Projecting the shifting climate envelope of species and how the landscape can enhance or hamper the response of populations.

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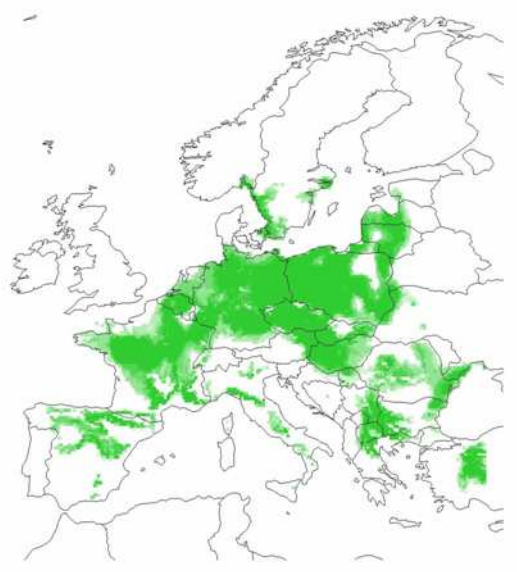
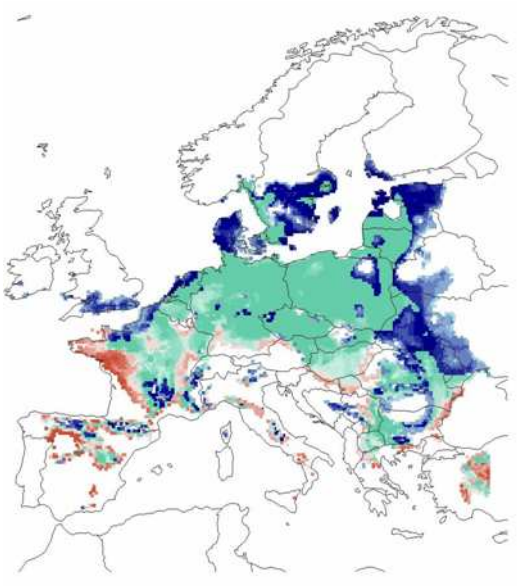
Branch

BIODIVERSITY
SPATIAL PLANNING
CLIMATE CHANGE

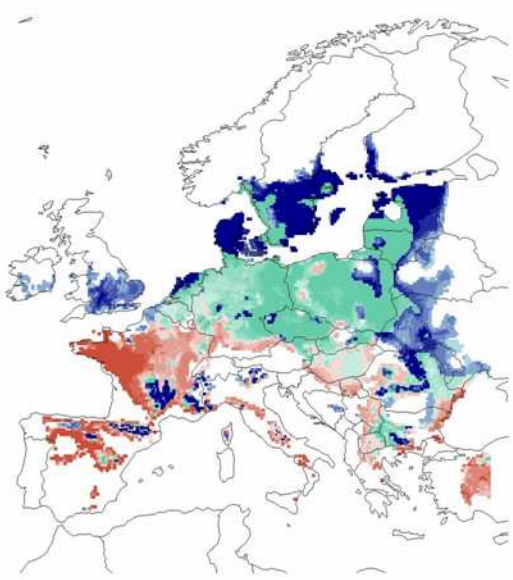
Predicted range shifts



2020



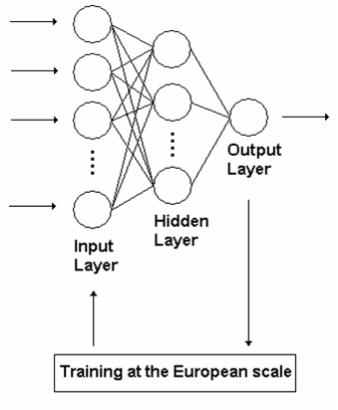
2050



New “climate space” – with habitat? – reachable?

