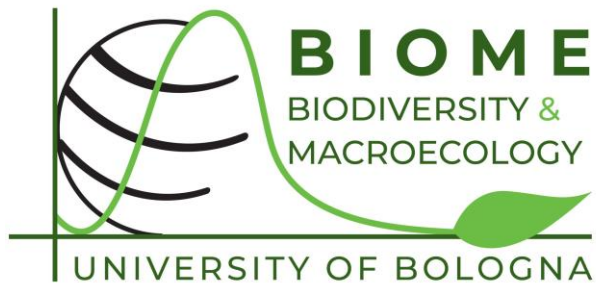




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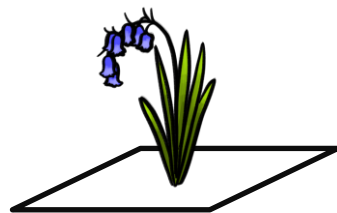


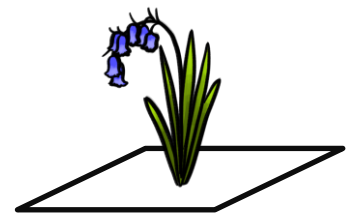
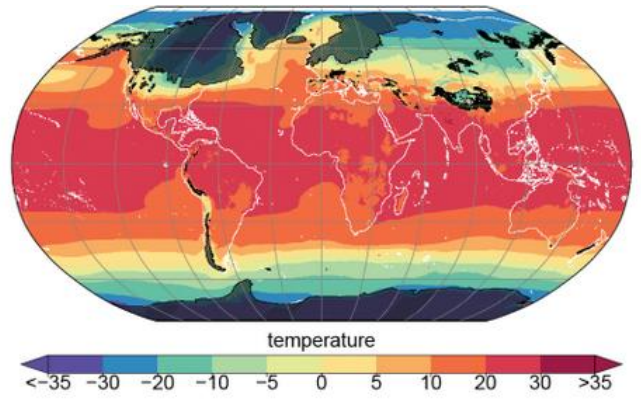
# Microclimate modelling to understand the understorey community assembly within forests.

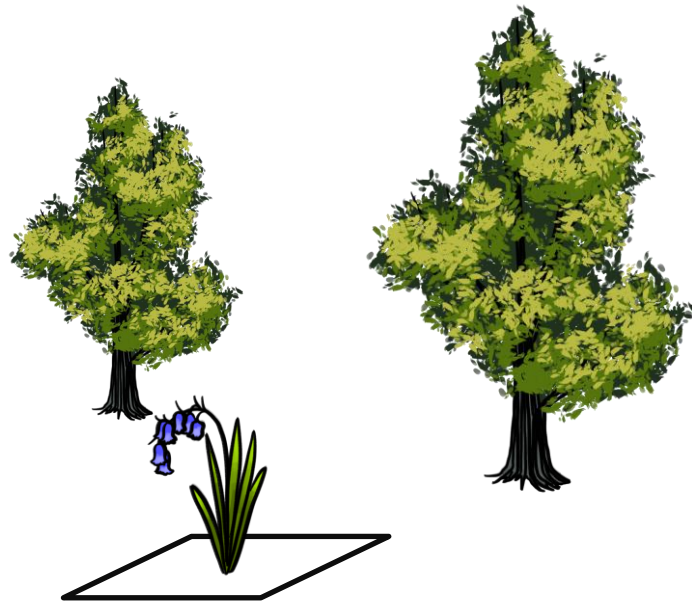
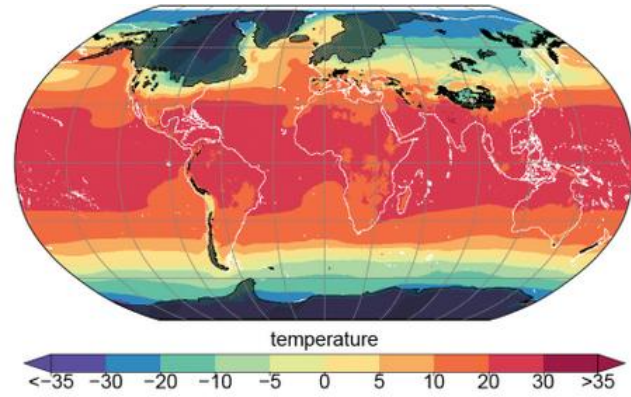
(MDB #9, sPlot #59)

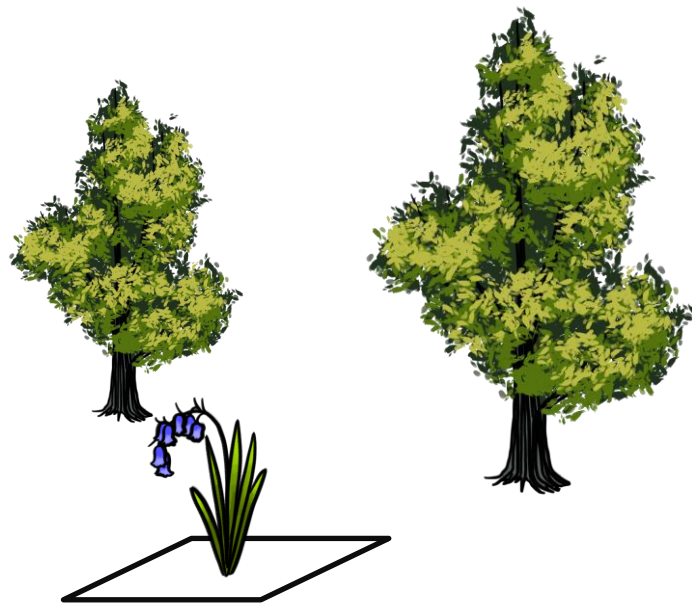
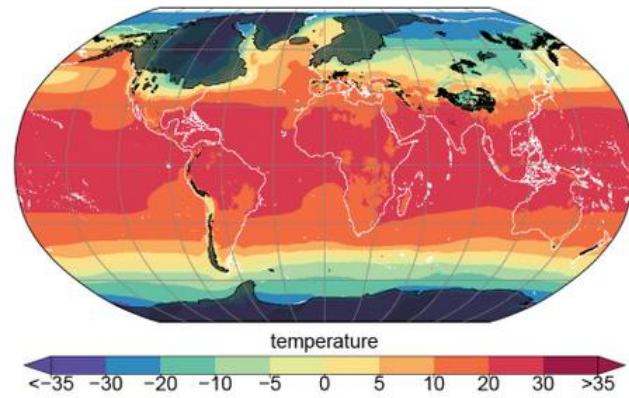
**Georg J. A. Hähn**

David Klinges, Daniela Hoss, Rocio Beatriz Cortes Lobos, Jonathan Lenoir, Jonathan von Oppen, MDB data contributors, Francesco Maria Sabatini & Rémy Beugnon

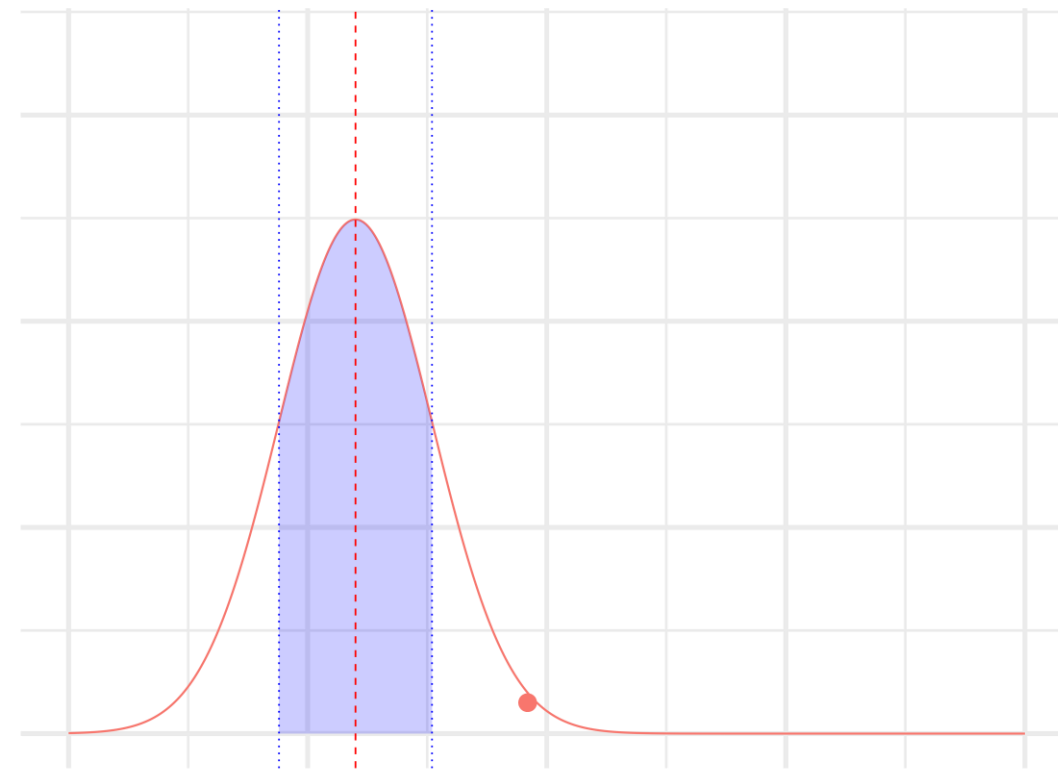






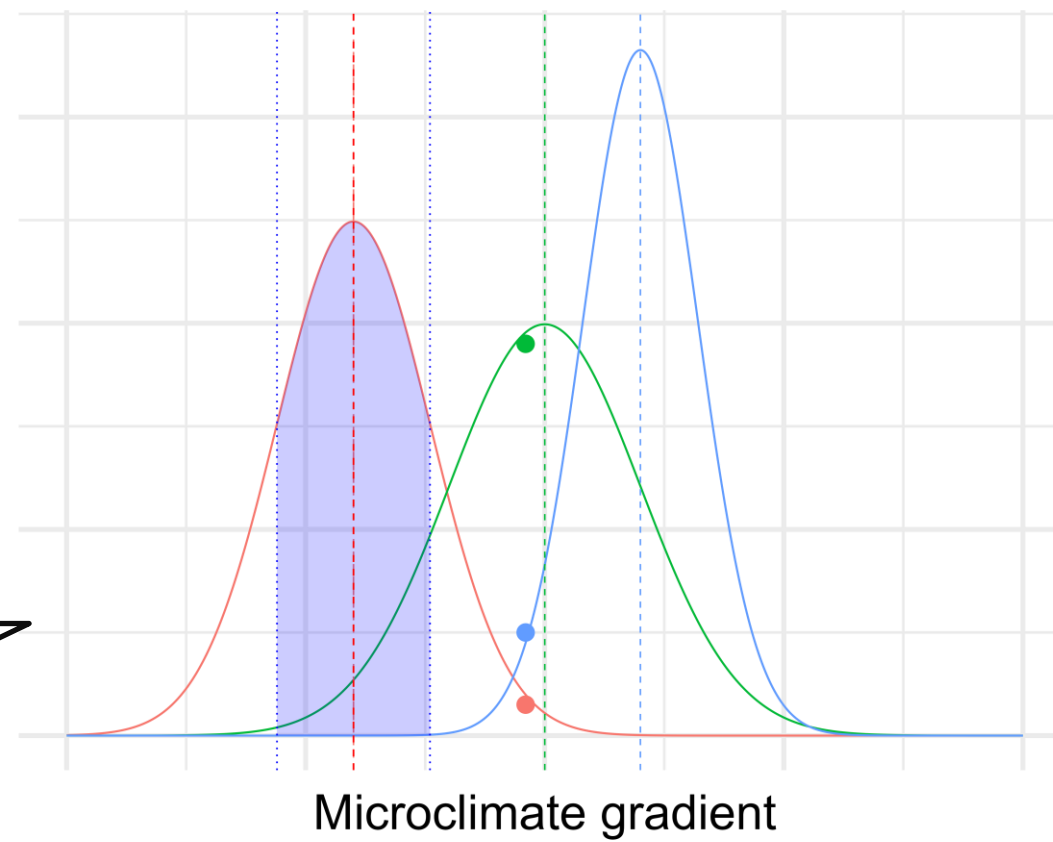


Species occurrence



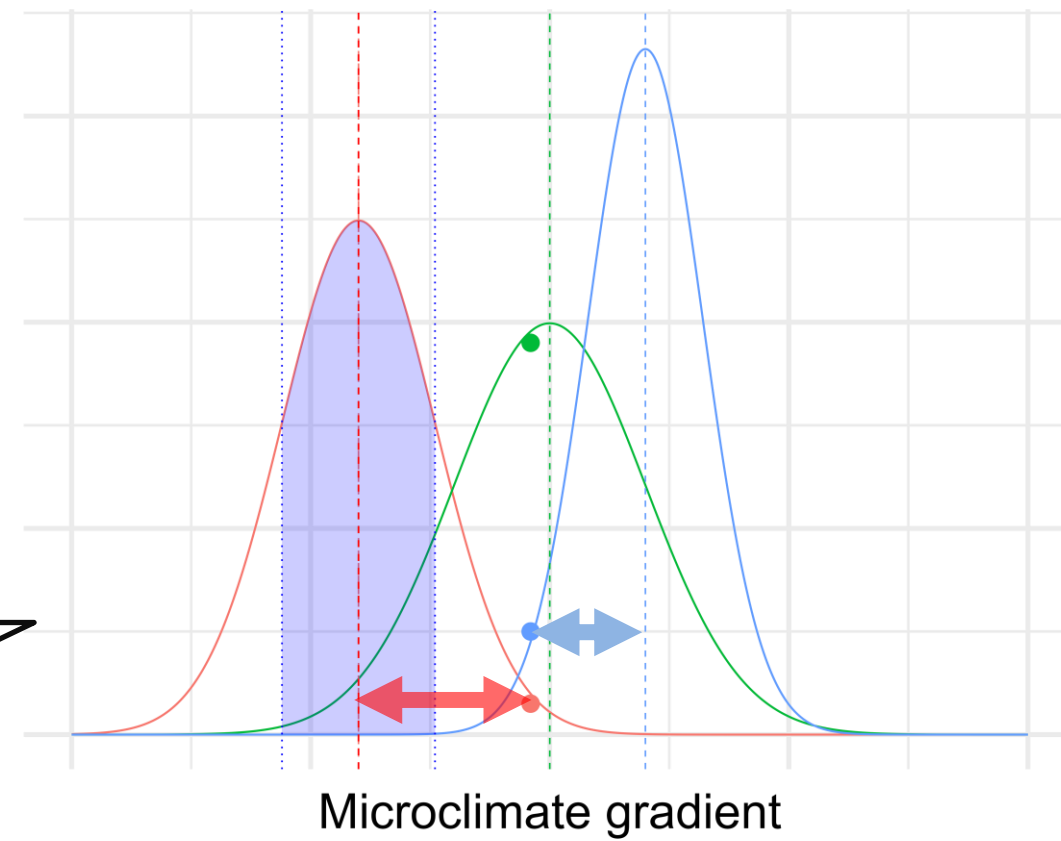
Microclimate gradient

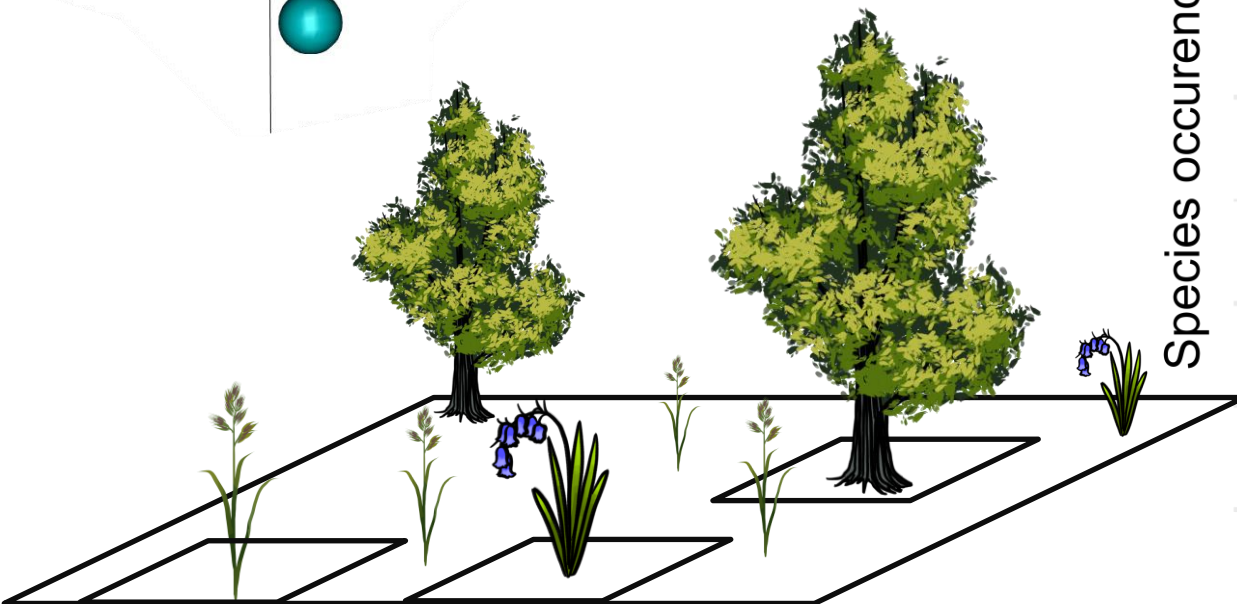
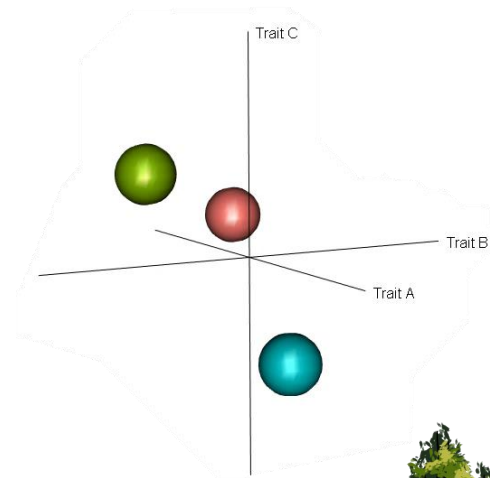




