Biogeographical network analysis of plant species distribution in the French Mediterranean area

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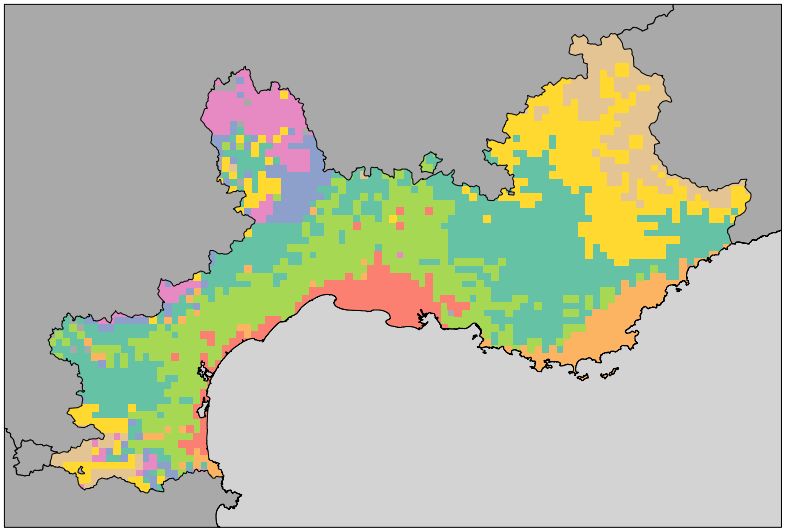
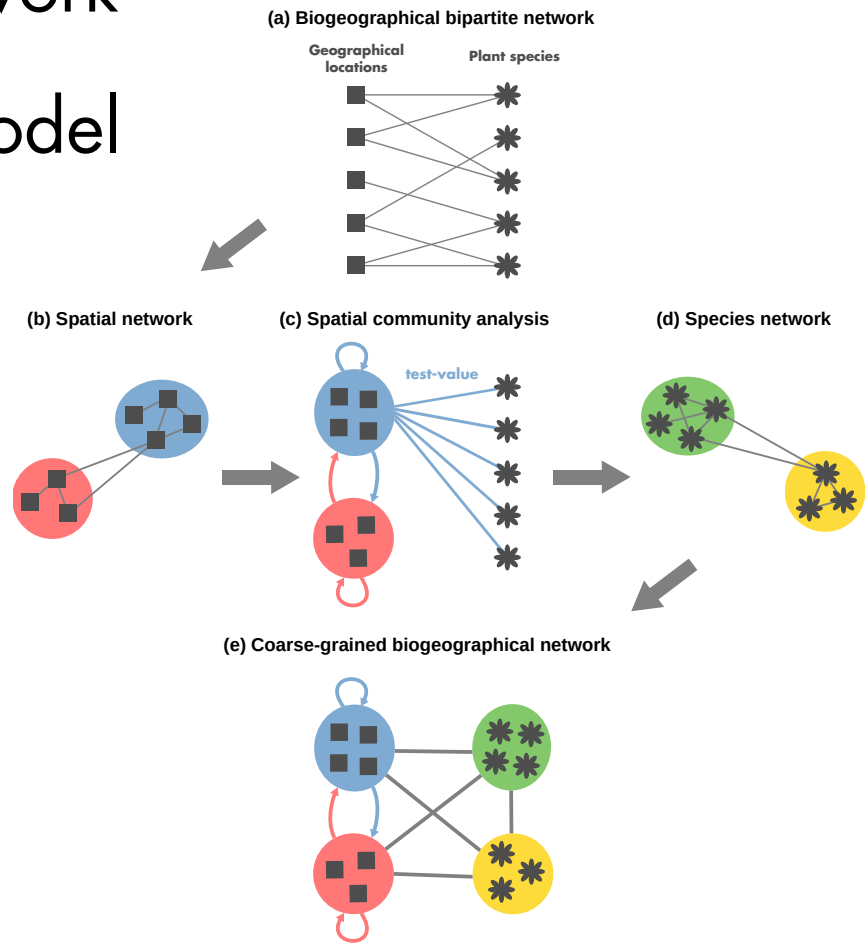
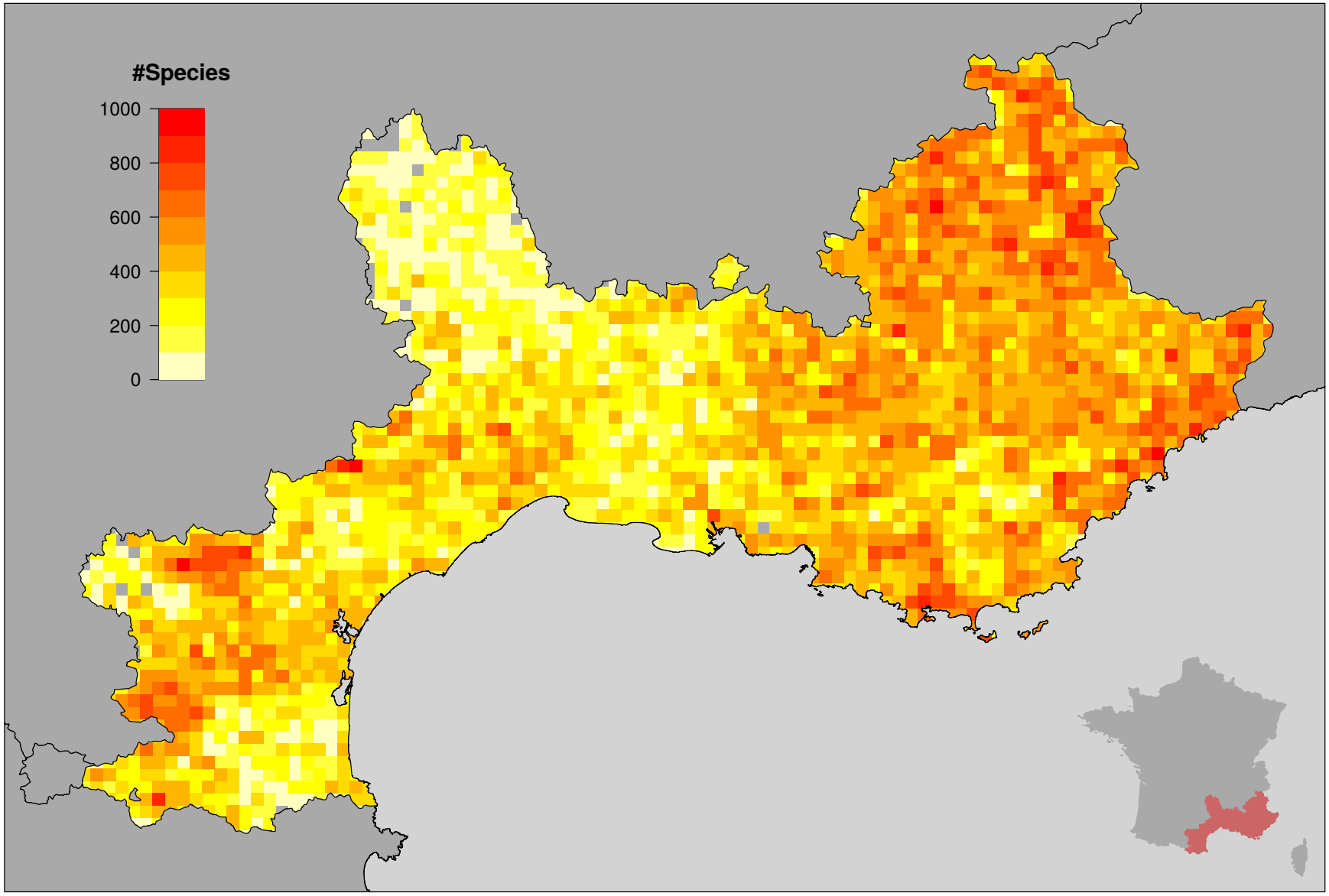
Motivation

