

# The role of bees in interaction networks with plants as a conservation argument

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## Conservation of pollinators

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- Conservation measures based primarily on threatened species lists
- Assessments ➤ species **diversity** and/or presence of **endangered taxa**

But...

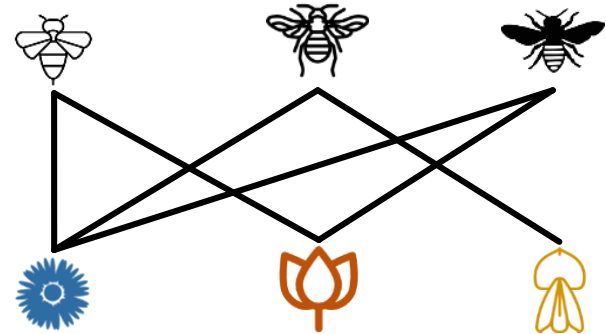
... taxonomical, ecological, morphological and “well-knownness” bias

... species share space and time with others ➤ frameworks of relationships

Introducing new criteria and a paradigm shift towards  
**conserving assemblages** and **ecological functions**  
to protect the **stability** of the ecosystem

## Interaction network analysis

- Represent biological interactions
  - Species = nodes
  - Interactions = links
- Architecture not random
  - supposed relationship between some structural features and stability/robustness against disturbances
  - the possibility of investigating species functional roles (niche)



## Interaction network analysis

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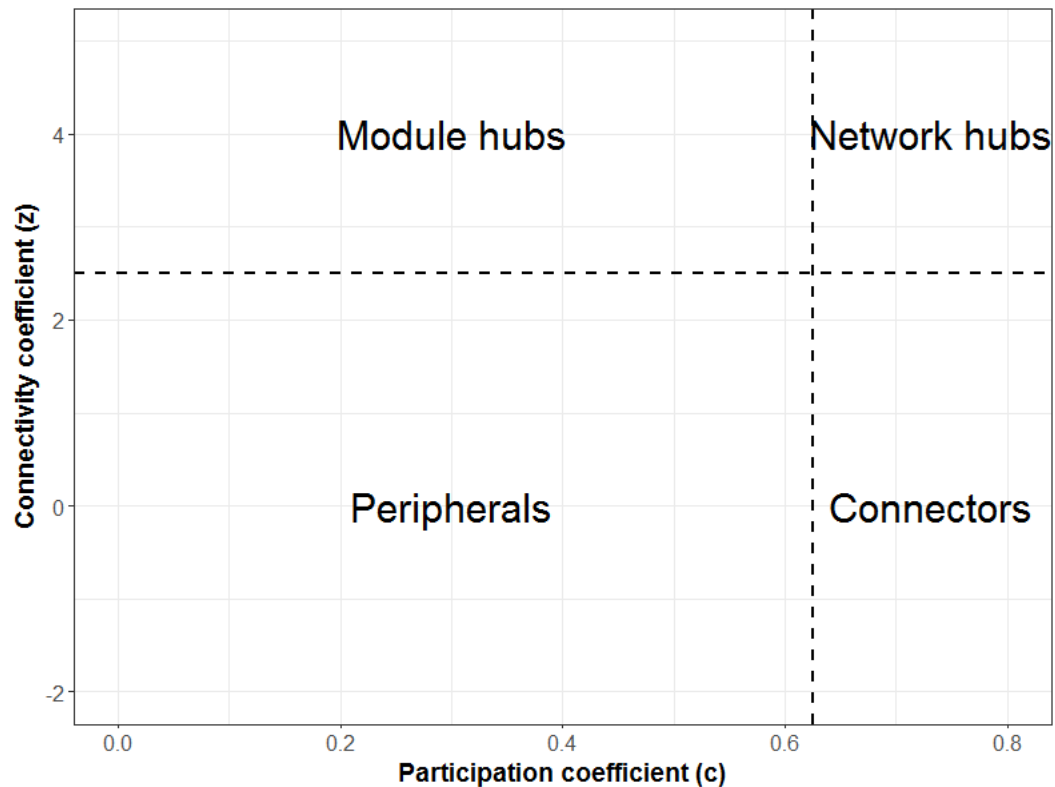
### ➤ Modular structure

