

# **Pollinators and Biodiversity**

## **Balances, ecosystem services and environmental challenges**

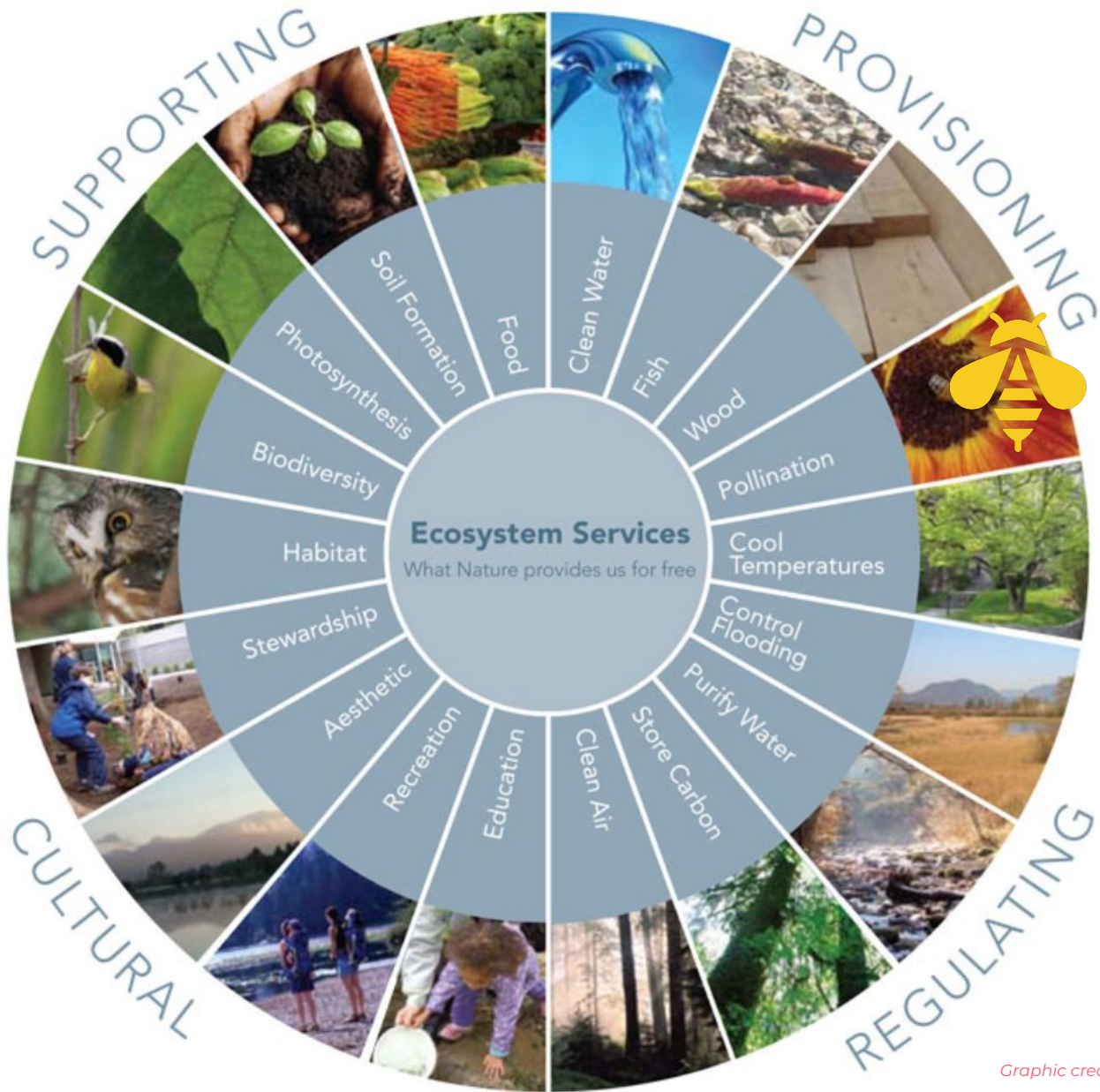
*Turin, 20/05/2026*



## INDEX

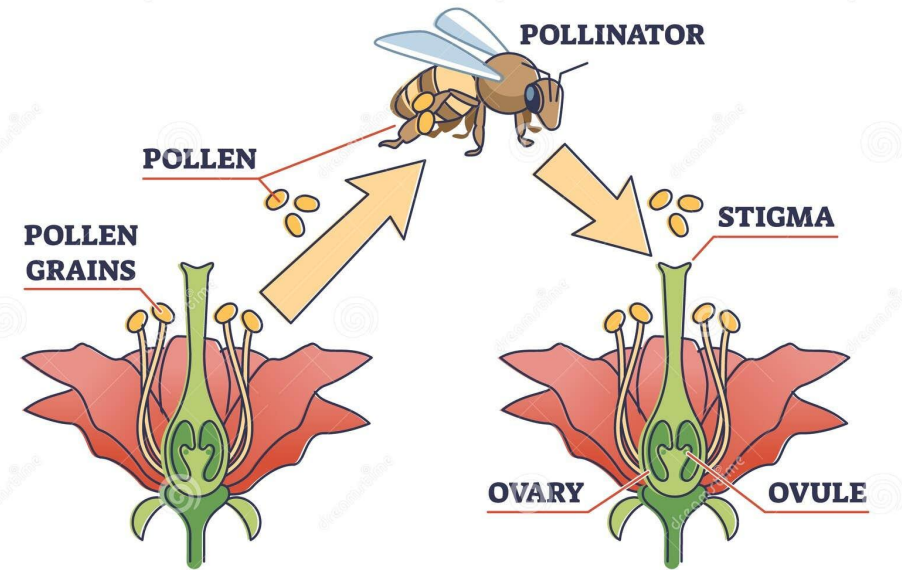
1. The role of pollinators for ecosystems, agriculture and biodiversity.
  2. Diversity of pollinators – complementarity
  3. Honey bees in this ecological system
  4. The decline of pollinators: a real and global problem
  5. The real challenge is to protect ecosystems as a whole
- 



