European initiatives for pollinator monitoring

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23/05/2024, Collègue de France, Solutions to monitor plants, pollinators and their interactions in a changing world

A bit of background

- Biodiversity and population trends in Europe?
- Nature restauration law and pollinators
- Data to implement actions -> EU-POMs and European plan for pollinators

Biodiversity of pollinators in Europe

Bees

2138

Syrphid flies

892

Fresh water fishes

524

Butterflies

393

Dragonflies

137

Reptiles

151

Mammals

228

Aquatic Plants

393

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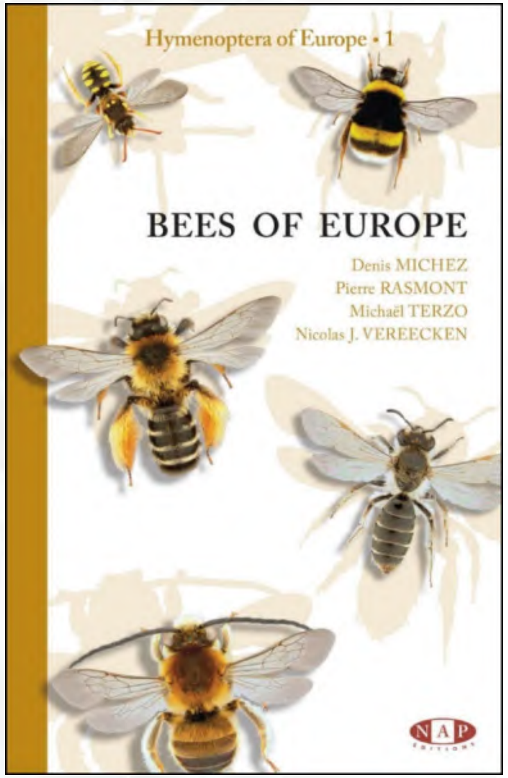
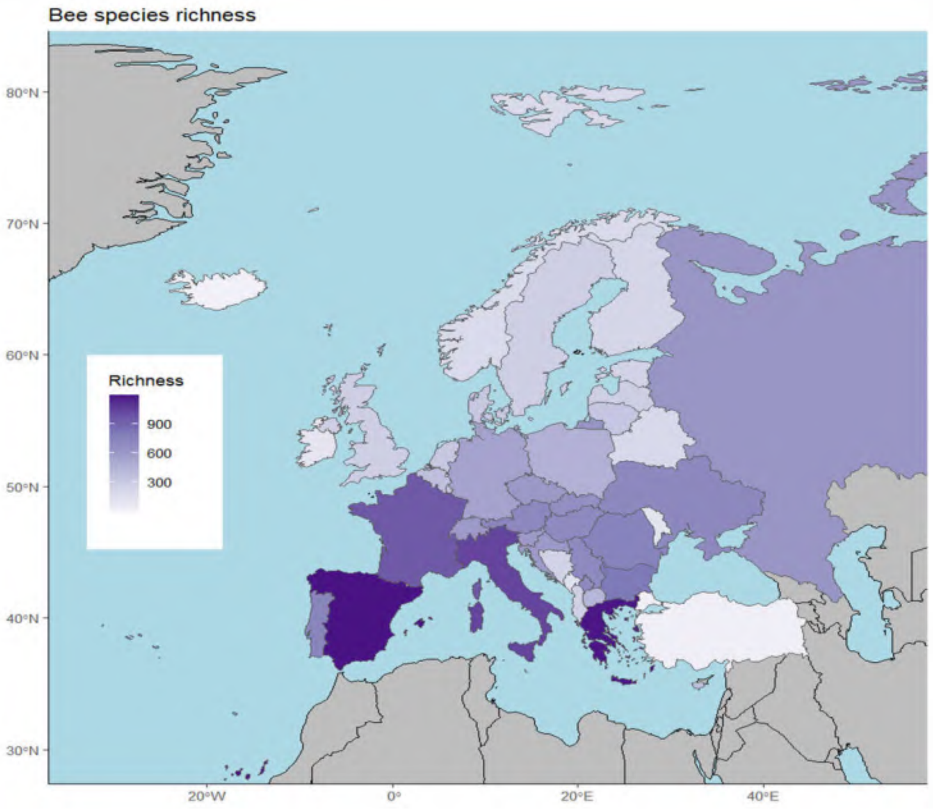
Biodiversity of pollinators in Europe





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ORIGINAL ARTICLE

Insect Conservation and Diversity

National records of 3000 European bee and hoverfly species: A contribution to pollinator conservation

EUROPEAN BEES

2,138 species recorded
(Ghisbain et al. 2023)

North-South gradient of diversity
(Reverté et al. 2023)

North South gradient of knowledge

20% Endemics

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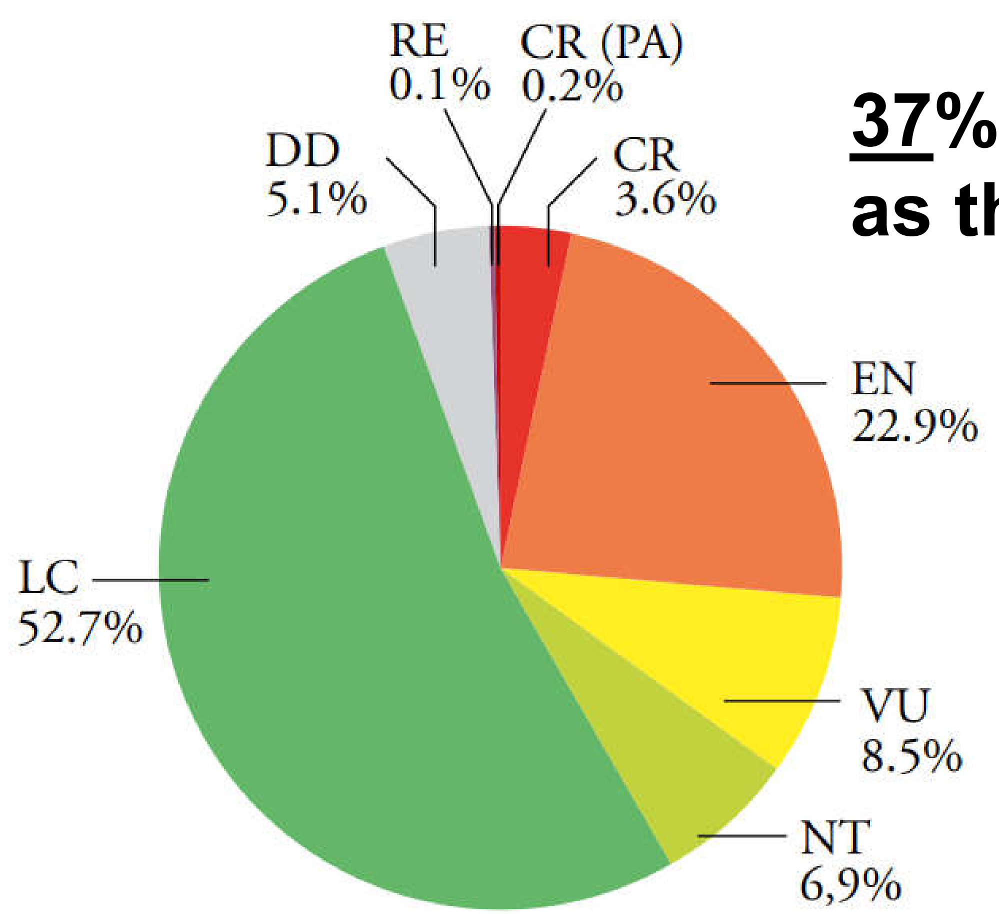
European Red Lists


Pollinators on the edge: our European hoverflies

The European Red List of Hoverflies

A. Vujić, F. Gilbert, G. Flinn, E. Englefield, Z. Varga, C.C. Ferreira, F. Eggert, S. Woolcock, M. Böhm, J. Vbra, R. Mergy, A. Ssymank, W. van Steenis, A. Aracil, R. Földesi, A. Grković, L. Mazanek, Z. Nedeljković, G.W.A. Pennards, C. Pérez, S. Radenković, A. Ricarte, S. Rojo, G. Ståhls, L.-J. van der Ent, J. van Steenis, A. Barkalov, A. Campoy, M. Janković, L. Likov, I. Lillo, X. Mengual, D. Milić, M. Miličić, T. Nielsen, G. Popov, T. Romig, A. Šebić, M. Speight, T. Tot, A. van Eck, S. Veselić, A. Andric, P. Bowles, M. De Groot, M.A. Marcos-García, J. Hadrava, X. Lair, S. Malidžan, G. Nève, D. Obreht Vidakovic, S. Popov, J.T. Smit, F. Van De Meutter and N. Veličković

European Commission | IUCN | RED LIST | SSC Species Survival Commission



37% assessed as threatened

Vujic et al. 2022. hoverflies ERL

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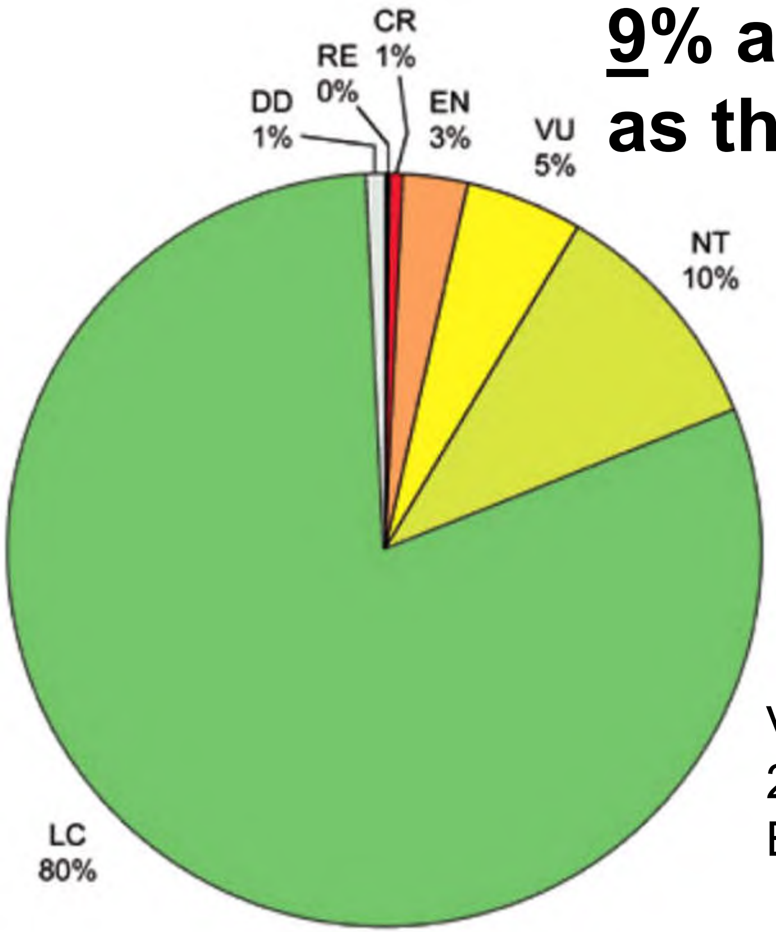
European Red Lists