- Multi-scale biogeographical structure of a region
- Species co-occurence network
- Comparison with a null model

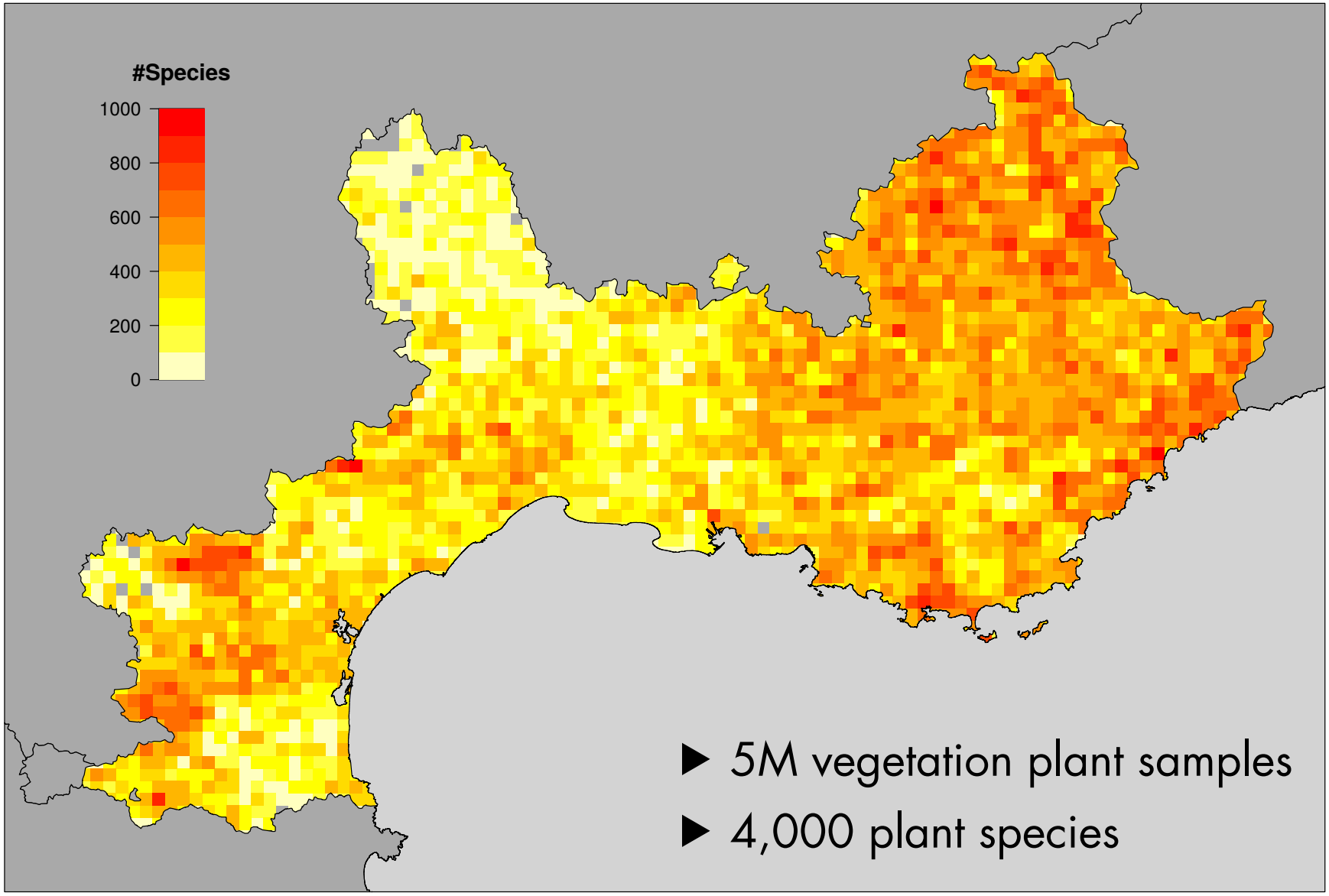