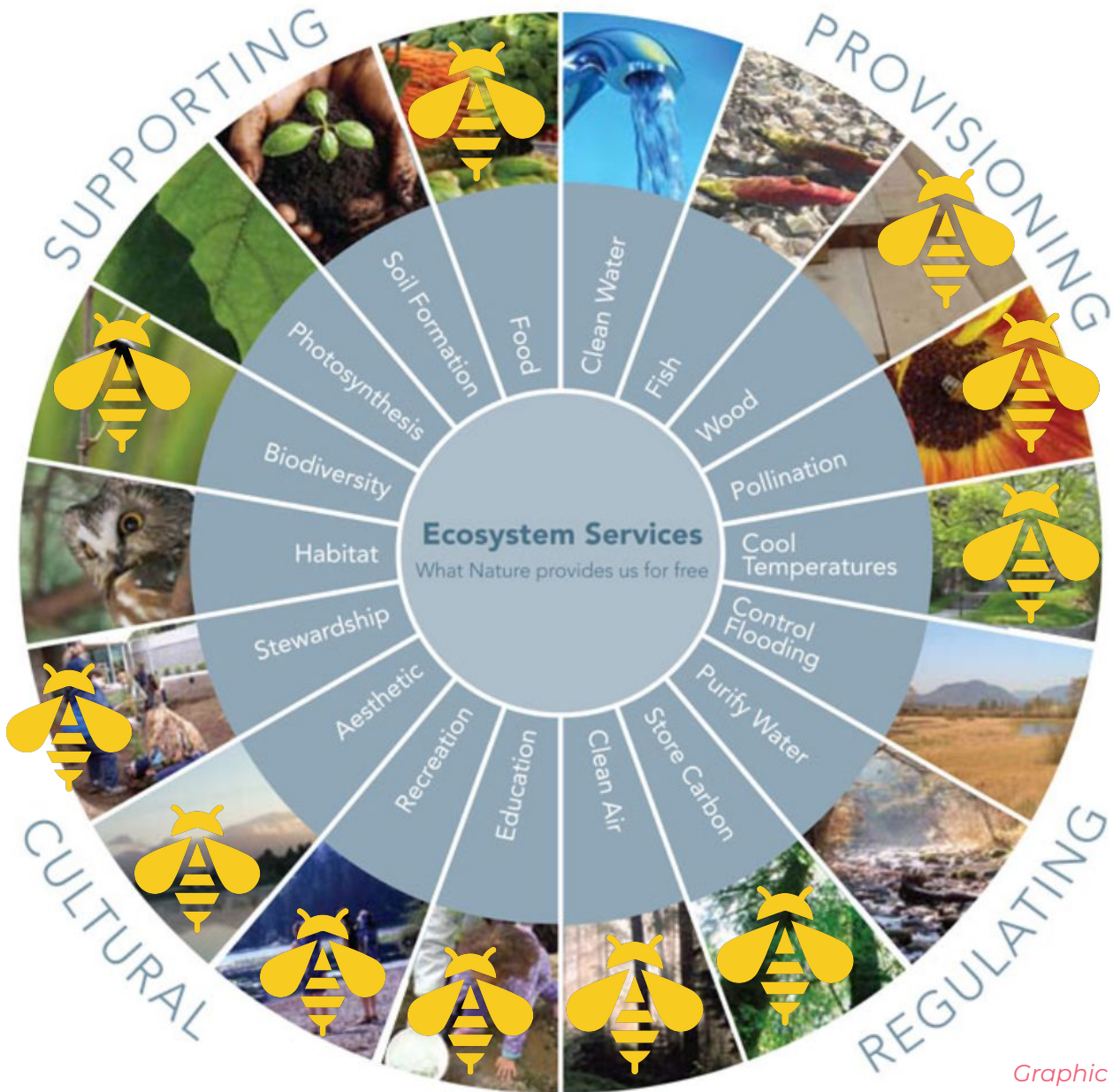


Graphic credit: TEEB Europe

# POLLINATION



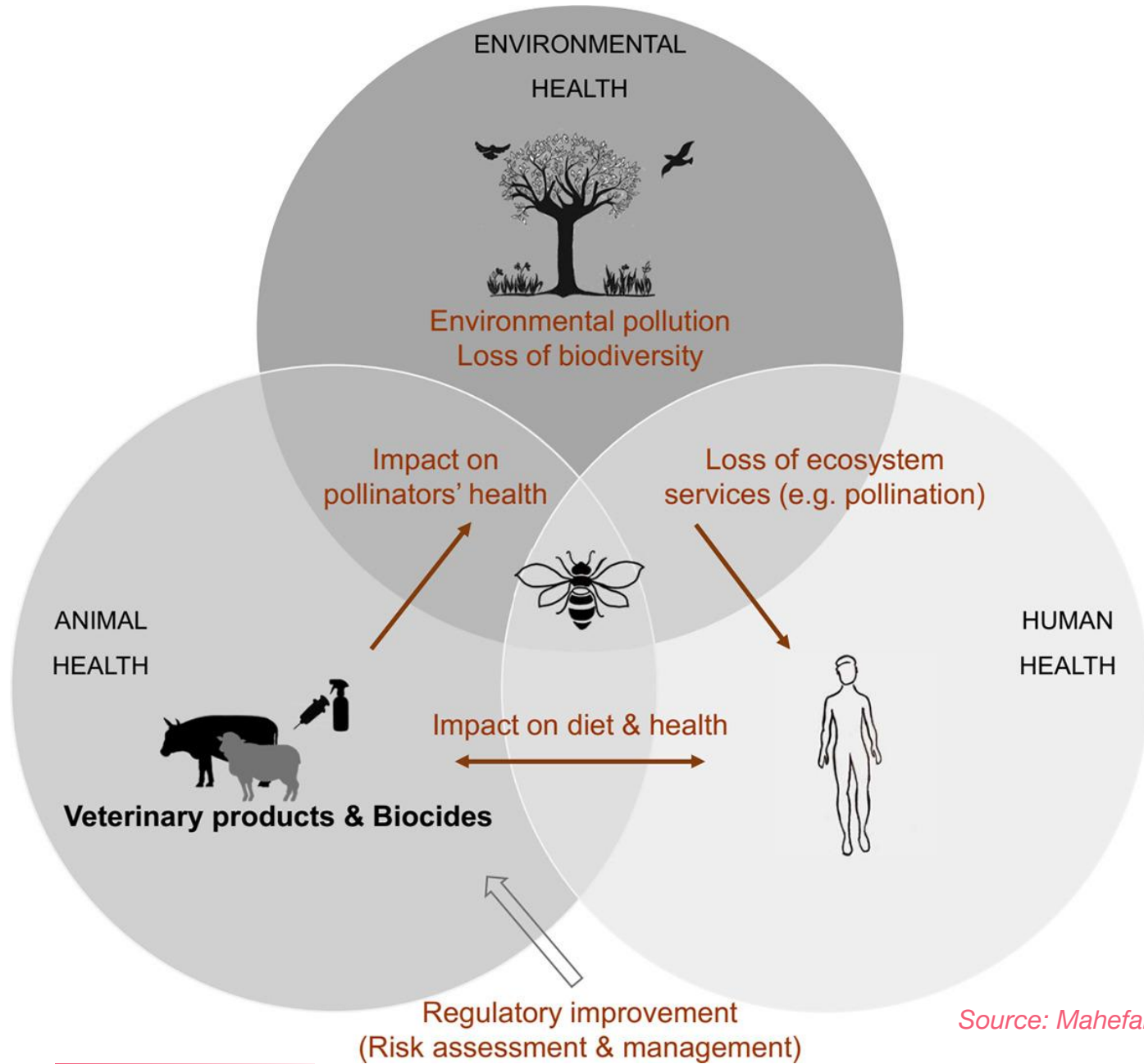




# The role of bees in ecosystem services

+ Constant monitoring of environmental quality

Graphic credit: TEEB Europe



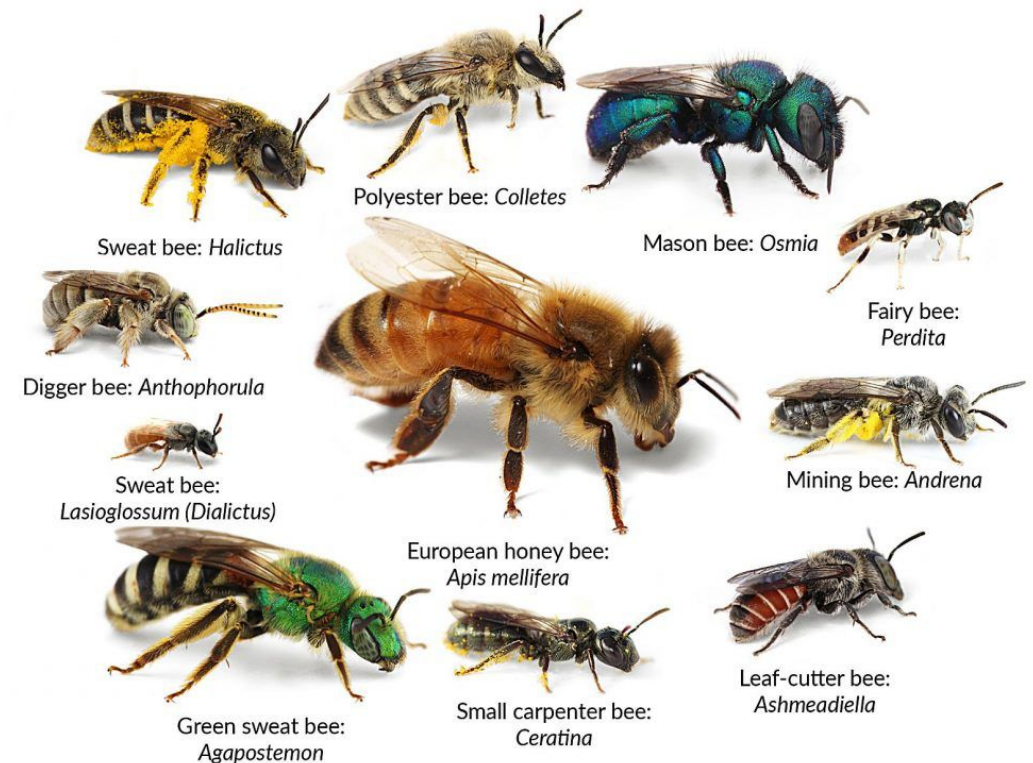
# The "One Health" approach and the bees

Source: Mahefarisoa et al, 2021

# Information on pollinators

**MANY DIFFERENT SPECIES** differing in size and foraging range (from metres to kilometres)

- Where they nest
- Their dietary requirements
- The period of their activity
- Short or long proboscis, generalists (polylectic) versus specialists (oligolectic, monolectic), diurnal/nocturnal, etc.
- The annual cycle: one generation, two or more generations, type of overwintering (larva, adult, fertilised female)
- The degree of sociality: solitary, colonial, communal, quasi-social, semi-social, eusocial



Reference:  
<https://www.parkrecord.com/entertainment/professor-wants-public-to-bee-informed-about-pollinators/>

