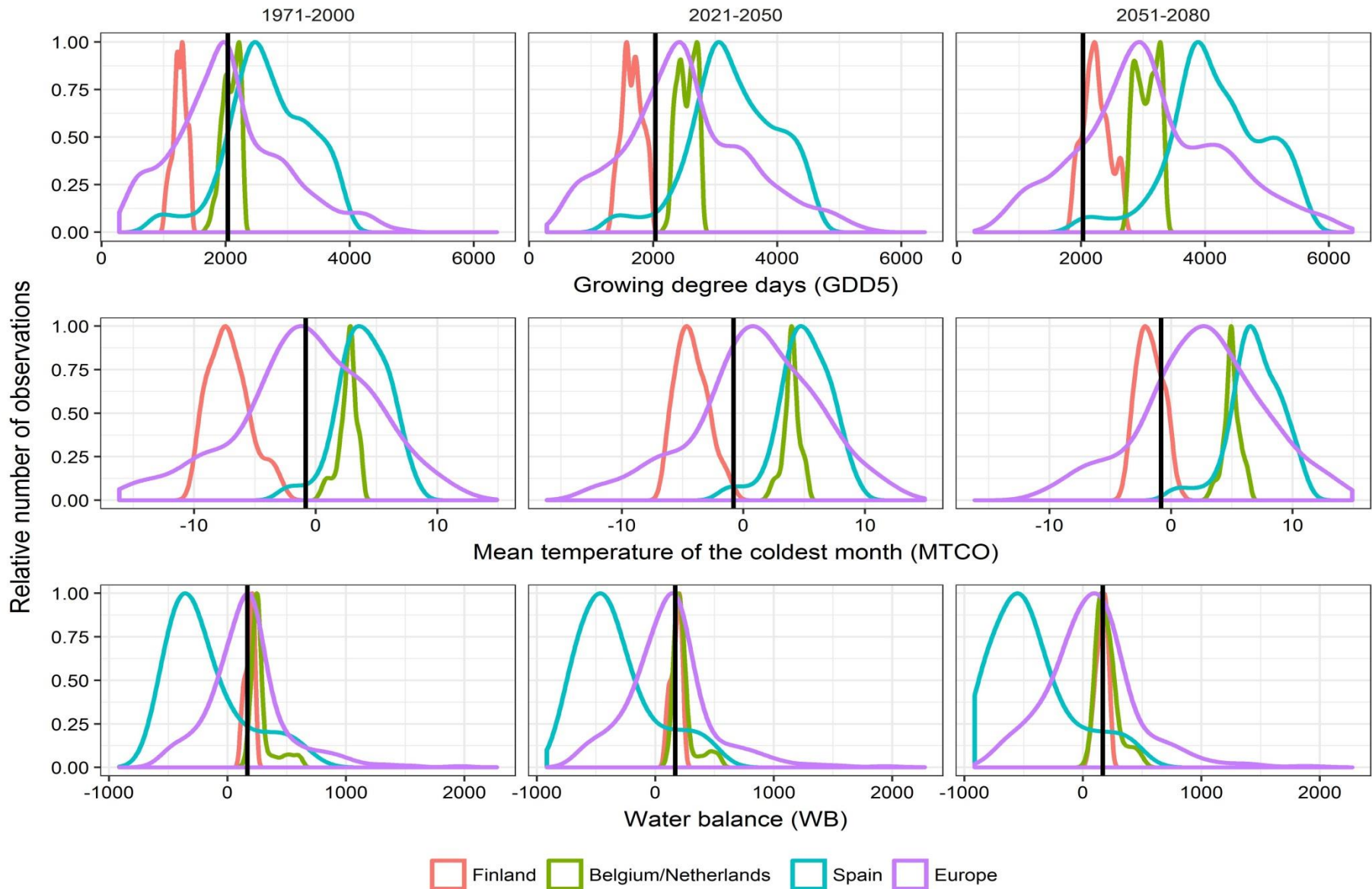
Belgium/Netherlands

Finland

Spain



Overlap local – continental envelope



Overlap local – continental envelope