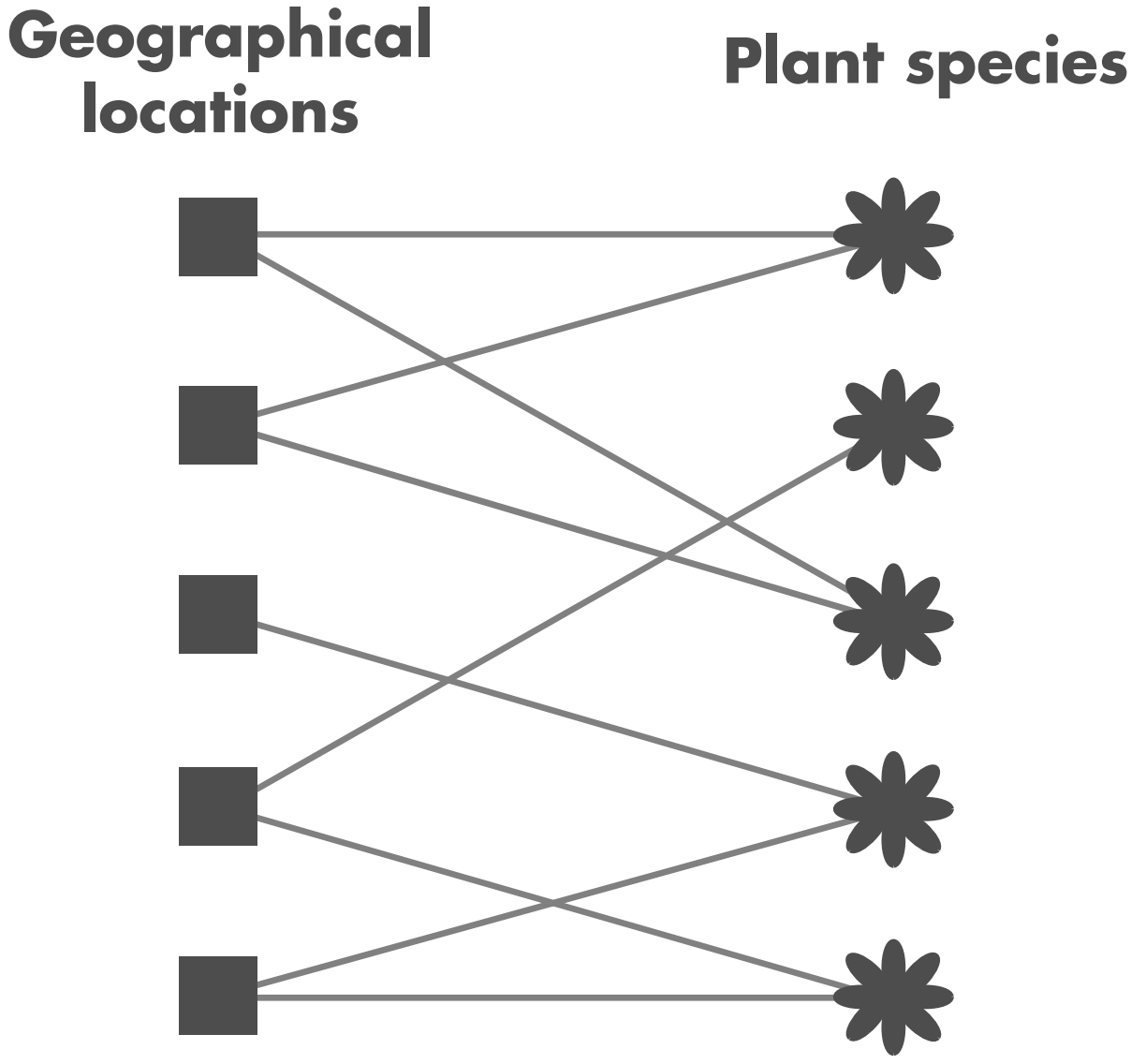
Study area



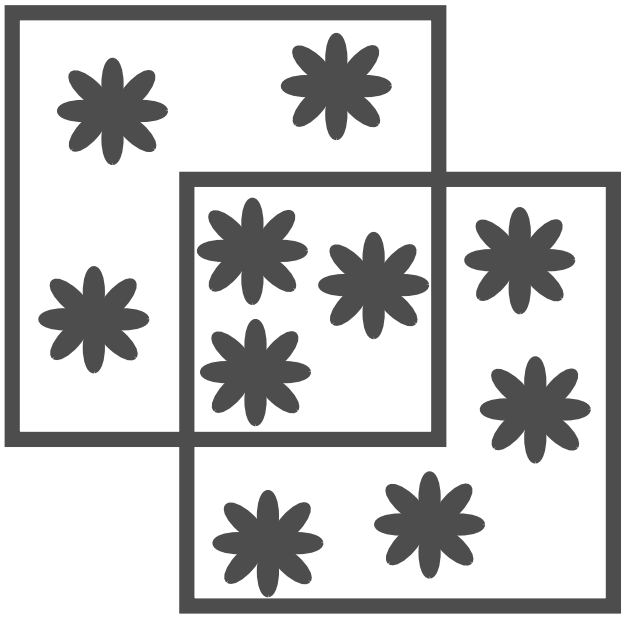
Study area


#Species
1000
800
600
400
200
0
▶ 5M vegetation plant samples
▶ 4,000 plant species