DIVERSITY

# Information on pollinators



Size



Nesting sites



*Anthidium manicatum*  
© Hubert Baltus

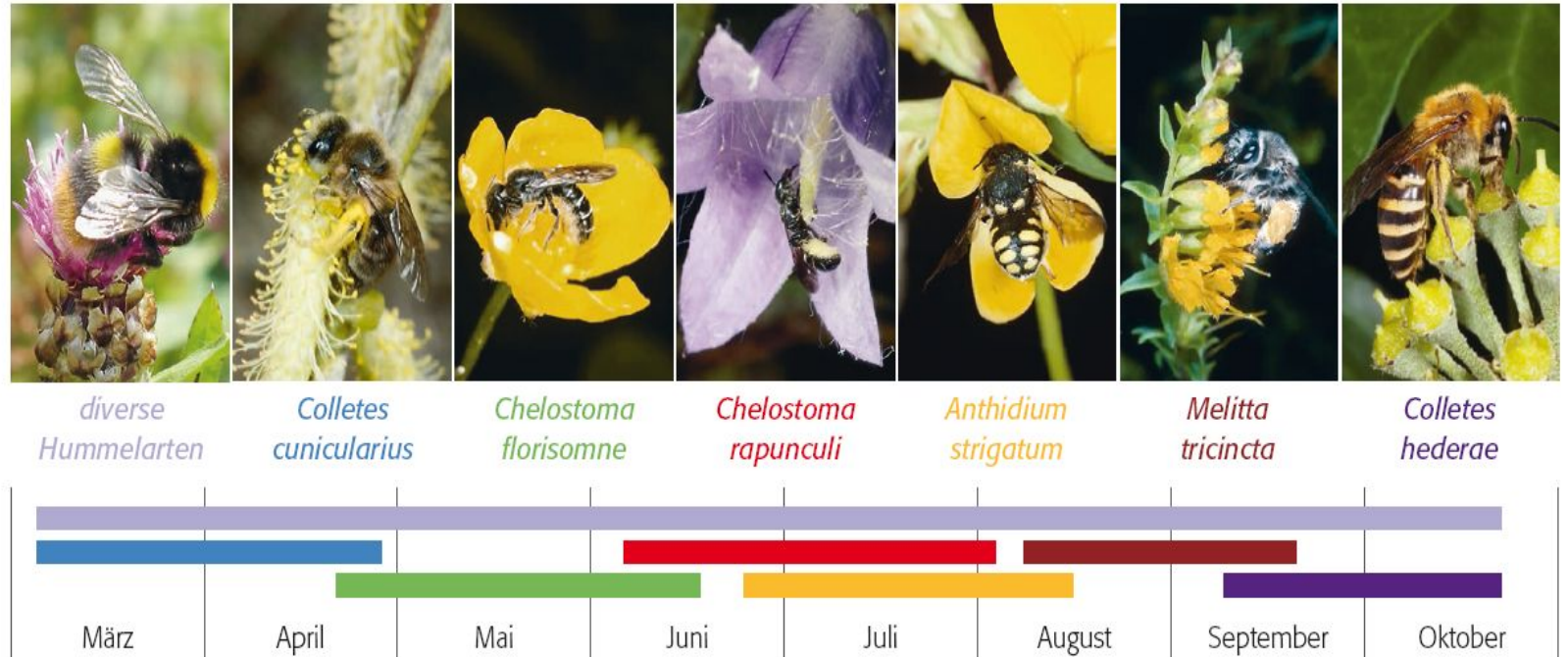


Quantity of flowers required

## DIVERSITY

# Information on pollinators

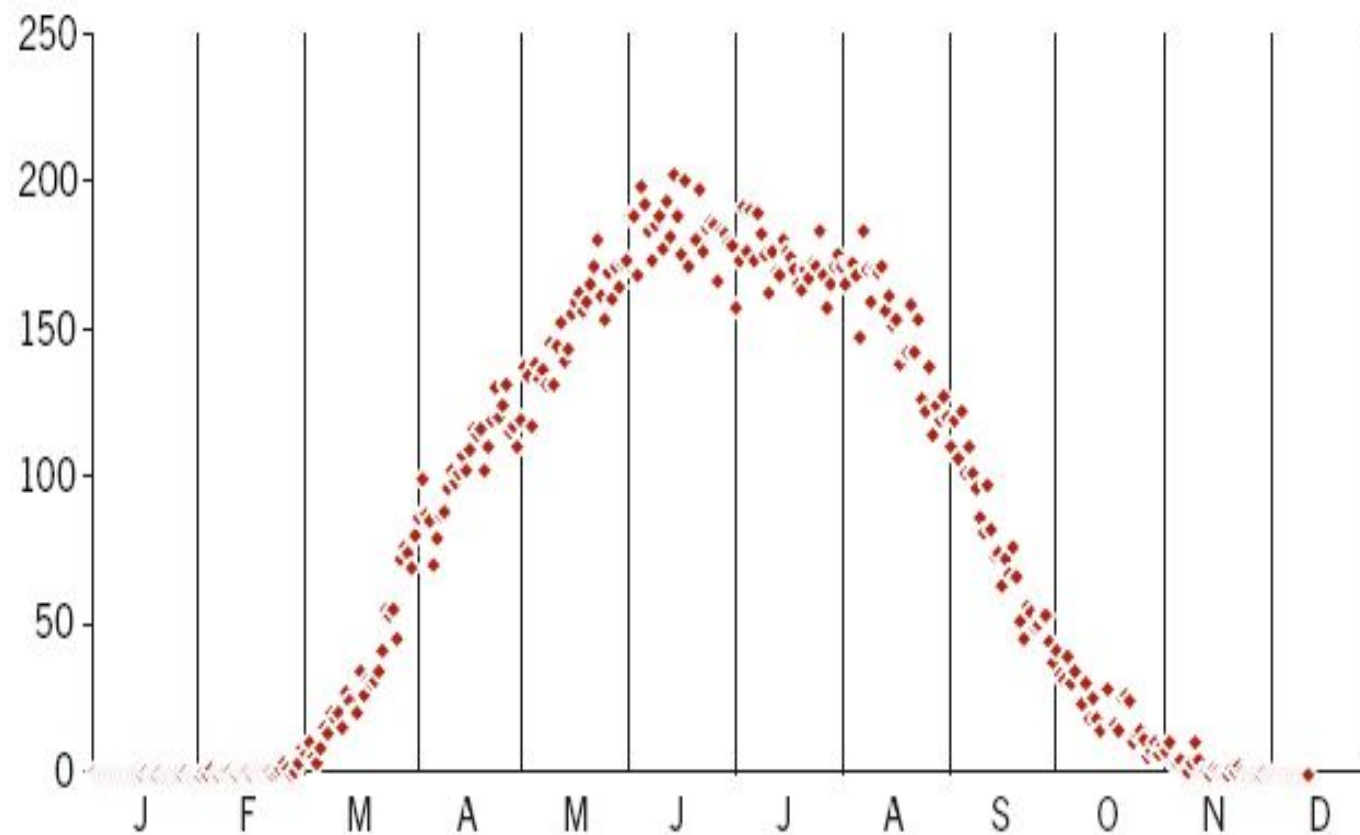
Some species will be present practically all year round (bumblebees), whilst others will only be seen at specific times of the year.



## DIVERSITY

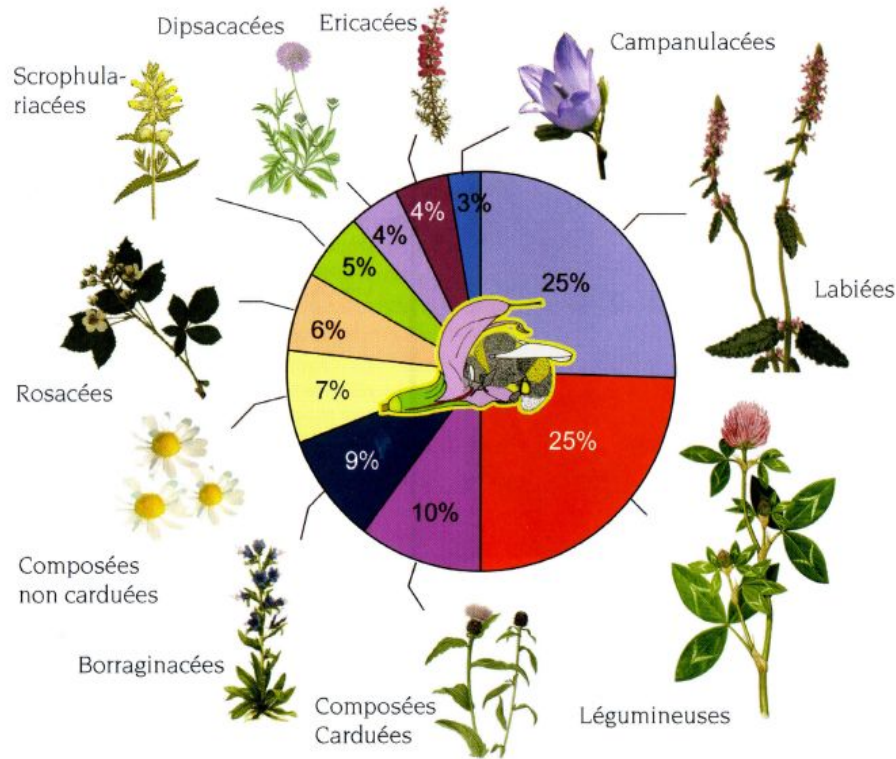
# Informazioni sugli impollinatori

Number of wild bee species observed each day in the Netherlands (cumulative data). The highest number (203 species) was recorded on 10 June.