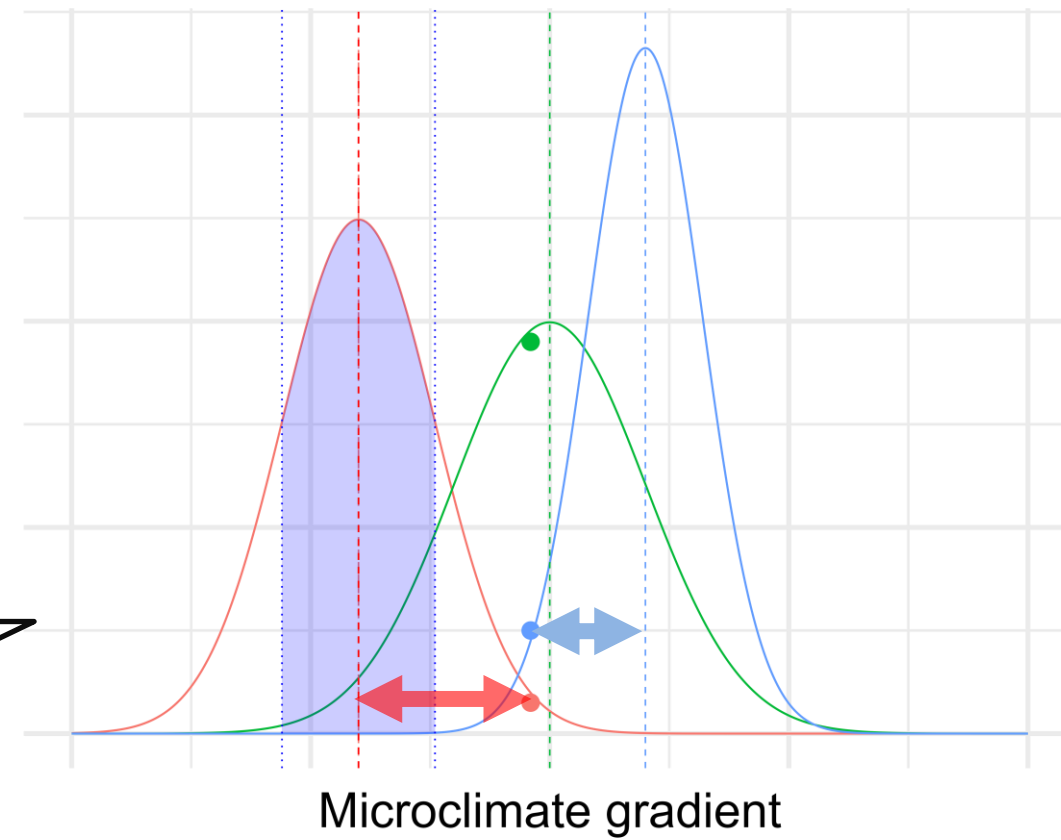


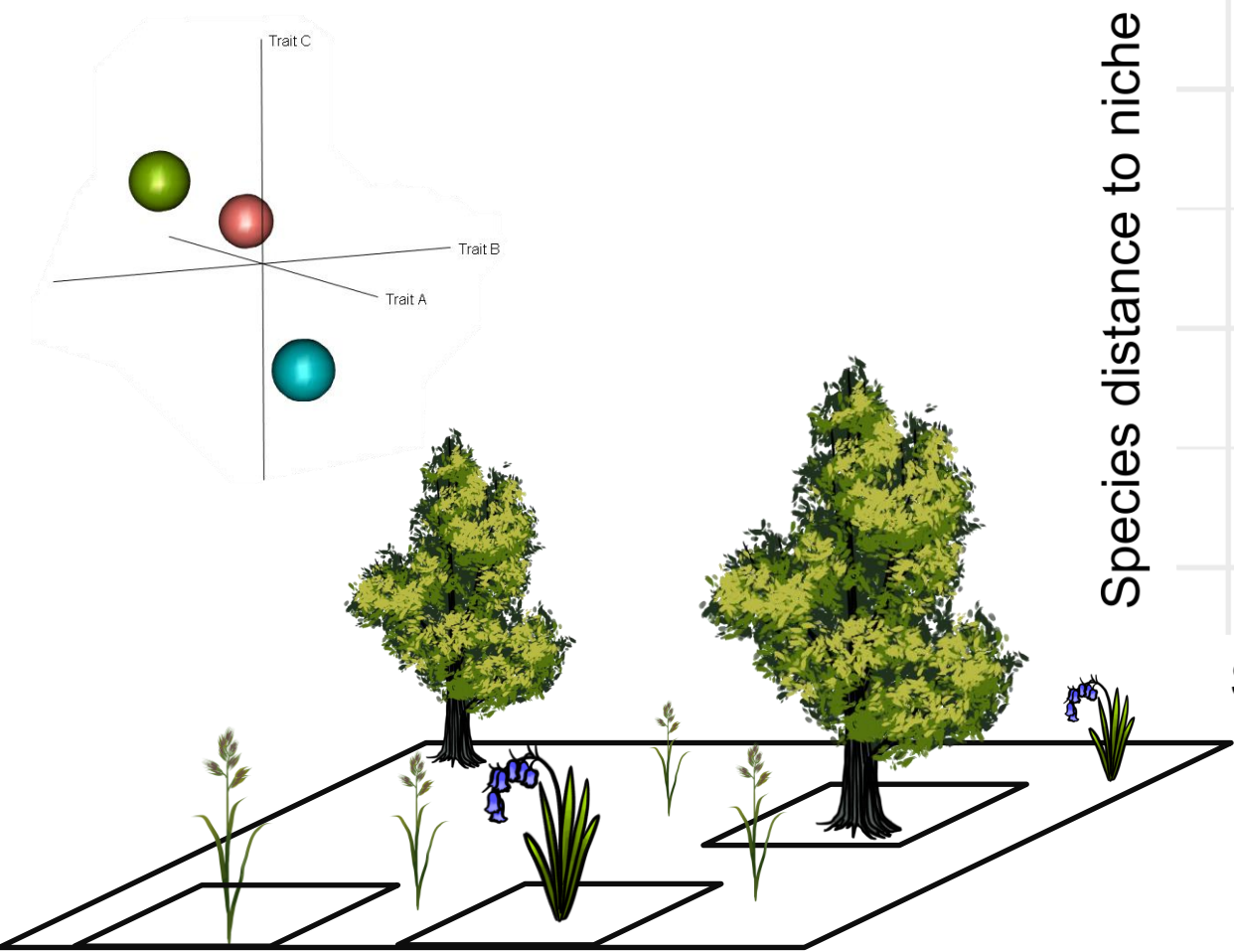
Species occurrence



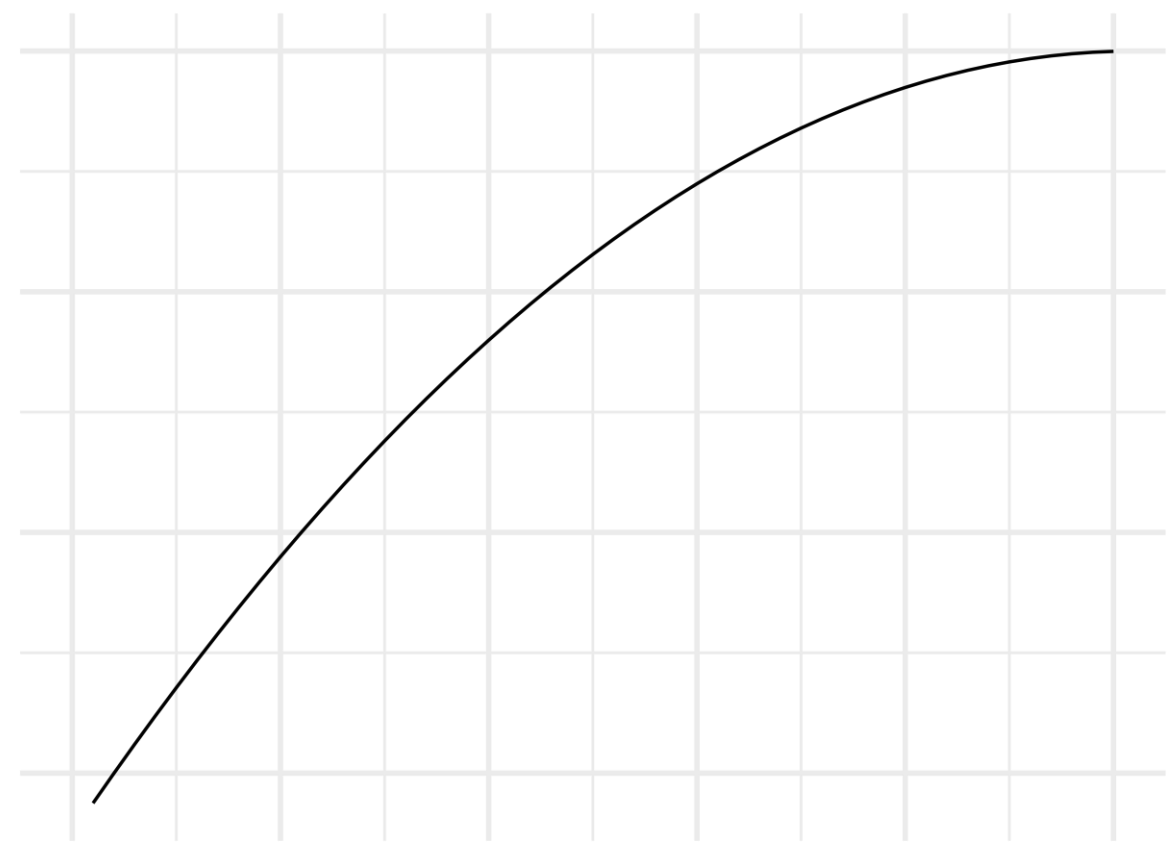


Species occurrence





Species distance to niche optima



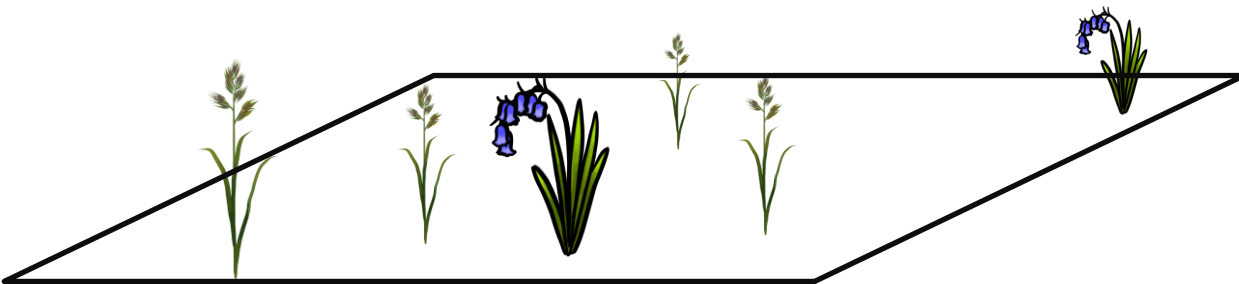
Species trait distance to community centroid





a project of  **iDiv**

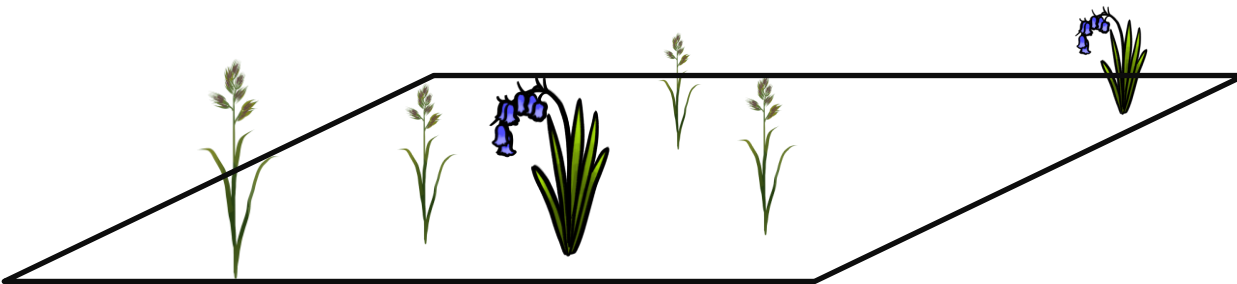
~150,000 vegetation plots  
(understorey + tree layer)






a project of  iDiv

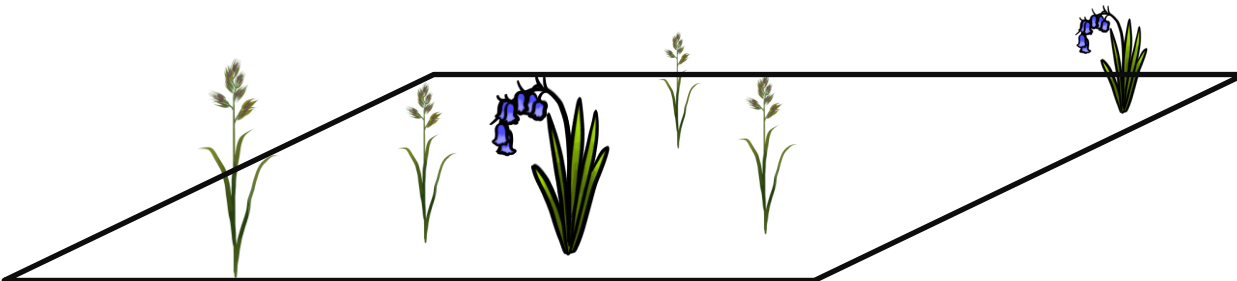
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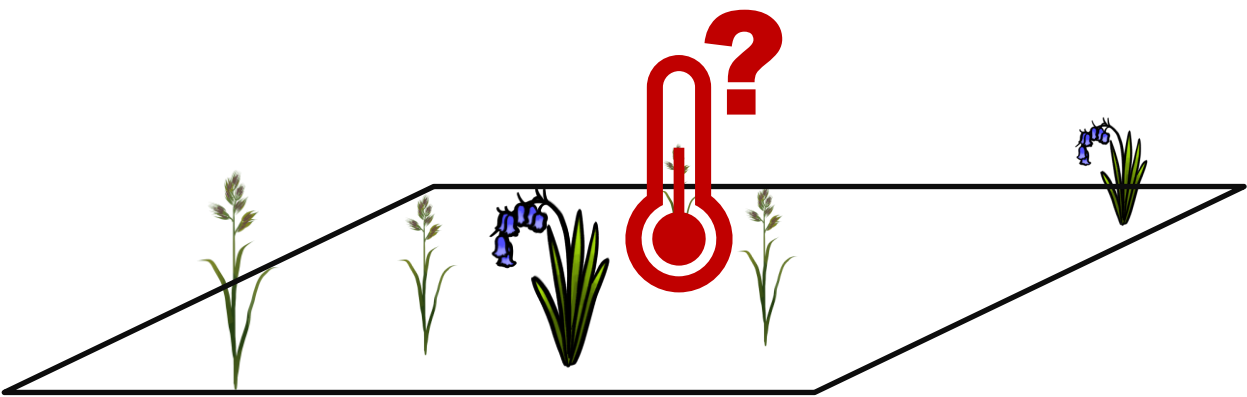


