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

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

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**CCS 2017 | Cancùn, Mexico**

*September 19, 2016*

Conservatoire Botanique National  
Méditerranéen

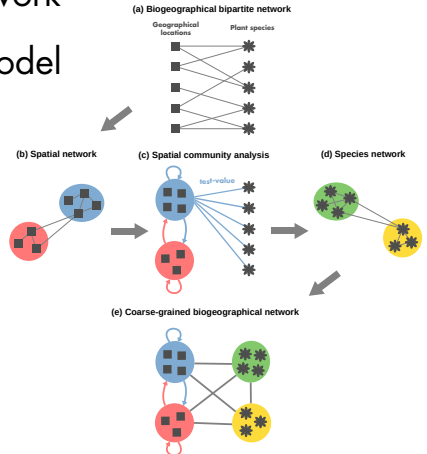
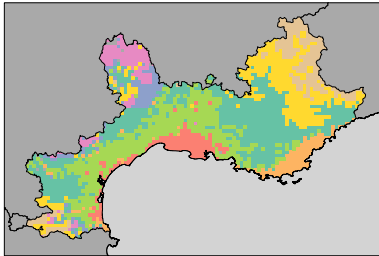


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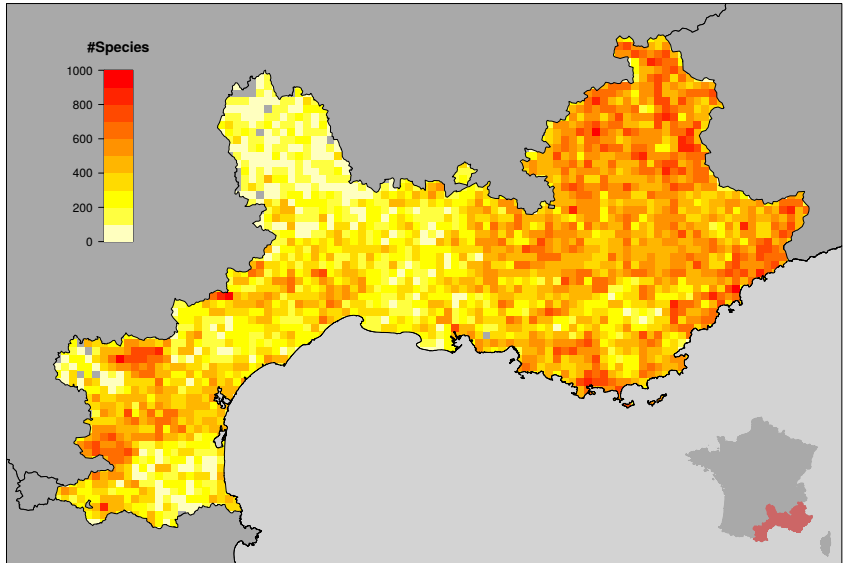


# Motivation

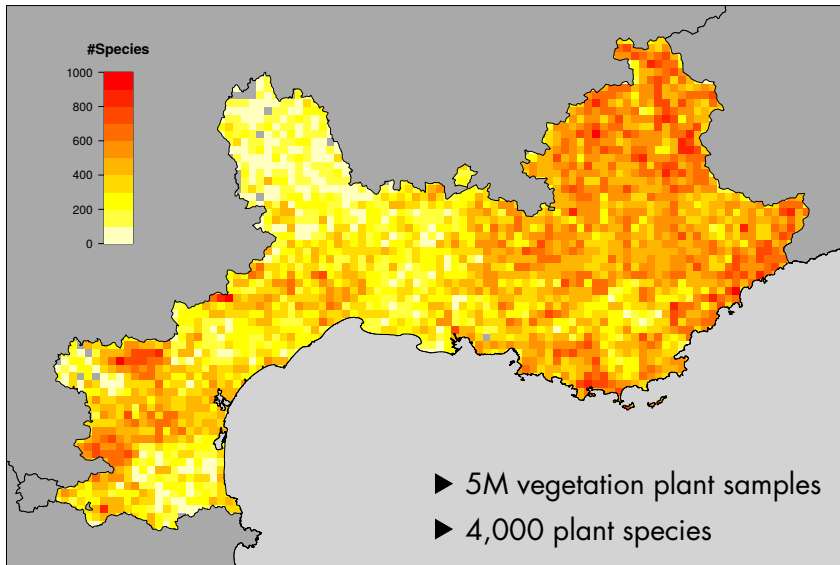
- ▶ Multi-scale biogeographical structure of a region
- ▶ Species co-occurrence network
- ▶ Comparison with a null model