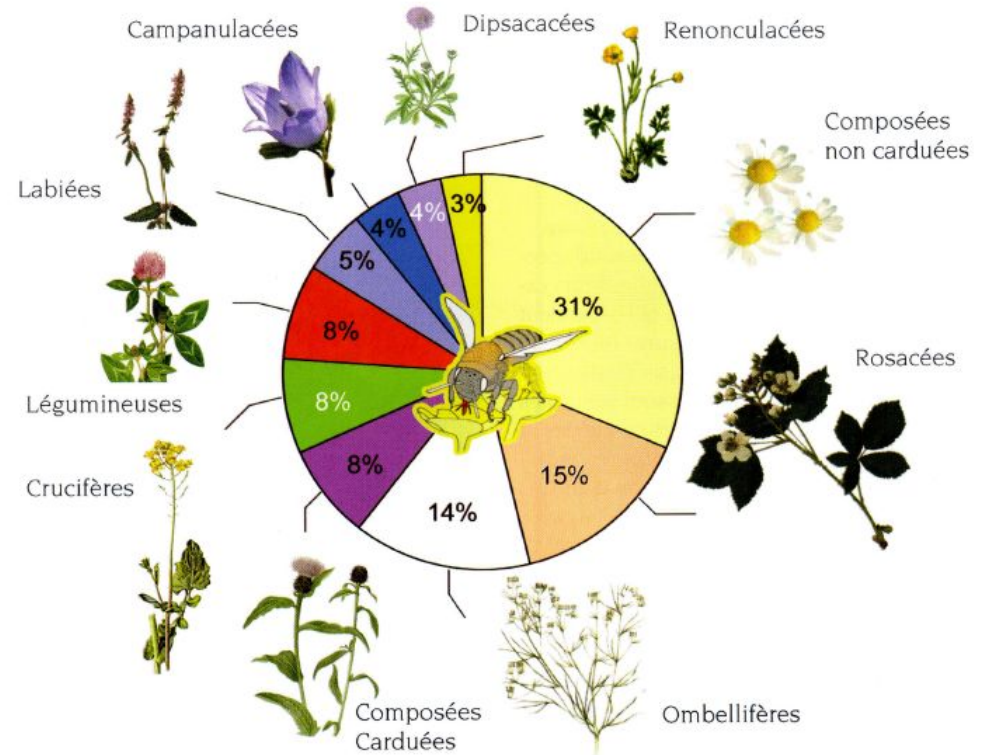
Source: EIS Pays-Bas.

## Flower families preferred by long-tongued bees



*Bombus terrestris*

## Flower families preferred by short-tongued bees

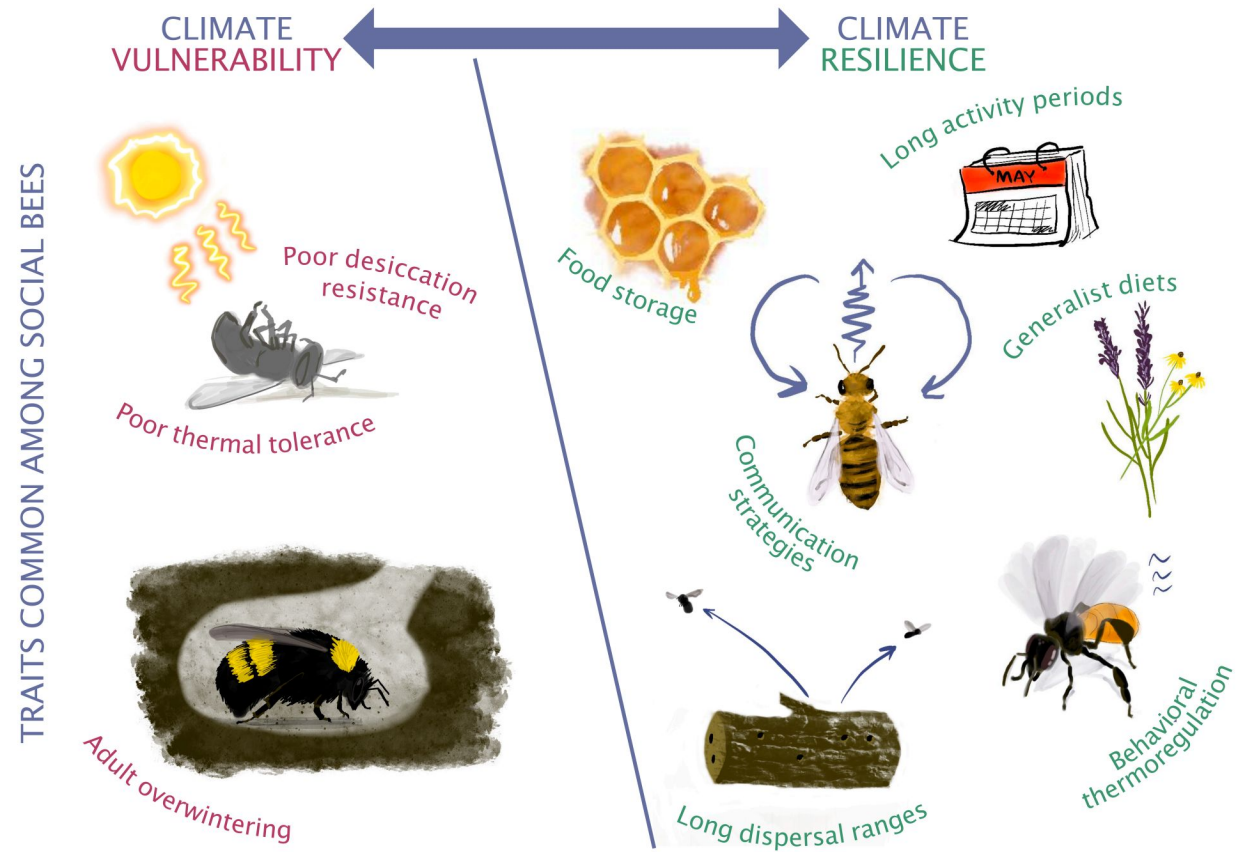


*Andrena cineraria*

# Informazioni sugli impollinatori

## Sensitivity to climate change

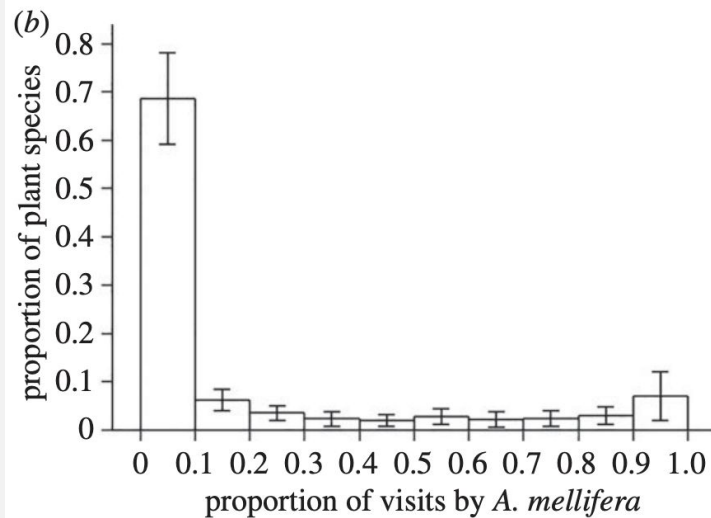
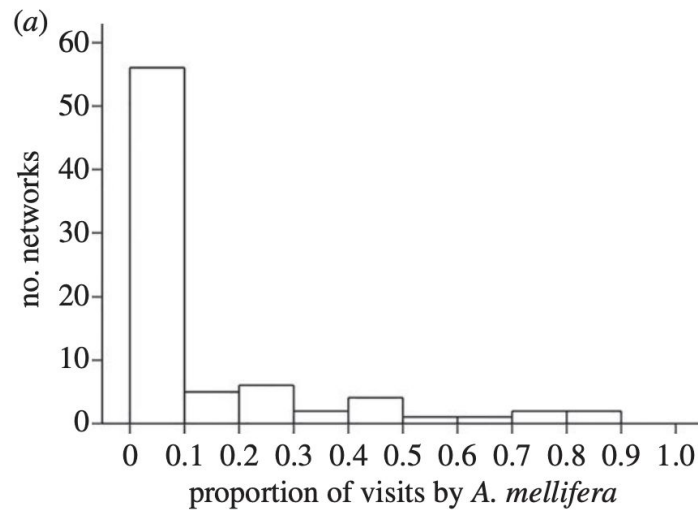
Behavioural, physiological and life-history traits common among social bees, categorised by their capacity to determine vulnerability or resilience in the face of climate change. It is important to emphasise that not all social bees possess these characteristics and that their effect on responses to climate change will vary depending on the environmental context.