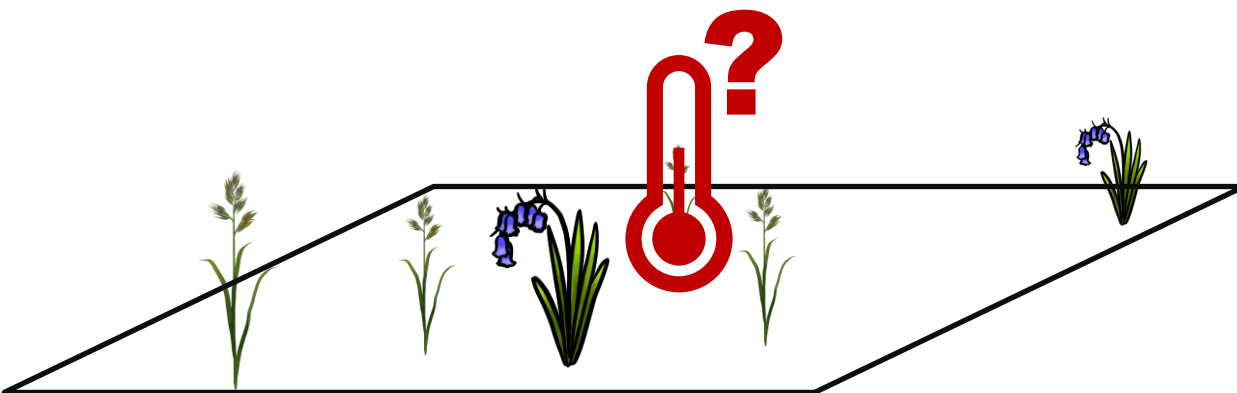


a project of  iDiv

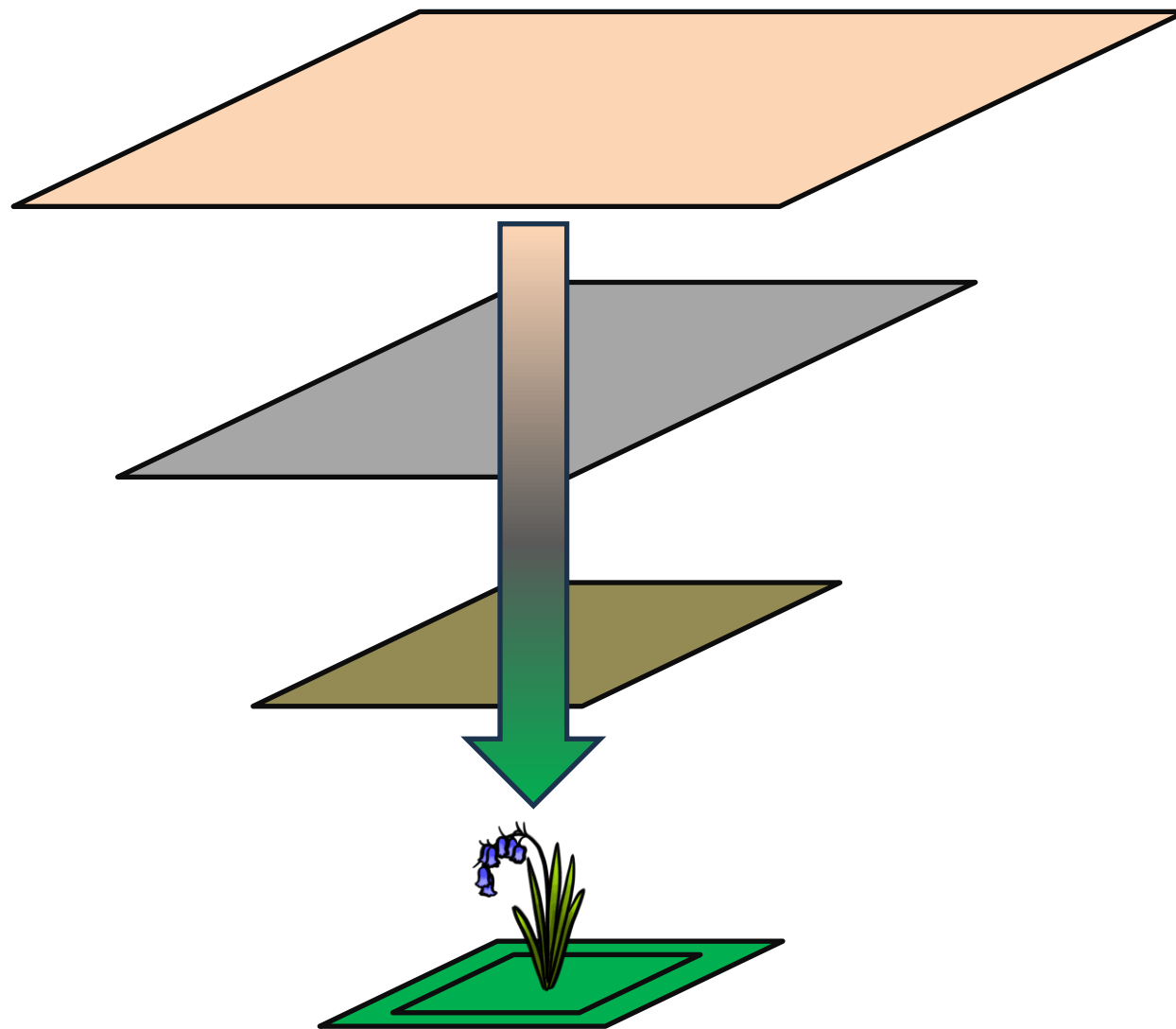
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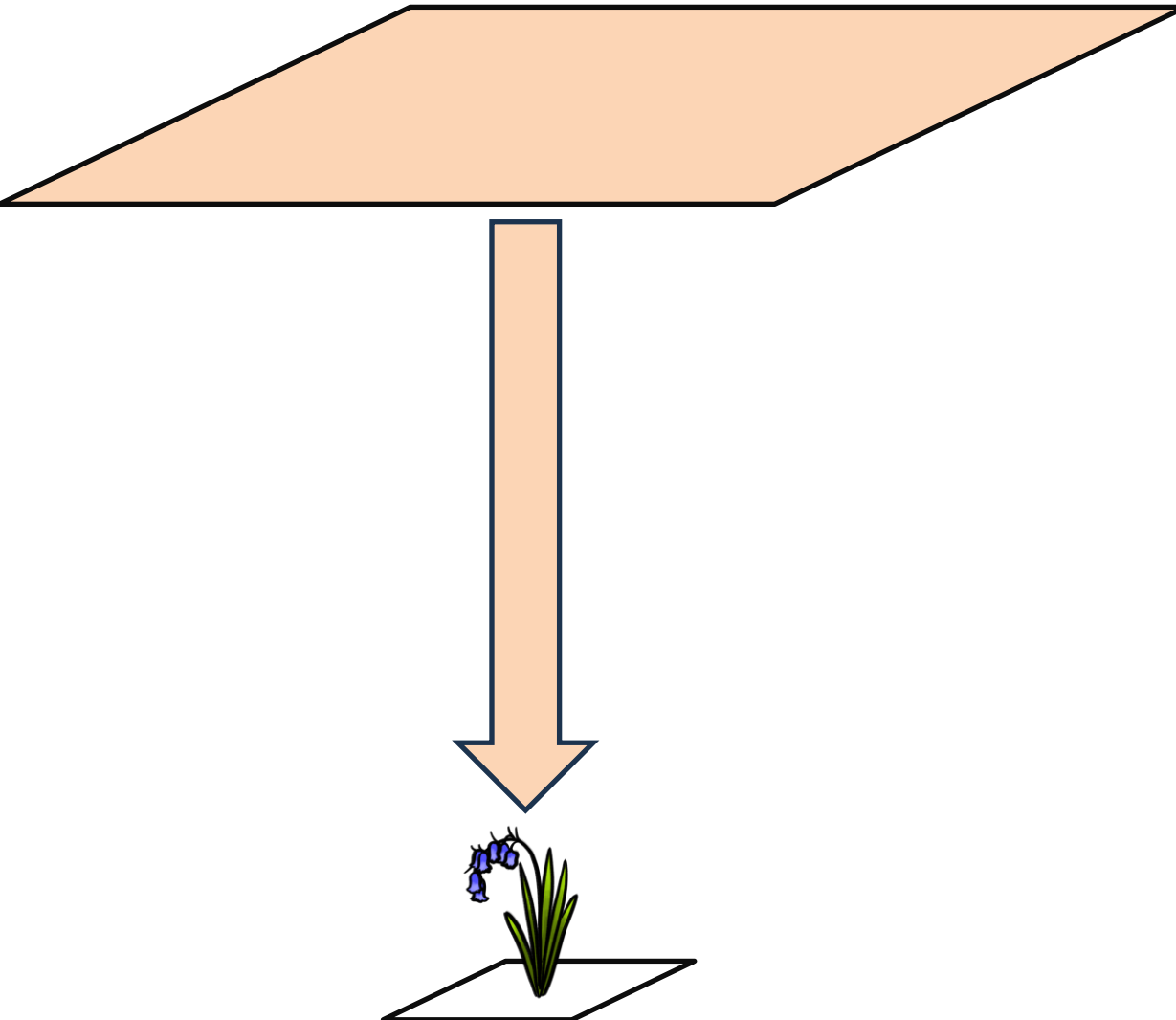




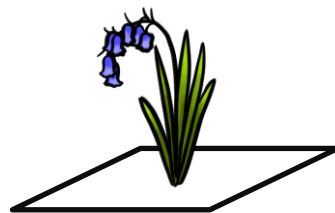


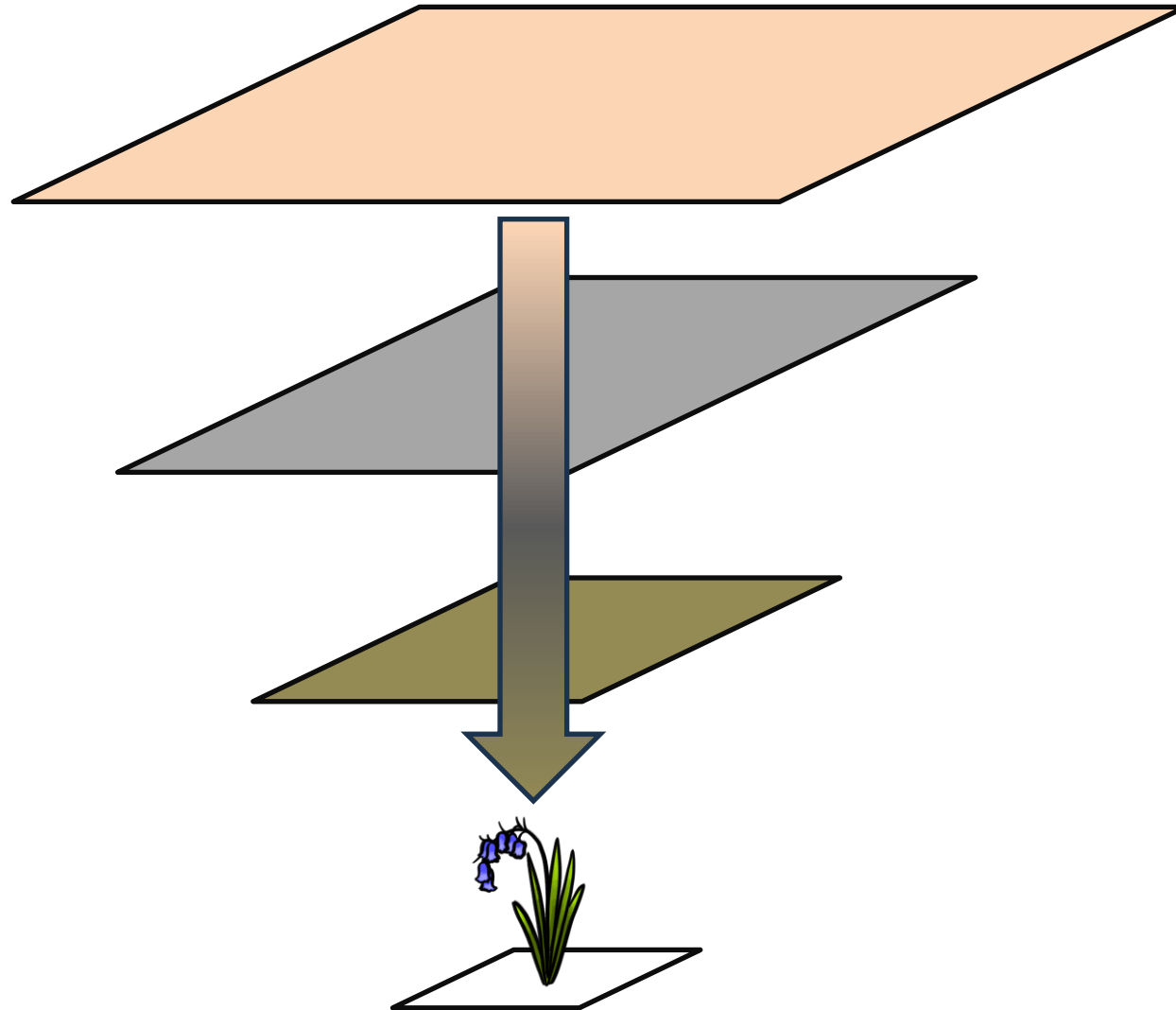
Mechanistic microclimate model (*microclimf*, Maclean 2025)





Abiotic data: Climate - ERA 5 Land  
Spatial resolution: 9 km  
Temporal resolution: hourly from 1950 to yesterday

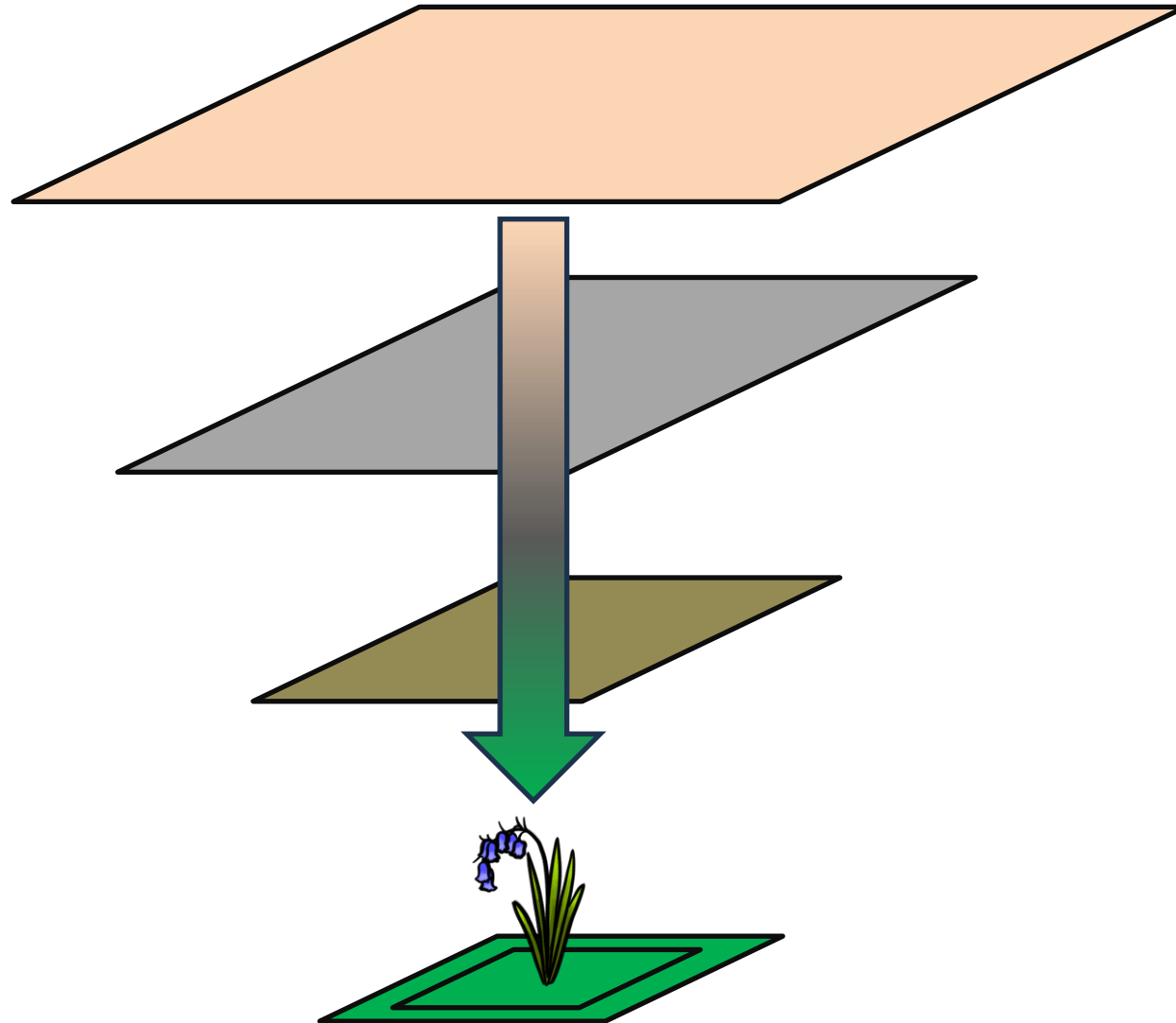




Abiotic data: Climate - ERA 5 Land  
Spatial resolution: 9 km  
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Abiotic data: Digital elevation model  
Spatial resolution: 30 m  
Temporal resolution: N/A