9% assessed as threatened

Van Swaay et al. 2010. Butterflies ERL

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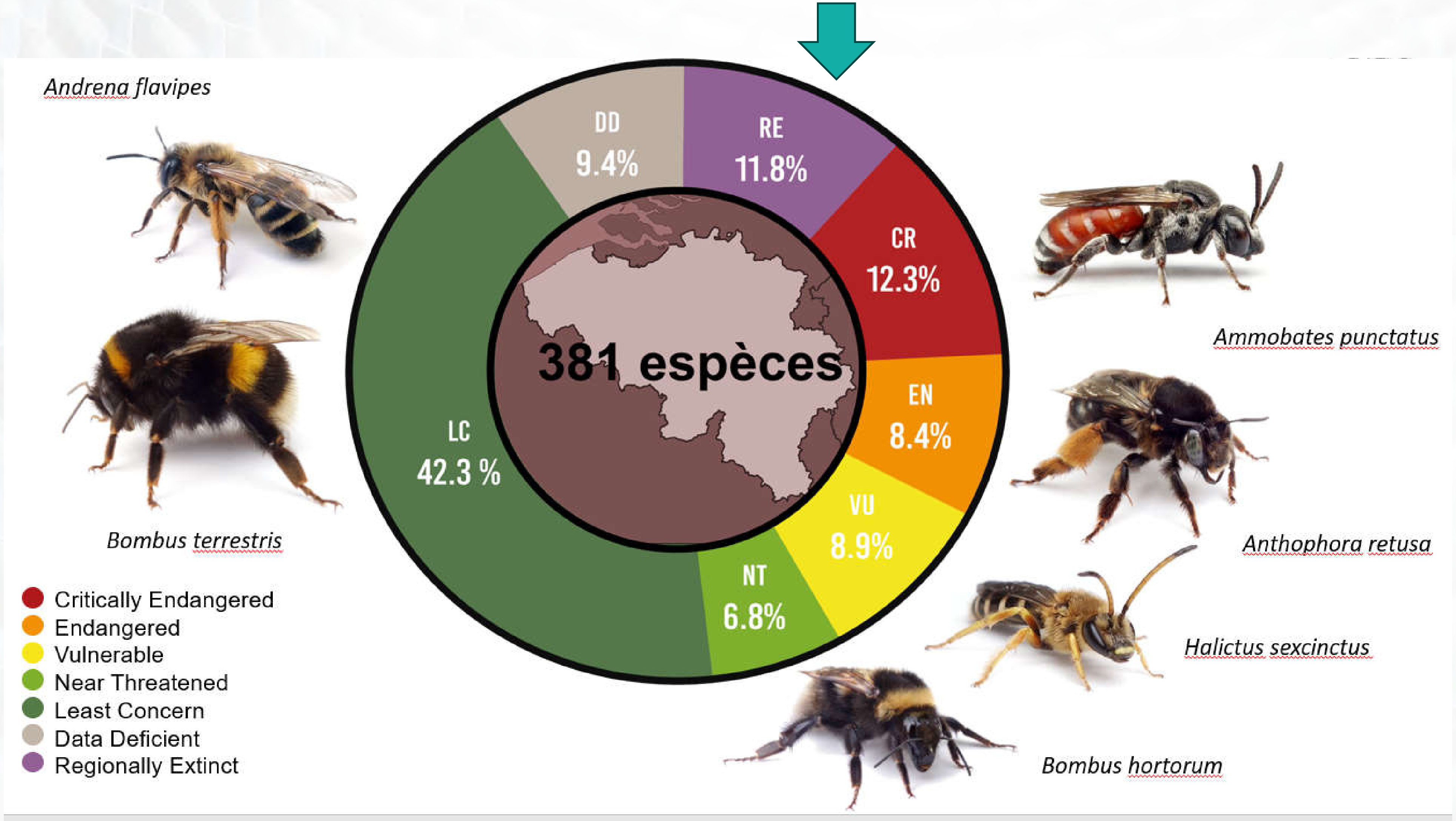
National Red Lists



Drossart et al. 2019. Belgian bees red list.

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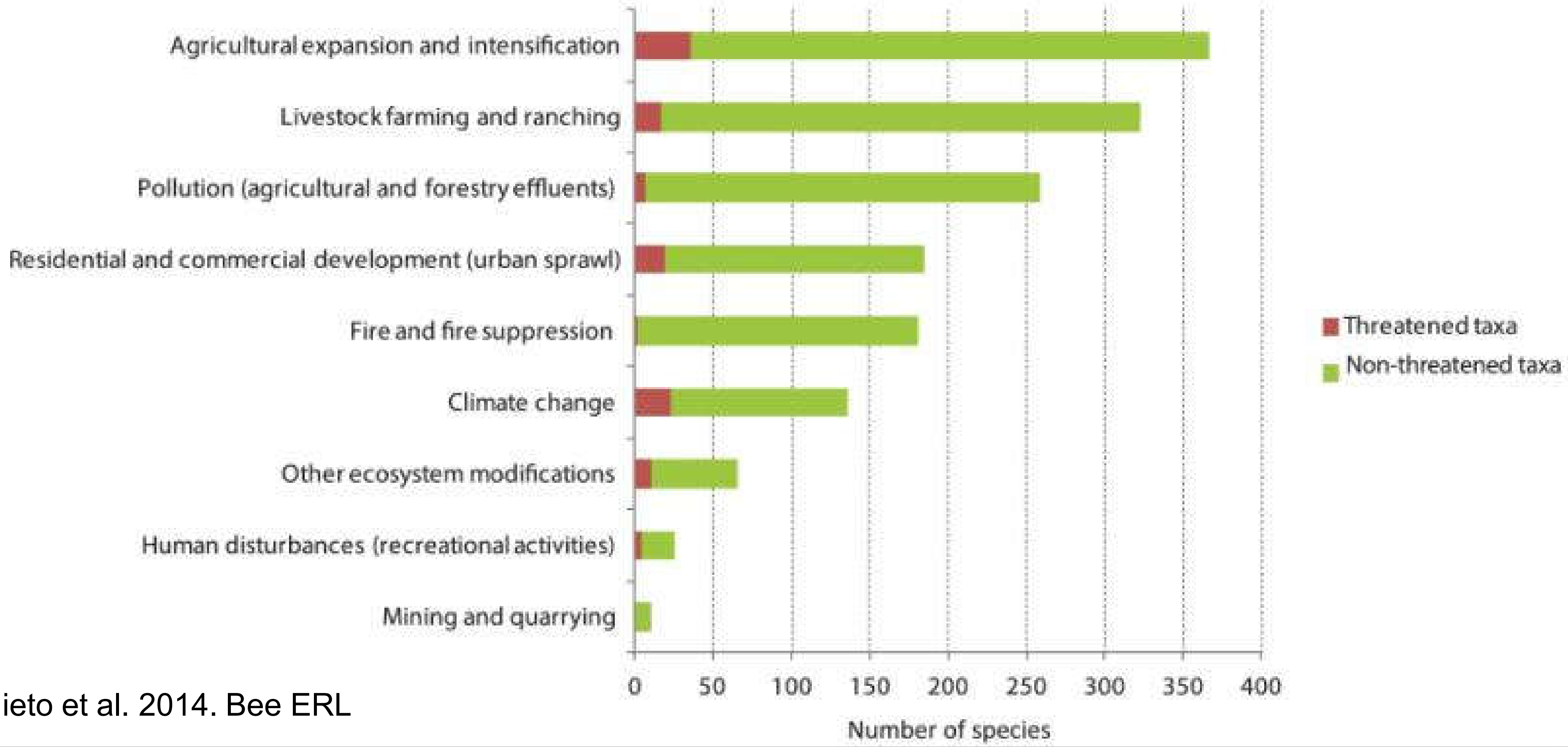
Major threats



Nieto et al. 2014. Bee ERL

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Groups declining : even the common ones

Impact of climate change? Study in Europe on bumblebees.

- *Around 38–76% of European bumblebee species currently classified as 'Least Concern' are projected to loss of at least 30% of territory by 2061–2080*

Article

Projected decline in European bumblebee populations in the twenty-first century

https://doi.org/10.1038/s41586-023-06471-0

Received: 10 February 2023

Accepted: 21 July 2023

Published online: 13 September 2023

Check for updates

Guillaume Ghisbain[1,2] ✉, Wim Thiery[3], François Massonnet[4], Diana Erazo[1], Pierre Rasmont[2], Denis Michez[2] & Simon Dellicour[1,5] ✉

Habitat degradation and climate change are globally acting as pivotal drivers of wildlife collapse, with mounting evidence that this erosion of biodiversity will accelerate in the following decades[1–3]. Here, we quantify the past, present and future ecological suitability of Europe for bumblebees, a threatened group of pollinators ranked among the highest contributors to crop production value in the northern hemisphere[4–8]. We demonstrate coherent declines of bumblebee populations since 1900 over most of Europe and identify future large-scale range contractions and species extirpations under all future climate and land use change scenarios. Around 38–76% of studied European bumblebee species currently classified as 'Least Concern' are projected to undergo losses of at least 30% of ecologically suitable territory by 2061–2080 compared to 2000–2014. All scenarios highlight that parts of Scandinavia will become potential refugia for European bumblebees; it is however uncertain whether these areas will remain clear of additional anthropogenic stressors not accounted for in present models. Our results underline the critical role of global change mitigation policies as effective levers to protect bumblebees from manmade transformation of the biosphere.