Source: <https://doi.org/10.1111/1365-2656.14160>



## *Apis mellifera*, number 1?



Source: [doi.org/10.1098/rspb.2017.2140](https://doi.org/10.1098/rspb.2017.2140)

In the regions covered by the study ( $n=80$ ), it was detected in 16 out of the 18 regions (approx. 90%) where it is native, and in 38 out of 62 (61%) where it is not.

The average percentage of visits was 19% across the 54 regions where it was present.

- The most frequent floral visitor in 17 regions
- An overview of plant taxonomies
- The sole recorded visitor for 4.5% of plant taxa
- Accounted for the majority of visits to 17% of plant taxa
- Not recorded as visitors for nearly half (49%) of plant taxa

# Interactions between managed and wild animals

## The importance of plant-pollinator networks for pollination

Numerous scientific publications highlight the importance of having a good variety of pollinators to improve pollination.

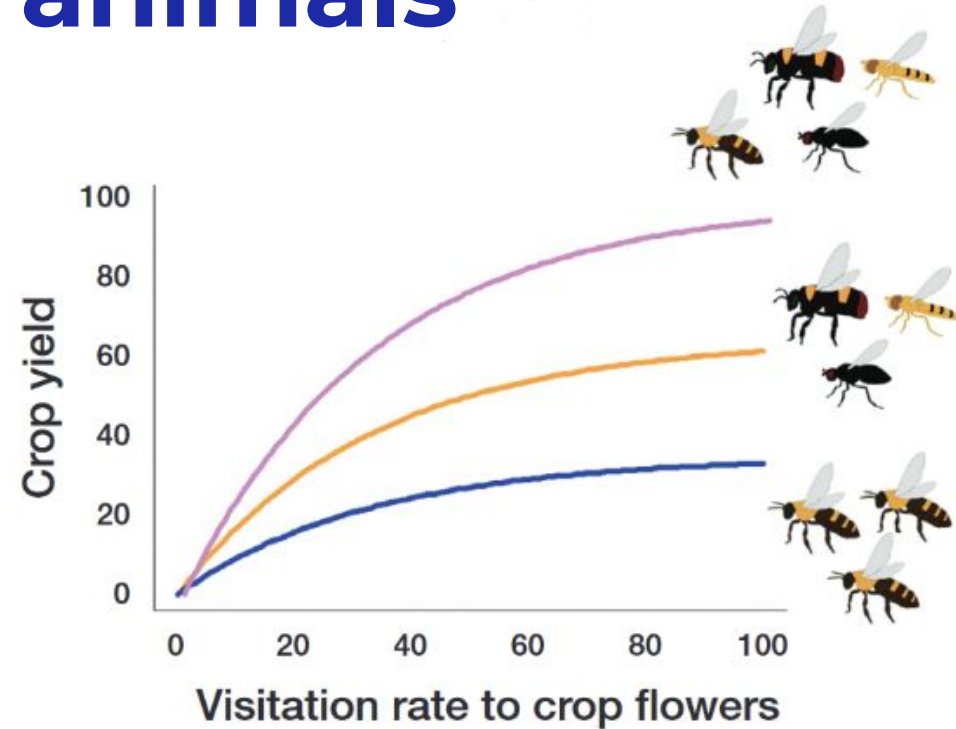


FIGURE 1: Pollination efficiency of *Apis mellifera* (blue line), solitary bees alone (yellow line) and the action of *Apis mellifera* combined with wild bees (purple line). The axes represent the pollination efficiency and yield of the agricultural crop in percentage (%). Image reproduced from Garibaldi *et al.* (2014).

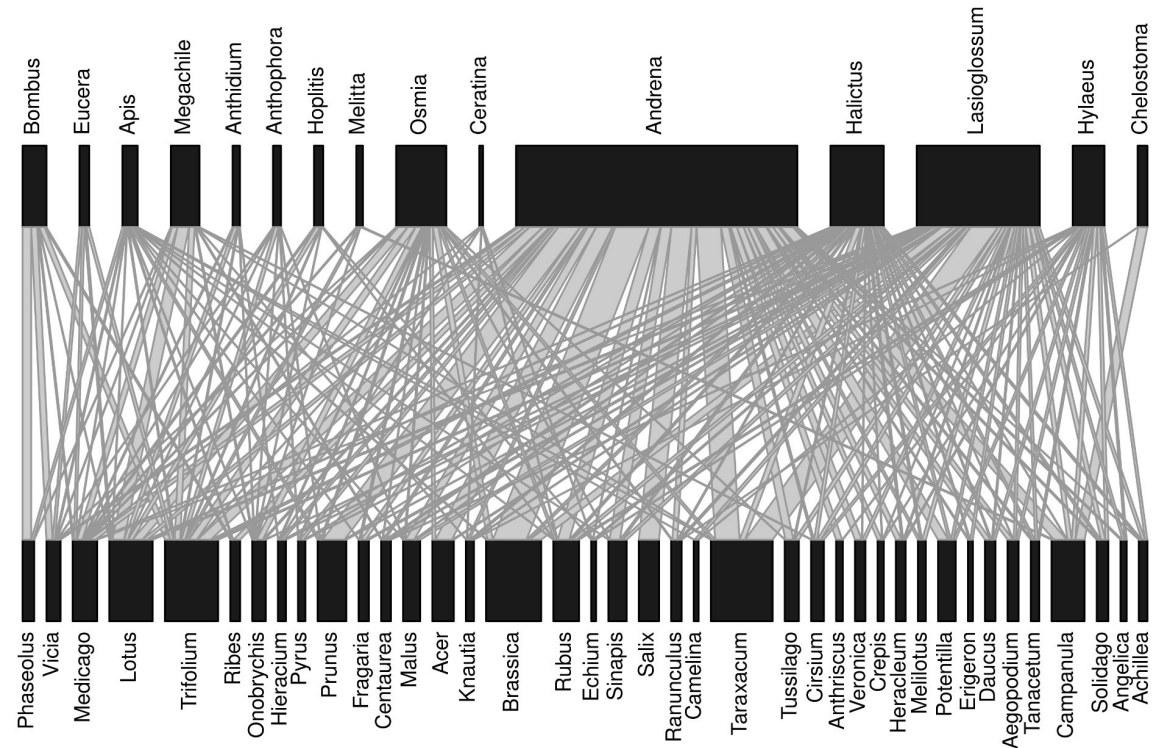
## INTERACTIONS

# Plant-pollinator interaction

Coevolution of plants and their pollinators

Biological factors influencing the interaction between plants and pollinators

The flowering phenology of a plant in relation to the activity of its pollinators



\* San Martin et al., unpublished



# Phenology and plant traits

**Phenology:** the timing of a plant's flowering in relation to the activity of its pollinators.

**Visual indication:** Larger flowers (or larger clusters) – more effective long-distance signals = a competitive advantage in attracting pollinators.

**Energy efficiency:** maximising the reward-to-effort ratio – a large flower takes too much time VS smaller and more easily accessible flowers.



# Phenology and plant traits

**Large flowers/inflorescences:** Attract large pollinators (bumblebees, butterflies and beetles), offering ample landing space and greater availability of nectar and pollen.

**Small flowers/flower clusters:** preferred by small insects (small solitary bees and hoverflies), efficient access to nectar.

**Flower shape matters:** Large, open or robust flowers are favoured by many large pollinators. Others prefer specific shapes suited to their mouthparts. Other factors: bilateral symmetry, tube length, spur depth, flower landing platforms.

**Colour:** the differing preferences of various pollinators for different flower colours.

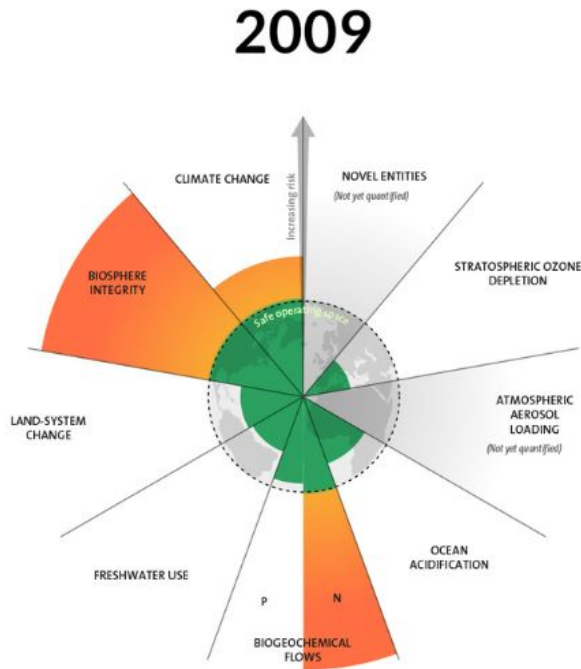
**Scent (Volatile Organic Compounds, VOCs):** pollinator-mediated selection.