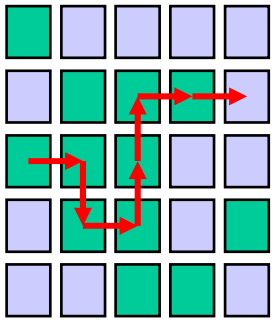
Overview

Climate envelope model



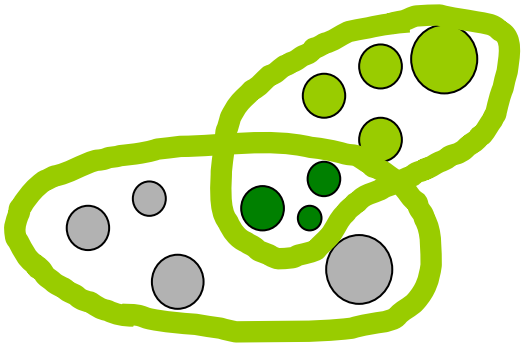
SPECIES

Dispersal model



GridWalk

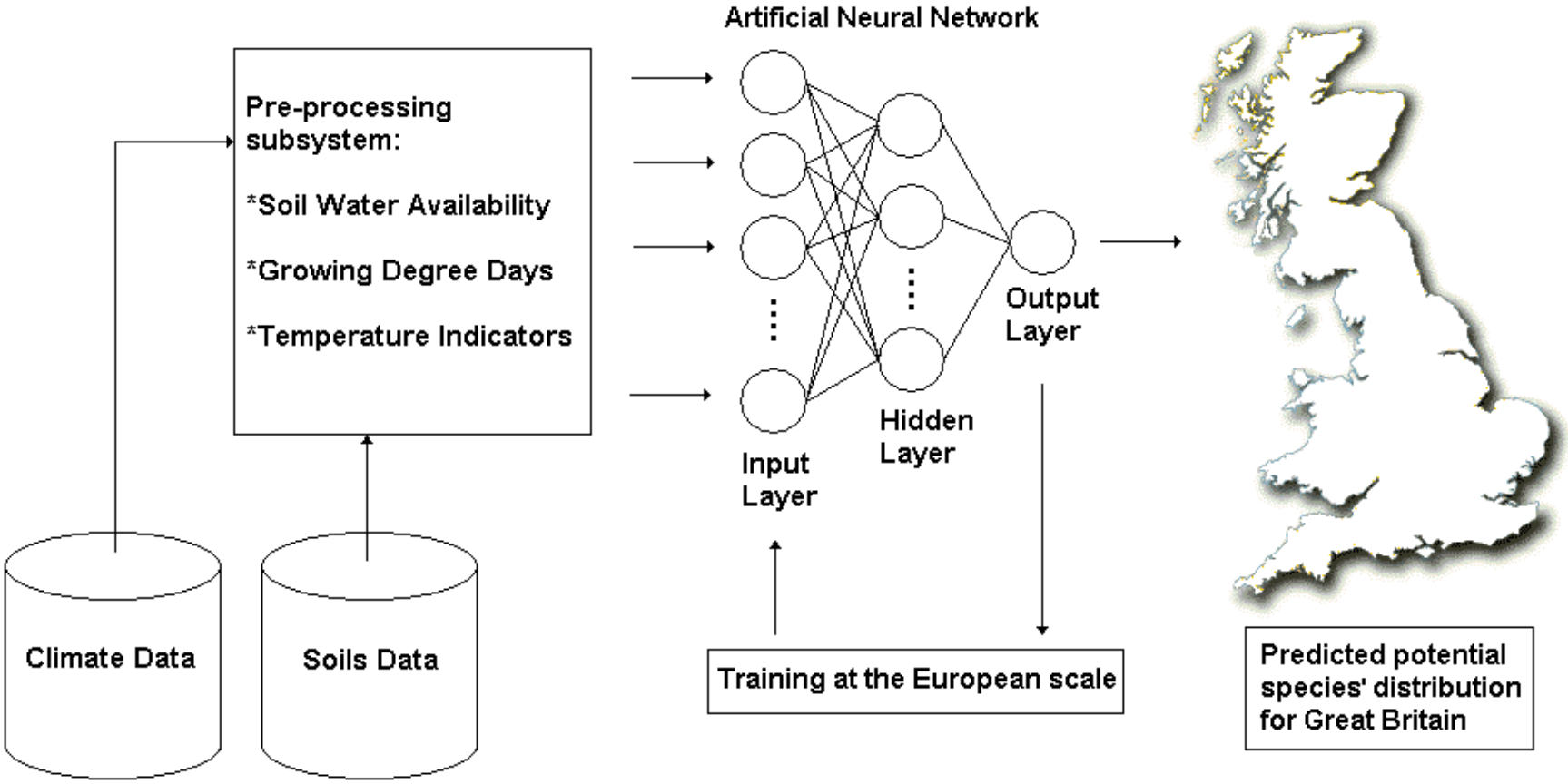
Ecological network analysis



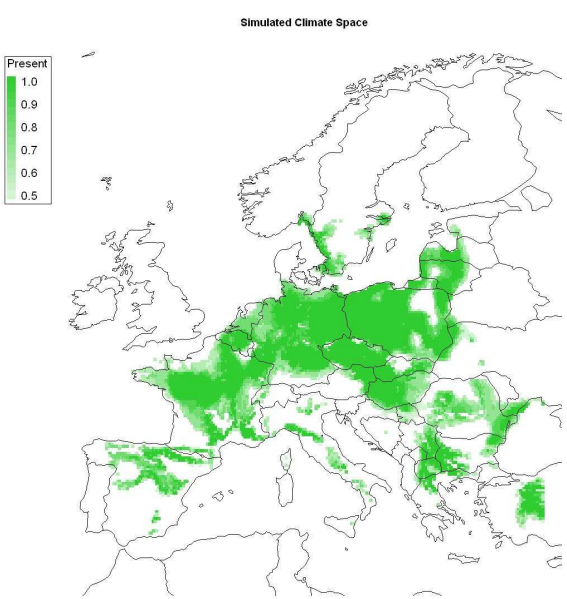
CENA

- *current, 2020 and 2050 (time slices)*
- *HadCM3 with A2 emission scenario*
- *3 forest + 3 meadow + 3 marshland species*