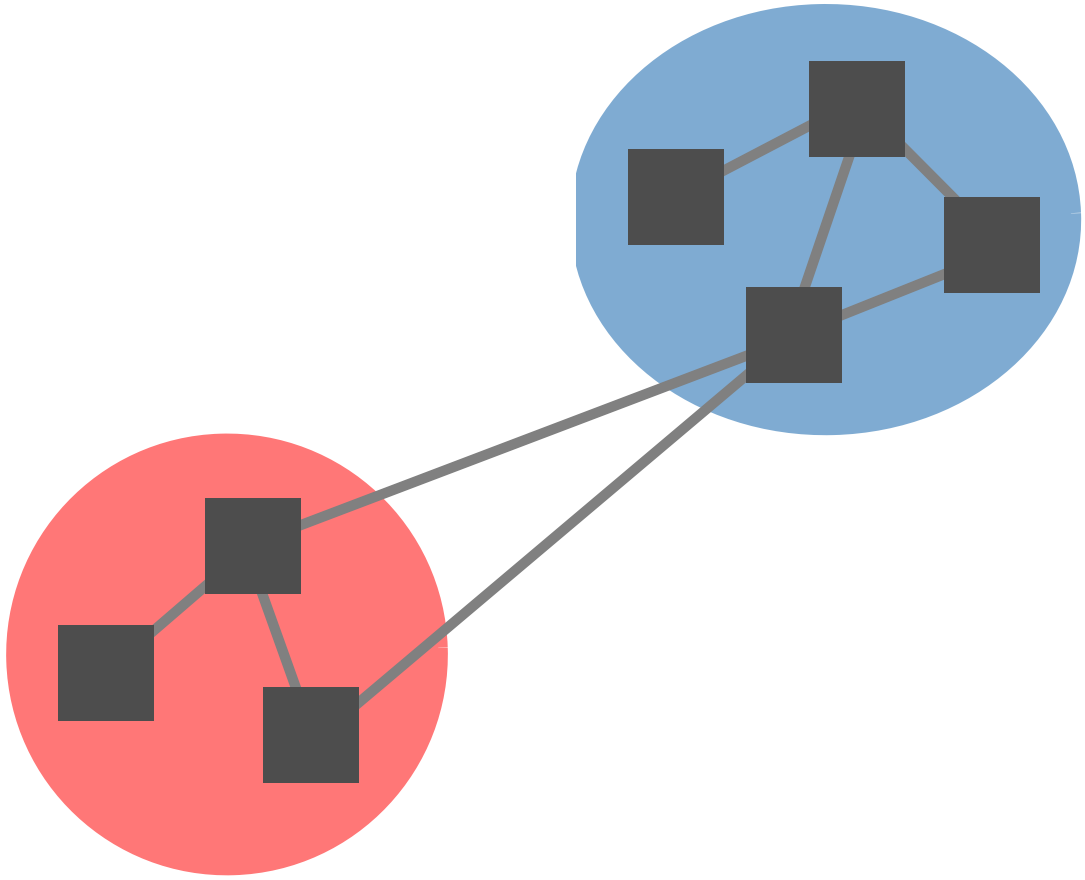
Spatial ecological bipartite network



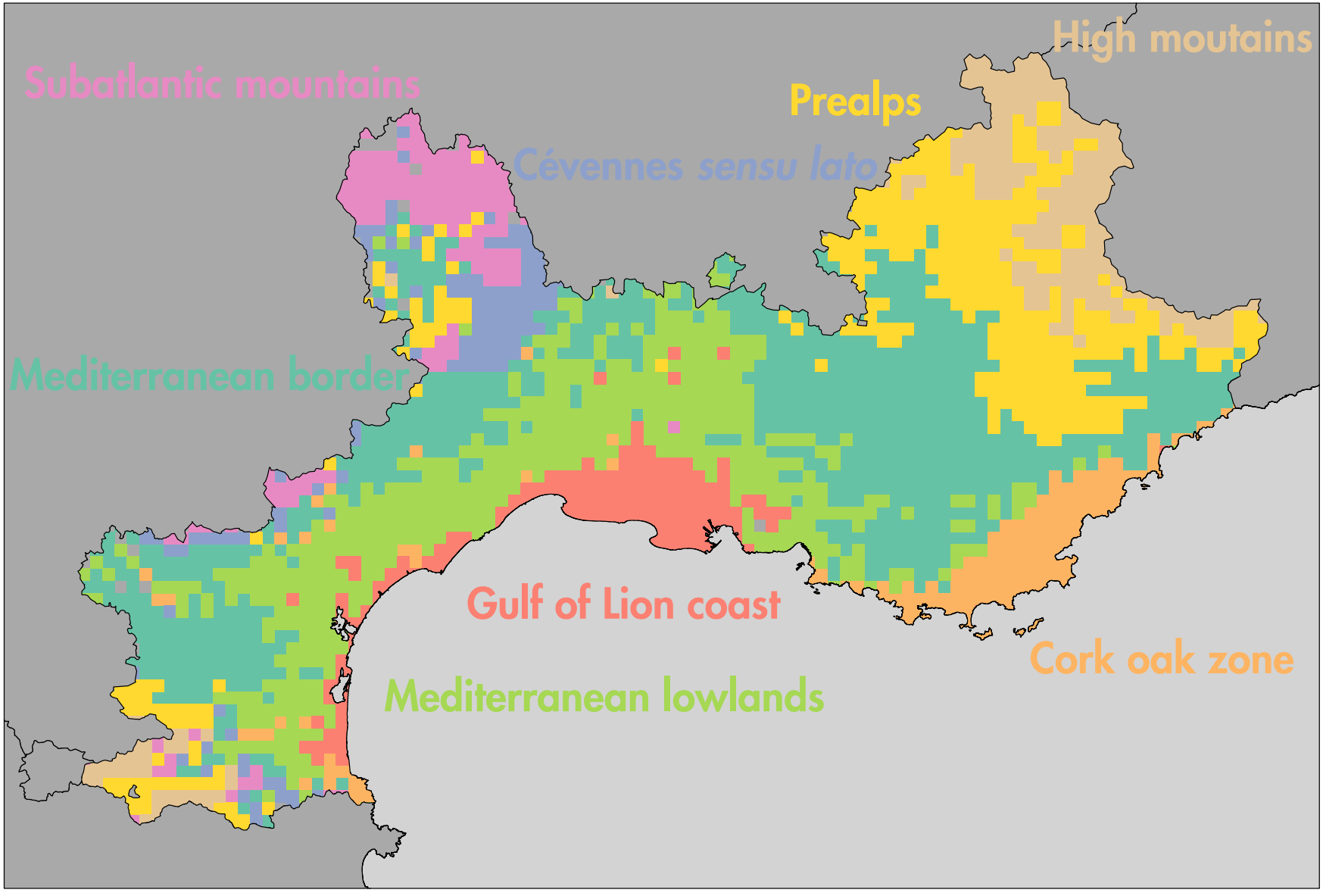
Spatial network



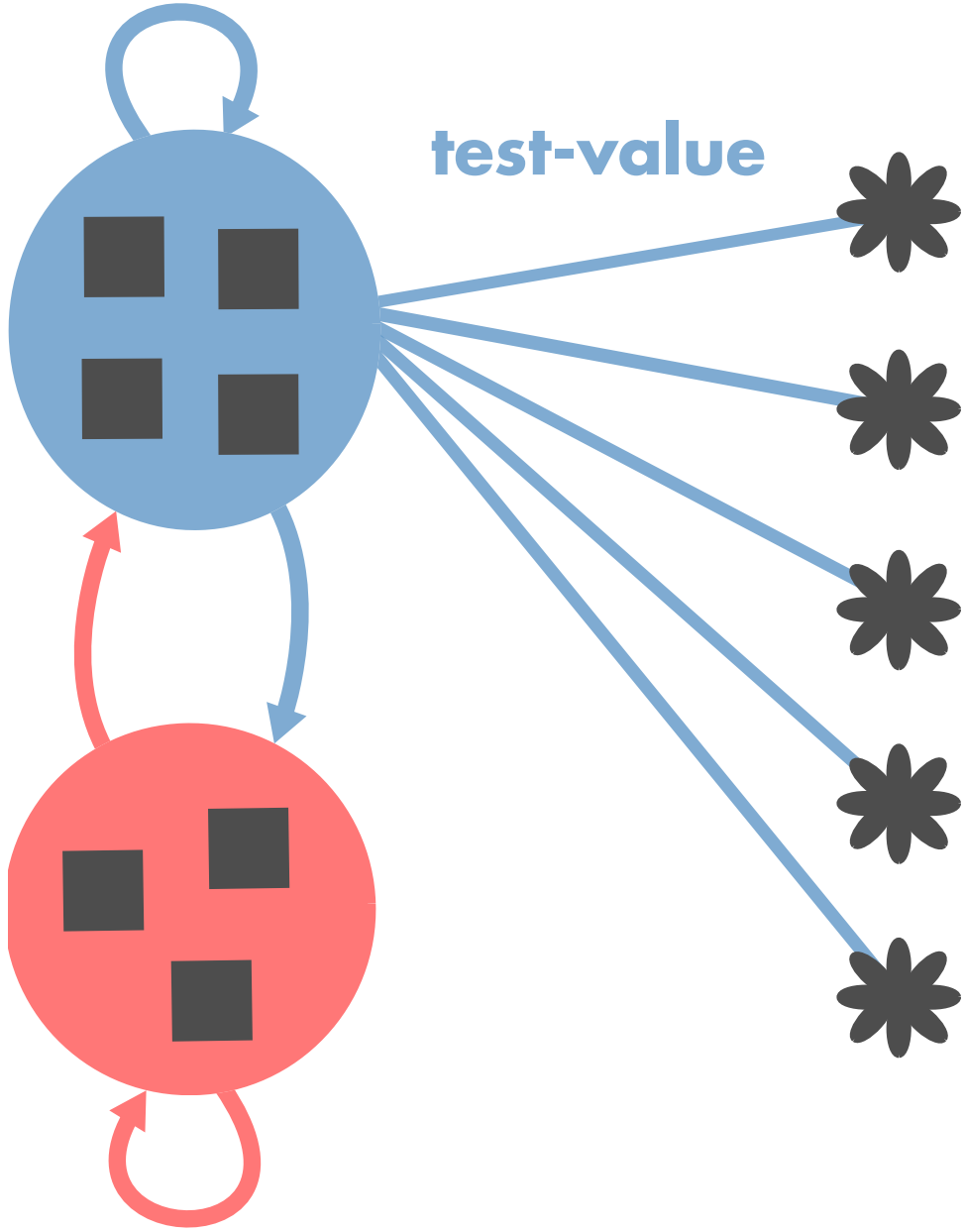
$$J_{ij} = 3/10$$



Coherent biogeographical regions



Spatial community analysis



Spatial community analysis

- **n** geographical locations
- species **i** present in $\mathbf{n_i}$ geographical locations
- spatial community **j** composed of $\mathbf{n_j}$ locations
- $\mathbf{n_{ij}}$ locations with species **i** in community **j**

$$\rho_{ij} = \frac{n_{ij} - \frac{n_i n_j}{n}}{\sqrt{\frac{n-n_j}{n-1}\left(1 - \frac{n_j}{n}\right)\frac{n_i n_j}{n}}}$$