**Timing and duration of flowers.**

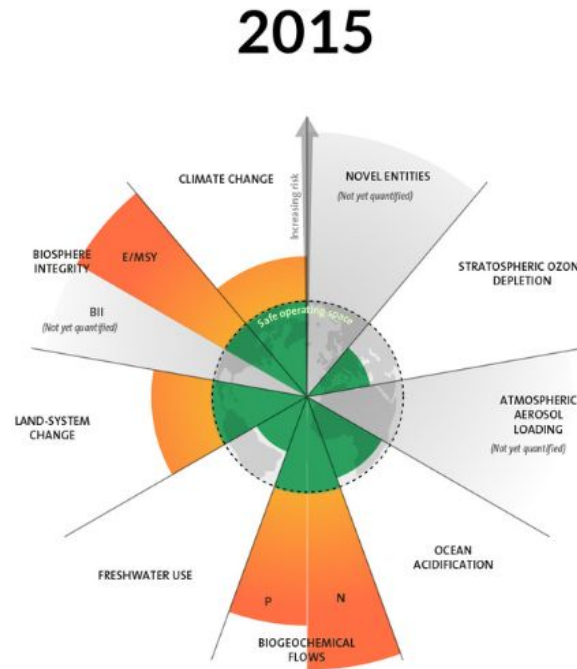


## The status quo

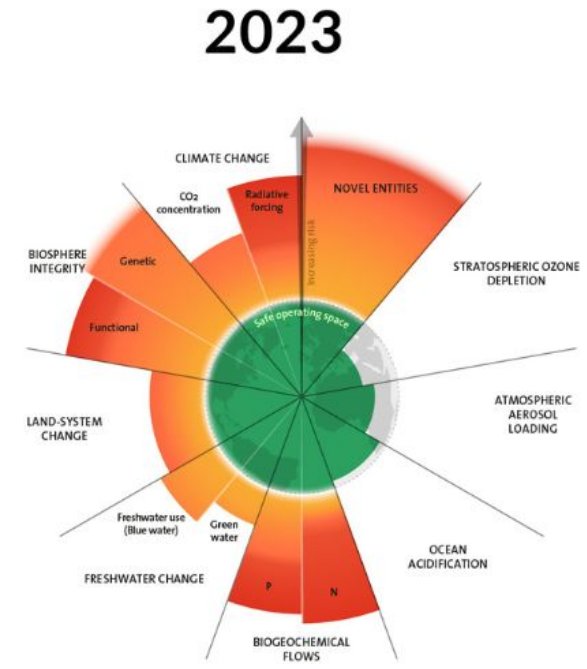
# Established beyond any shadow of a doubt



7 boundaries assessed,  
3 crossed



7 boundaries assessed,  
4 crossed



9 boundaries assessed,  
6 crossed

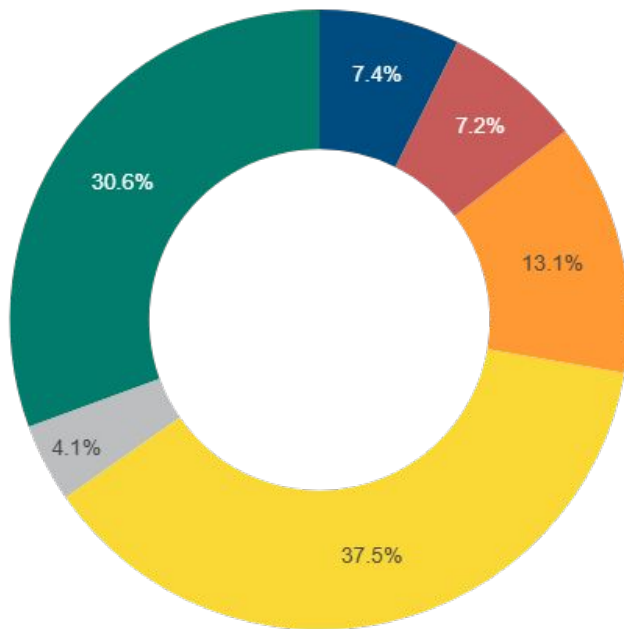
Fuente: <https://www.stockholmresilience.org/research/planetary-boundaries.html>

## The status quo

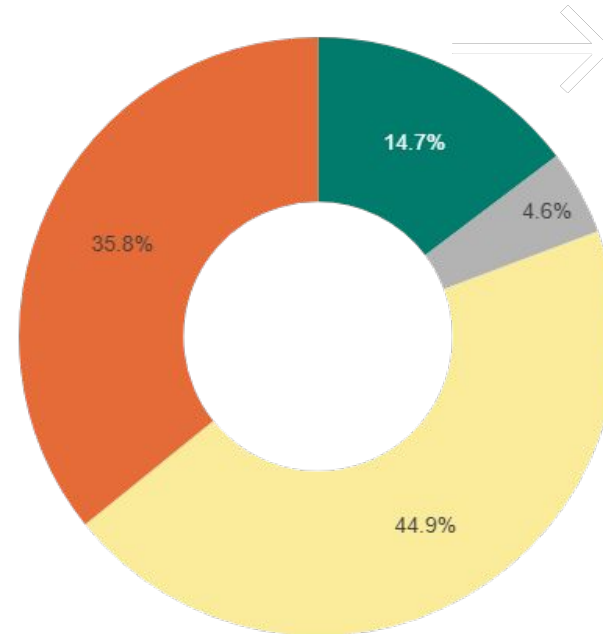
# The state of biodiversity in Europe

81% of habitats, 39% of birds and 62% of non-bird species of community interest are in a "poor" or "bad" condition.

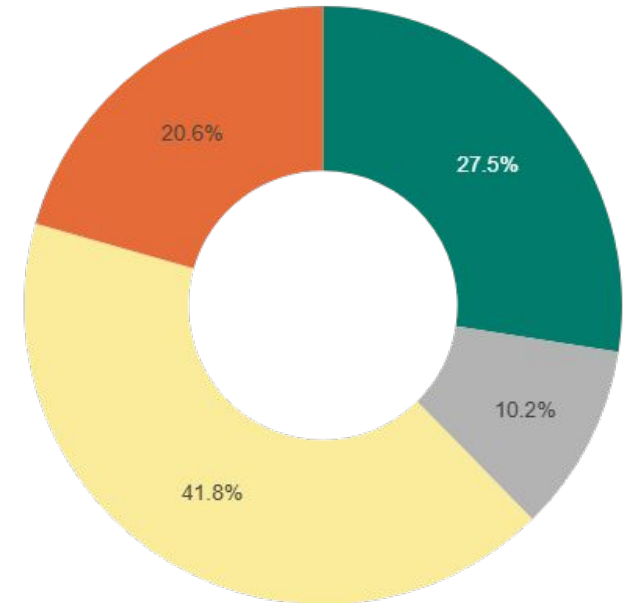
Number of surface water bodies (%)



818 assessments of habitat status



2,825 assessments of species status



■ High ■ Good ■ Unknown ■ Moderate ■ Poor ■ Bad

■ Good ■ Unknown ■ Poor ■ Bad

EEA, 2025 -

<https://www.eea.europa.eu/en/europe-environment-2025/thematic-briefings/biodiversity-and-ecosystems/state-of-europes-biodiversity>

The status quo

# The state of biodiversity in Europe



Measuring the pulse of European biodiversity

## European Red List of Bees

Denis Michez\*, Mira Boustani\*, Ahlam Sentil, Jordan Benrezkallah, Natasha de Manincor, Thomas J. Wood, Piliuca Álvarez Fidalgo, Matthieu Aubert, Vittorio Bellotto, Paolo Biella, Petr Bogusch, Jordi Bosch, Thomas Brau, Keith Browne, Frédéric Carion, Leopoldo Castro, Bjorn Cederberg, Joanna Clay, Thomas Debont, Jovana Bili Dubačić, Raffaele Dall'Olio, Simon Dellicour, Jelle Devalez, Rémi Devorsine, Eric Dufrêne, Pilar De la Rúa, Bastien De Tandt, Dimitri Evrard, Simone Flaminio, William Fioraliso, Paolo Fontana, Serge Gadoum, Mercè Galbany Casals, Hugo Gaspar, Antoine Gekière, Maxence Gérard, Benoît Geslin, Max Kasperek, Justyna Kierat, Patrick L. Kohl, Michael Kuhlmann, Per Kryger, Nicolas Leclercq, Romain Le Divelec, Shawn Lemaire, Sarah Lescot, Patrick Lhomme, Jessica Litman, Leon Marshall, Grace P. McCormack, Arrigo Moro, Sonja Mudri Stojnić, Esther Ockermueller, Andrzej Oleksa, Francisco Javier Ortiz-Sánchez, Sébastien Patiny, Juho Paukkunen, Adrien Perrard, Theodora Petanidou, M. Alice Pinto, Simon G. Potts, Christophe Praz, Sanne C.L. Put, Vladimir G. Radchenko, Pierre Rasmont, Fabrice Requier, Sara Reverté, Stephan Risch, Steve Rogenstein, Paolo Rosa, Carlos Ruiz, Benjamin Rutschmann, Rémi Santerre, Jan Smit, Jakub Straka, Joffrey Thulier, Clément Tourbez, Aurore Trottet, Nicolas J. Vereecken, Paul H. Williams, Eleanor Winter, Dominique Zimmermann, and Guillaume Ghisbain

## IUCN Red List, 26 February 2026

172 of the 2,000 species present in Europe are currently threatened with extinction.