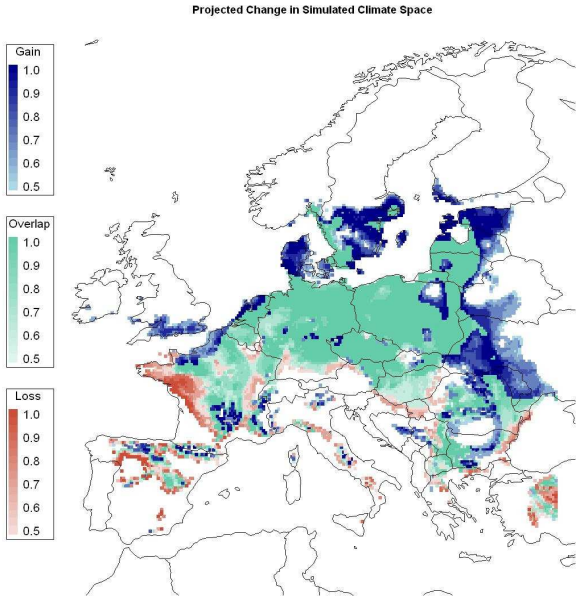
SPECIES model



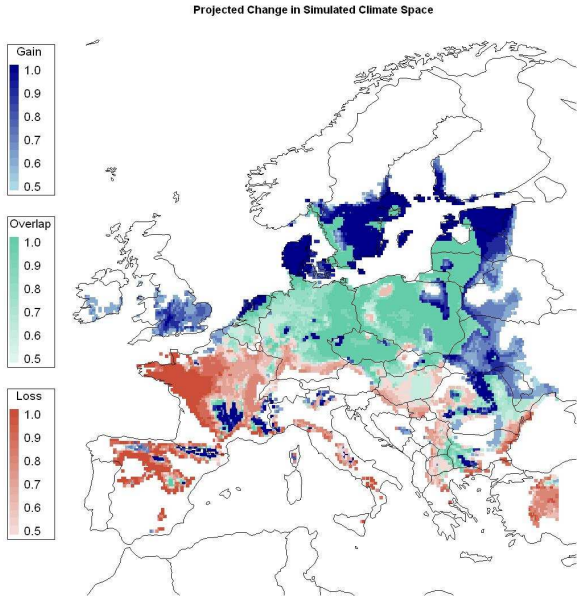
Middle spotted woodpecker



current



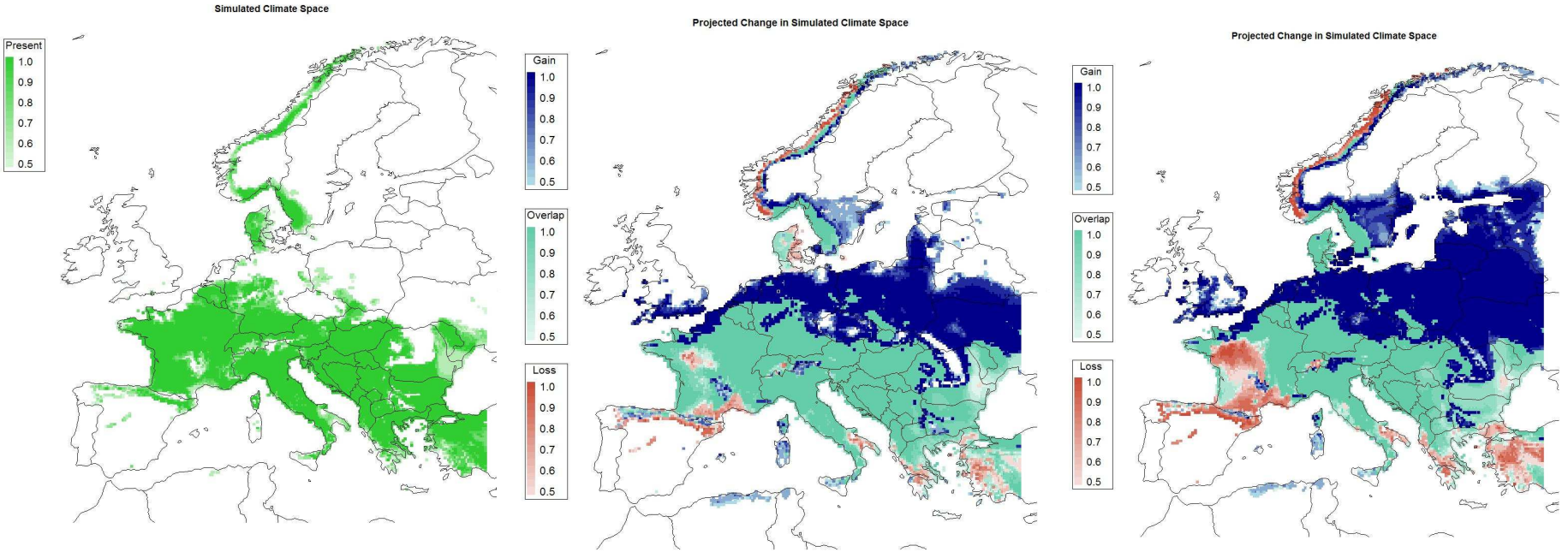
HadCM3 2020 A2



HadCM3 2050 A2