Spatial community analysis

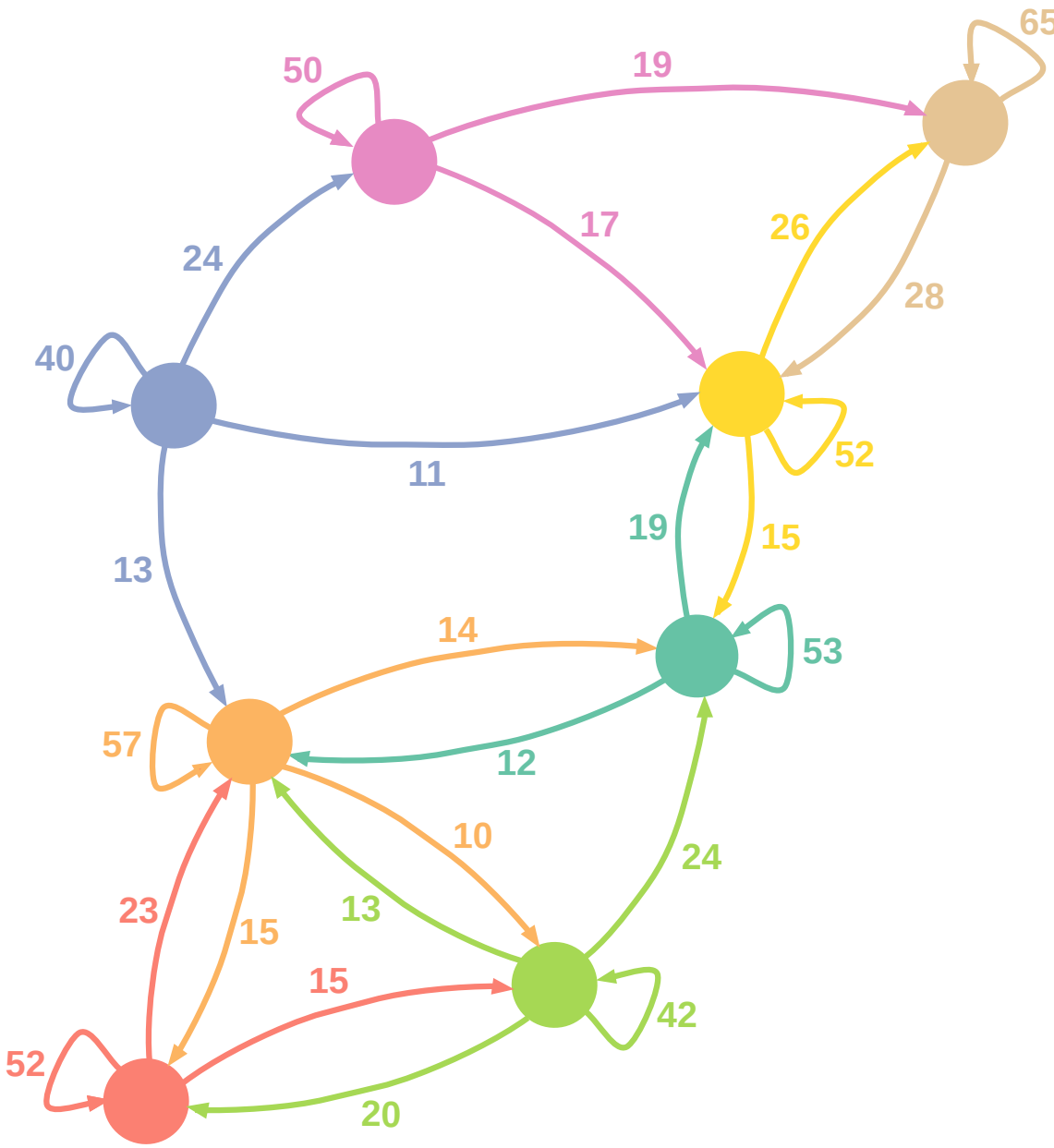
$$\rho_{ij}^{+} = \rho_{ij} 1_{\rho_{ij} > 1.96}$$