Abiotic data: Soil conditions  
Spatial resolution: 1 km  
Temporal resolution: N/A



Abiotic data: Climate - ERA 5 Land  
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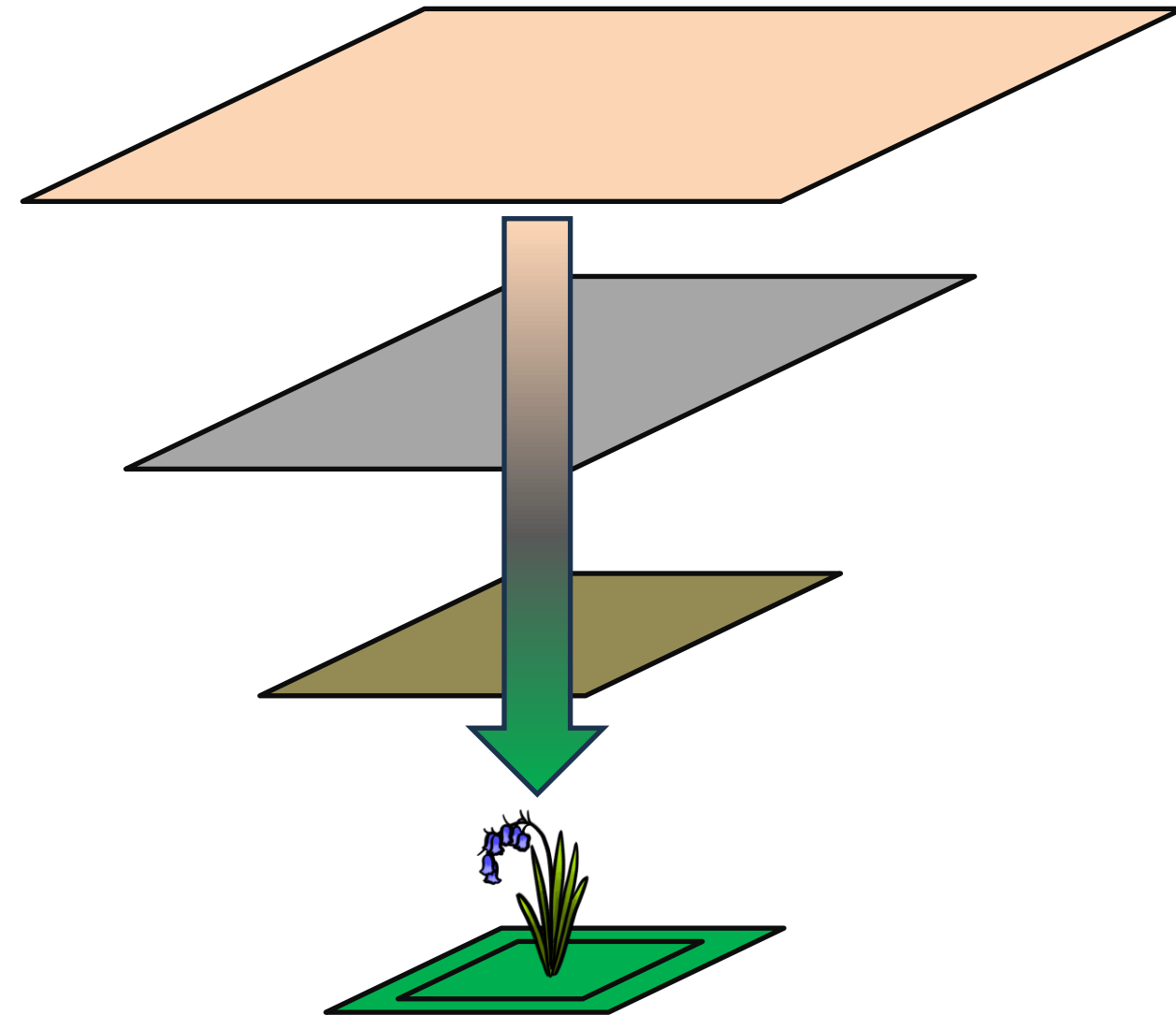
Abiotic data: Digital elevation model  
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Temporal resolution: N/A

Abiotic data: Soil conditions  
Spatial resolution: 1 km  
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Biotic characteristics

8 biotic characteristics

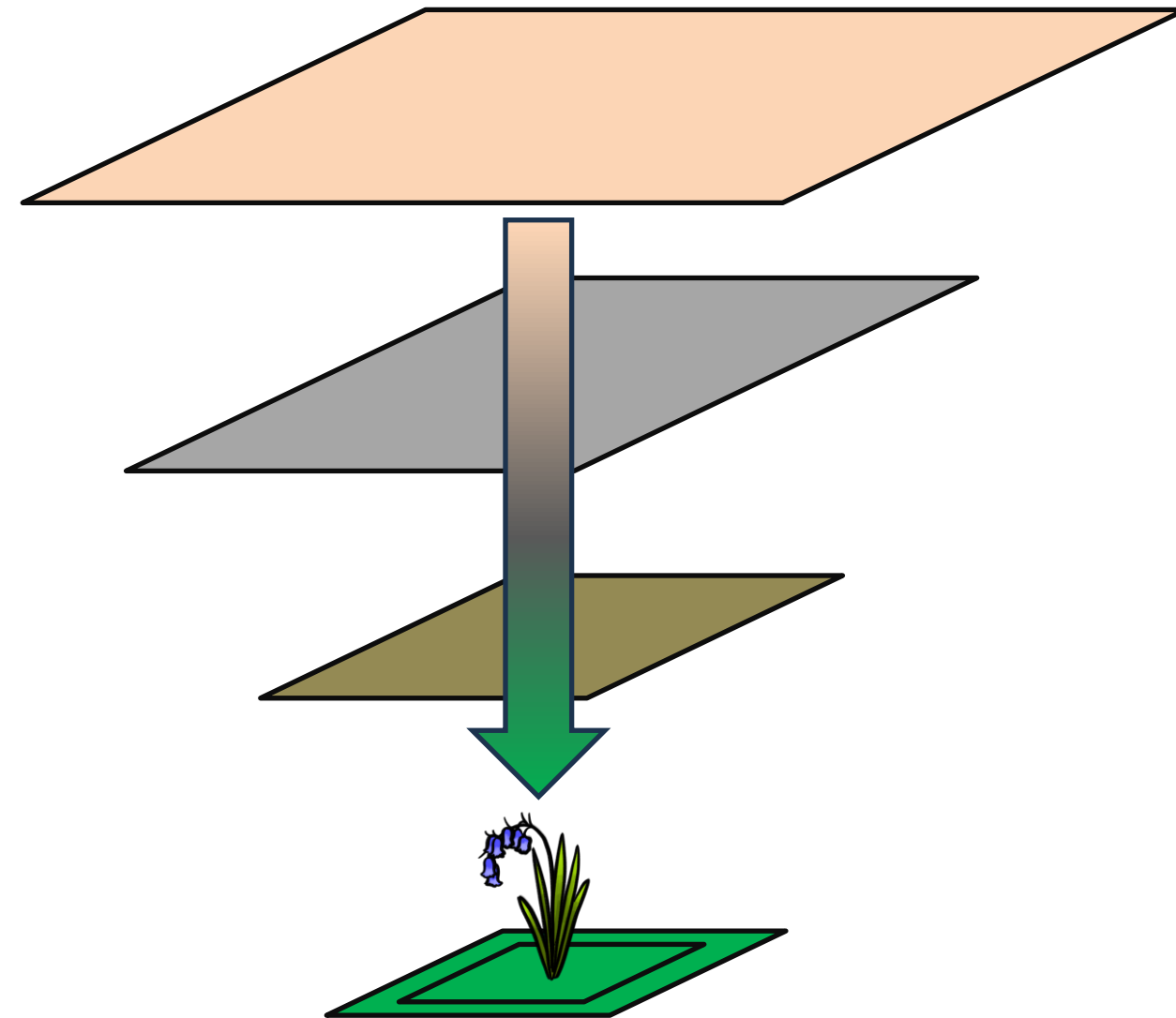
Plant area index (PAI) most important



8 biotic characteristics

Plant area index (PAI) most important

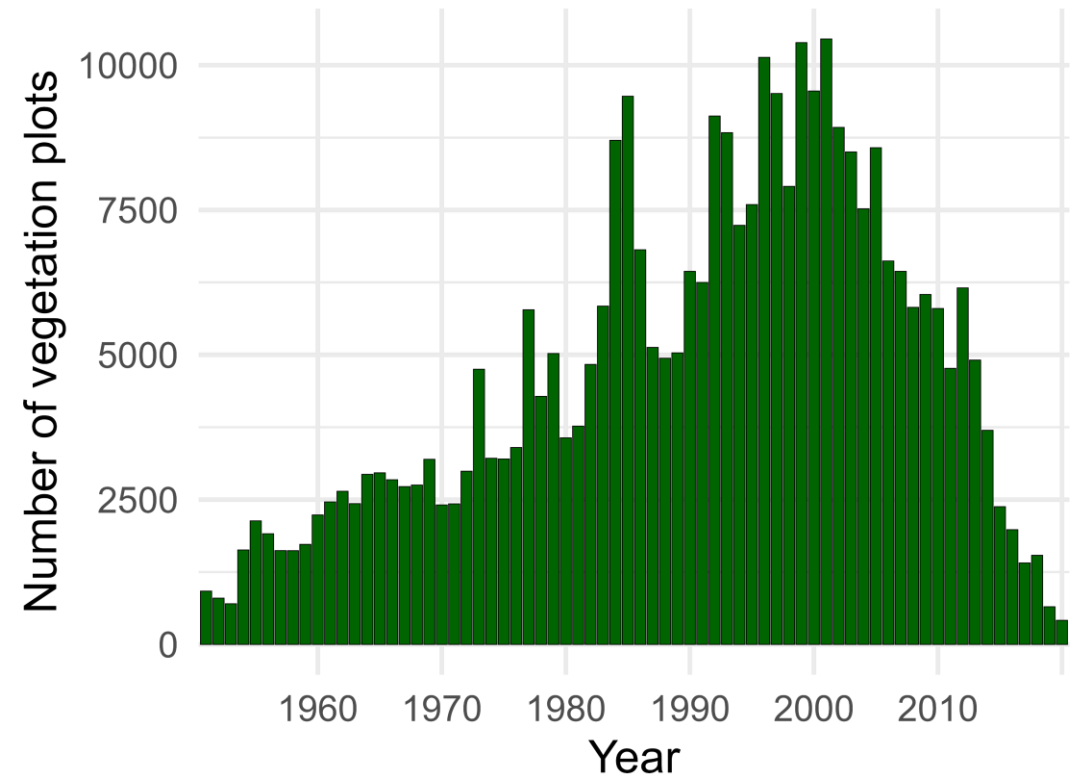
Remote sensed data from 2000 onwards



## 8 biotic characteristics

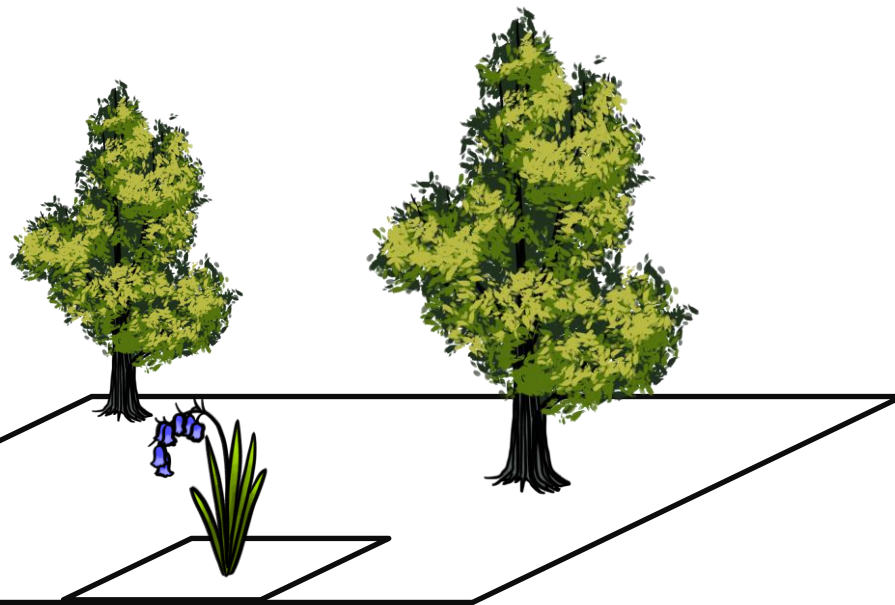
Plant area index (PAI) most important

Remote sensed data from 2000 onwards



## Forest types:

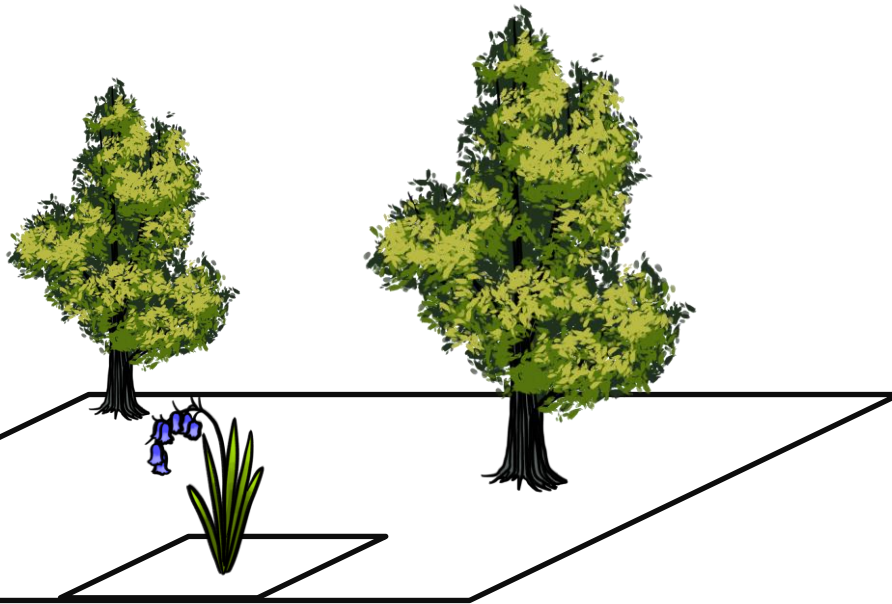
Deciduous broadleaf forest, Evergreen broadleaf forest,  
Deciduous needleleaf forest, Evergreen needleleaf forest,  
Mixed Forest



Forest types:

Deciduous broadleaf forest, Evergreen broadleaf forest,  
Deciduous needleleaf forest, Evergreen needleleaf forest,  
Mixed Forest