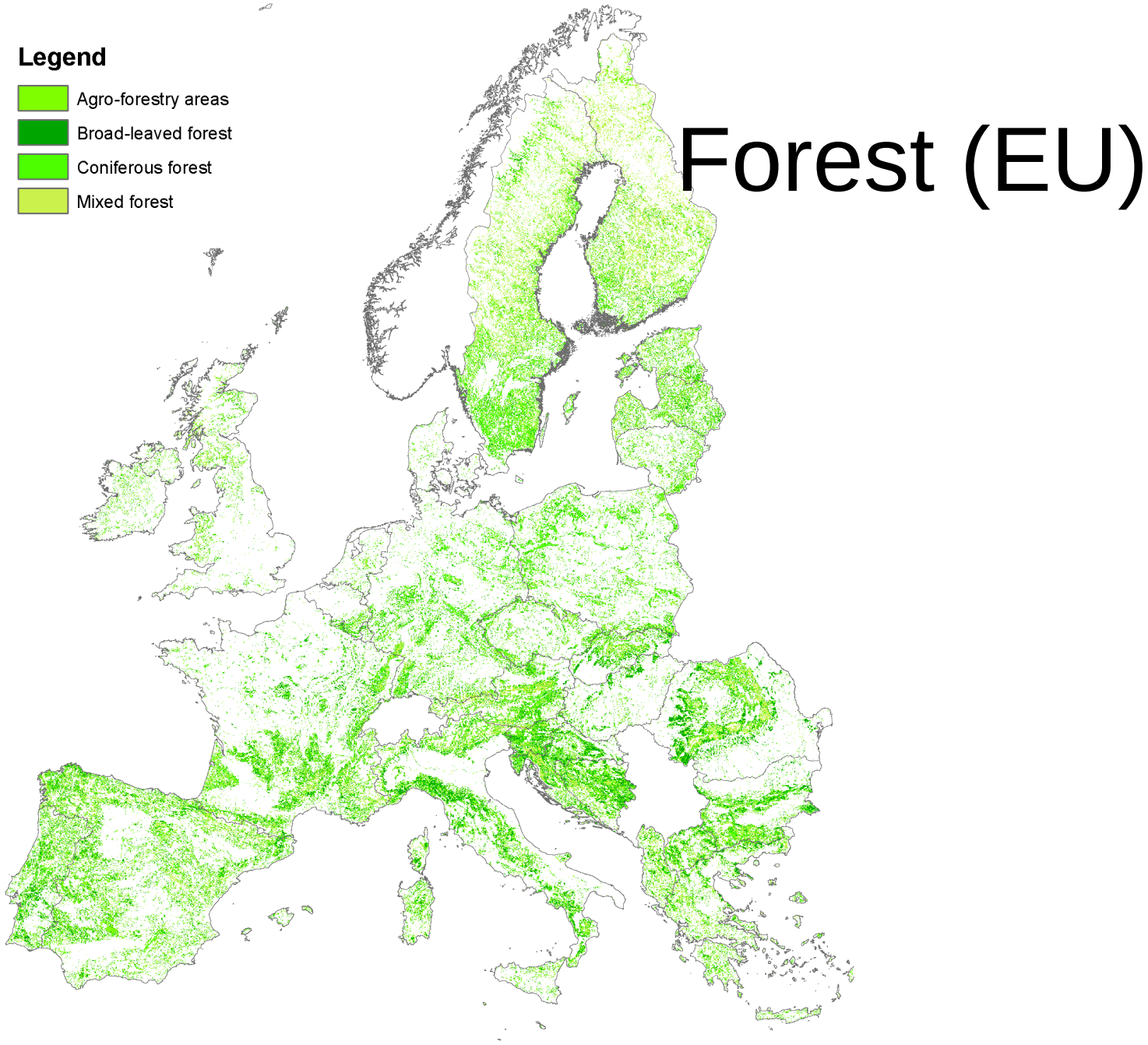
Potential suitable climate space

Agile frog

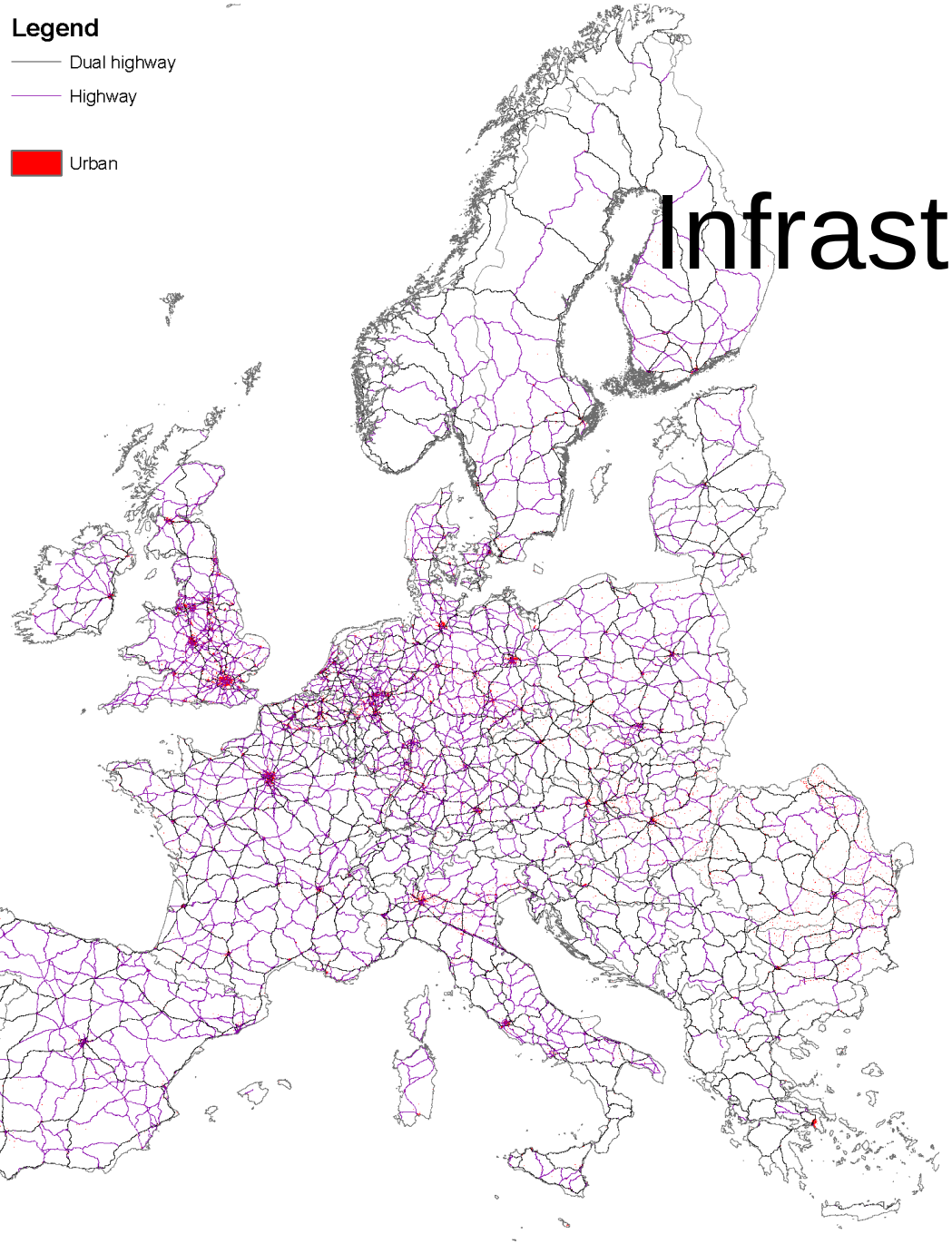


current HadCM3 2020 A2 HadCM3 2050 A2

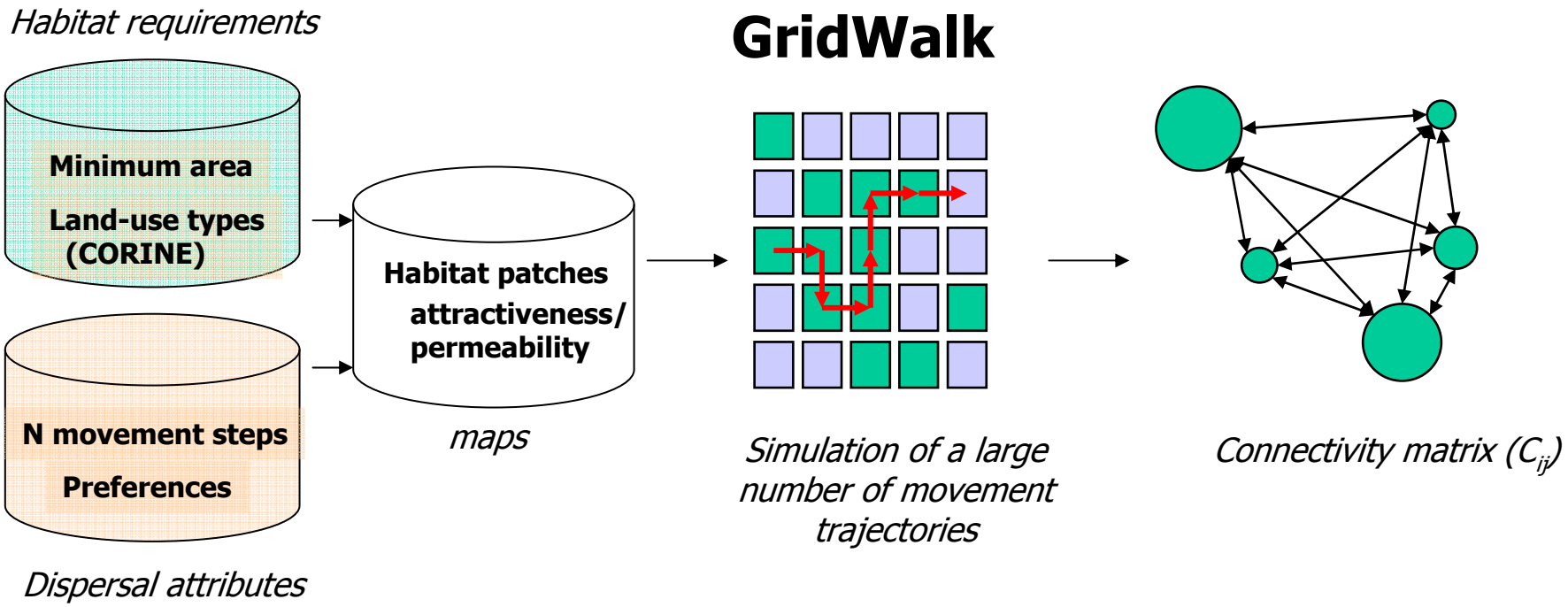
Potential suitable climate space


Legend
Agro-forestry areas
Broad-leaved forest
Coniferous forest
Mixed forest
Forest (EU)

Infrastructure



Habitat patches & connectivity



Habitat and permeability map

Ecological Network Analysis

- Only the patches in suitable climate space, e.g. for 2020
- Patch size & quality -> nr of pairs (N_i)
- Average nr of dispersers per pair (b)
- Flows of migrants between patches:

$$F_{ij} = C_{ij} * N_i * b$$

- Patch i belongs to network (with j patches) when:

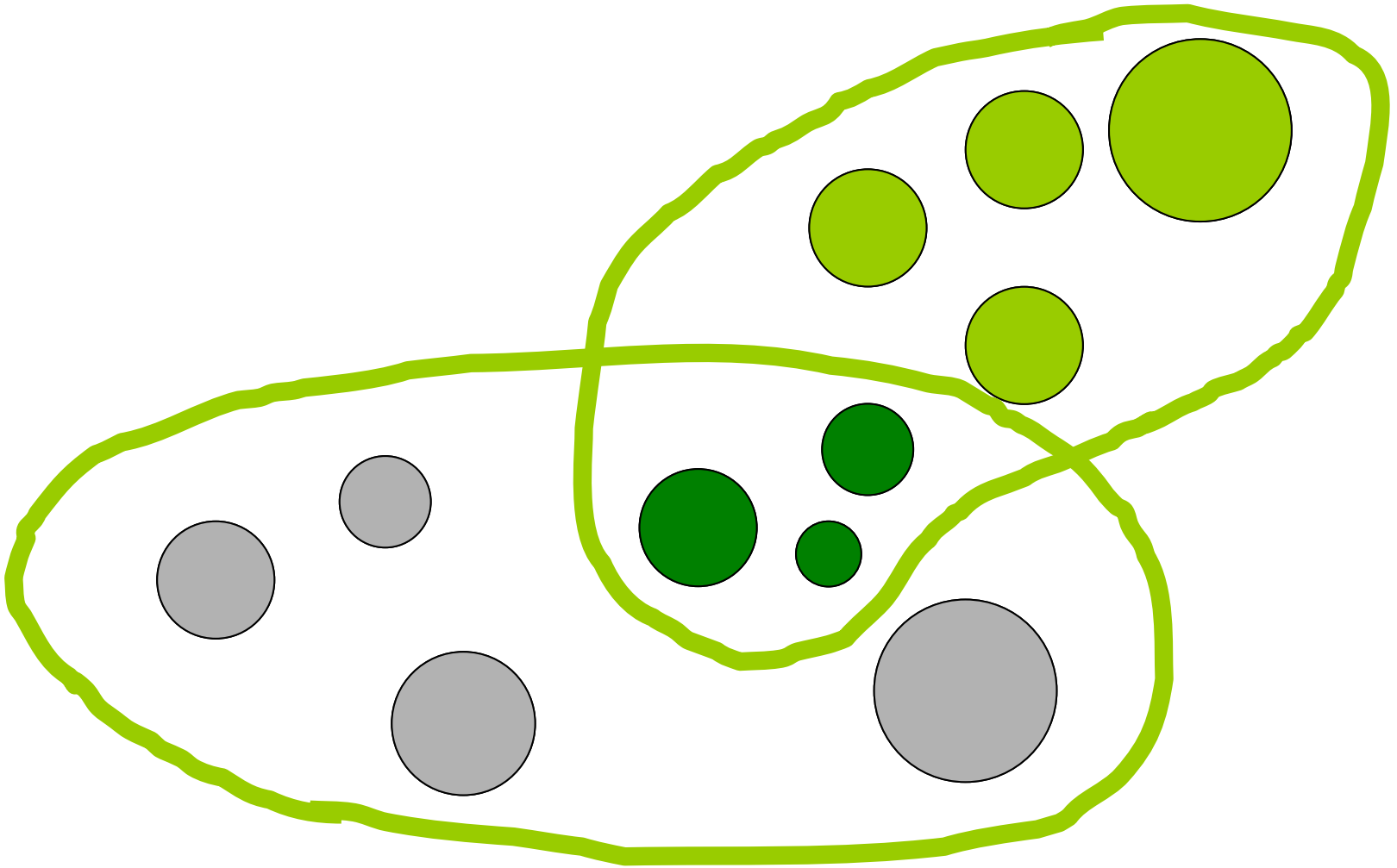
$$\sum_j F_{ij} > T \quad \text{or} \quad \sum_j F_{ji} > T$$