$$\hat{\rho}_{ij}^{+} = \rho_{ij}^{+} / \sum_i \rho_{ij}^{+}$$

$$\lambda_{jj'} = \frac{1}{|A_j|} \sum_{i \in A_j} \hat{\rho}_{ij'}^{+}$$

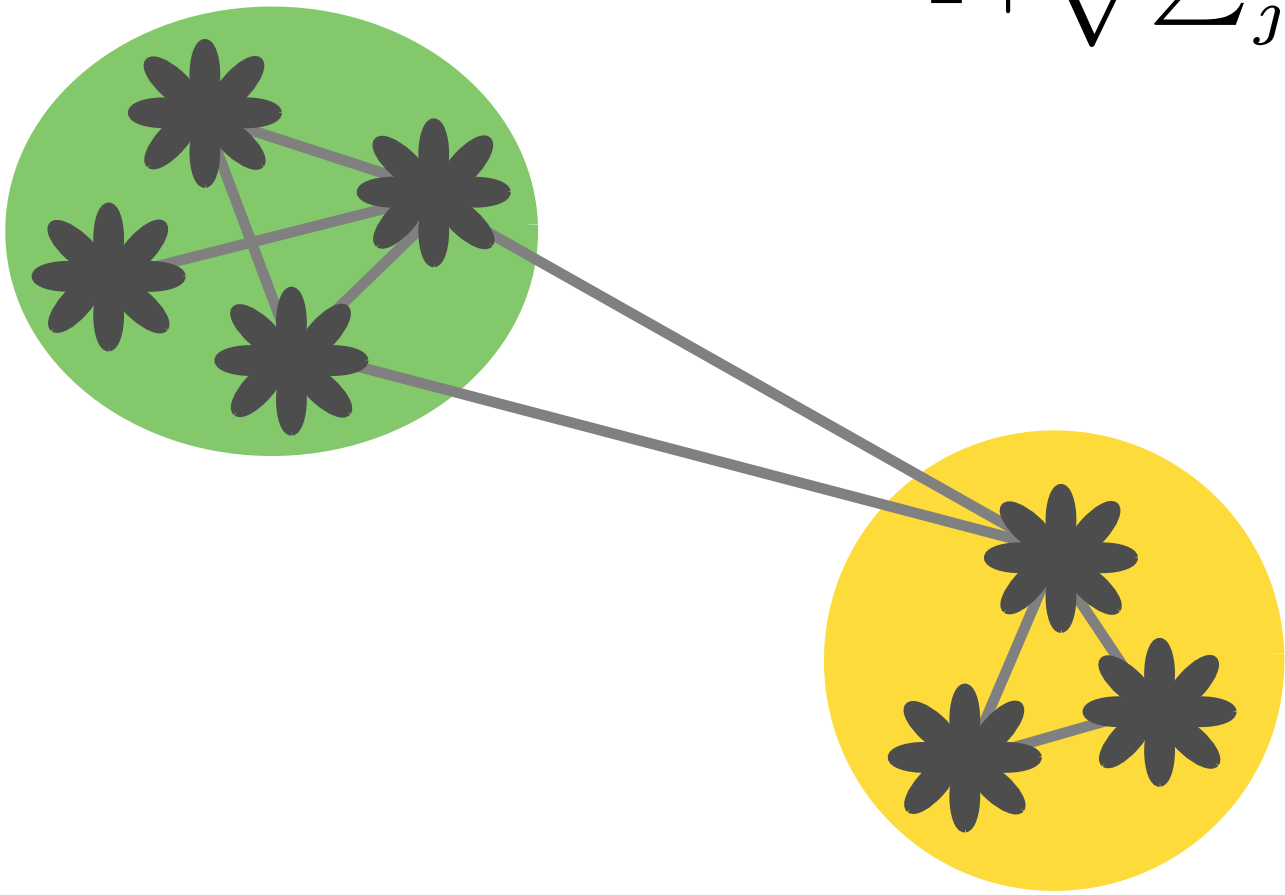
$$A_j = \{ i \,|\, \rho_{ij} > 1.96 \}$$