# Study area



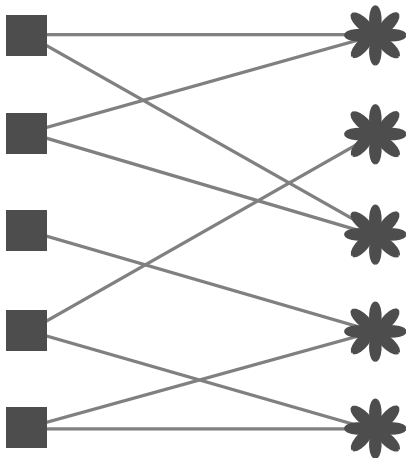
# Study area



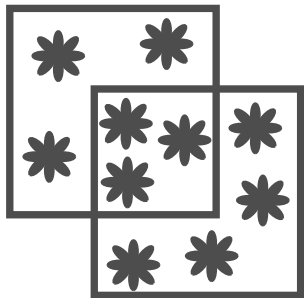
# Spatial ecological bipartite network

**Geographical  
locations**

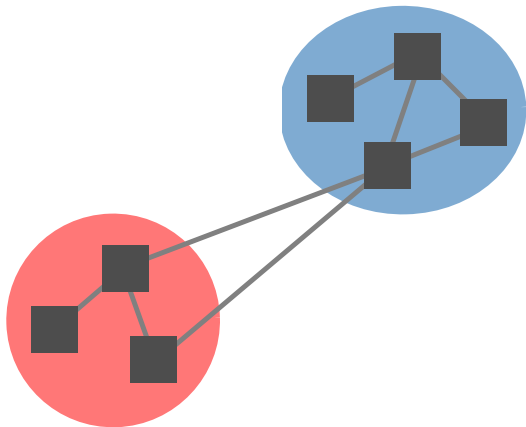
**Plant species**



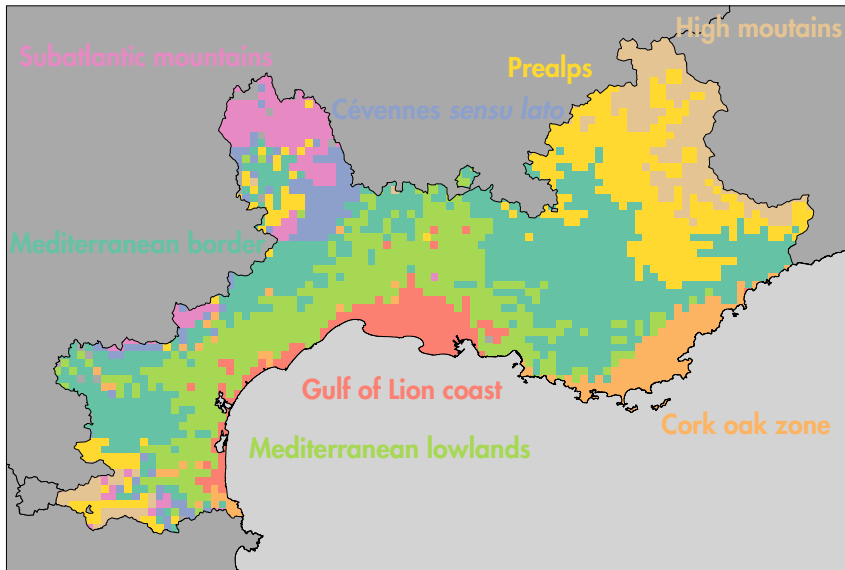
# Spatial network



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

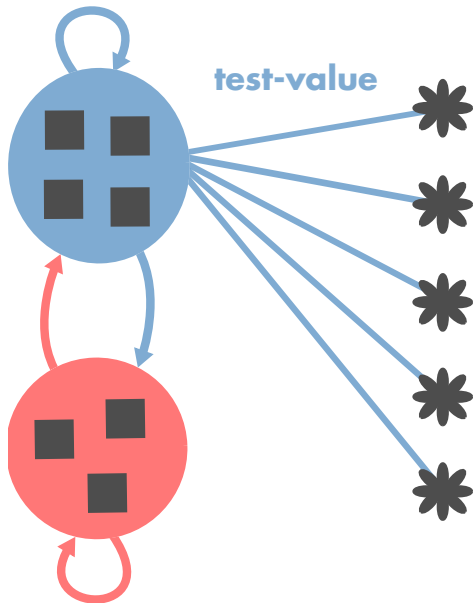


# Coherent biogeographical regions





# Spatial community analysis



# Spatial community analysis

- ▶  $n$  geographical locations
- ▶ species  $i$  present in  $n_i$  geographical locations
- ▶ spatial community  $i$  composed of  $n_i$  locations
- ▶  $n_{ij}$  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

