

# BELBEES

## Multidisciplinary assessment of BELgian wild BEE decline to adapt mitigation management

DURATION  
1/12/2013 – 28/02/2018

BUDGET  
1 311 899 €

### PROJECT DESCRIPTION

Recent researches show a general decline of pollinators in the world. With a long naturalist tradition, the dynamics of biodiversity in Belgium is one of the best known in the world. A previous analysis of the distribution of wild bees showed that out of 360 species, almost one third were already extinct or in regression. Since then, the situation is probably worse as in other countries. However, we lack detailed data to assess both the magnitude of the decline and the nature of the explanatory drivers involved. Now, environmental and economic issues related to pollination ecosystem service "pollination" become critical. Some restoration actions are launched at the federal and regional levels, but it is essential to clearly identify the causal factors and their combination in order to act properly.

Several hypotheses are cited to explain the disappearance of pollinators:

- climate change
- changes in the structure of rural landscapes that increase the fragmentation and isolation of populations leading to loss of genetic diversity
- increasing agricultural intensification and standardization of production processes eliminating food sources
- the use of pesticides that may have direct and indirect effects on populations of pollinators
- the development of diseases

The general goals of the project are: 1) to collect and analyze data on recent changes in wild bee populations in Belgium, and 2) to assess the respective roles of different assumptions on the decline to identify field action combinations needed to restore pollination service in agro-ecosystems.

A very important historical material is available in the Belgian collections (> 200,000 specimens). Since only a part of the collections is checked and encoded, an essential step is to complete or validate the taxonomic identifications and to store detailed observations. When on a locality old data are sufficiently numerous to be a past reference, new entomological samples will be collected in similar conditions to measure the differences in species composition, the composition of pollen collected, the presence of some pesticides, and diseases. Databases of explanatory factors will be developed to test climate change, land use and floral resources hypotheses.



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These two sets of data will perform the following **specific analyses**:

- dynamic trend of the geographical distribution of species, using the methods of maximum entropy and Bayesian probabilities for correct sampling and detectability bias
- spatial dynamic of food preferences by comparing the pollen loads of old and new samples in the same areas;
- spatial dynamic of food resources using flora distribution atlases in ancient and modern Belgium
- genetic diversity evolution of the DNA of old and new samples to quantify the genetic diversity and identify possible bottlenecks;
- landscape dynamics (land use and structures) related to pollinators;
- spatial dynamic of invasions viruses and other pathogens in ancient and recent samples;
- spatial dynamic of pesticide use by literature review and comparing the residues in past and recent samples.

A **comprehensive comparative analysis** will identify the specific or different driver combination roles using the techniques of meta-analysis, path-analysis and multivariate variance partitioning methods taking into account spatial and temporal covariates. Overall, these analyses will measure the proportion of variance explained by different factors and their interaction with covariance. As all regions will not show the same pattern at the same time, the geographical variation of the dynamics of these interactions should increase the power of the analysis.

The analysis of the key factors of bee populations will check all major hypothetical causes of their decline. It will help to identify the typical characteristics of landscapes and land use that are more favorable to wild bees and therefore targeting agricultural policies and development of the most efficient landscape to meet in short-term at the global pollinator crisis. Doing so, our project is fully in line with the Federal Bee Plan in terms of care for bee health and plans for bee conservation. All results will be published in international peer-review papers, BELSPO reports, BELBEES meetings, and general audience publications.



## CONTACT INFORMATION

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## LINKS

<http://www.zoologie.umh.ac.be/index.html>  
<http://www.zoologie.umh.ac.be/hymenoptera/>