Ghisbain et al. 2023. *Nature*

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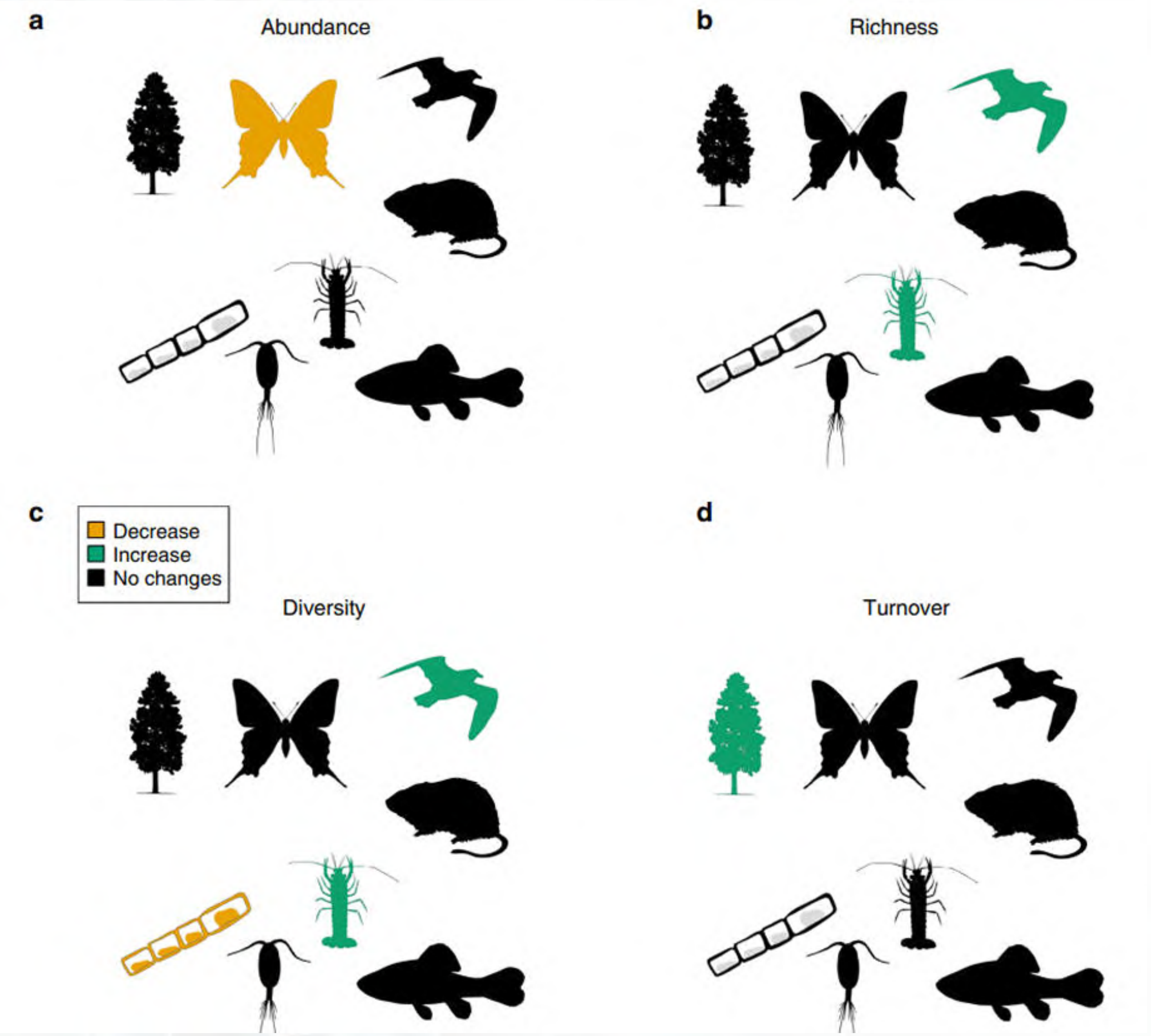
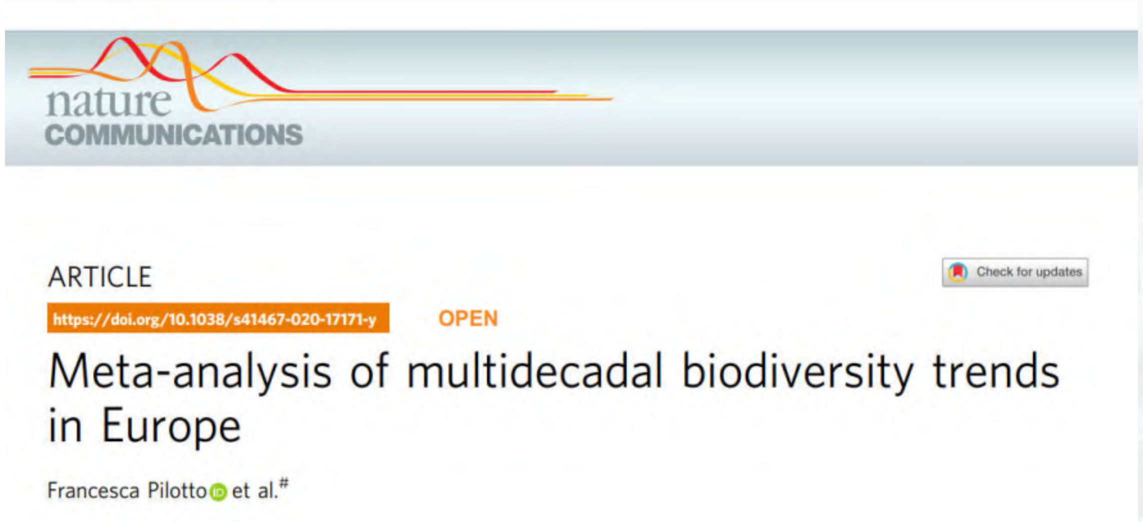
Pollinators decline stronger?




nature COMMUNICATIONS

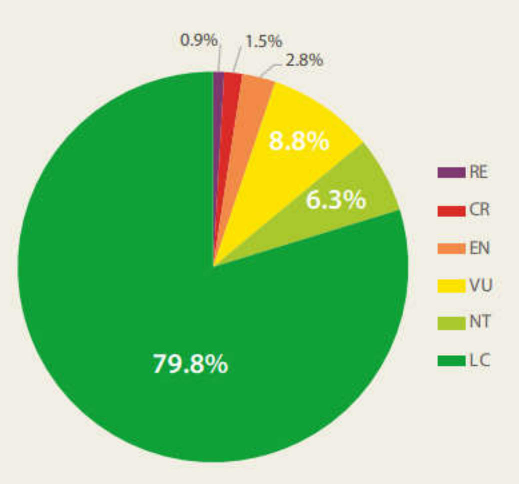
ARTICLE

Check for updates

https://doi.org/10.1038/s41467-020-17171-y OPEN

Meta-analysis of multidecadal biodiversity trends in Europe

Francesca Pilotto et al.#



13% assessed as threatened

BirdLife international 2021. Birds ERL

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Facts behind the NRL

- *Biodiversity and population trends in Europe?*

80%	10%	70%
of habitats are in poor condition	of bee and butterfly species risk extinction	of soils are in an unhealthy condition

- <u>Nature restauration law and pollinators</u>

"Restoration" is a process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed

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Nature restauration law

Vote for legally binding EU nature **restoration** targets to restore biodiversity and degraded ecosystems

GOAL: restore at least **20%** of the EU's land and sea areas by 2030

First ever focused specifically on the recovery of nature in EU member states.

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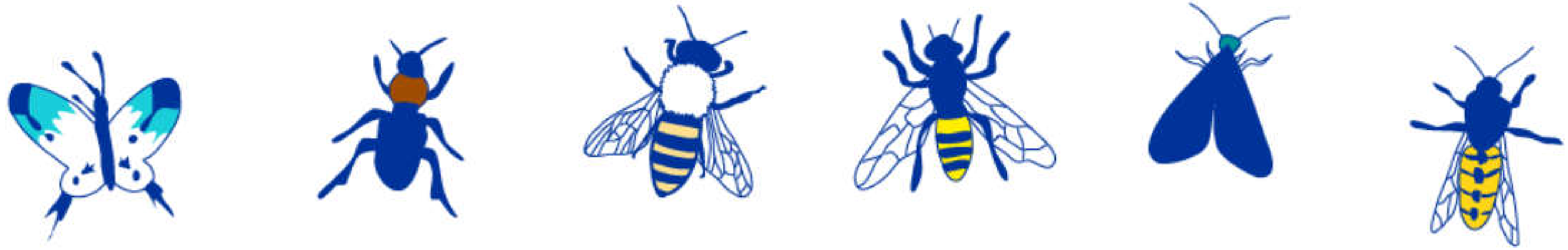
Nature restauration law and pollinators

Pollinators

Wild bees are the best know pollinators. Nonetheless, other insect species also contribute to pollinating flowers, which is **crucial for ensuring that crops can grow**. Almost €5 billion of the EU's annual agricultural output is directly attributed to insect pollinators.

The new rules would **reverse pollinator decline** and increase their populations by 2030.

Pollinators in Europe include butterflies, beetles, bees, hoverflies, moths and wasps.



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Facts behind the NRL

- *Biodiversity and population trends in Europe?*
- *Nature restauration law and pollinators*

