Spatio-temporal floral resource shifts in Belgium

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- Introduction -

In recent decades, the intensification of agriculture and urbanization has been followed by an **overall loss of biodiversity in the Belgian countryside** [1]. Such landscape disturbances led to an overall reduction of floral resources availability at a country-wide scale [2].

The **wild bee decline** was highlighted in the 1980s in Belgium [3]. Because flowers are key resources for bees, the wild bee decline is likely to be partly caused by a loss of their plant resource diversity. We tested here if there is a link between plant resource dynamics and the status of bees (declining *vs* stable bee species).

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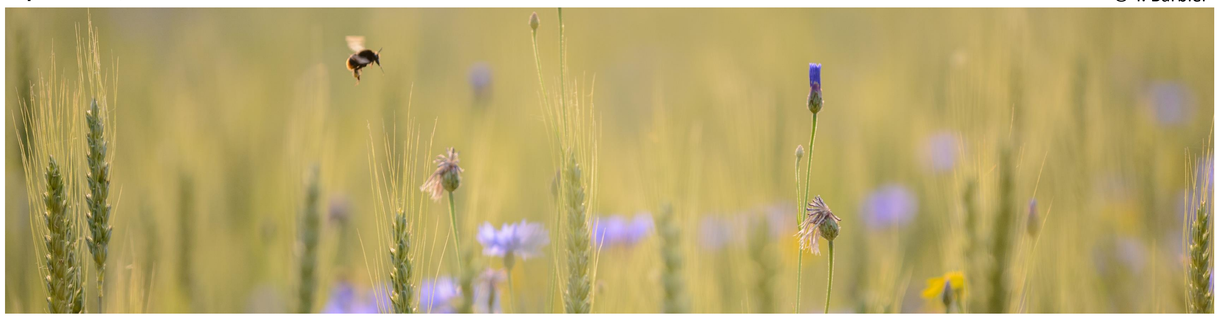

- Materials and Methods -

Compilation of floristic data

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Identification of floral resources

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Mapping temporal shifts

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Diff. declining *vs*. stable bees

- **7 million of plant species data**
- Resolution of 4*4 km squares
- **Two periods** compared (1930-1970 *vs* 1970-2017)
- Selection of **well-sampled squares** [4]

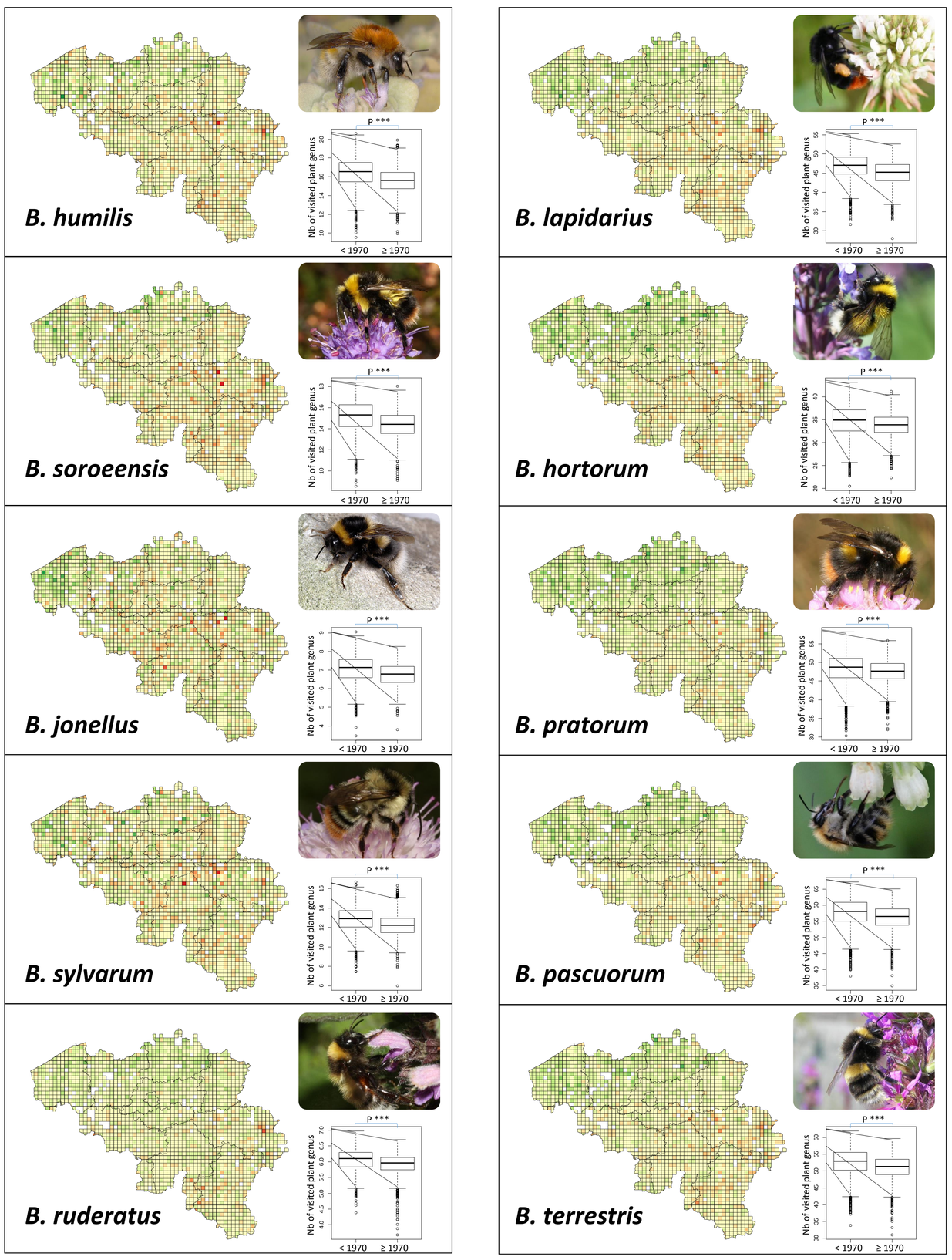
- Plant genus visited by **five declining and five stable bumblebees** [6]
- Information from **interaction network data** recorded in Belgium (database of UMons & ULiège) [5] and **pollen loads** [6,7, 8]