- Tendency of species to interact more together than with species from other modules
- The more a network is modular, the more disturbances may be limited to a module
- Role of species
  - **Connectivity coefficient ( $z$ ):** standardized nb of links to other species in the module
  - **Participation coefficient ( $c$ ):** level to which the species is linked to other modules



## Interaction network analysis

- Assigning a **role** to each species based on their  $c$ - $z$  coefficients

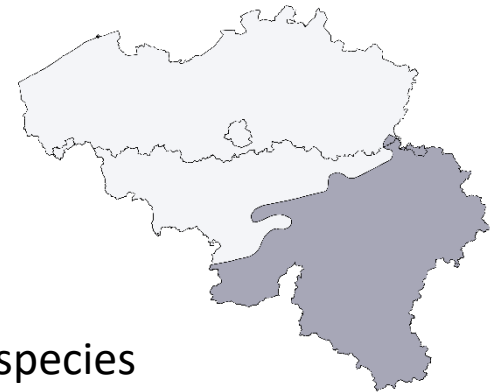


GUIMERA & AMARAL, 2005; OLESEN *et al.*, 2007

## Material & Method

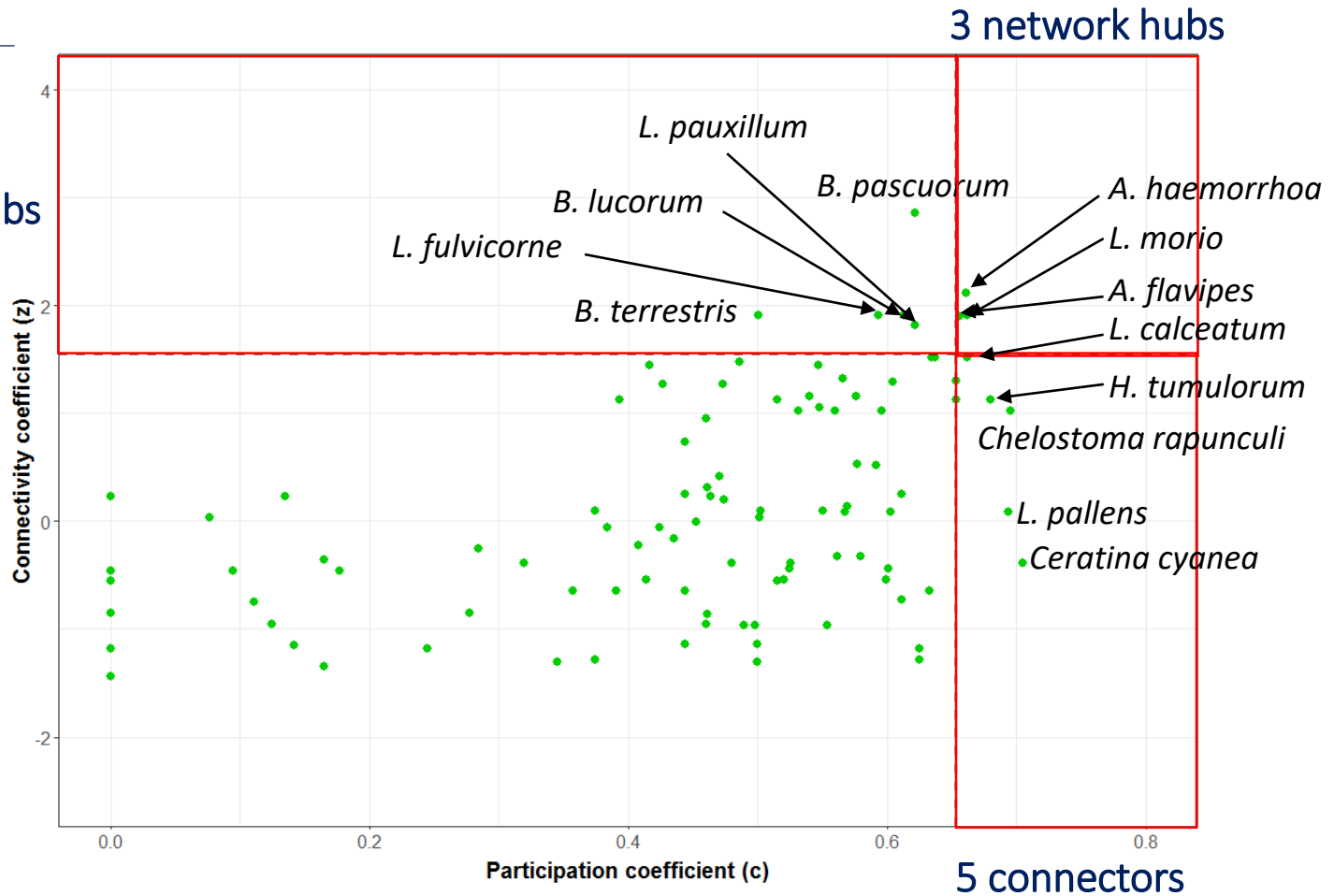
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- Continental bioclimatic region of Belgium
- Historical database (BDFGM) (> 1900)
- Binary interaction networks between bee and plant species  
(1990-2010: 795 interactions between 126 bee sp and 137 plant sp)
- Computation of bipartite **network modularity**
- Characterization of **bee species role** in the network according to their *cz*-coefficients compared to mean *cz* of species in null models