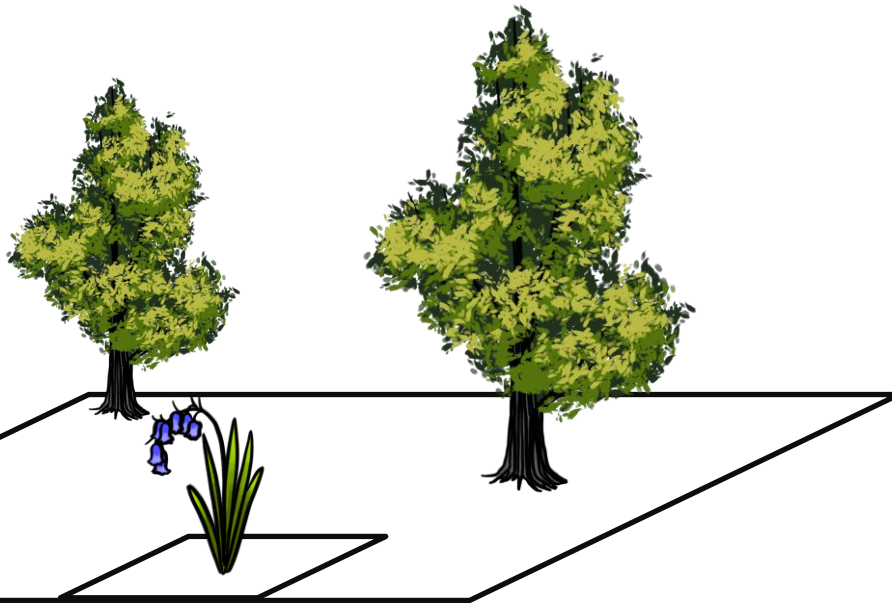
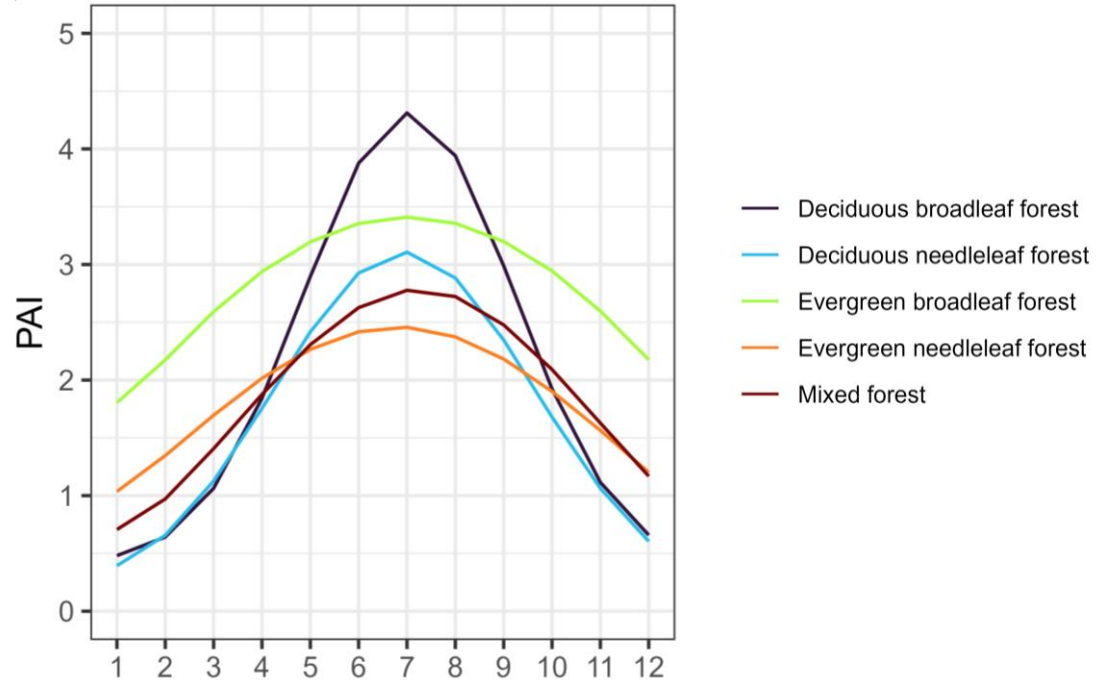
Classify vegetation plots by tree species leaf phenology



Forest types:

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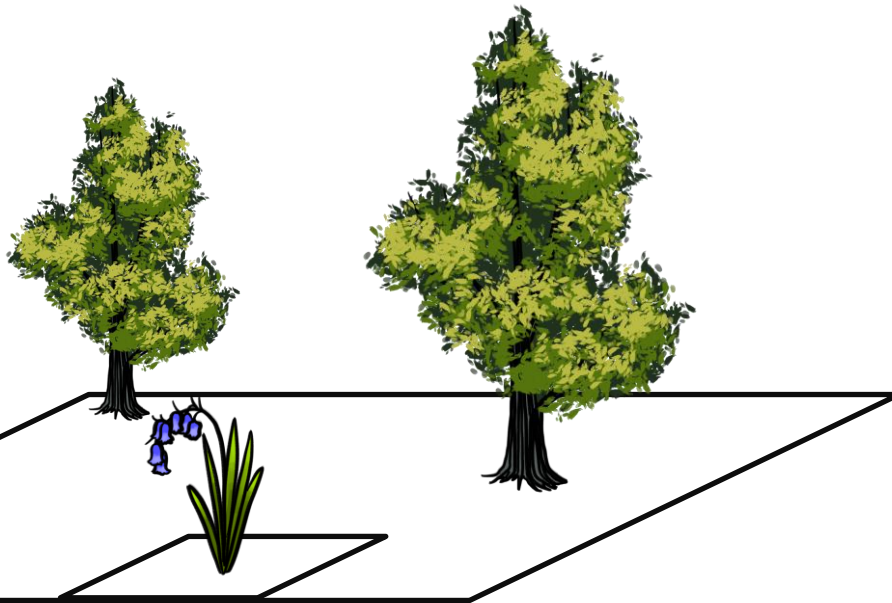


Forest types:

Deciduous broadleaf forest, Evergreen broadleaf forest,  
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Classify vegetation plots by tree species leaf phenology

Prediction for 352 forest sites  
with 780 temperature sensors  
(SoilTemp/MDB)

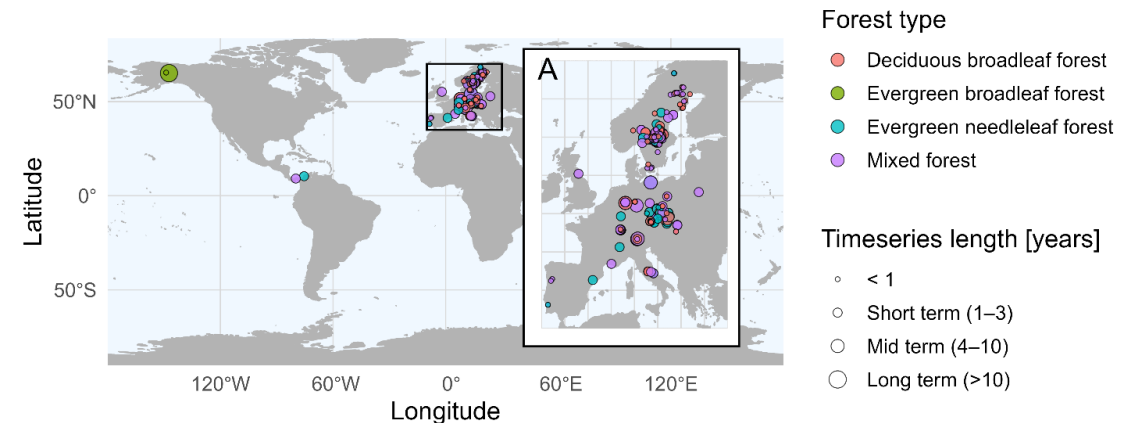
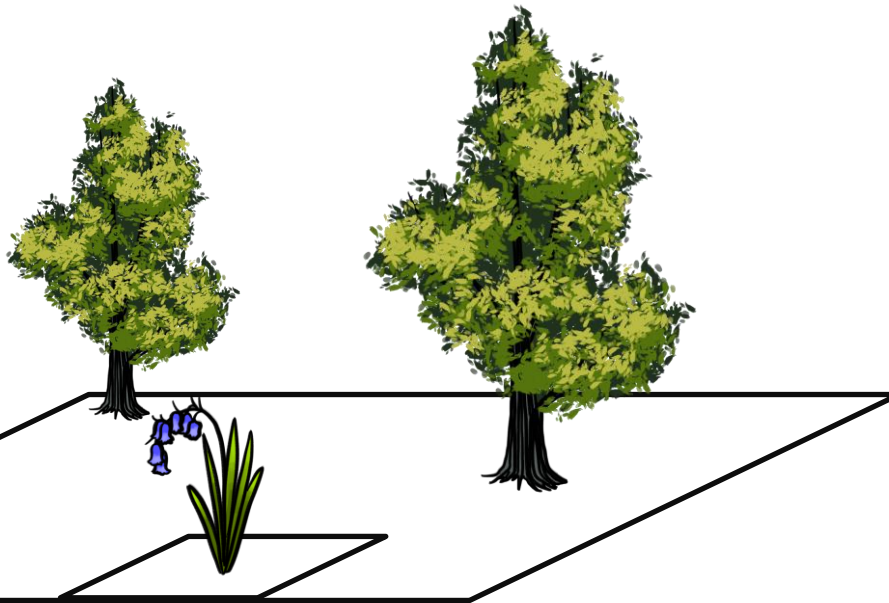


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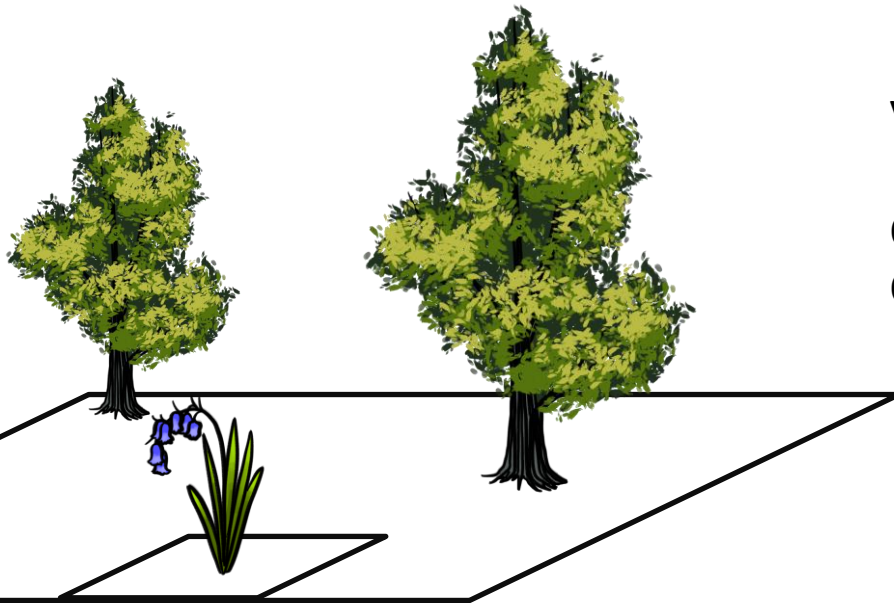
Deciduous broadleaf forest, Evergreen broadleaf forest,  
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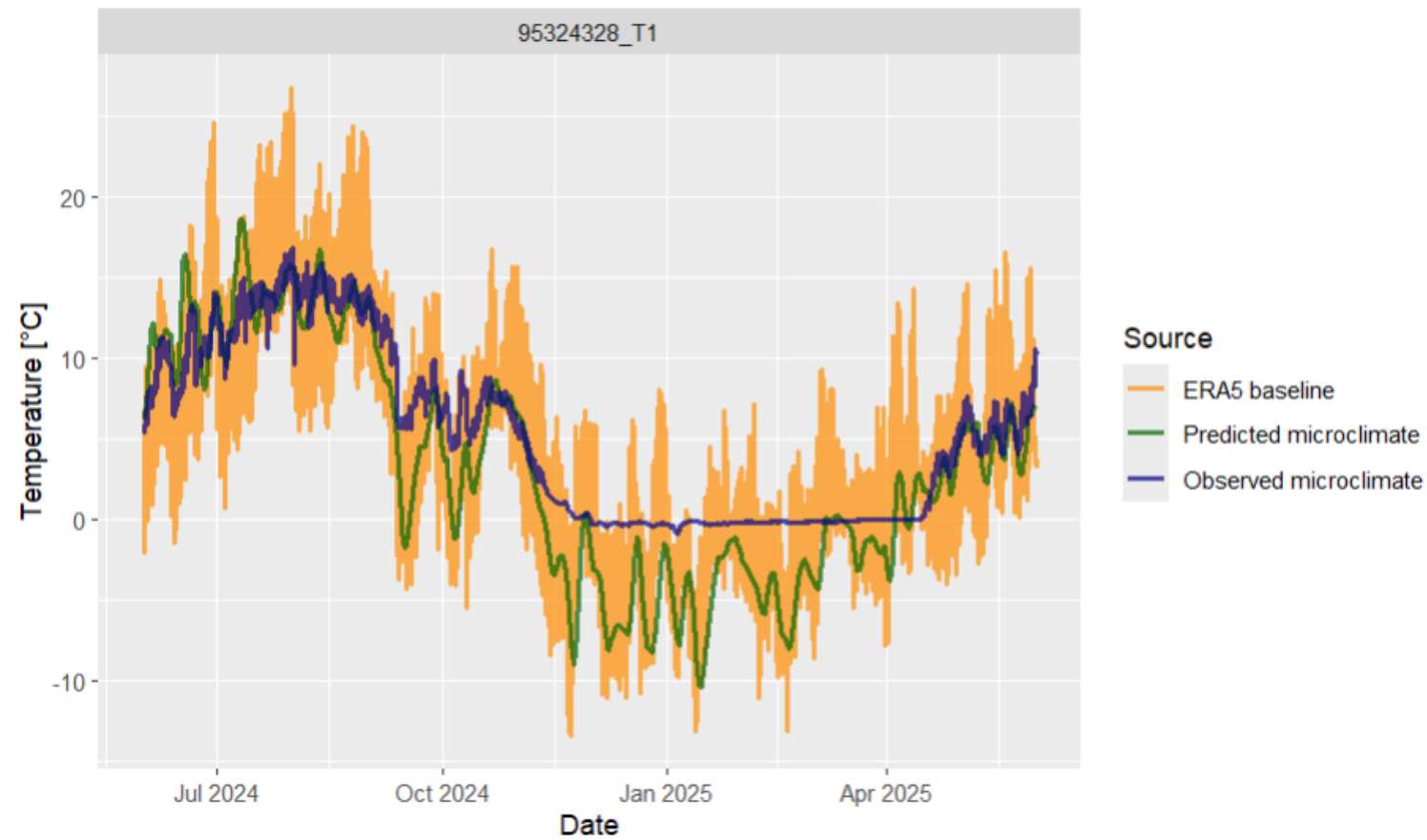
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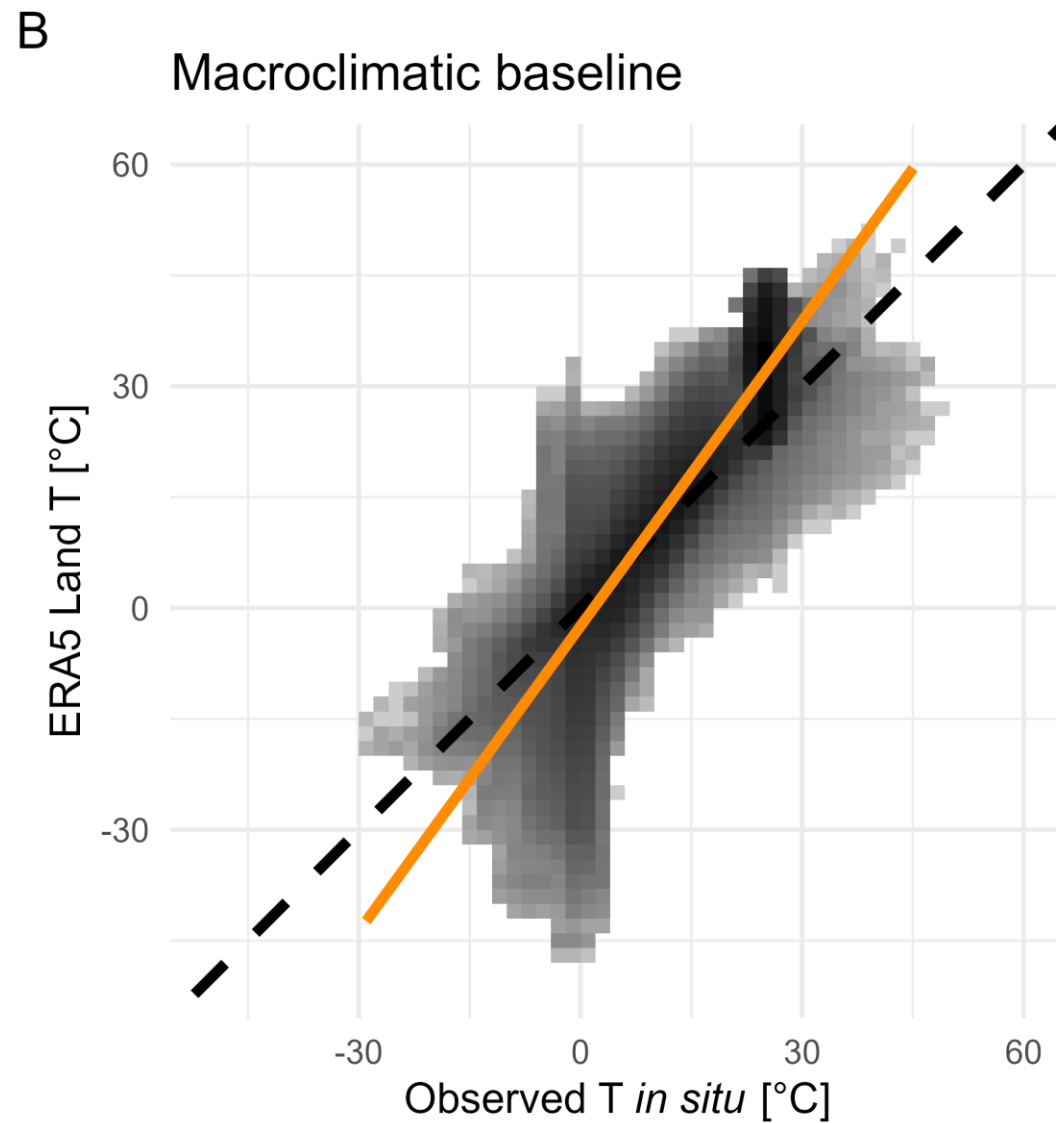
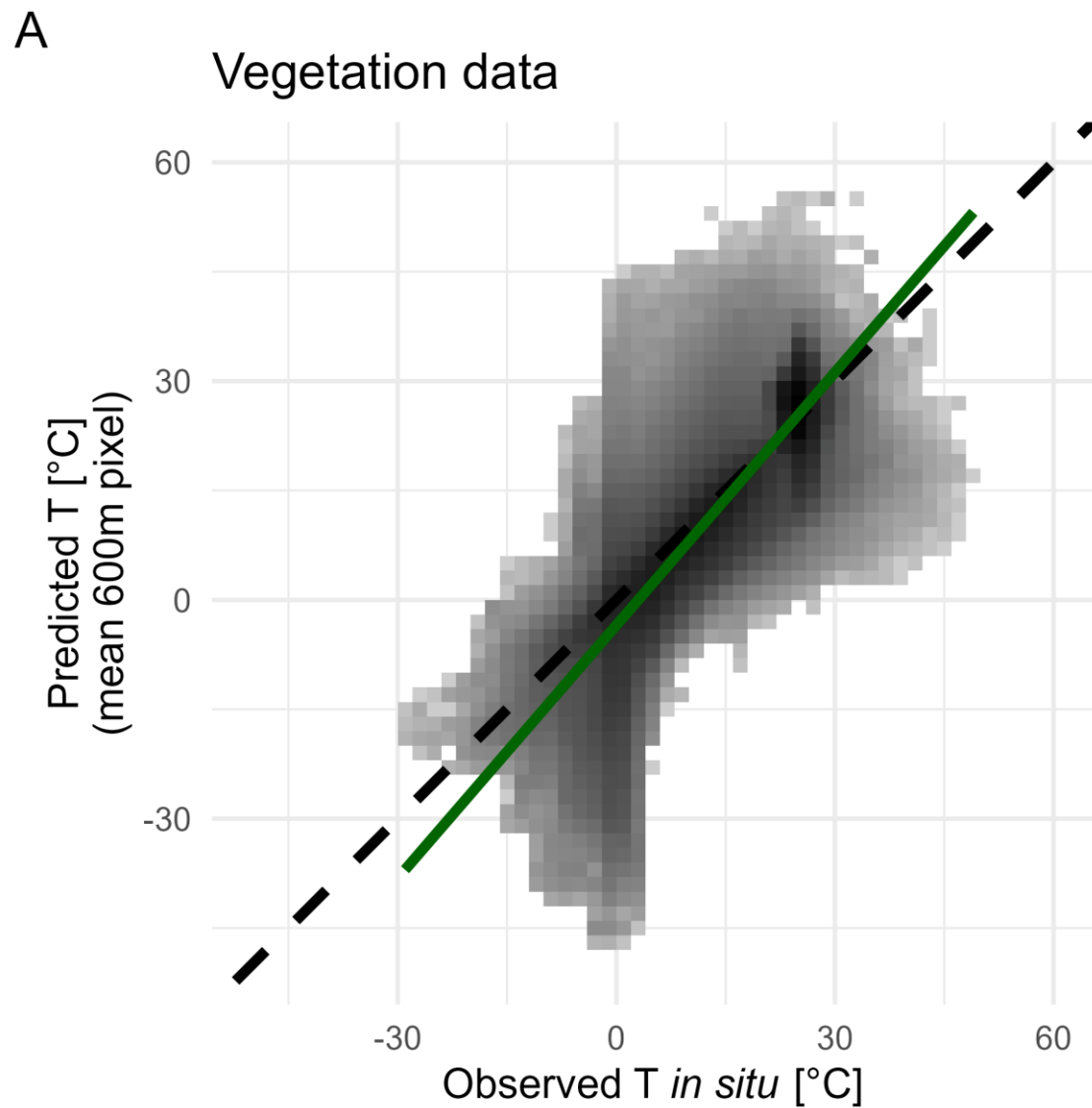
Prediction for 352 forest sites  
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Validation of hourly data and yearly bioclimatic variables