RESEARCH ARTICLE

### More than 75 percent decline over 27 years in total flying insect biomass in protected areas

Caspar A. Hallmann<sup>1\*</sup>, Martin Sorg<sup>2</sup>, Eelke Jongejans<sup>1</sup>, Henk Siepel<sup>1</sup>, Nick Hoffland<sup>1</sup>, Heinz Schwan<sup>2</sup>, Werner Stenmans<sup>2</sup>, Andreas Müller<sup>2</sup>, Hubert Sumser<sup>2</sup>, Thomas Hörrn<sup>2</sup>, Dave Goulson<sup>3</sup>, Hans de Kroon<sup>1</sup>

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REASON

# Causes of biodiversity loss



Habitat loss



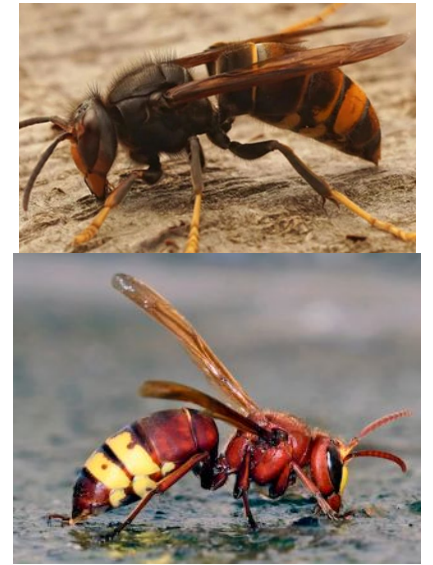
Land-use change



Climate change



Pollution



Invasive species

# Beekeepers = messengers of a problem (biomonitors)

History of public narratives (politics)

1. Female and male beekeepers raise public awareness about an environmental problem
2. It is a beekeeping problem: Kill the messenger (discourage)
3. But wild pollinators and other insects are also in decline
4. Competition between managed and wild bees: Kill the messenger (discourage)

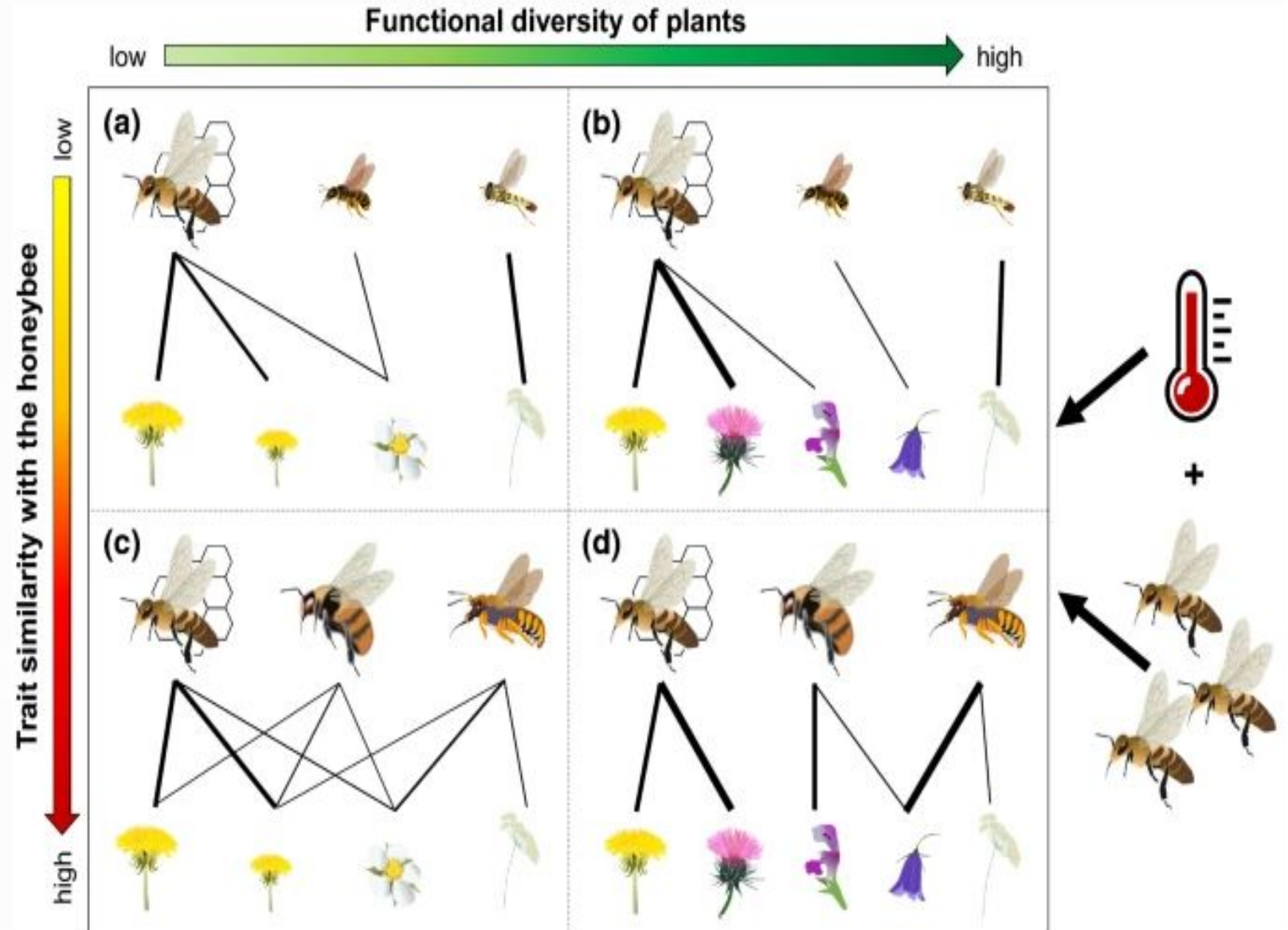
**We are witnessing a collapse of biodiversity:  
keep your eyes open for the indicators!**

## INTERACTION

### Competition for space/food

POSITIVE ASPECT: the wide functional variety of flowers

NEGATIVE ASPECT: the presence of bees similar to honey bees (size, tongue length, dietary requirements, etc.)



# Interactions between managed and wild animals

## Competition for resources

Inconsistent scientific evidence

The effects depend on: **l'eterogeneità del paesaggio e l'abbondanza delle piante.**

- **Carrying capacity:** indications of sustainable hive densities, but context-specific data are required.
- **Overcrowding (high hive density):** interspecific and intraspecific stress.
- Wild bees compete with each other to secure nesting sites.

It is crucial to increase and support the development of diverse floral and nesting resources in order to limit, if not completely eliminate, interspecific competition, particularly in agroecosystems.

