

# **S**TATUS AND **T**TRENDS OF **E**UROPEAN **P**POLLINATORS

Key Findings from the STEP project





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## 2.3 Future climatic risks for European bumblebees

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### Summary of the science

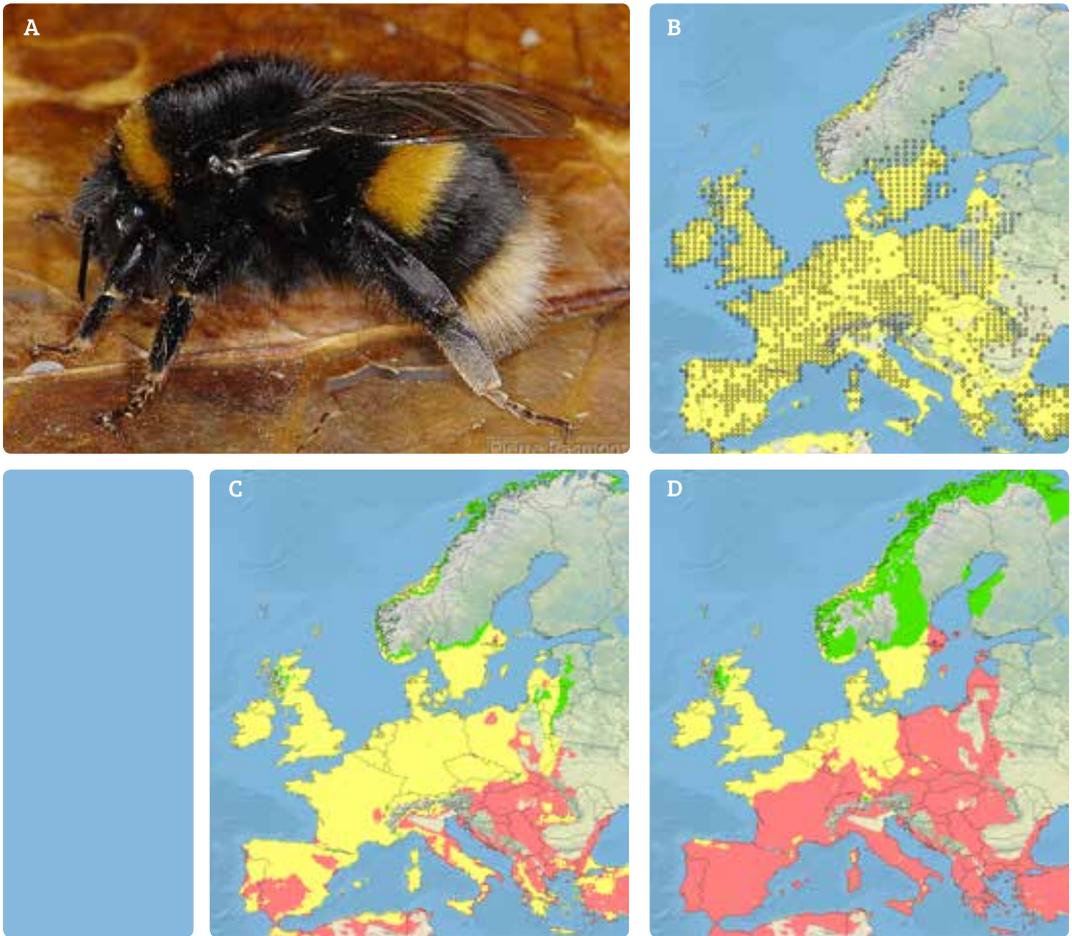
Bumblebees are important wild and managed pollinators but future climate change will pose serious risks on them. Based on species distribution data for all 69 European bumblebee species, gathered within STEP (see Atlas Hymenoptera; [www.atlashymenoptera.net](http://www.atlashymenoptera.net)) and corresponding, biologically relevant climate data, we modelled their climatically suitable areas under current conditions. Based on these models, we projected future suitable areas according to three climate change scenarios for 2050 and 2100<sup>\*</sup>: (i) SEDGE: Sustainable European Development Goal scenario (expected temperature increase for Europe in 2100 is 3.0°C), (ii) BAMBU: Business-As-Might-Be-Usual scenario (expected temperature increase for Europe in 2100 is 4.7°C) and (iii) GRAS: GRowth Applied Strategy scenario (expected temperature increase for Europe in 2100 is 5.8°C). Taking into account a careful assessment of the dispersal capability of the species, we found that the vast majority of bumblebees (up to 46 species in 2050 and up to 52 species in 2100) will suffer from range contractions. Only four to five species might be able to expand their ranges, and up to eleven species will keep their status quo. The future fate of the bumblebees also differed considerably among the three scenarios. Under the most severe climate change scenario (GRAS), 22 species would lose nearly all their suitable area, leading them at the verge of extinction in Europe. Under the less severe climate change scenarios (SEDGE and BAMBU), it would be only two or three species. These dramatic projections are in accordance with the present conservation status as proposed by the IUCN Red List (see case study 1.2).