- **Rarefaction** to correct sampling bias per period
- Computation of shifts of resource diversity as **(div2-div1)/(div2+div1)** with div1 and div2 = genus resource diversity before and after 1970, resp.

- Comparison of **resource genus diversity** between periods (Wilcoxon tests, paired = T) and **rate of change** between declining and stable bees (Wilcoxon test).

- Results -

Declining species ⟷ P*** ⟷ **Stable species**



- We observed a significant decrease of diversity of visited plant genus for all bee species (p-value < 0.001)
- This decline of resources is significantly higher in the case of declining bee species (p-value < 0.001)
- Positive shifts of floral resource diversity are mainly located in the North of Belgium (Flemish region).

- Conclusion and perspectives -

The observed decrease in resource diversity is consistent with the drastic land use changes observed in Belgium during the last century [1]. However, sampling biases may persist despite rarefaction of our plant*IFBL square matrices. This could be partly responsible of the increasing diversity in the Flemish region.

Although its effect on bee population is combined with other factors (pesticides, diseases,...), this analysis **suggests a link between floral resource dynamics and the decline of bees** which depend on them.

Shifts of resource diversity being probably continuous, we would like to verify these shifts on shorter periods. The use of other indices (e.g. abundance) would be tested.

The lists of plants used as resources by the studied bees will also be implemented by complementary data (e.g. GBIF). If you wish to collaborate and share additional data or other data that could allow us to extend the analysis to other genus of wild bees, **contact us**!

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REFERENCES: **[1]** HANCE et *al.*, 2010. *Agriculture et biodiversité;* **[2]** GOULSON et *al.*, 2015. *Science*; **[3]** LECLERCQ et *al.*, 1980. *Notes Fauniques de Gembloux*; **[4]** BIESMEIJER et *al.*, 2006. *Science*; **[5]** RASMONT et *al.*, 2015. Biorisk; **[6]** KLEIJN & RAEMAKERS, 2008. *Ecology*; **[7]** MOQUET, 2017 (thesis); **[8]** ROGER et *al.*, 2017. *Global change biology*.

ACKNOWLEDGEMENTS: we would like to thank Yvan Barbier (DEMNA), Wouter Van Landuyt (INBO), François Ridremont (ULg, Gembloux ABT), Claude Dopagne (ULg) and Hugues Lecomte (DEMNA for the IPRW) who provided floristic data. © BWARS, Atlas Hymenoptera, M. Folschweiller & S. Vray.

This study was supported by the BELBEES Project "Multidiciplinary assessment of BELgian wild BEES decline to adapt mitigation management" (BELSPO ; BR/132/A1/BELBEES); the SAPOLL Project "Sauvons nos pollinisateurs/Samenwerken vor pollinators" (Interreg V fwvl), this programme is co-financed by the European Regional Development Fund; and the European Research Council (ERC) Starting Grant Project "Ecophysiological and biophysical constraints on domestication in crop plants" (Grant ERC-StG-2014-639706-CONSTRAINTS).