- Data to implement actions -> EU-POMs

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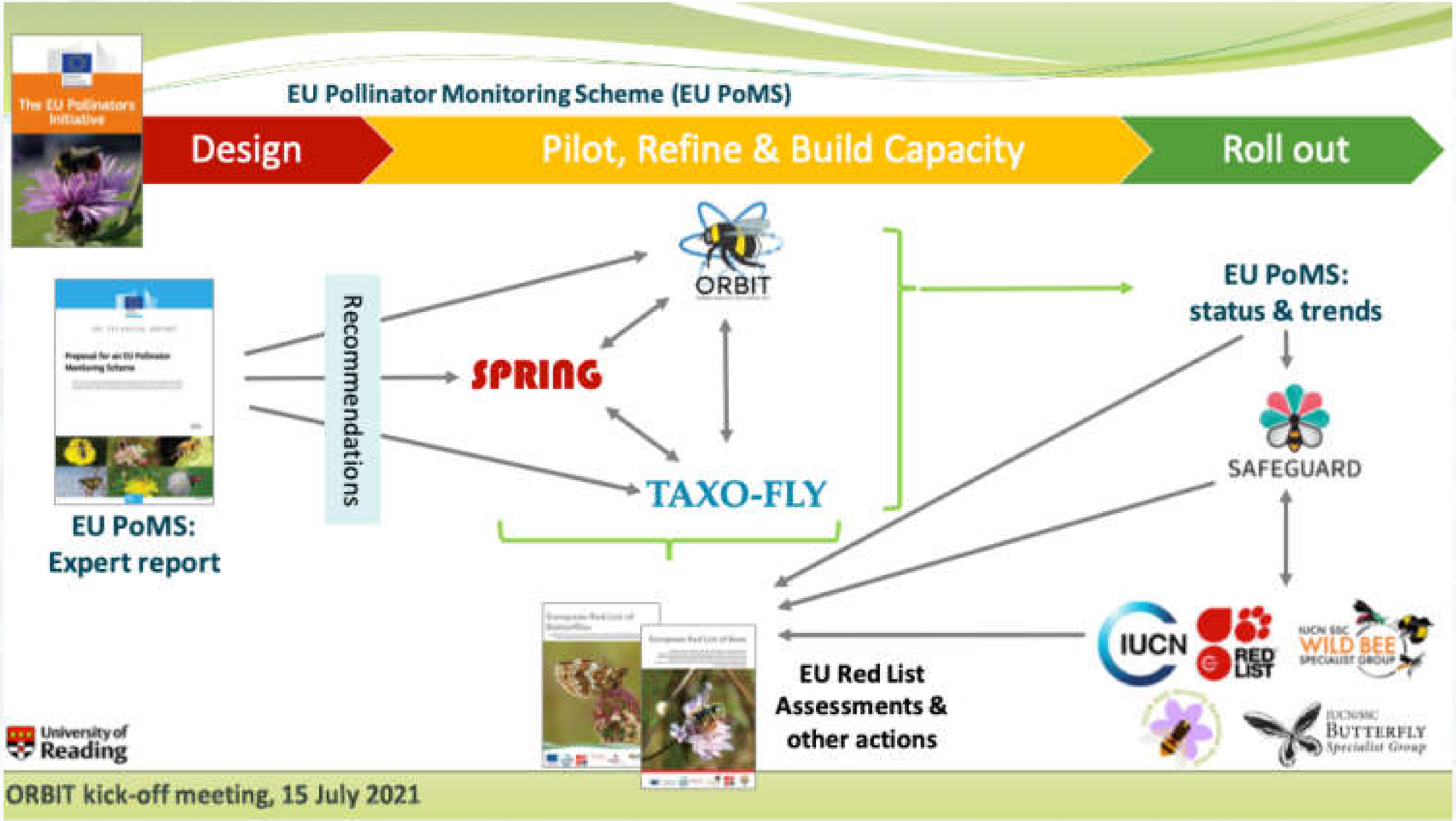
EU PoMS -> We need coordinated methods, we need people, we need data, we need actions



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Focus on two “capacity building” project

ORBIT project

- Taxonomic resources for EU Pollinator Monitoring Scheme
- New and developing tools for the identification of bees (Insecta, Apoidea)

SPRING project

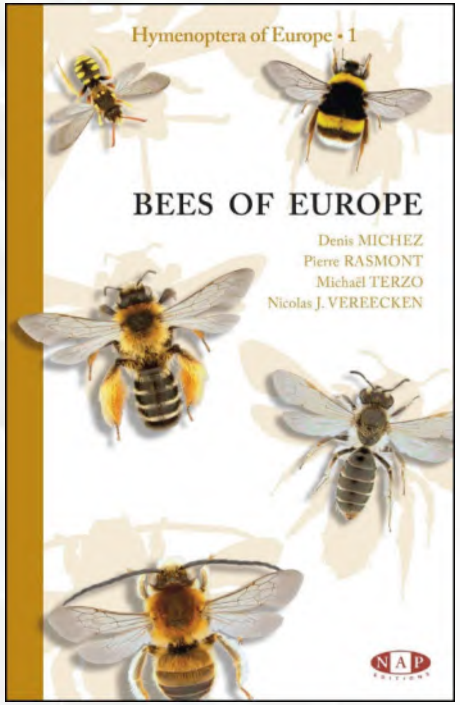
- Strengthening Pollinator Recovery through INdicators and monitorinG
- Developing protocols for monitoring pollinators in Transects and pan traps

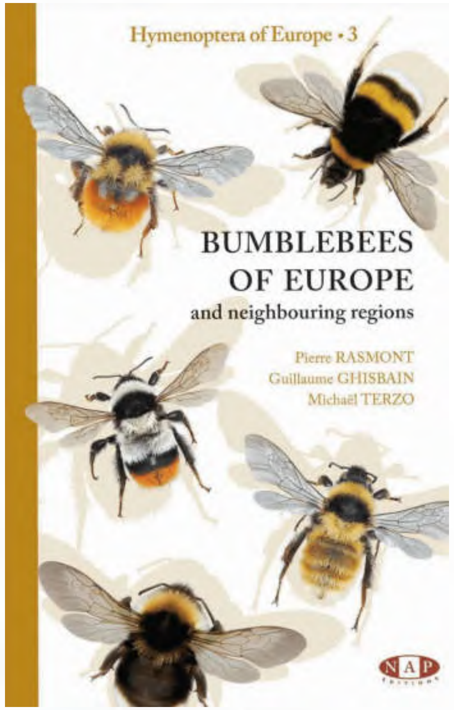
Other projects

- New IUCN Red list of the European bees, horizon projects (Safeguard, Poshbee, WildPosh), biodiversa projects (Restpol), ...

Orbit (2021-2025): what do we have?

1. **Identification of wild bees:**
   a. Identification to bee genera: Michez et al. 2019 (Bees of Europe)
   b. Identification to bee species: Few taxonomic revisions to European level (Rasmont et al. 2019, Smit 2018) other revisions are mostly based on local fauna, in national languages.





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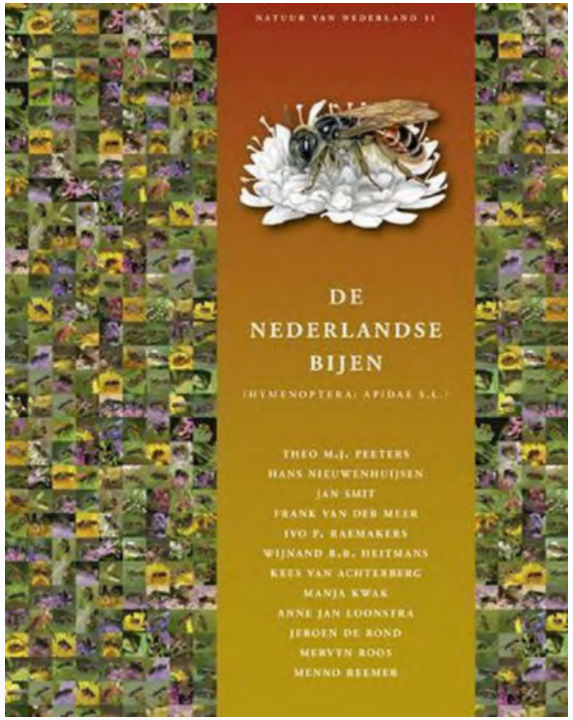
Orbit: what do we have?

- Situation at European scale: in North European countries the identification at species level is easier than in the South because the species diversity is lower than in South Europe.
- In the North and in some central European countries (e.g. Germany, the Netherlands and Switzerland) there are complete identifications keys and books, but none has been published for countries with large species diversity as Portugal, Italy and Greece.



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Orbit: what do we have?

- Most of the currently available revisions or identification keys to species level are outdate or based on national level (in native languages) (from Michez et al. 2019).
- Comprehensive and updated keys to EU level are missing in almost all genera.

Tableau 8. Références bibliographiques non exhaustives pour l'identification des espèces d'abeilles européennes. Les références suivies d'un asterix considèrent seulement une partie de la faune européenne, soit d'un point de vue taxonomique, soit d'un point de vue géographique. N= nombre d'espèce en Europe (d'après Rasmont *et al.* 2017).

Familles/ Sous-familles	Genres	N	Références bibliographiques
ANDRENIDAE			
Andreninae	*Andrena*	444	Warncke (1968), Osytshnjuk (1978)*, Schmid-Egger& Scheuchl (1997)*, Osytshnjuk (2005)*, Ariana et al. (2009)*, Dardon *et al.*(2014)*, Falk (2015)*
Panurginae	*Camptopoeum*	4	Osytshnjuk (1978)*, Schmid-Egger & Scheuchl (1997), Patiny (1999), Wood & Cross (2017)
	Clavipanurgus	1	-
	Flavipanurgus	6	Warncke (1972), Wood & Cross (2017)
	Melitturga	6	Osytshnjuk (1978)*, Schmid-Egger & Scheuchl (1997)
	Panurgus	13	Osytshnjuk (1978)*, Patiny (1999), Patiny *et al.* (2005)
	Panurginus	14	Osytshnjuk (1978)*, Schmid-Egger & Scheuchl (1997)
	Simpanurgus	1	-
APIDAE			
Apinae	*Amegilla*	11	Friese (1897), Alfken (1927), Osytshnjuk& Ponomareva (1978) Herrero & Pérez-Iñigo (1982, 1985), Brooks (1988)
	Ancyla	7	Warncke (1979)
	Anthophora	78	Friese (1897), Osytshnjuk& Ponomareva (1978) Herrero & Pérez-Iñigo (1982, 1985), Brooks (1988), Rasmont (1995), Amiet *et al.* (2007)*, Falk (2015)*
	Apis	1	-
	Bombus	71	Pittioni (1939), Løken (1973, 1984), Panfilov (1978), Rasmont (1984), Rasmont *et al.*(1986), Amiet (1996)*, Falk (2015)*
	Cubitalia	2	Tkalcu (1984)
	Eucera	86	Osytshnjuk& Ponomareva (1978), Amiet *et al.* (2007)*, Falk (2015)*
	Habropoda	3	Schwarz & Gusenleitner (2001)
	Melecta	22	Lieftinck (1980), Amiet *et al.* (2007)*, Falk (2015)*
	Tarsalia	2	Warncke (1979)
	Tetralonia	1	-
	Tetraloniella	19	Osytshnjuk& Ponomareva (1978)