Spatial community analysis

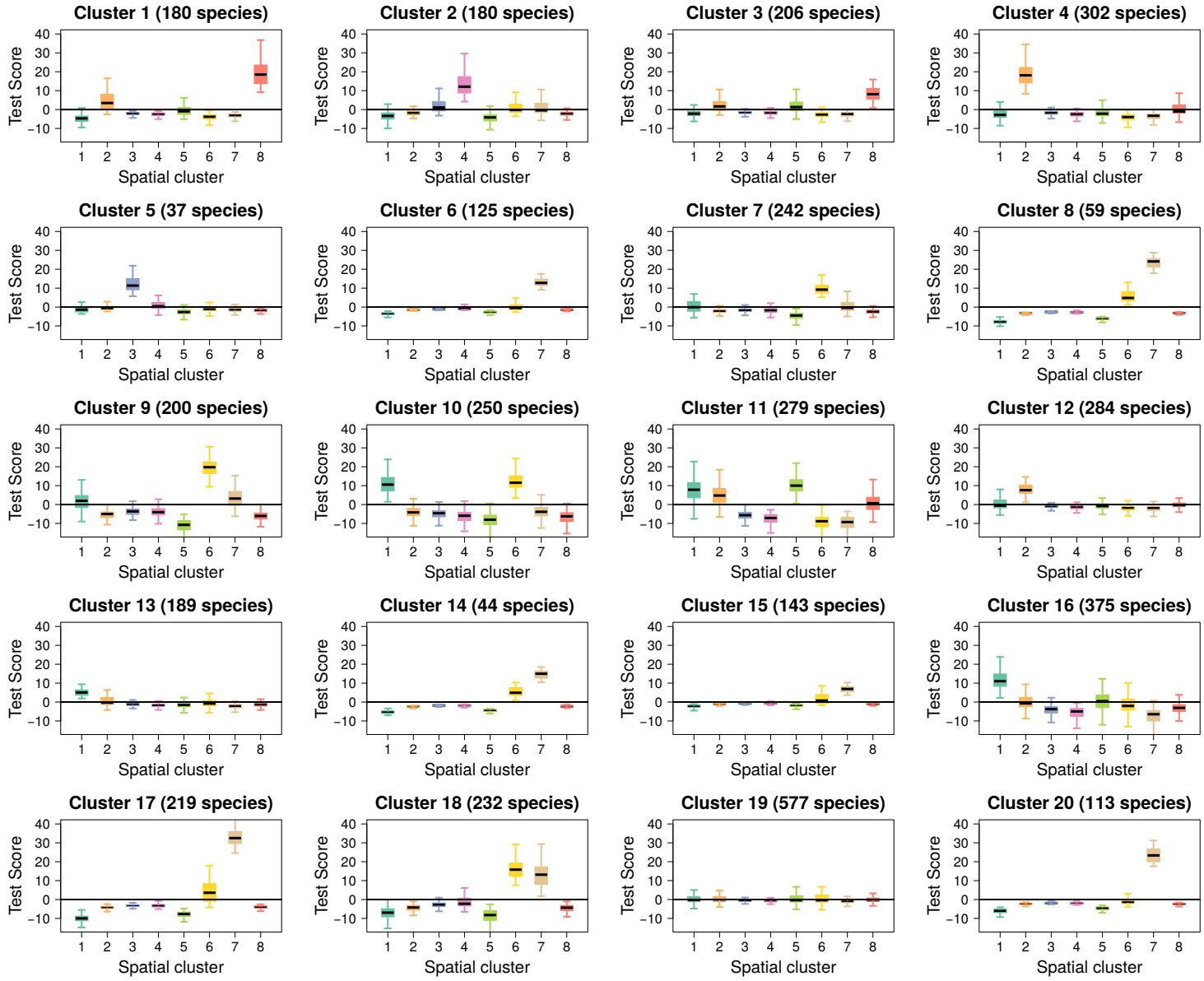


Network of species

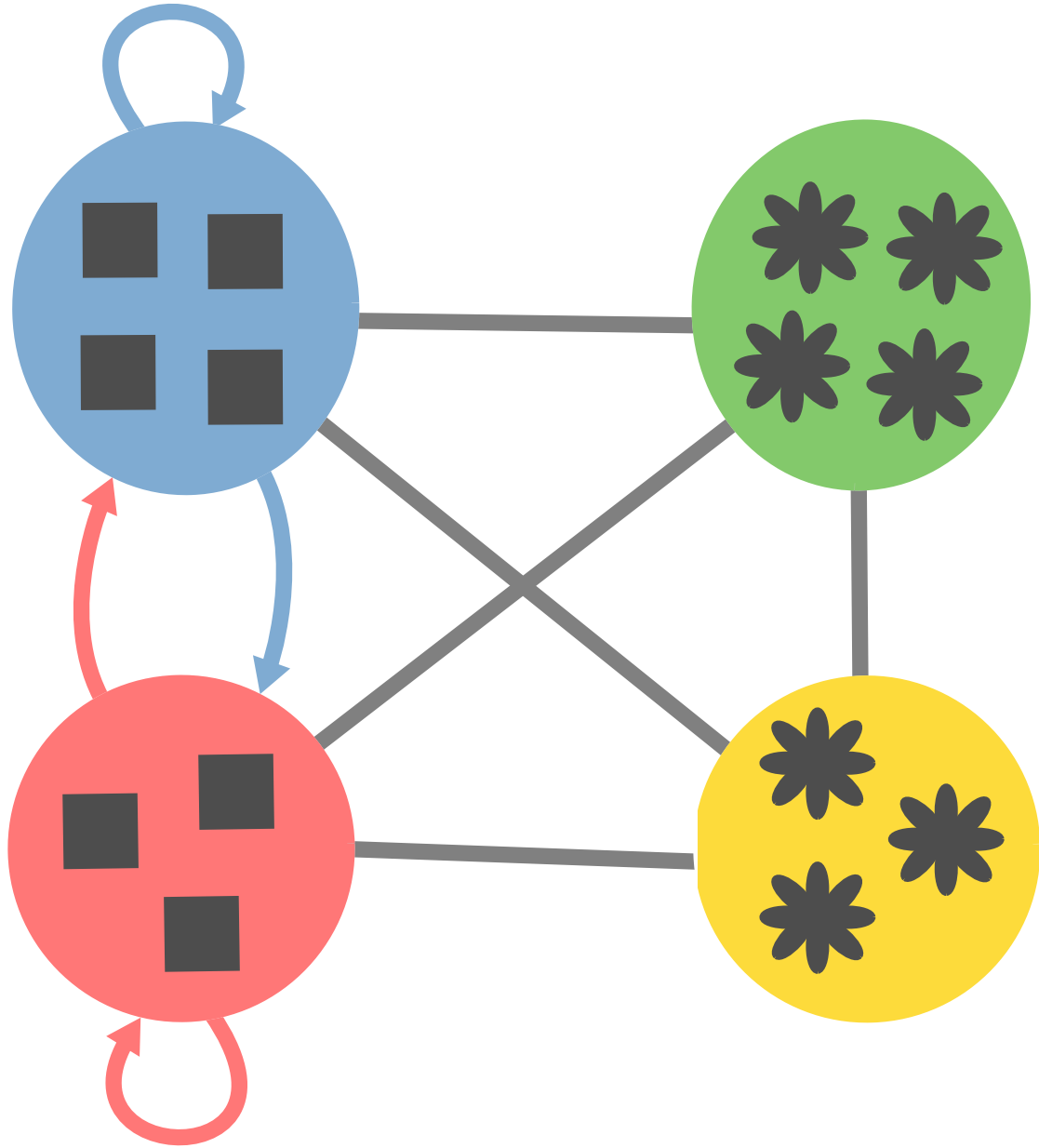
$$s_{ii'} = \frac{1}{1+\sqrt{\sum_j (\rho_{ij} - \rho_{i'j})^2}}$$



Network of species



Take home message



Acknowledgement

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