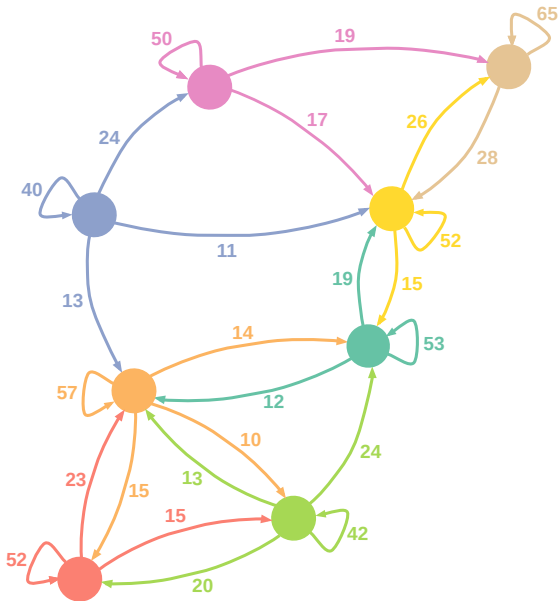
$$\rho_{ij}^+ = \rho_{ij} \mathbf{1}_{\rho_{ij} > 1.96}$$

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

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

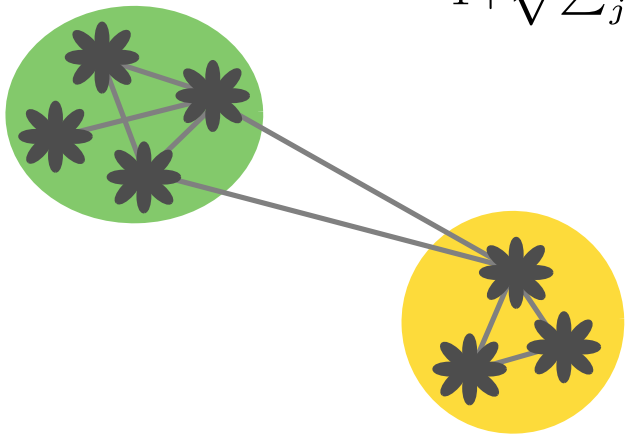
$$A_j = \{i \mid \rho_{ij} > 1.96\}$$

# Spatial community analysis

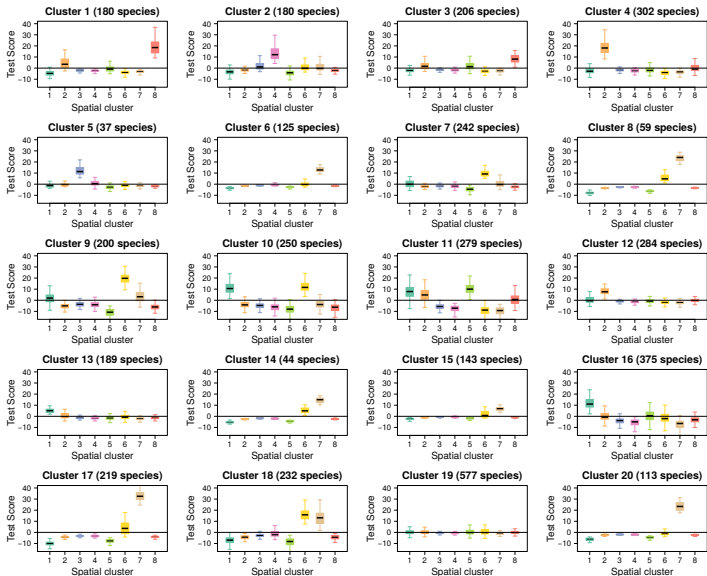


# Network of species

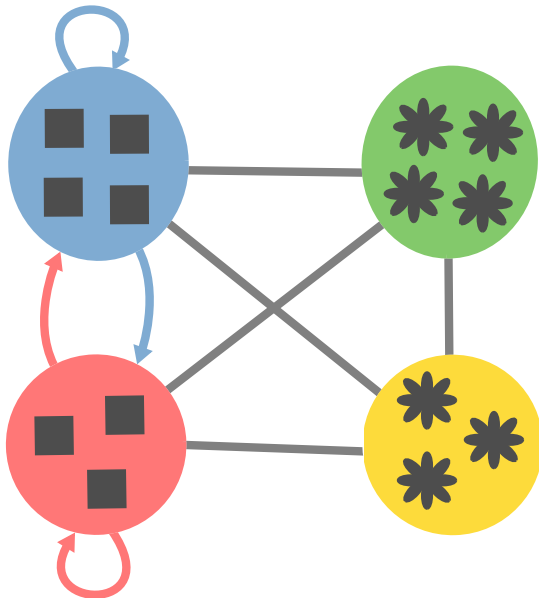
$$S_{ii'} = \frac{1}{1 + \sqrt{\sum_j (\rho_{ij} - \rho_{i'j})^2}}$$



# Network of species



# Take home message



# Acknowledgement



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Méditerranéen



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**Olivier Argagnon**