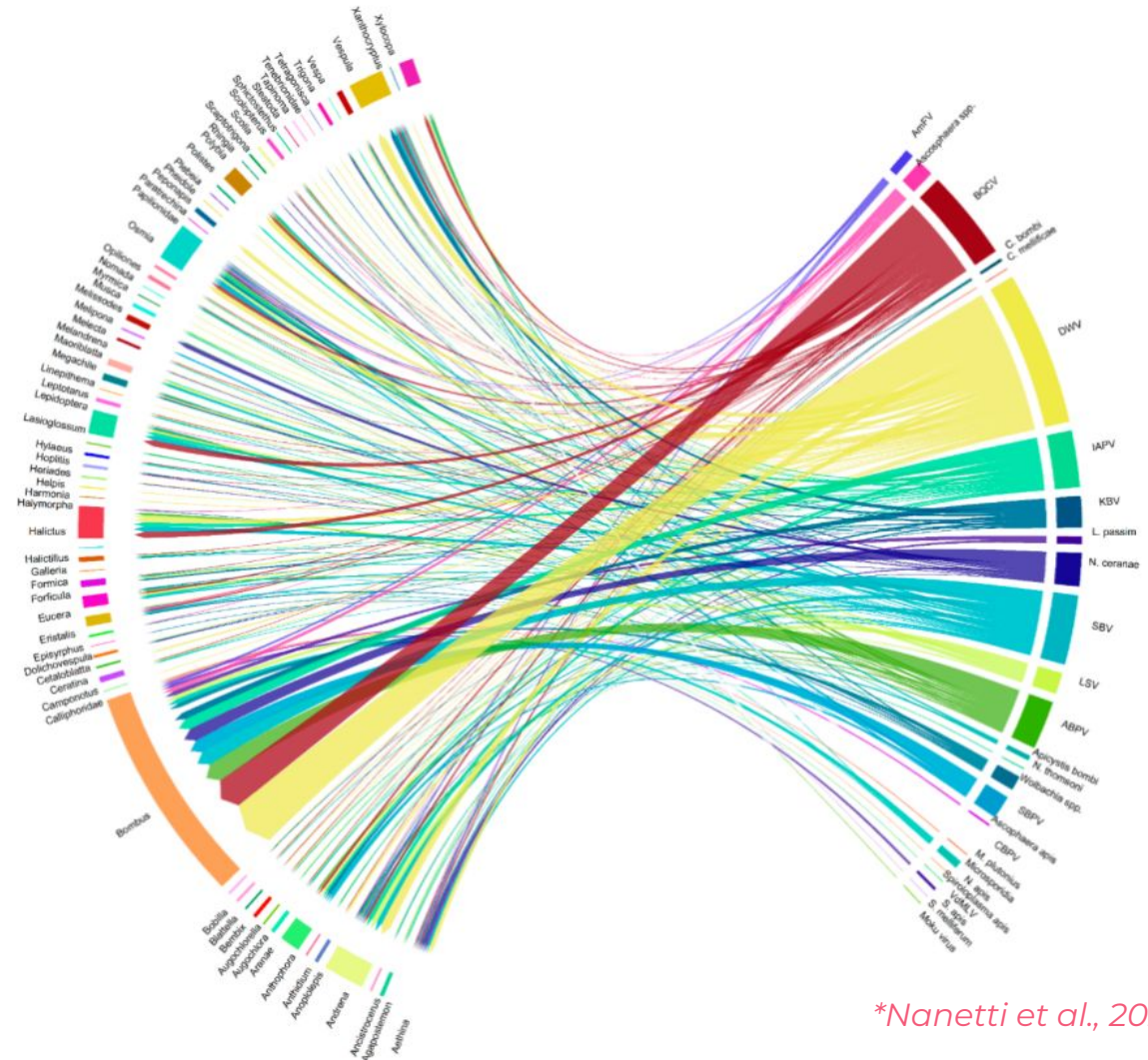
## Is There a Carrying Capacity for Bees?

Land managers and beekeepers are keen to determine and use a carrying capacity for bees (managed or native) in any given landscape. This is a challenge given the number of bee species in any given landscape combined with the dynamics of pollen and nectar availability, which are specific to each plant, but also impacted by climate, soil, and other variables. To be accurate and effective, this information would be required on individual bee species. [Cane and Tepedino \(2016\)](#) have developed a metric to compare the intensity of colony-level honey bee foraging to individual native bee foraging using the Hive Units Monthly (HUM). The HUM allows for an estimate of the potential fitness impact on the native bee community, much in the same way that grazing is managed on public lands ([Cane and Tepedino 2016](#)). Using this metric, one honey bee colony can collect pollen the equivalent of 110,000 brood chambers produced by native bees (*Megachile rotundata* Fabricus in this case). In this manner, the predictive impact of each honey bee colony could be gauged and anticipated. It should be noted, however, that **aiming to establish a carrying capacity for natural landscapes may be a flawed approach as true resource limitation is unlikely given that floral pollen and nectar recharges daily and is commonly overproduced as an evolutionary strategy.**

# Interactions between managed and wild animals

## Distribution of microbes/pathogens/parasites

- When does a microbe become a pathogen?
- The planet is not sterile.
- Most studies show that bees have been in contact with microbes/pathogens (Risk = Exposure).
- Pathogenicity?
- **APIARY MANAGEMENT:** Maintaining a low prevalence of pathogens/parasites.



*\*Nanetti et al., 2021*

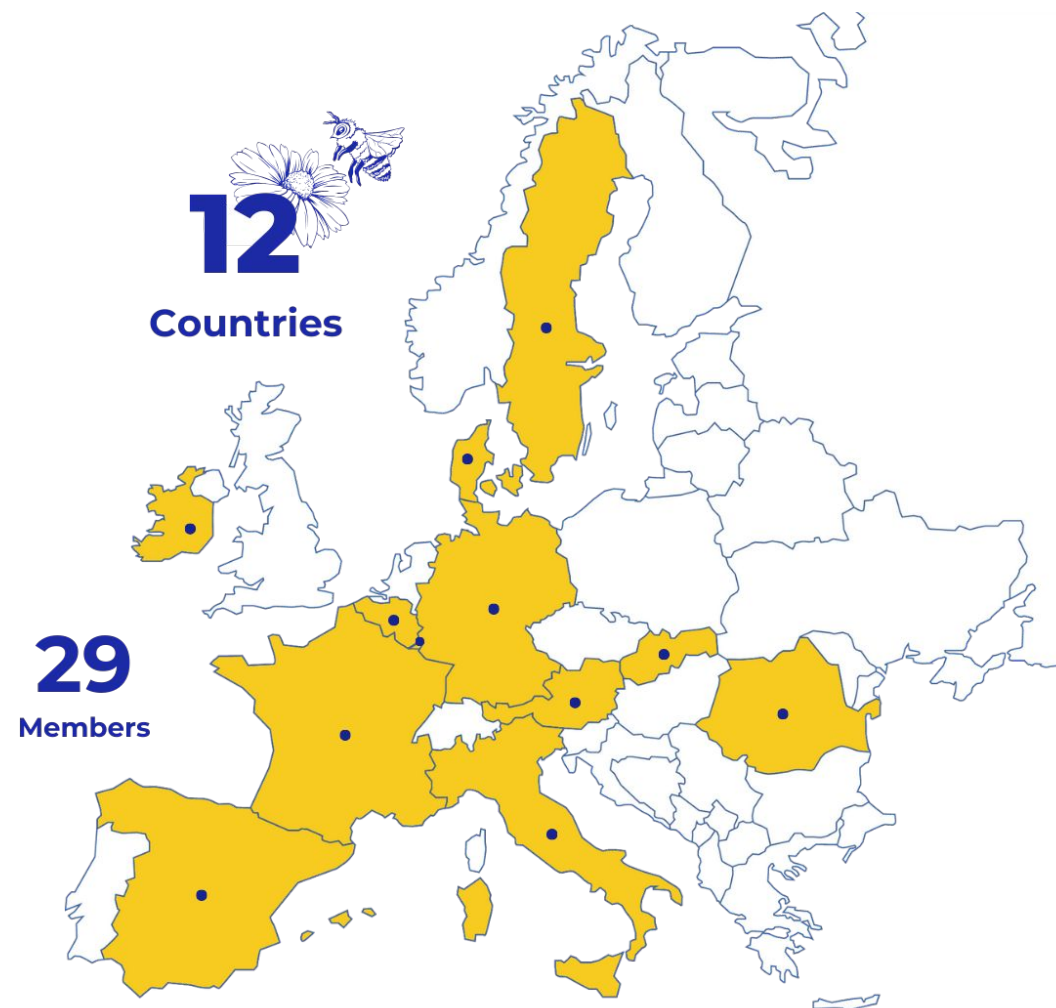
*\*Capela et al., In press*

## CONCLUSIONS

- **Beekeeping: a service to society** – pollination and environmental quality monitoring.
- Beekeepers, naturalists and researchers describe a coherent picture: **We are witnessing a negative trend in biodiversity, including pollinators.**
- Do not lose sight of the root causes of the problem: **habitat loss, pollution and climate change.** We must work towards addressing these.
- In cases where a potential negative interaction between pollinators may occur, **the option to assess the carrying capacity of the area.**



**Our members help us monitor the implementation of EU legislation on the ground.**



## SUPPORT

Donations allows us to work together for a healthier environment and a society that understands the vital role of bees and pollinators in maintaining the balance between biodiversity and food production.

With your help, we can push for meaningful policy changes, work with experts to create impactful strategies, and educate communities on fostering pollinator-friendly environments. Together, we can protect these essential species and ensure a thriving, sustainable planet for future generations.

narbutas



APIVITA



CGI



good  
lab



datasnipper

kynetec

benevity

# Thank you for your interest in our mission

*Together we can make a difference! If you would like to  
become a member, volunteer or ambassador for BeeLife,  
contact us!*

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