

# Trends of bumblebee (*Bombus*) populations in Belgium: a 100-year record

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## Introduction

Bumblebees are among the most essential pollinators for their services to both natural ecosystems and agricultural production [1,2].

However, they are undergoing a strong decline [3-6] fostered by habitat loss, fragmentation and degradation through agricultural intensification [7-11].

More recently, several studies have also implicated climate change in their decline [12,13].



*Bombus lapidarius* on *Trifolium repens*.



*Bombus pascuorum* on *Symphytum officinale*.

The aims of this project are to :

- 1) Collect and analyze data on **changes in bumblebee populations** in Belgium during the last century ;
- 2) Assess the respective roles of **land use and climate changes** in the decline of bumblebee populations.

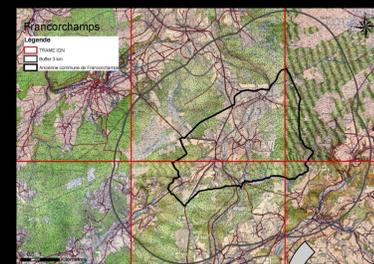
Here, we present preliminary results about the land use changes and the changes of bumblebee communities in Belgium.

## Methodology

We use a comparative approach based on past and present land use and bumblebees data in Belgium, between 1910 and nowadays.

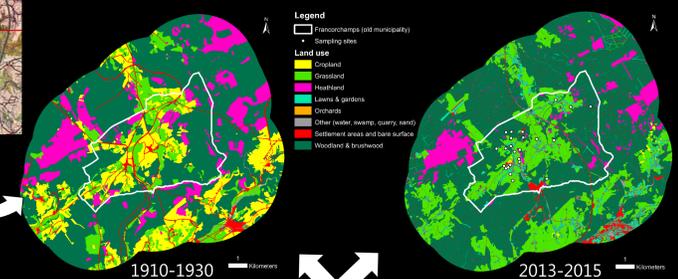
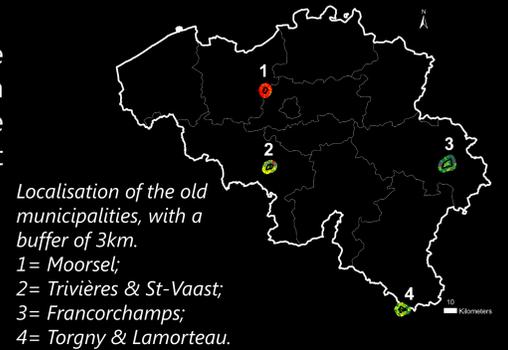
For fieldwork and land use analyses, we focused on 4 localities in the different biogeographical regions of Belgium.

Species richness and Hurlbert's index are computed for both periods. The formula for Hurlbert's index used here is the simplified version proposed by Rasmont *et al.* 1990 [14].



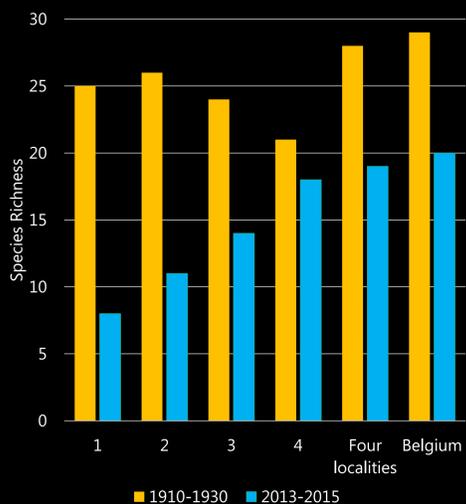
Old topographic maps were manually vectorised and classified in 8 land use types using ArcGIS 10, in a buffer of 3km around the old municipality. Here the example of Francorchamps (n°3).