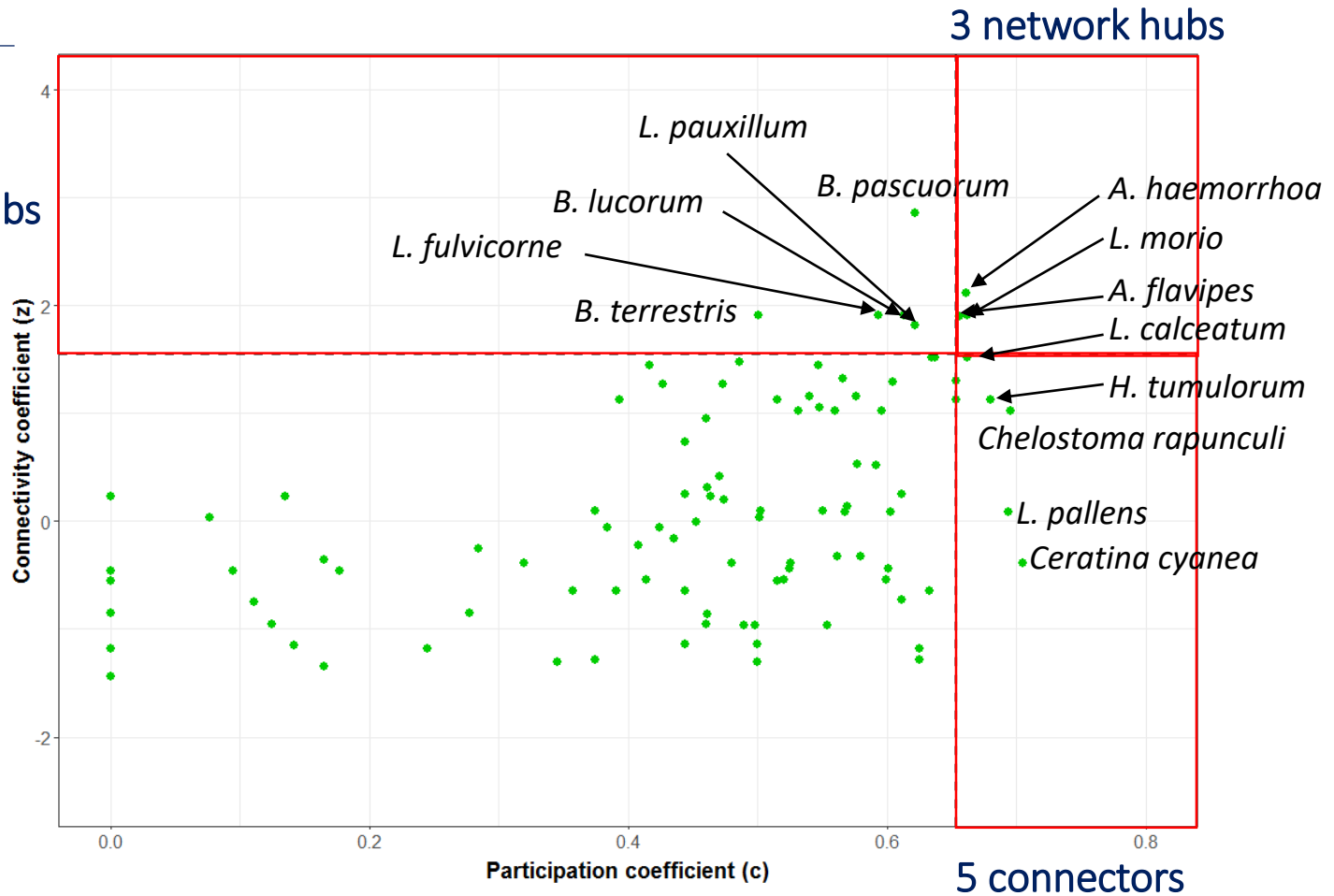
## Results

5 module hubs



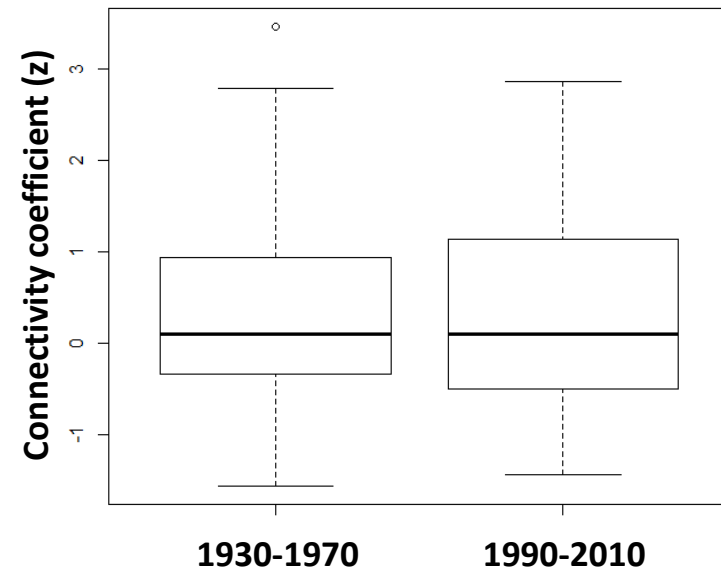
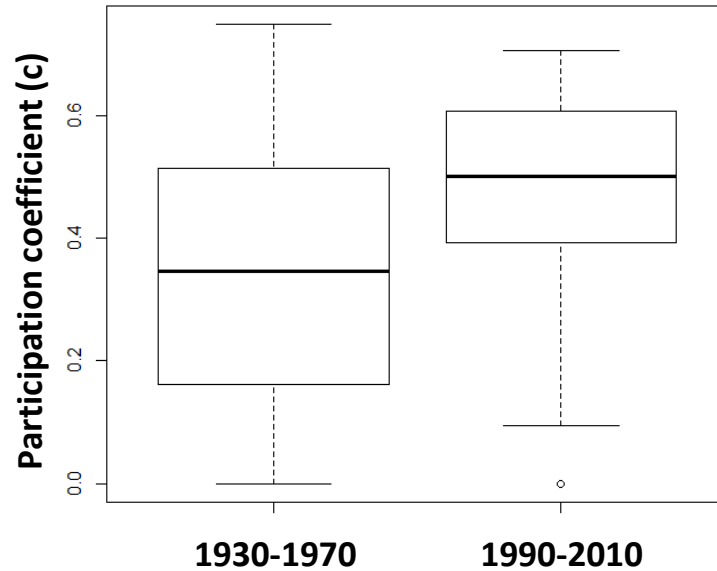
## Results

5 module hubs





## Results



- Five key species on both periods ➤ *A. haemorrhua*, *A. flavipes*, *H. tumulorum*, *L. calceatum*, *B. pascuorum*

## Conclusion

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Network analysis ► detecting key species for **network cohesiveness**

- **Large generalists**
- **Monitoring** (checking ecosystem functioning after restoration, sp introduction,...)
- **Role of plants** should be considered in order to identify essential resources  
JACQUEMIN et al. (poster n° 211 Session 3 on 20 September) *Spatio-temporal floral resource shifts in Belgium*
- Bee species currently targeted by conservation measures are peripherals
  - **High heritage interest** ► protection of key species could help to preserve the greatest number of interactions and support many of these species.

TYLIANAKIS et al., 2010; KAISER-BUNBURY & BLÜTHGEN 2015;  
LEANDRO et al., 2017; BIELLA et al., 2017; GRENIÉ et al., 2017; VIOLLE et al., 2017



**Thank you for your attention**

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