- T = minimum required exchange of migrants with network

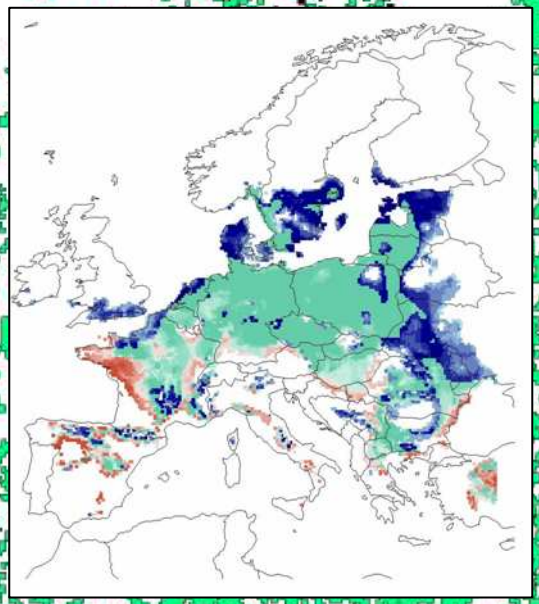
“Climate-based ecological network analysis”

- Relate the networks of the different time slices to each other
  - Common habitat patches (“overlap”)?

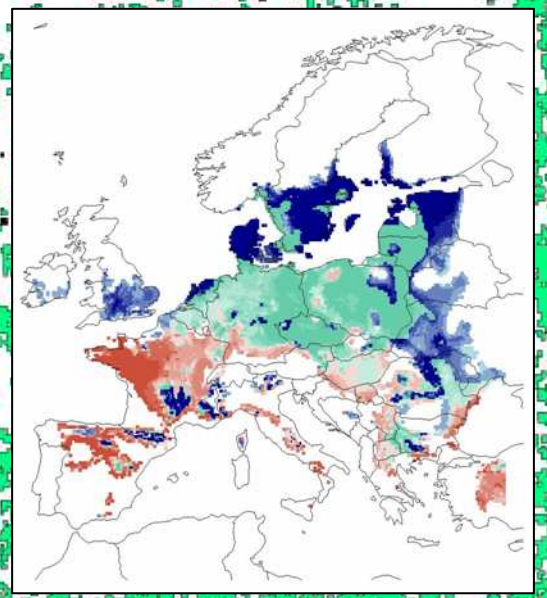
Networks at different times



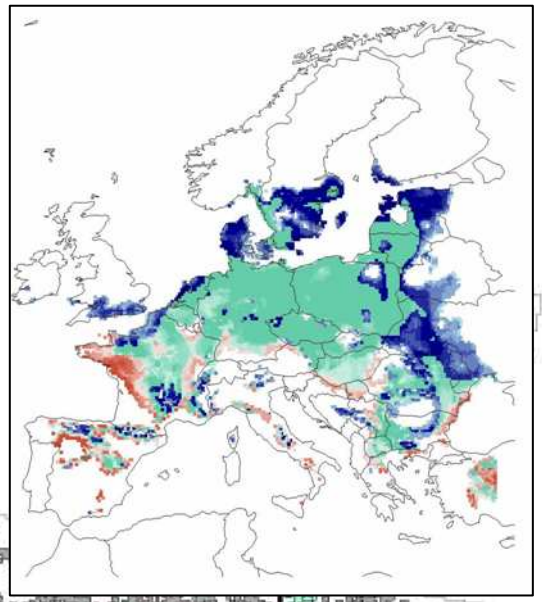
2020



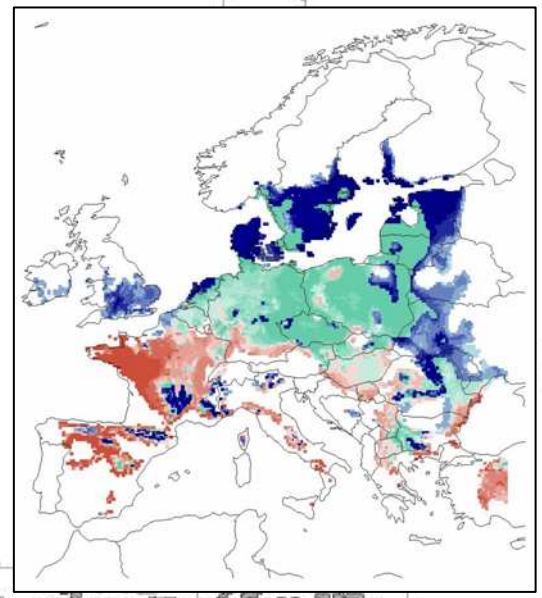
2050



2020



2050



mitigation

- Linking networks
- Strengthening networks in refuge areas

Future steps

- Enhancing the network analysis with methods to assess colonization sequences (spatial and temporal pattern in range expansion)
- Models with population-dynamics and continuous climate change