	Thyreus	12	De Beaumont (1939), Lieftinck (1968), Osytshnjuk& Ponomareva (1978).
Nomadinae	*Ammobates*	14	Osytshnjuk& Ponomareva (1978), Amiet *et al.* (2007)*
	Ammobatoides	4	Osytshnjuk& Ponomareva (1978), Amiet *et al.* (2007)*
	Biastes	3	Osytshnjuk& Ponomareva (1978), Amiet *et al.* (2007)*
	Chiasmognathus	1	-
	Epeoloides	1	-
	Epeolus	17	Osytshnjuk& Ponomareva (1978), Amiet *et al.*(2007)*, Falk (2015)*
	Nomada	80	Osytshnjuk& Ponomareva (1978), Amiet *et al.* (2007)*, Falk (2015)*
	Parammobatodes	2	Schwarz (2003)
	Pasites	1	Osytshnjuk& Ponomareva (1978), Amiet *et al.*(2007)*
	Schmiedeknechtia	1	-
	Triepeolus	1	-
Xylocopinae	*Ceratina*	28	Amiet *et al.* (2007)*, Terzo *et al.* (2007)*, Falk (2015)*
	Xylocopa	6	Amiet *et al.* (2007)*, Terzo *et al.* (2007)*
COLLETIDAE			
Colletinae	*Colletes*	62	Amiet *et al.* (1999)*, Ortiz-Sánchez*et al.* (2004)*, Proshchalykin & Kuhlmann (2012)*, Falk (2015)*
Hylacinae	*Hyaleus*	86	Dathe (1980), Amiet *et al.* (1999)*, Falk (2015)*
HALICTIDAE			
Rophitinae	*Dufourea*	20	Ebmer (1993)*, Amiet *et al.* (1999)*, Pesenko *et al.* (2000)*, Falk (2015)*
	Rhophitoides	2	Schwammberger (1975), Amiet *et al.* (1999)*, Pesenko *et al.* (2000)*
	Rophites	8	Amiet *et al.* (1999)*, Pesenko *et al.*(2000)*
	Systropha	2	Amiet *et al.* (1999)*, Pesenko *et al.*(2000)*, Patiny & Michez (2006)
Nomiinae	*Nomiapis*	8	Warncke (1976), Amiet *et al.* (1999)*, Pesenko *et al.*(2000)*, Bakker (2002)*
Nomioidinae	*Ceylalictus*	1	-
	Nomioides	5	Amiet *et al.* (1999)*,Pesenko *et al.*(2000)*
Halictinae	*Halictus*[1]	75	Blüthgen (1924)*, Ebmer (1969), Pesenko *et al.* (2000)*, Amiet *et al.* (2001)*, Falk (2015)*
	Lasioglossum	175	Blüthgen (1924)*, Ebmer (1970, 1971)*, Pesenko *et al.* (2000)*, Amiet *et al.* (2001)*, Falk (2015)*
	Sphecodes	47	Amiet et al. (1999)*,Pesenko *et al.*(2000)*, Bogusch & Straka (2012), Falk (2015)*
	Thrincohalictus	1	-

MEGACHILIDAE			
Lithurginae	*Lithurgus*	3	Amiet *et al.* (2004)*
Megachilinae	*Afrantbidium*	3	-
	Aglaoapis	1	-
	Anthidiellum	2	-
	Anthidium	17	Amiet *et al.* (2004)*, Falk (2015)*
	Chelostoma	25	Amiet *et al.* (2004)*, Torres *et al.* (2012)*, Müller (2015)* Falk (2015)*, Falk (2015)*
	Coelioxys	28	Amiet *et al.* (2004)*, Ortiz-Sanchez *et al.* (2009), Falk (2015)*
	Dioxys	6	Amiet *et al.* (2004)*
	Ensliniana	1	-
	Eoanthidium	4	-
	Haetosmia	2	-
	Heriades	6	Amiet *et al.* (2004)*, Falk (2015)*
	Hofferia	1	Müller & Trunz (2014)*
	Hoplitis	101	Müller (2012, 2014a, 2014b, 2015, 2016)*, Falk (2015)*, Müller & Mauss (2016)*
	Icteranthidium	5	-
	Megachile	86	Amiet *et al.* (2004)*, Ortiz-Sanchez *et al.* (2012), Falk (2015)*, Praz (2017)
	Metadioxys	1	-
	Osmia	101	Amiet *et al.* (2004)*, Falk (2015)*
	Paradioxys	1	-
	Protosmia	13	Müller (2017)*
	Pseudanthidium	9	-
	Rhodanthidium	7	-
	Stelis	24	Amiet *et al.* (2004)*, Ornosa *et al.*(2009), Kasparek (20015), Falk (2015)*
	Stenoheriades	3	Müller & Trunz (2014)*
	Trachusa	6	Kasparek (2017)
MELITTIDAE			
Dasypodainae	*Dasypoda*	17	Amiet *et al.*(2007)*, Michez *et al.* (2004), Falk (2015)*, Radchenko (2016)*
Melittinae	*Macropis*	3	Amiet *et al.* (2007)*, Michez & Patiny (2005), Falk (2015)*
	Melitta	18	Amiet *et al.* (2007)*, Michez & Eardley (2007), Falk (2015)*

[1] Le genre *Halictus* comprend ici les *Seladonia* et les*Vestitohalictus* qui sont considérés comme des genres à part entière dans Rasmont *et al.* (2017).

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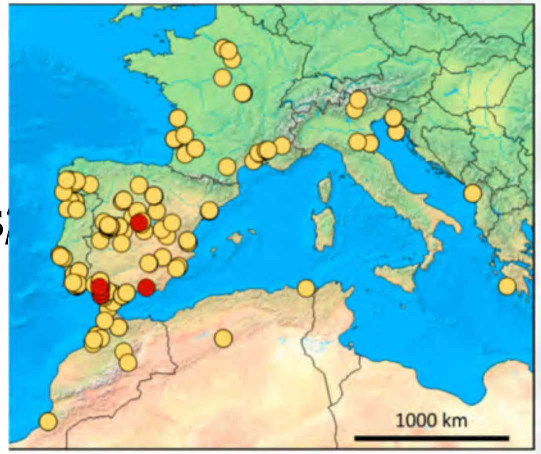
Orbit: What tools are in development?

Factsheet will: (1) summarize the **taxonomy**; (2) provide **diagnoses**; (3) high-resolution **pictures** of diagnostic traits, (4) pictures of the bees in their habitats, if available; (5) **summarize the biology** (including host-plant associations and other ecological/behavioural traits); (6) **maps**; (7) **barcodes**; (8) description and **keys to genus level**.

Fully open-access internet platform.



MOLECULAR ECOLOGY RESOURCES
Molecular Ecology Resources (2015) doi: 10.1111/1755-0998.12363

DNA barcoding largely supports 250 years of classical taxonomy: identifications for Central European bees (Hymenoptera, Apoidea *partim*)

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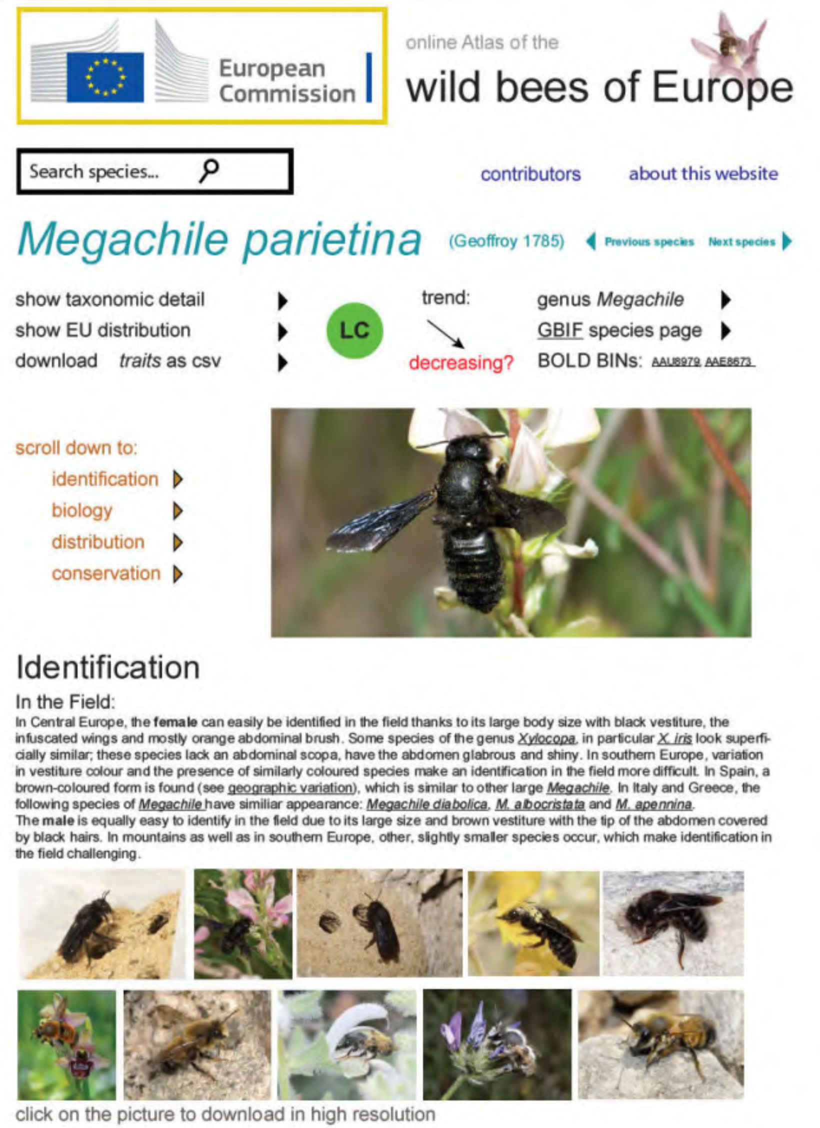
Orbit: What tools are in development?



European Commission

online Atlas of the

wild bees of Europe

Search species...

contributors   about this website

Megachile parietina (Geoffroy 1785)   Previous species   Next species

show taxonomic detail
show EU distribution
download *traits* as csv

LC

trend:
decreasing?

genus *Megachile*
GBIF species page
BOLD BINs: AAU8979 AAE8673

scroll down to:
- identification
- biology
- distribution
- conservation

Identification

In the Field:

In Central Europe, the **female** can easily be identified in the field thanks to its large body size with black vestiture, the infuscated wings and mostly orange abdominal brush. Some species of the genus *Xylocopa*, in particular *X. iris* look superficially similar; these species lack an abdominal scopa, have the abdomen glabrous and shiny. In southern Europe, variation in vestiture colour and the presence of similarly coloured species make an identification in the field more difficult. In Spain, a brown-coloured form is found (see geographic variation), which is similar to other large *Megachile*. In Italy and Greece, the following species of *Megachile* have similiar appearance: *Megachile diabolica*, *M. albocristata* and *M. apennina*.
The **male** is equally easy to identify in the field due to its large size and brown vestiture with the tip of the abdomen covered by black hairs. In mountains as well as in southern Europe, other, slightly smaller species occur, which make identification in the field challenging.

click on the picture to download in high resolution

European Commission

online Atlas of the

wild bees of Europe

Search species...

contributors   about this website

Megachile parietina (Geoffroy 1785)   Previous species   Next species

Identification

In the lab:

Member of the subgenus *Chalicodoma*
Female with elongate mandible without cutting edge. Vestiture entirely black, except at low elevation in Spain (*Megachile parietina baetica*). Scopa orange in Western Europe, black on Balkan Peninsula. Tarsi always dark brown. Clypeus without short, modified hairs (see *M. lefebvrei* and *M. albocristata*, which can also be entirely dark). Abdomen without spots of white hairs laterally on terga (see *M. apeninna*). In Spain, similar to *M. rufescens setulosa*, which differ in dense tergal fringes of hairs. Body size 15-18mm.
Male with vestiture brown, black on tip of abdomen (except on Island of Carpathos). Front coxa without tooth, mandible elongate, without inferior projection. Preapical carina of T6 multidentate, laterally without spine (see *M. lefebvrei* and *M. albocristata*). Hind basitarsus dark. A certain identification in southern Europe necessitates the examination of the hidden sterna. Sternum 4 marginally smooth, without groove or carina (with groove and carina in *M. pyrenaica* and *M. rufescens*). Sternum 5 with wide median emargination, emargination approximately a third of sternal width (much shorter in *M. rufescens* and *M. pyrenaica*). Sternum 6 with two lateral brush of modified, thickened hairs, and 2 long submedian processes. Genitalia as in parietina-group of subgenus *Chalicodoma*.
Praz (2017); Rebmann (1969); Amiet et al. (2004). Scheuchl (2006)

click on the picture to download in high resolution

Open taxonomic questions

The species shows considerable geographic variation sometimes associated with deep genetic divergences. At low elevations in Spain, the subspecies *M. parietina baetica* is found, which shows brown vestiture, strongly constrating with other European populations. The nominal, black form is however found in range sympatry at high elevations in the Sierra Nevada. Since both forms appear to be associated with distinct ecological niches, the subspecific rank is maintained for *M. parietina baetica*. In southeastern Europe, the subspecies *M. parietina nestorea* is found, in which the female abdominal brush is entirely black. This form shows substantial genetic divergence compared to the nominal form. Lastly, weak geographic variation is observed on the Island of Carpathos, leading to the description of an endemic subspecies. Morphological and genetic differentiation is weak and this subspecies is not recognized.
Tkalcu (1992); Praz et al. (2021).

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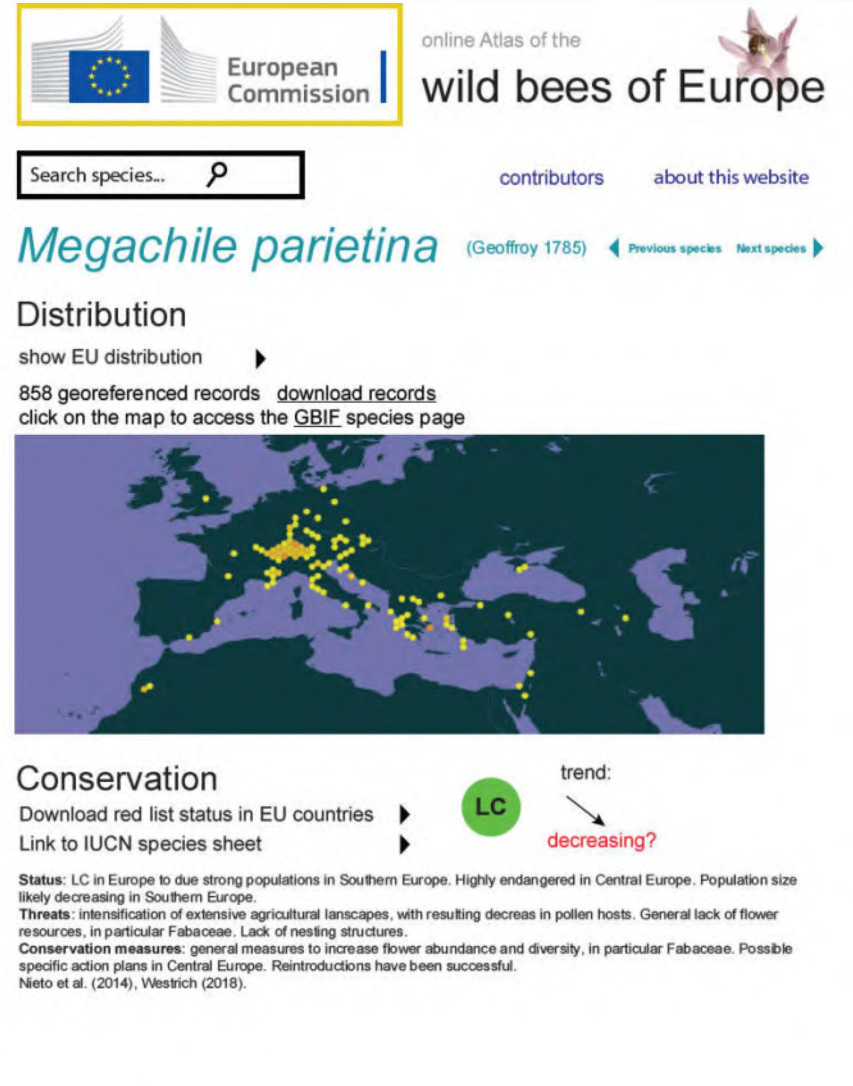
Orbit: What tools are in development?



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Orbit: what tools do we also need?

There is a mismatch between species richness and the number of publications associated to different genera (Wood et al. 2020). While the family Andrenidae represents 23% of bee species richness in Europe and pollinate an important number of plants, including crops, basic taxonomic and biological information is still lacking for this diverse group (Wood et al. 2020a).

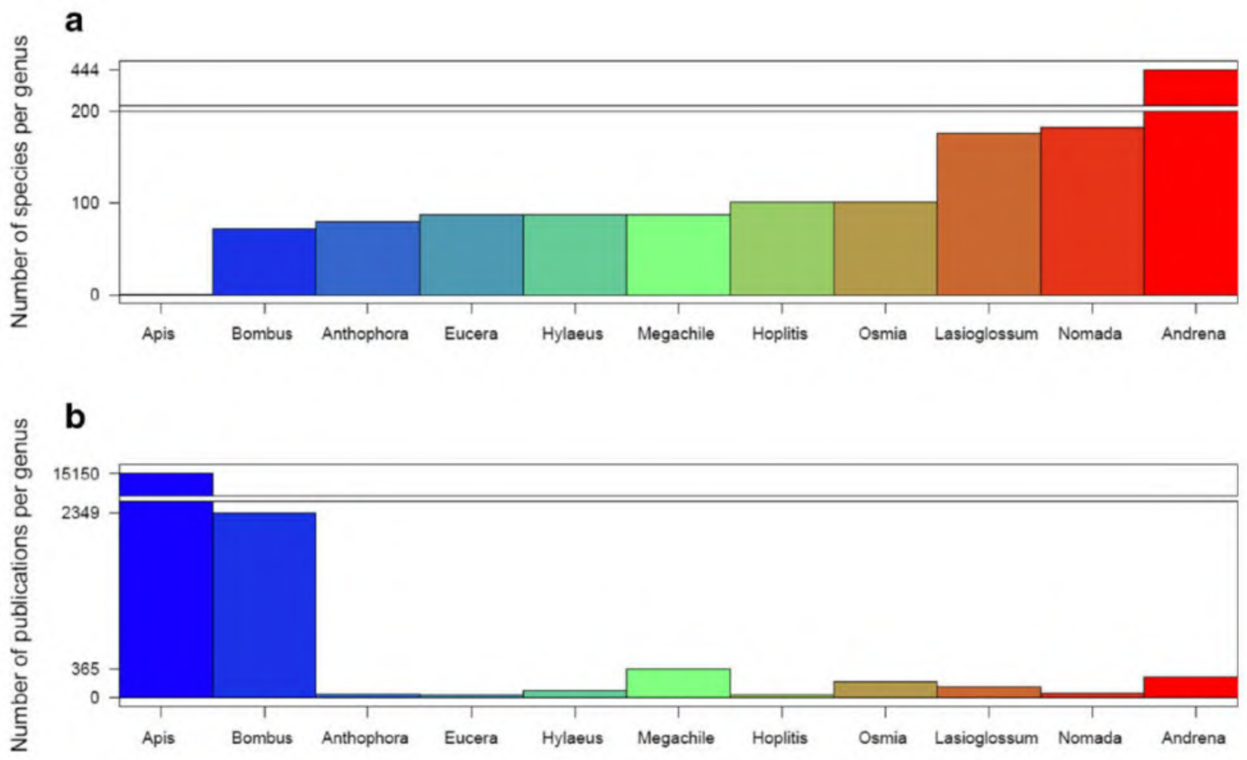

Figure 2. Species diversity per genus is not related to scientific publications (Wood et al. 2020b). **a.** The top 10 European bee genera with the highest species diversity. **b.** The number of publications recorded in Scopus for the top 10 most diverse European bee genera and for the genus *Apis*.

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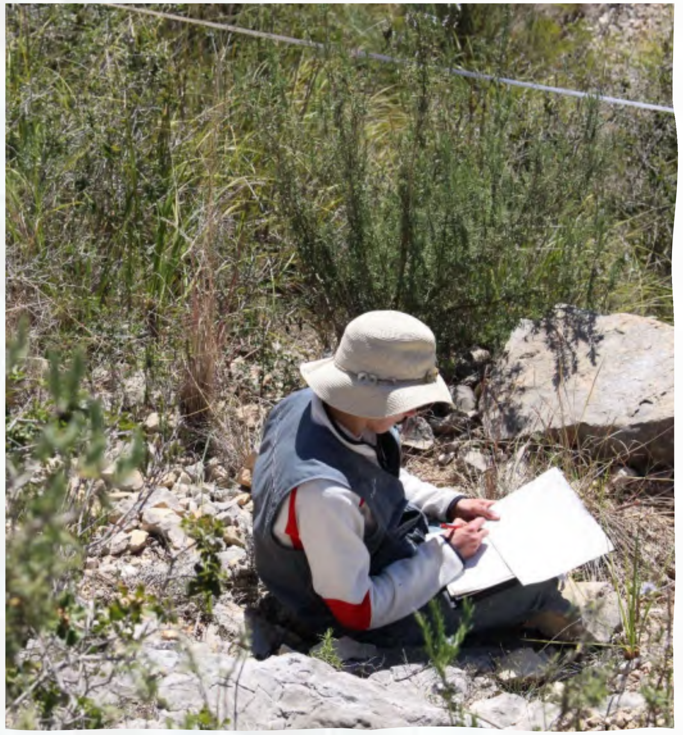
Spring (2021-2023): what do we have?

Monitoring

SPRING has started (1) monitoring of transects in all Europe (10% of the number of final goal of sites); (2) training courses: basic, intermediate, advanced for volunteers and associated researchers and technicians.