Observed ~ microclimf prediction  
Observed ~ macroclimate baseline (ERA 5 land)

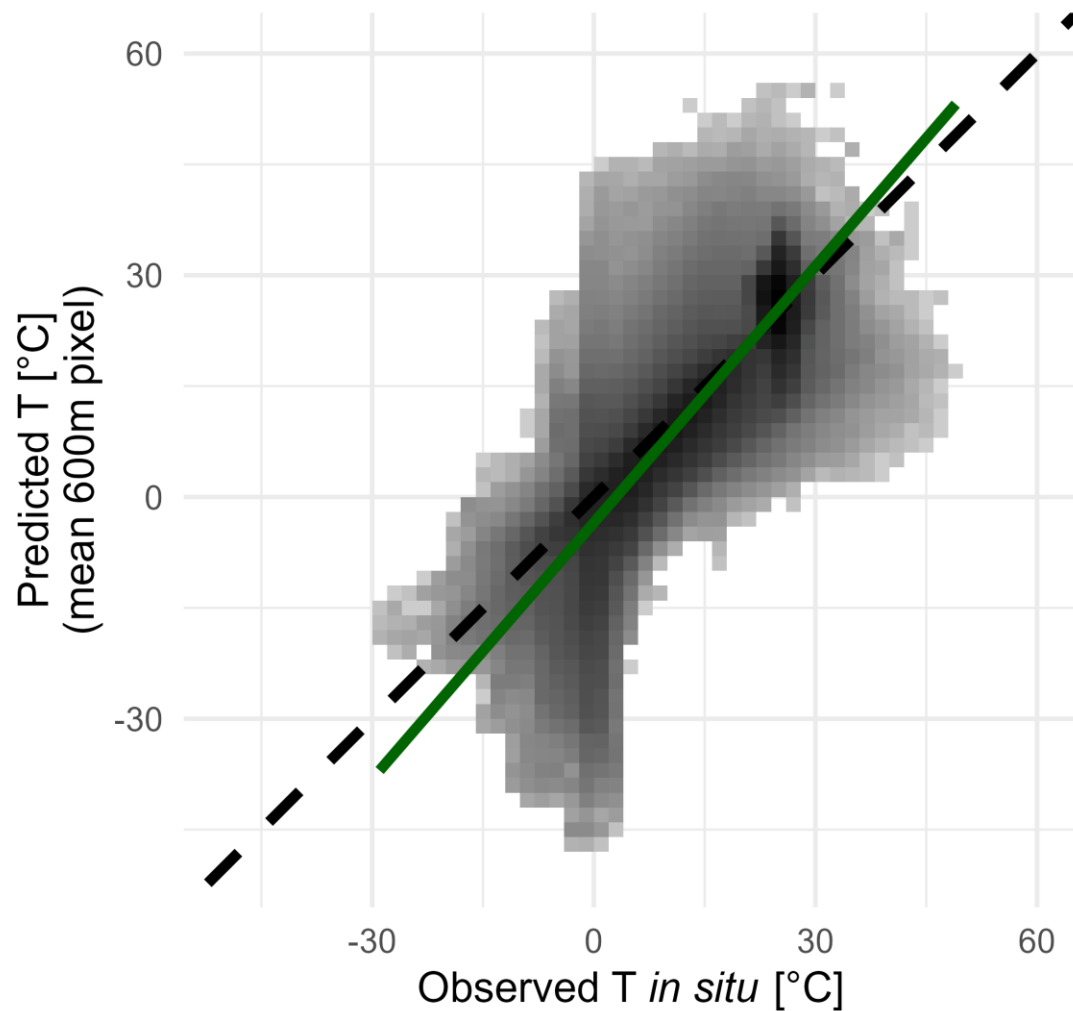






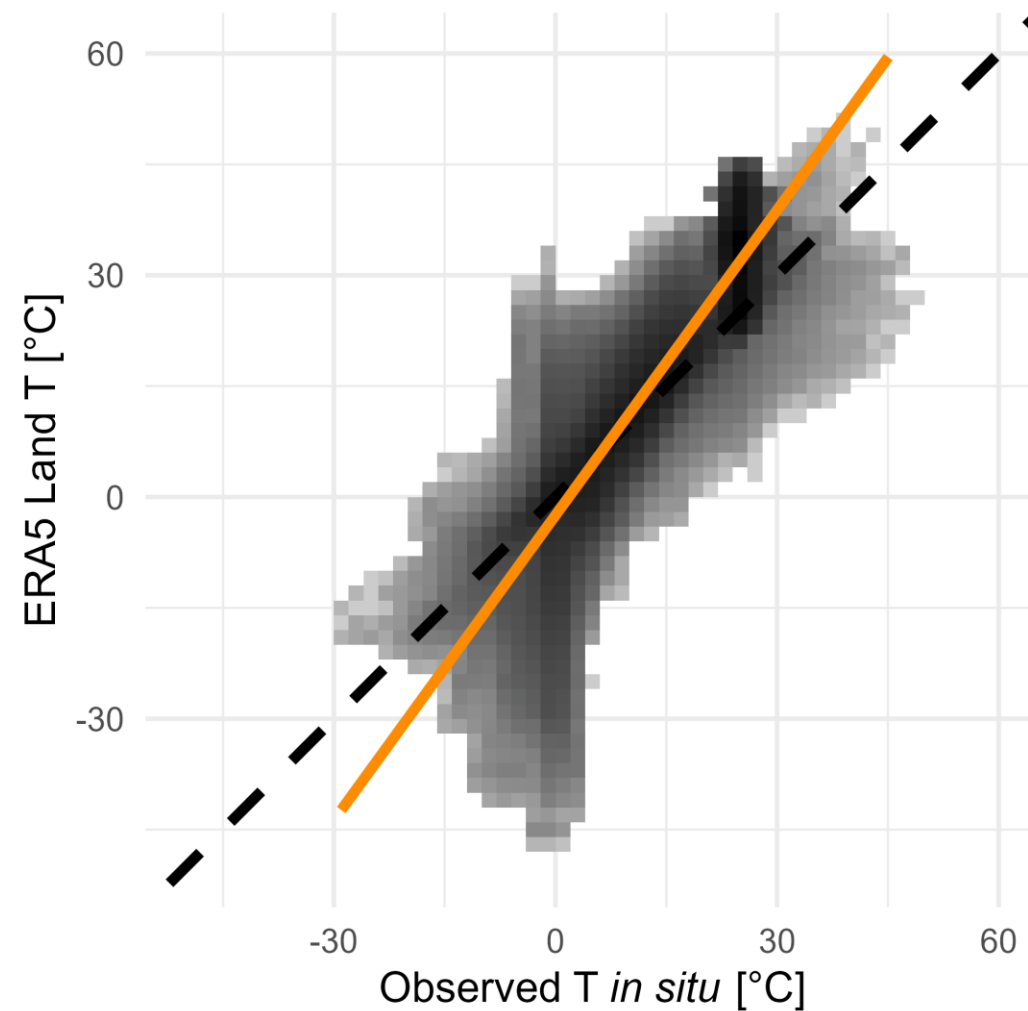
A

## Vegetation data



B

## Macroclimatic baseline



0.873

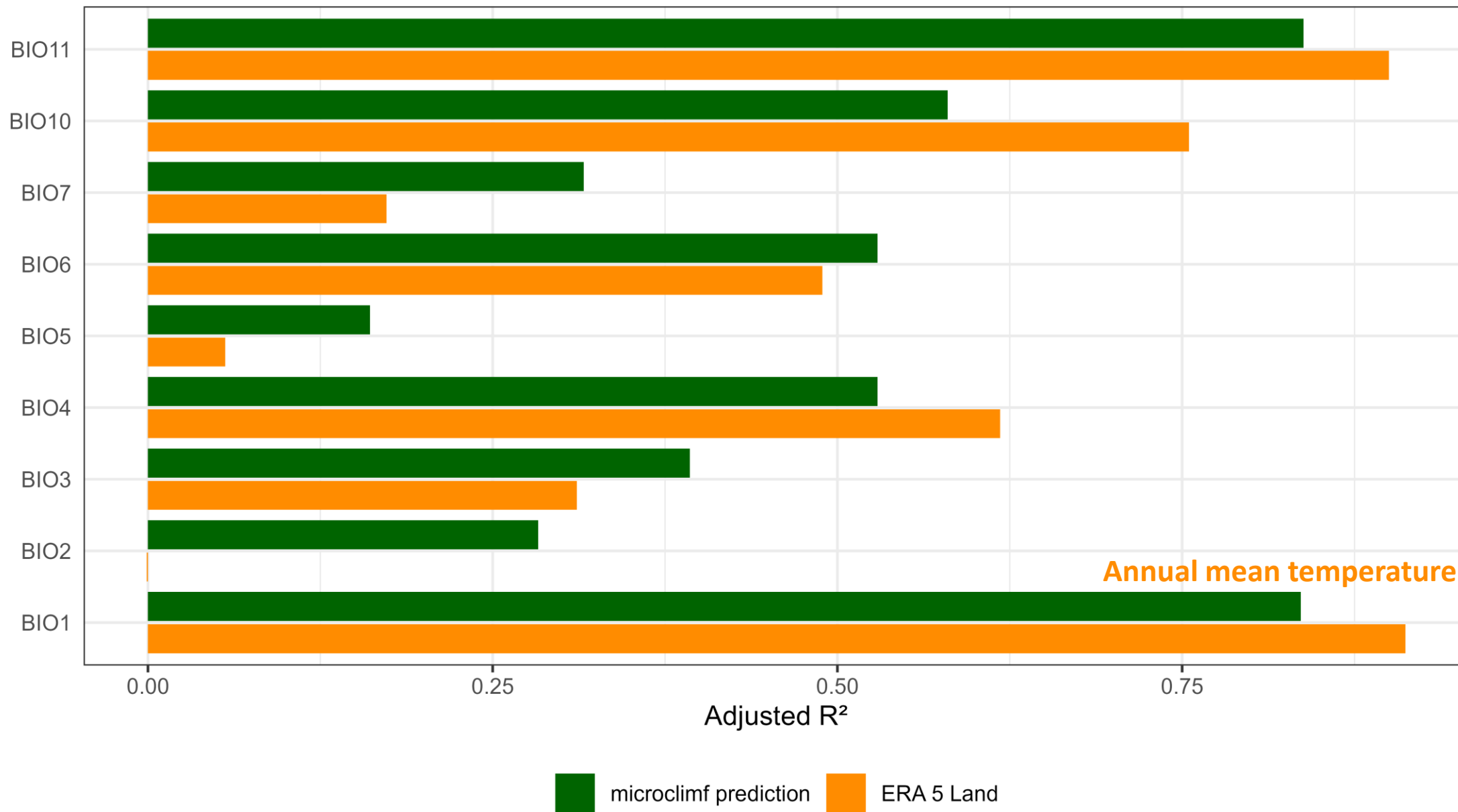
adj.  $R^2$ 

0.871

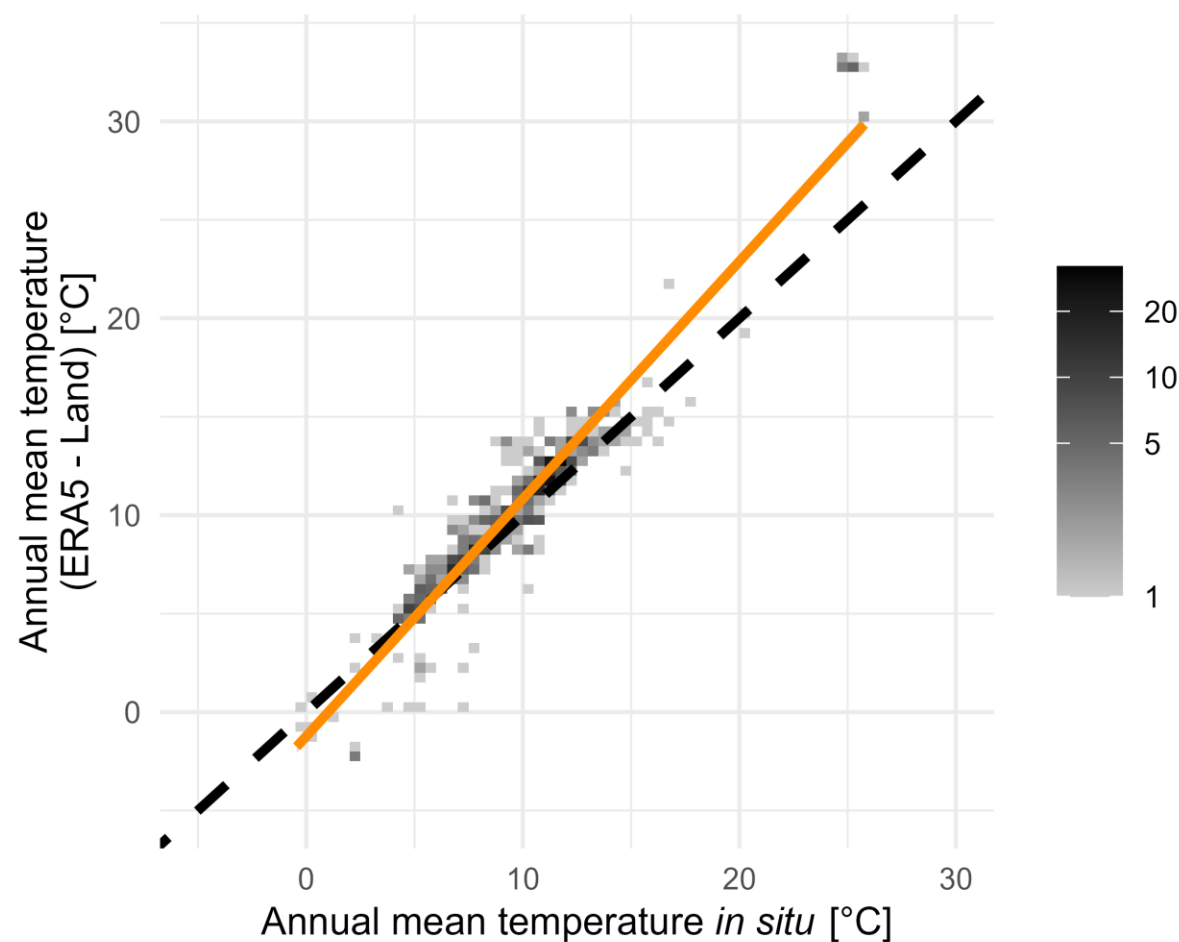
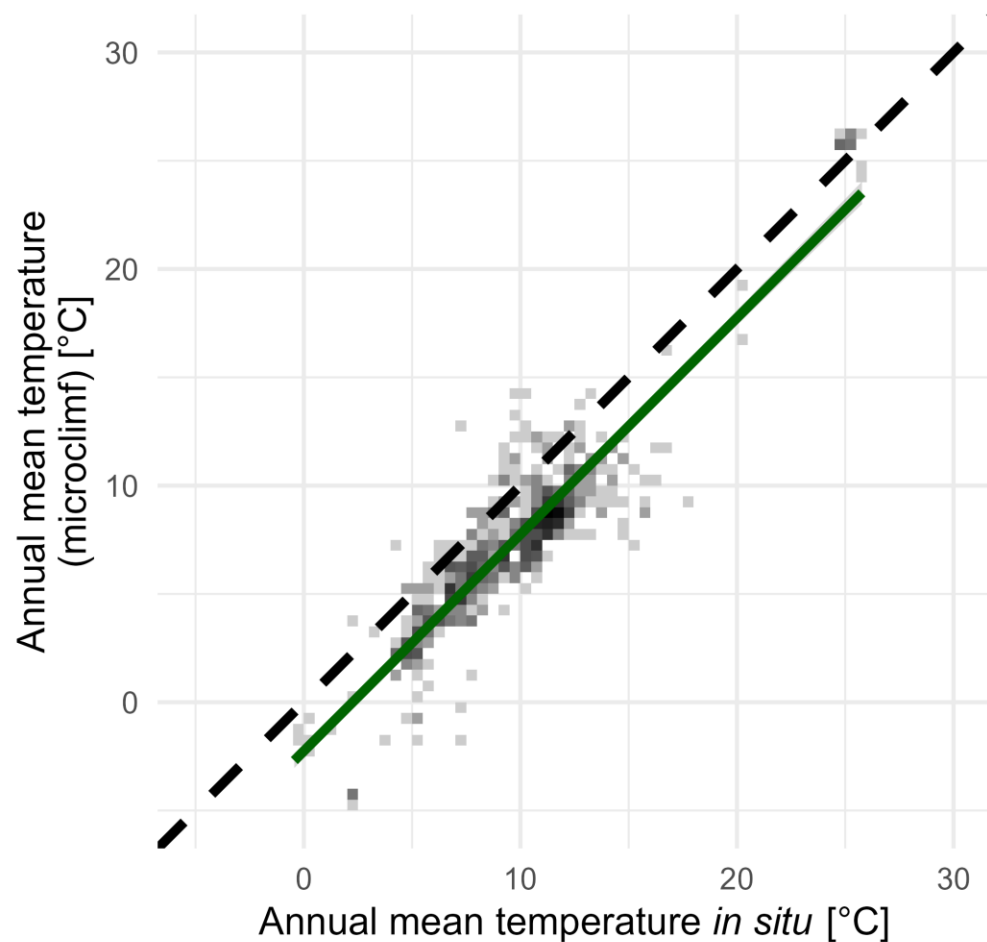
3.418

