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## Landscape context affects the abundance & diversity of bees on annual crops in Europe

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### Introduction

Bee populations are declining worldwide (Biesmeijer *et al.* 2006), and this loss may alter the stability of the pollination service bees provide (e.g. Chapin *et al.* 2001). It is therefore urgent to better understand the relationship between bee populations and biogeographic conditions. We assessed the impact of landscape contexts on the abundance and diversity of bees. The same protocol was used in 5 countries over Europe (France, Germany, Poland, Sweden & the United-Kingdom) in order to be able to generalize results on a larger scale.

### Methods

Bees in 5 crops (one per country) were sampled over a total of 45 sites x 4 dates in 2005 and a detailed land-use classification was used in a 3 km radius around each study site ((CORINE Land cover database). We extracted landscape parameters (nature & structure) using GIS & specific software (GRASS & FRAGSTAT). Then we used multivariate methods (correspondence, clustering, and partial least-square regression analyses) to quantify the impact of landscape features and geography on the abundance and diversity of bees in Europe at the sub-generic taxonomic level.

### Results

Three groups of bees emerged based upon their diversity and abundance patterns (1-Poland, Germany & Sweden; 2-United-Kingdom; 3-France). Overall abundance and diversity were positively affected by some natural habitat, such as transitional woodland-shrub, but also by some urban habitat, such as sport and leisure facilities and crops, such as pastures. But there were differences among the three groups due to the specific habitat response from the bees that dominated each group. We characterized bee groups that were positively affected either (i) only by natural habitat, (ii) only by urban habitat, (iii) by some natural, urban and crops habitats. Despite different pollinator guilds among the countries and crops, the landscape context still had a significant effect on the abundance and diversity of bees.

### References

- Biesmeijer, JC *et al.* (2006) Parallel declines in pollinators and insect-pollinated plants in Britain and the Netherlands. *Science*, **313**, 351-354.
- Chapin, FS *et al.* (2000) Consequences of changing biodiversity. *Nature*, **405**, 234-242.