Data sources	1910-1930	2013-2015
Bumblebees	Ball's collection (RBINS)	Fieldwork
Land use	IGN (topographic maps)	IGN (Top10Vector)

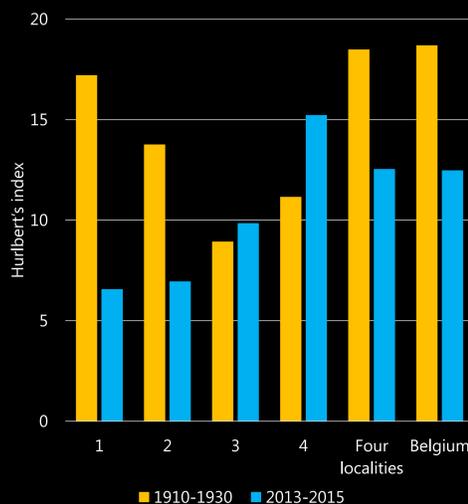


Old land use maps were then compared to recent land use maps (Top10Vector reclassified in the same 8 land use types)

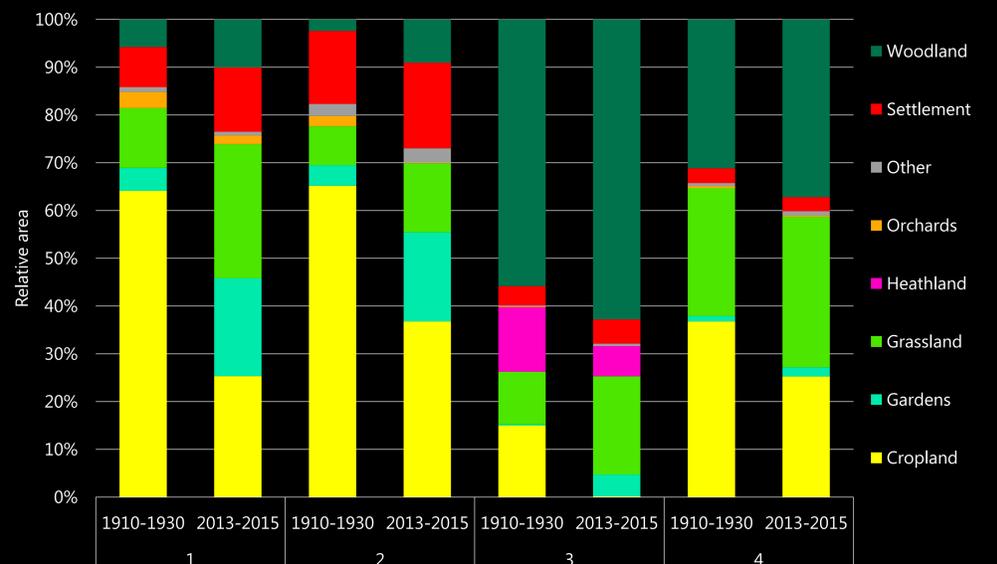
## Preliminary results and perspectives



Species richness for the four localities and both time periods, compared to the whole country.



Hurlbert's index (number of species expected in a 100 specimens sample), for the four localities and both time periods, compared to the whole country.



Relative area of each land use type in 1910-1930 and in 2013-2015, for the 4 localities with a buffer of 3 km around the old municipalities.

## Bumblebee communities

**In 100 years, 9 bumblebee species disappeared in Belgium.**

Species richness felt sharply in ¾ of the localities. However, for the 4<sup>th</sup> in the Belgian Lorraine region, species richness remained quite similar than 100 years ago. The expected number of species (Hurlbert's index) decreased in localities 1 and 2, and increased in 3 and 4.

## Land use

**The four localities have very different land use dynamics.** Localities 1 and 2 are largely dominated by cropland, the 3<sup>rd</sup> by forest and the 4<sup>th</sup> by cropland, grassland and forest. Cropland areas sharply decreased in all localities, and were mainly replaced by gardens, grassland, and forest. Settlement areas increased the most in the western localities (1 and 2).



*Bombus lapidarius* on a thistle.

## Bumblebees vs. land use

**The most preserved bumblebee community is in the locality where grasslands are the most abundant.** Localities where species richness decreased the most are those where settlement areas increased the most at the expense of cropland. Moreover, according to our observations and agricultural statistics, the locality where species richness remained the highest is the one where agriculture remained the least intensive and where leguminous crops were still present.

These preliminary results will be further refined and improved. Additional bumblebees data from all regions of Belgium will be added from the BELBEES project. We will then perform models combining land use, landscape and bioclimatic data in order to assess their respective roles in the decline of populations of these essential pollinators.



Nature reserve « Raymond Mayné » in Torigny (locality no 4).

## References

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