RMSE

3.440



## Annual mean temperature



microclimf prediction



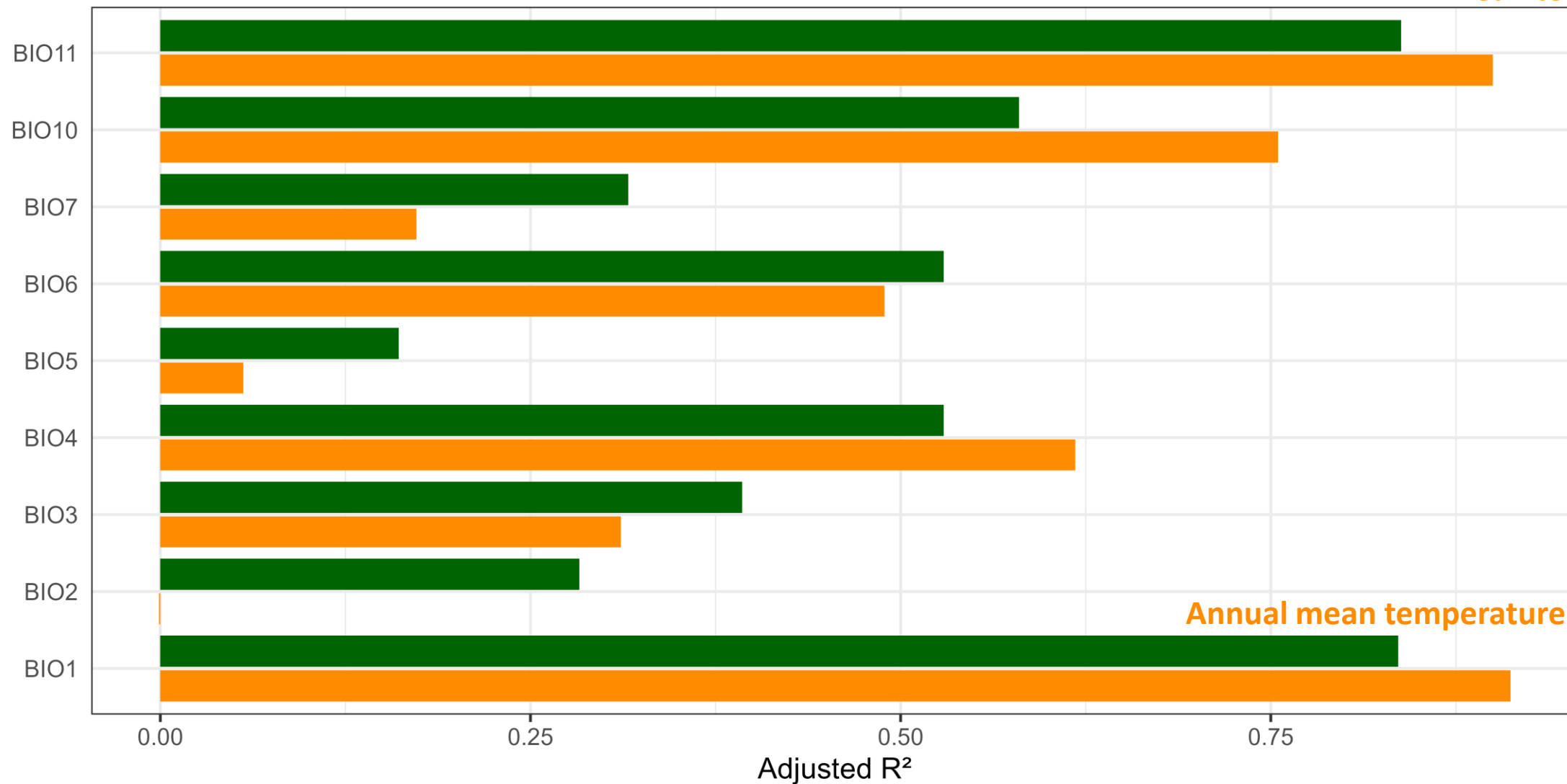
ERA 5 Land

Mean temperature

Coldest quarter

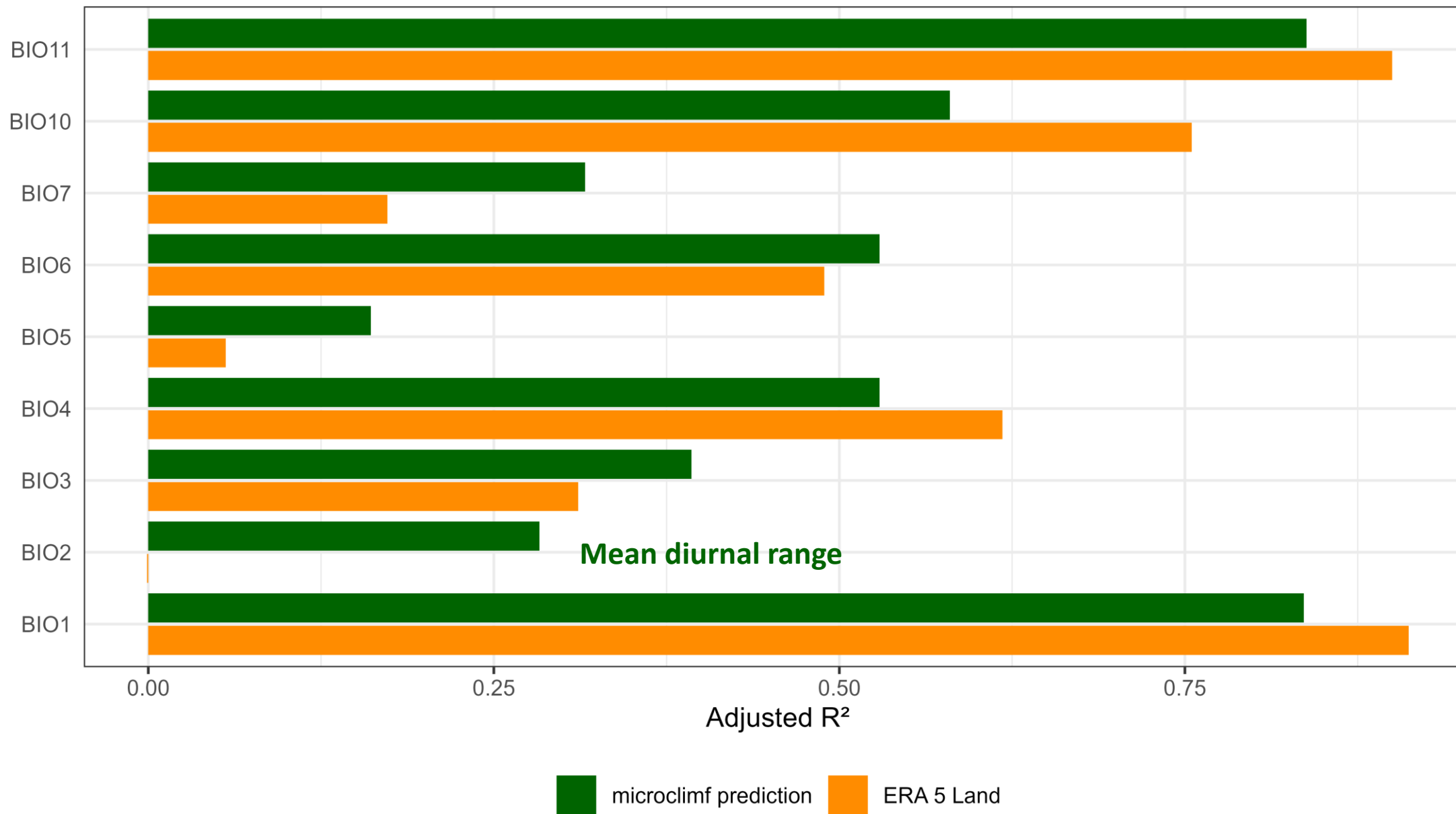
Warmest quarter

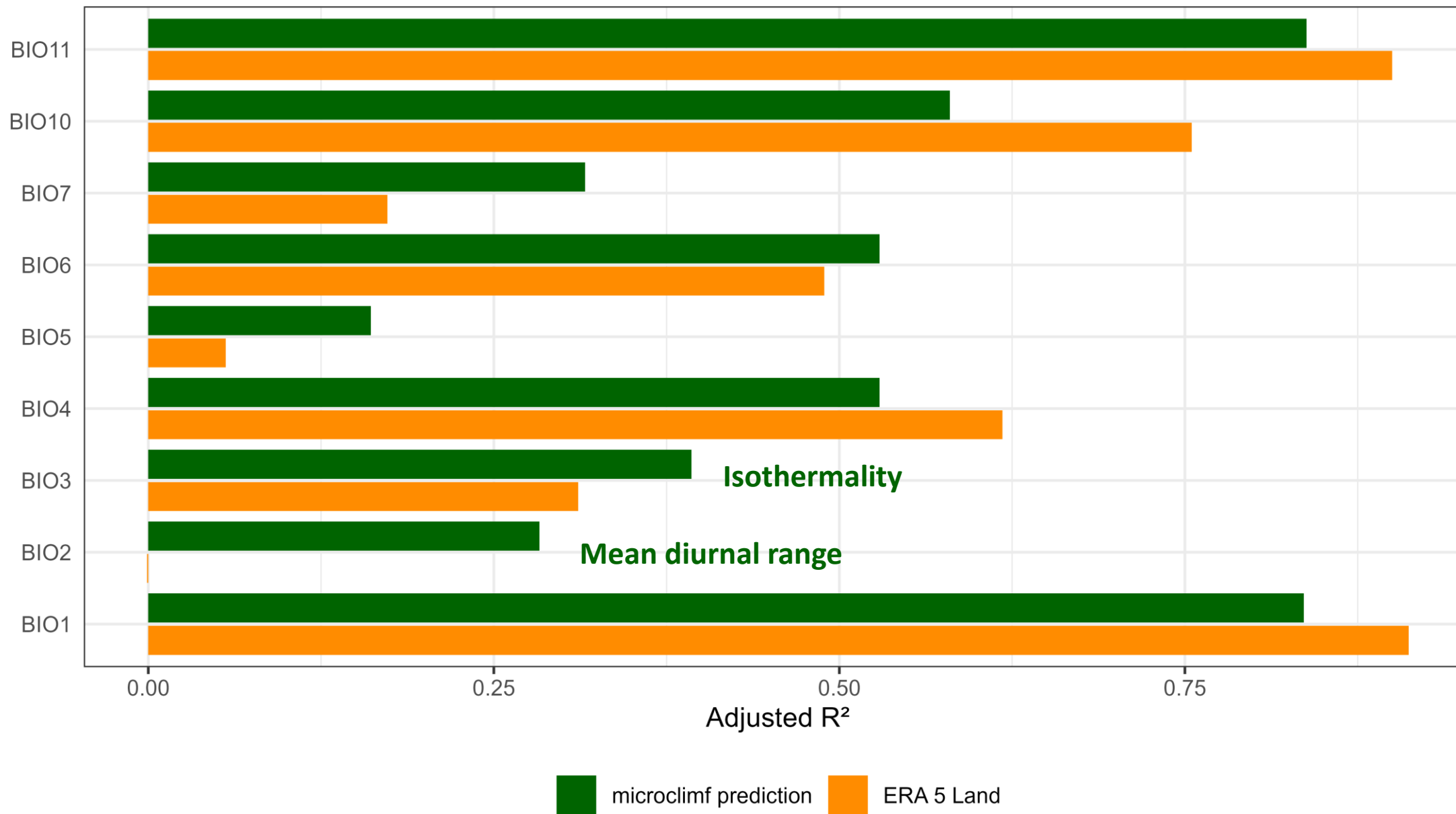
Annual mean temperature

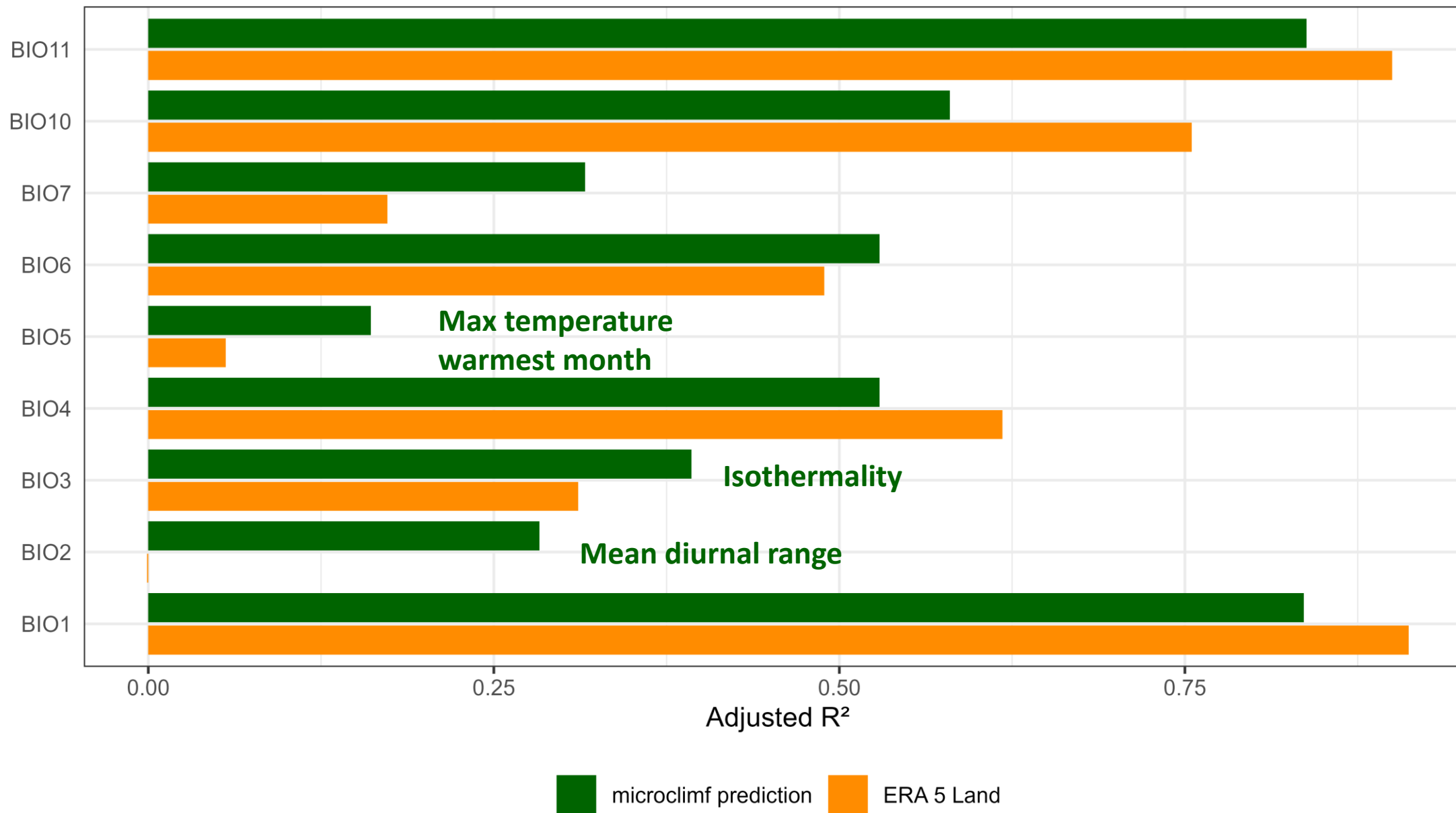


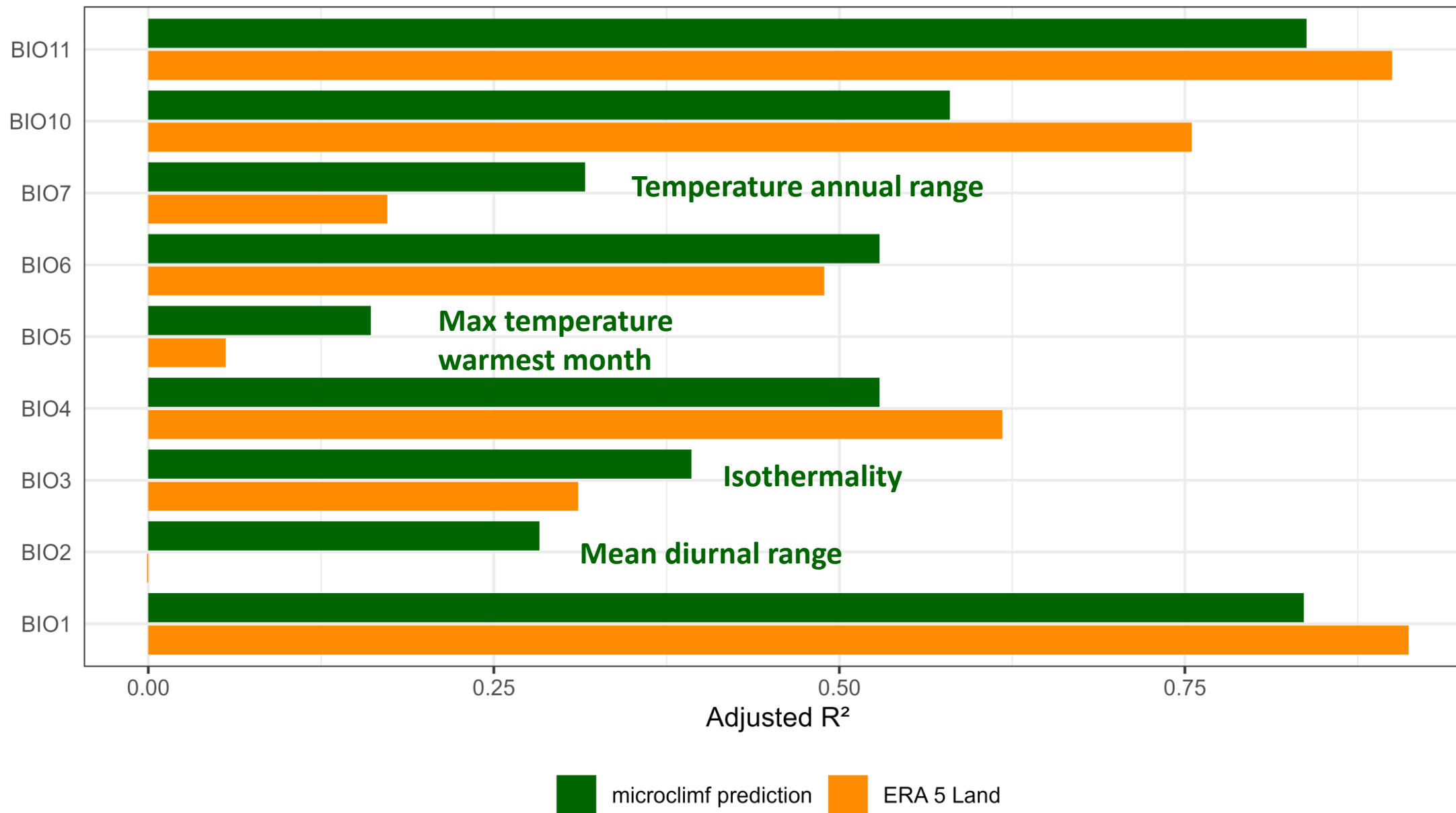
microclimf prediction ERA 5 Land



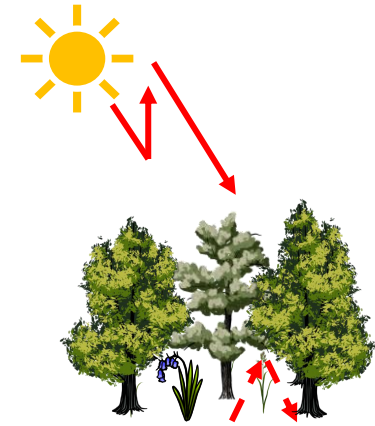




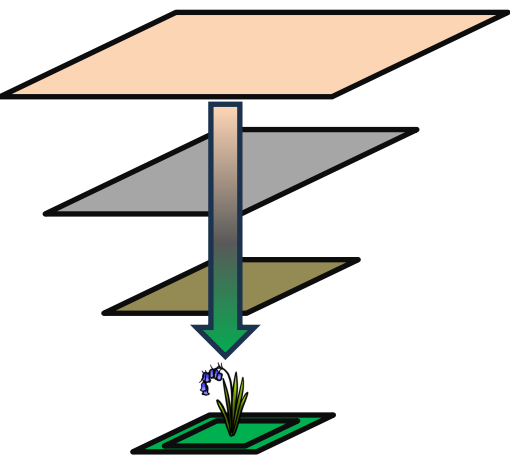
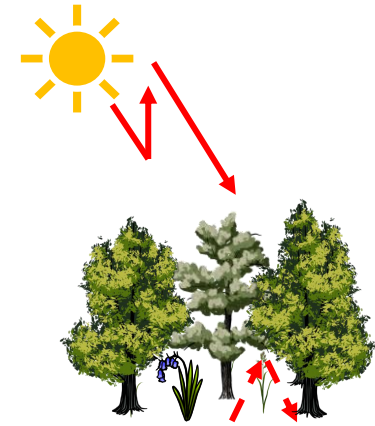




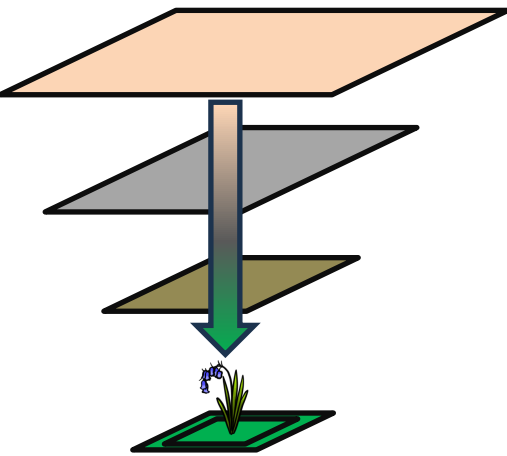
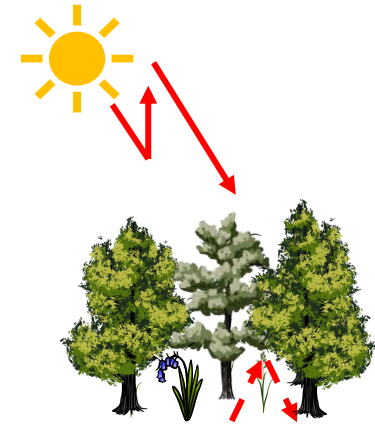
- microclimf can be applied without remote sensed data