Surveys from volunteers

Transects and pan traps processing

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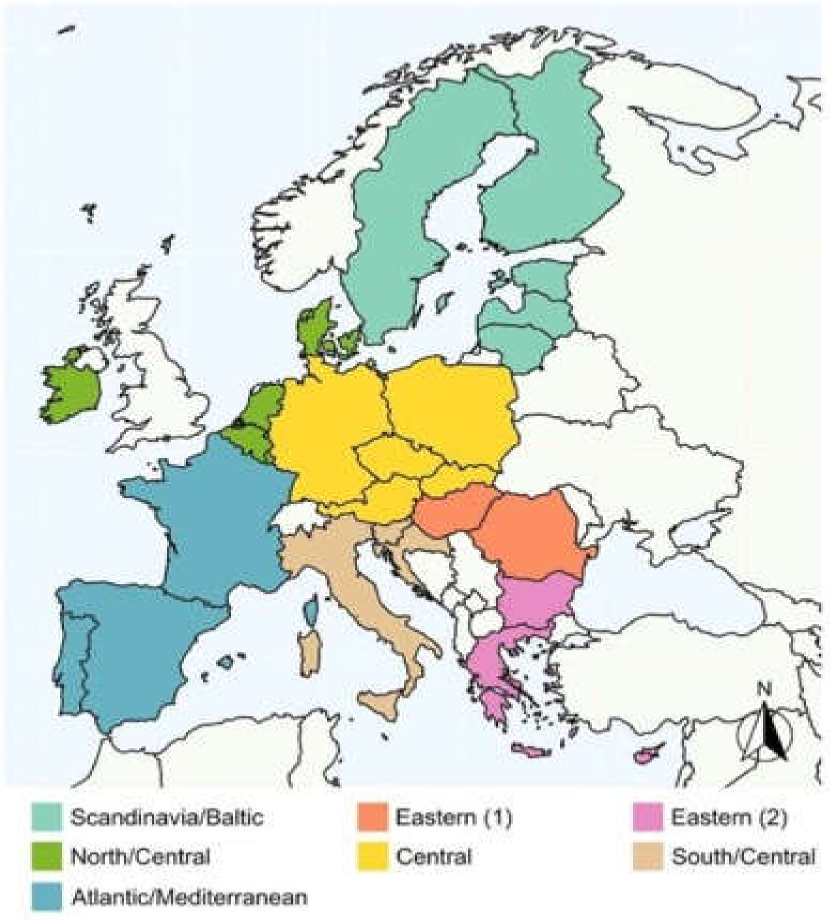
Spring: what do we have?

Monitoring



- ✓ Region 1. Scandinavia/Baltic: **Sweden**, Lithuania, Latvia, Finland, Estonia
- ✓ Region 2. Eastern 1. **Hungary**, Romania
- ✓ Region 3. Eastern 2. **Greece**, Bulgaria, Cyprus
- ✓ Region 4. Atlantic/Mediterranean. **Spain**, France, Portugal
- ✓ Region 5. North/Central. **Netherlands**, Belgium, Denmark, Ireland, Luxembourg.
- ✓ Region 6. Central. **Germany**, Czech Republic, Austria, Poland, Slovakia
- ✓ Region 7. South/Central. **Italy**, Croatia, Malta, Slovenia

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Training sessions

4 levels of trainings

4 sessions of advanced training for bees and hoverflies

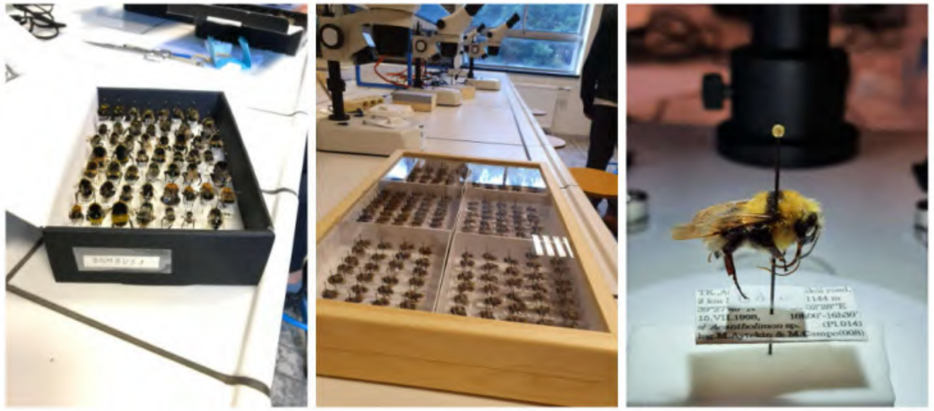
8 to 12 people per session from all EU27 countries

Challenge of determination

Spring: What tools are in development? On-line resources, reference collection and keys

PPT

KEYS



Reference collection

KEY TO THE FEMALES

1.Anterior tibia with a light cuticle, from light brown to yellowish (**Fig. 1**). Discs of the terga hairless and shiny (**Fig. 2**)……………………………………………………..***Dasypoda* (*Megadasypoda*) *visnaga***

Figure 1. Habitus in dorsal view of *D. visnaga*

Figure 2. Metasoma in dorsal view of *D. visnaga*

- Anterior tibia with a dark cuticle……………………………………………………...…………………..2

2. Galea with the external margin glabrous, sometimes a few setae at the apex. Maxillary palp shorter than half of the length of the galea (**Fig. 3**). Pygidial plate with a dense and adpressed pilosity, at least at the base. Malar space at least as long as the pedicel (**Fig. 4**) (except in *D. spinigera* in which the malar space is shorter). Hair of the scopa always plumose. Position of the nervulus either ante-, inter- or postfurcal ……………………………………………………... Subgenus ***Megadasypoda*** (partim) …. **4**

Figure 3. Galea and maxillary palp of *D. toroki*

Figure 4. Malar space of *D. braccata*

- External margin of the galea with setae at least on its apical half. Maxillary palp longer than or equal to half of the length of the galea (**Fig. 5**). Pygidial plate entirely glabrous. Malar space always clearly shorter than the pedicel (**Fig. 6**). Pilosity of the scopa either plumose or not. Nervulus always antefurcal………………………………………………………………………………………………. **9**

Spring: What tools are in development? New EU check lists

STEP 1 : Update of the species list from Nieto et al. 2014 at continental level

1965 species → **Update based on literature** → **Review of the list**

By alpha-taxonomists → **Review of the list and country records**

By national champions → **2138 species**

→ Publication of the updated check list with Syrphid community

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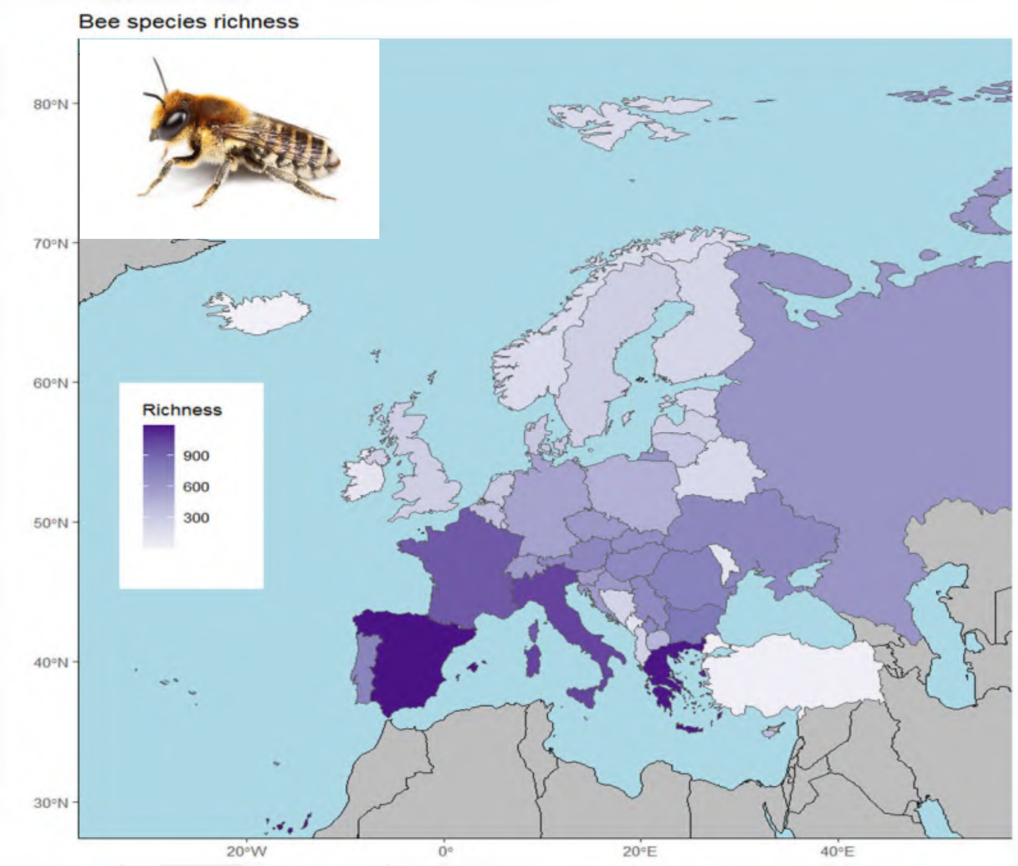
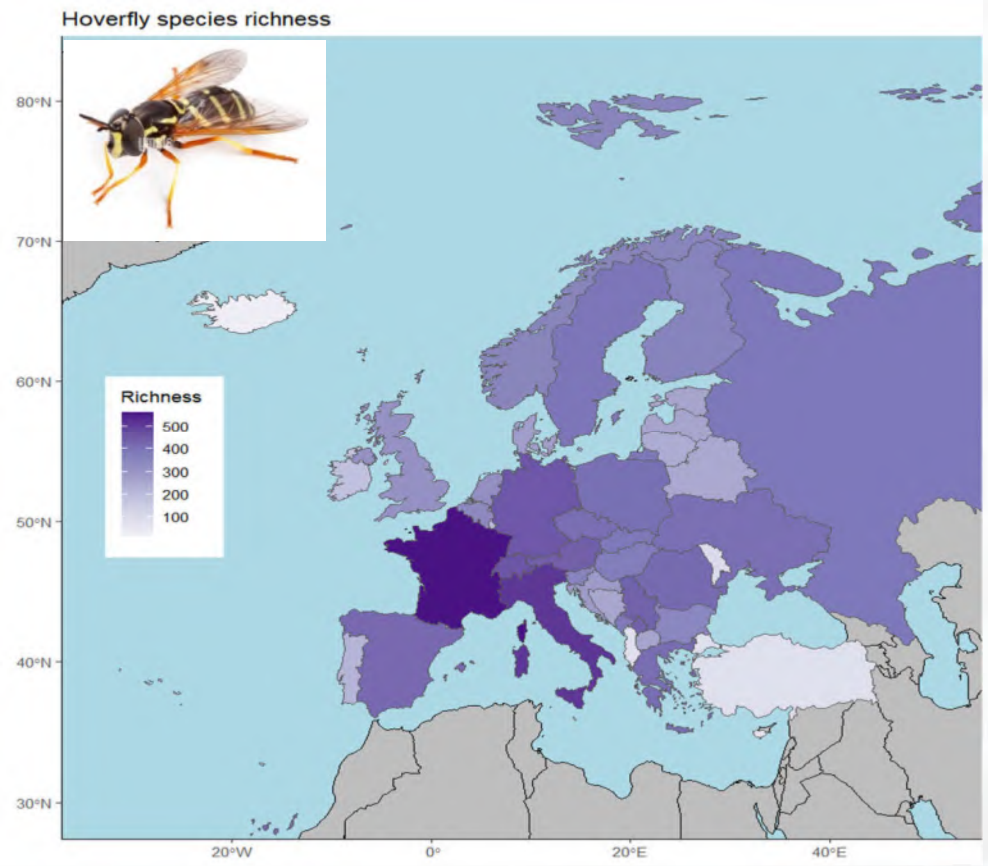
Spring: What tools are in development? National check lists