  - reducing computational requirements



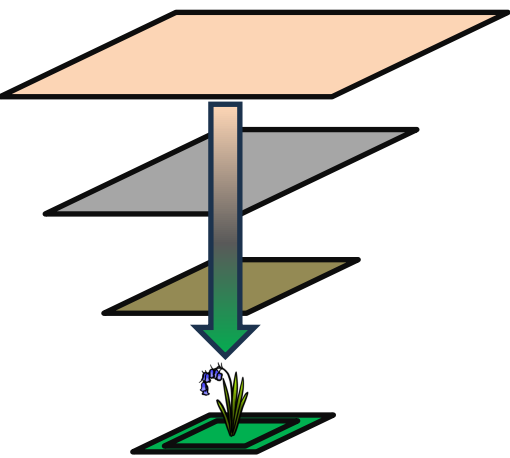
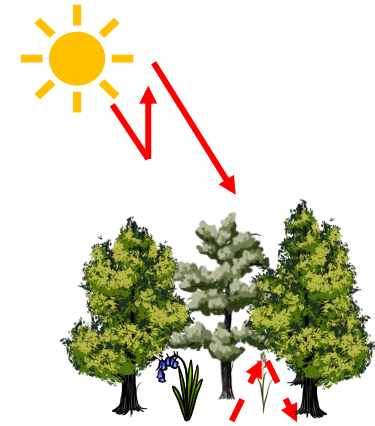
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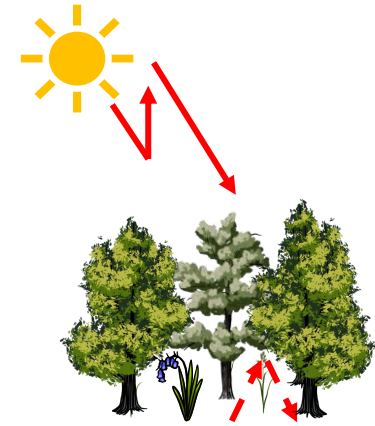
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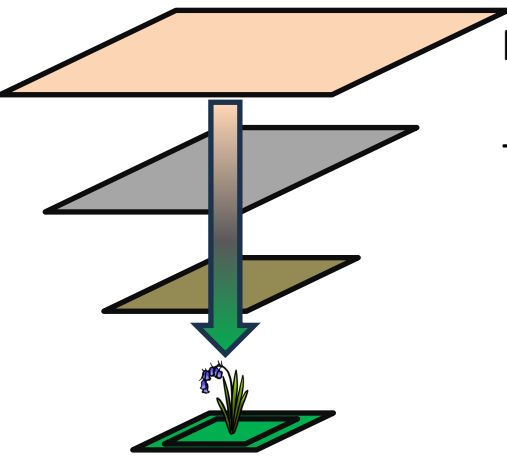


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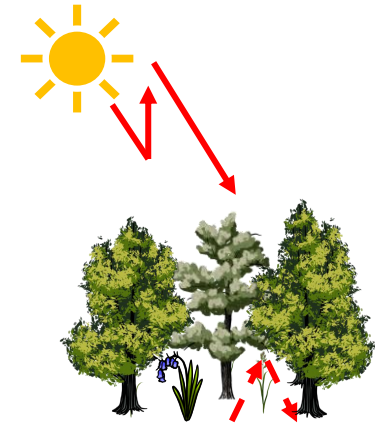


Next steps:

- Finalising validation manuscript “Using canopy tree composition for accurate forest microclimate predictions”



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- Predict below canopy temperature for sPlot and link to community assembly