STEP 2 : Country records for each country





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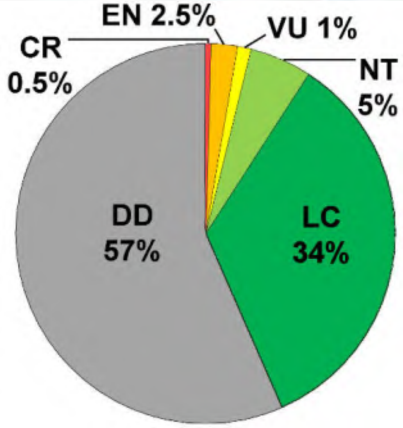
Other European initiatives: Update of European Red List -> Pulse

Assessment of the 1928 species with applicable criteria

Many families have poor data,
like Andrenidae and Megachilidae

Order	Family	Total	CR	EN	VU	NT	LC	DD	% Threatened
Hym.	Andrenidae	442	3	5	0	7	104	323	1.8
	Apidae	561	3	12	9	27	200	310	4.3
	Colletidae	141	0	10	8	7	54	62	12.8
	Halictidae	306	0	11	2	45	105	143	4.2
	Megachilidae	441	1	3	1	10	184	242	1.1
	Melittidae	37	0	5	2	5	14	11	18.9
Total		1928	7	46	22	101	661	1091	3.9



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Other European initiatives: WildPosh / Pollinera

Project results are expected to contribute to all of the following expected outcomes:

- Routes of exposure, linked to ecosystem and biodiversity dynamics to chemicals are better understood,
- Issues raised by the contamination of biodiversity in the natural environment are better known, including risks linked to existing contaminations (legacy), chemicals of emerging concern and accumulations in nature,
- Environmental fate of new chemicals of emerging concern is better understood,
- Toxicological and ecological impacts of contaminants are better understood and risk assessments for relevant highly exposed species are strengthened,
- **Prevention and mitigation measures are identified and developed -> <u>Support policy decision for transition</u>**

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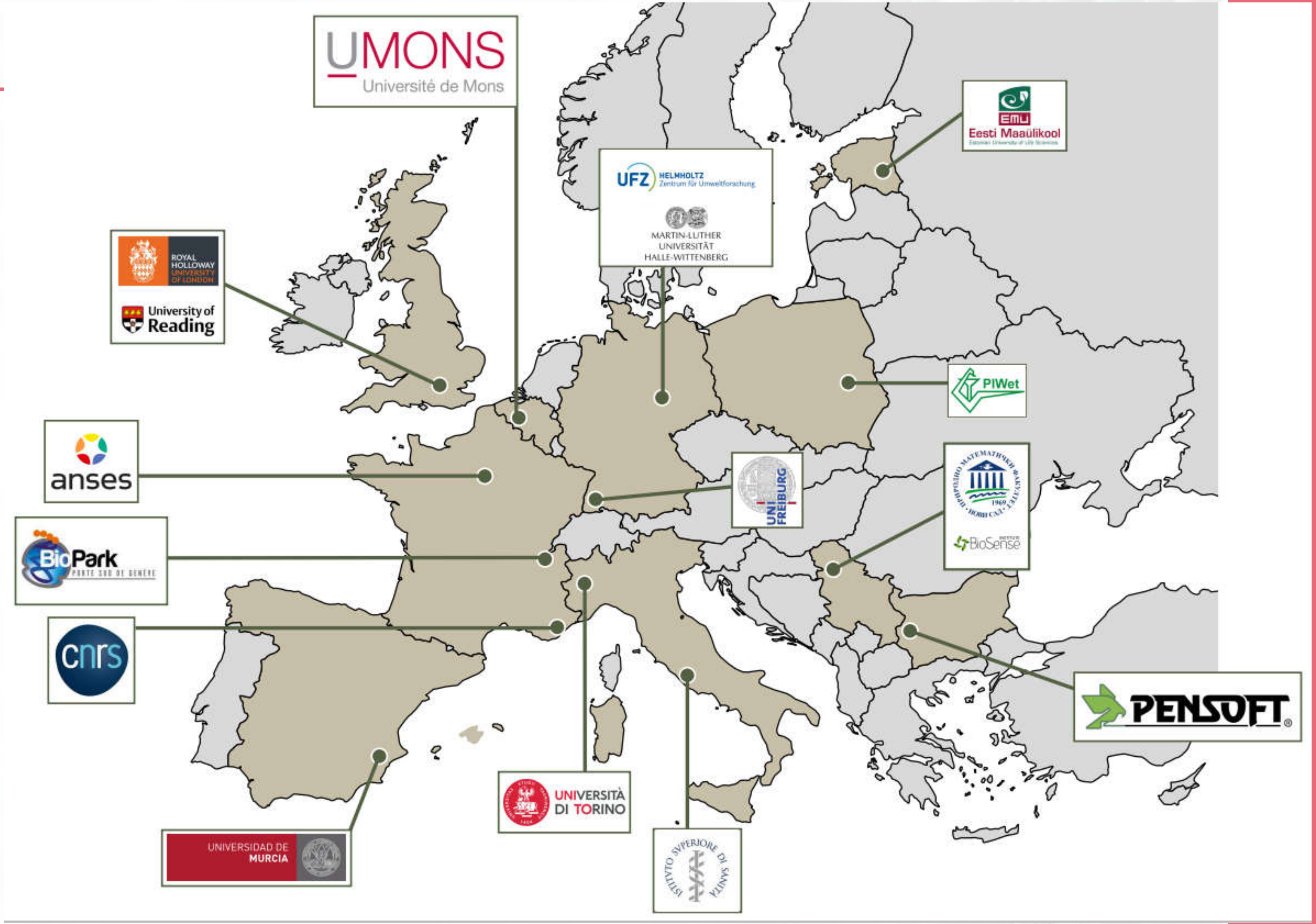
Who we are?

- 15 partners
- 2 associate partners (UK)
- UMONS coordinator

Universities

Research agency

Private company



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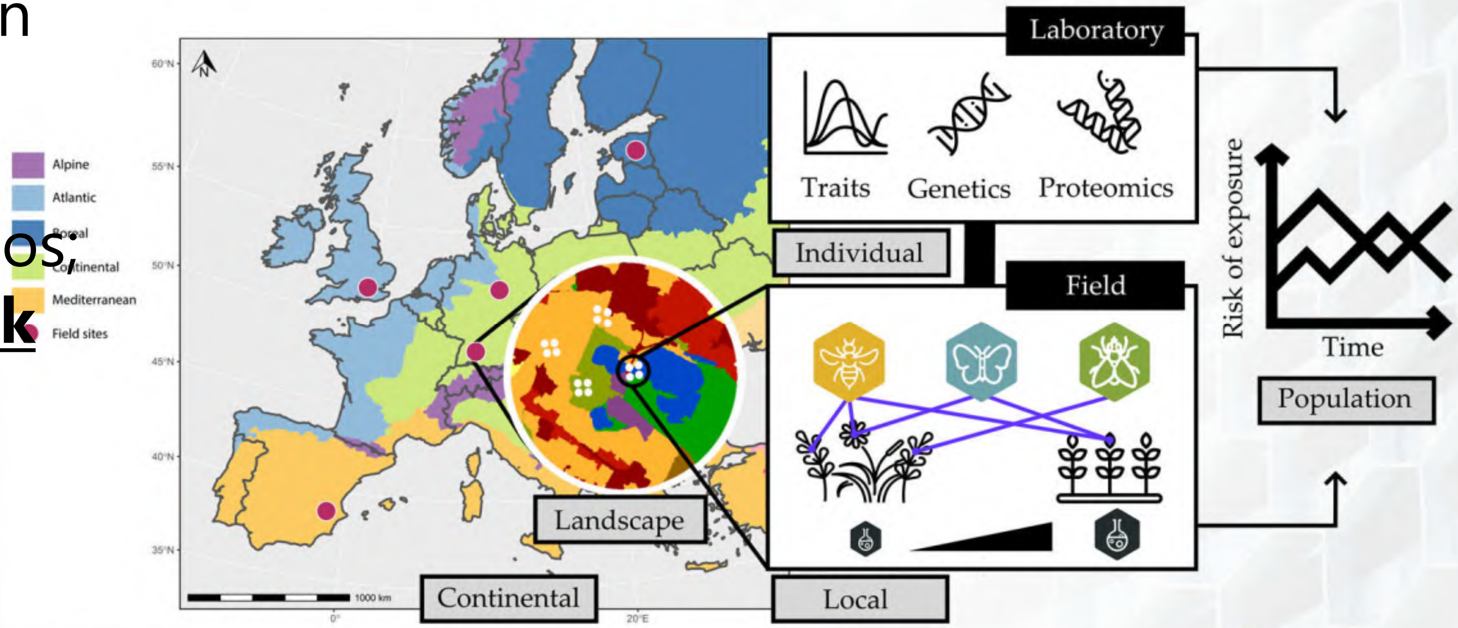
Objectives and conceptual framework

1. Determining the real-world agrochemical exposure profile of wild pollinators at landscape level, within and among sites;
2. Using integrated and controlled laboratory and semi-field experiments to characterise causal relationships between pesticides and pollinator health;
3. Building an open database on pollinator traits/distribution and chemicals to define exposure and toxicity scenarios;
4. **<u>Proposing new tools for risk assessment for wild pollinators</u>**



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TAKE HOME MESSAGE

- **Strong decline of pollinators, common and rare**
- **Development of capacity, data, assessment and action**
- **Results impacting policy**

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