Future changes in the distribution of single species will finally add up to overall changes in species richness of bumblebees. We found that reductions in bumblebee diversity will already be noticeable in most of the considered areas by 2050 (median potential loss of 22 to 38%) while this reduction will be drastic in 2100 for all scenarios (median potential loss of 42 to 88%). Only a few areas in the north and some mountain areas of Europe would be able to conserve a substantial part of their present diversity.

### Policy relevance

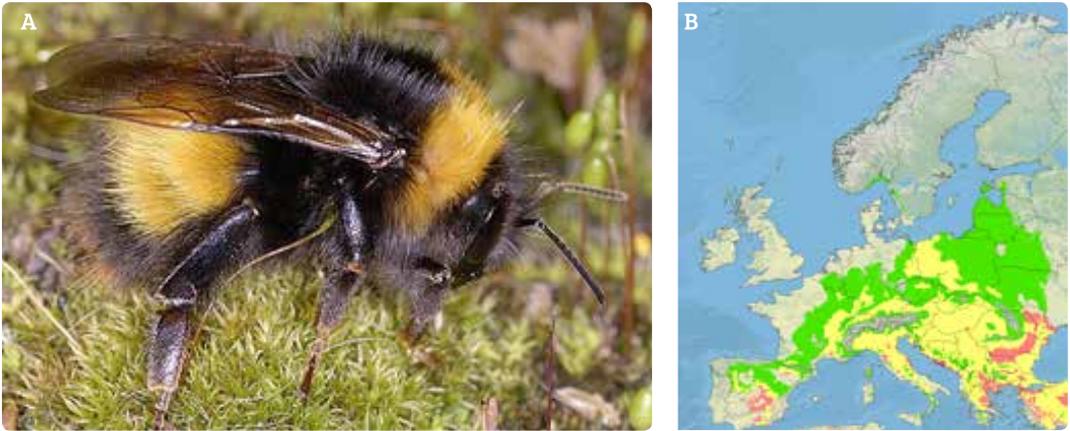
The considerable future losses of bumblebee species and their diversity across large areas in Europe give rise to serious concerns. Even the most abundant and widespread species are expected to contract (see Figures 1-2). Since bumblebees are presently one of the most effective and abundant wild and managed pollinators in temperate areas, and so their decline would lead to a reduction in the pollination of many wild plants and agricultural crops with potentially severe socio-economic consequences. This is further exacerbated by the fact that these potential reductions of pollination services are unlikely to be compensated for by other (managed) pollinators such as the honeybee (see Chapter 3).

<sup>\*</sup>The reference for the ALARM scenario is: Spangenberg J.H., Bondeau A., Carter T.R., Fronzek S., Jaeger J., Jylhä K. et al. (2012). Scenarios for investigating risks to biodiversity. *Global Ecology and Biogeography* 21: 5-18



**Figure 1.** (A) *Bombus terrestris*, one of the most common European bumblebees; (Rasmont et al.) (B) Starting with actual 1970-2010 distribution (black circles), we assessed the present suitable climatic area of each species (yellow area); here, for *Bombus terrestris*. (Rasmont et al.) (C) Future climatically suitable area for *Bombus terrestris* (GRAS scenario), 2050; at this time, even such an abundant species could already suffer from considerable regression in the south of Europe. (Rasmont et al.) (D) idem, 2100, at this time, all of Europe south of the Paris parallel would present unsuitable climates for *Bombus terrestris*, meaning climatic conditions as warm and dry as presently at the edge of Saharan desert. Red, lost areas with suitable climatic conditions; yellow, still suitable; green, new suitable conditions (Rasmont et al.).

The projected situation is so severe that it seems difficult to propose mitigation policies for the long term. If we do not manage to drastically decrease the emissions of greenhouse gases, conservation actions must focus on: (i) enabling the long-term survival in areas with increasingly worsening climatic conditions (i.e. at the southern range margins); and, (ii)



**Figure 2.** (A) *Bombus haematurus*, one of the few bumblebees that would find an expanded suitable area in each of the scenarios. This species is already expanding its distribution towards the west. (Rasmont) (B) Future climatically suitable area for *Bombus haematurus* (GRAS scenario), 2050. Red, lost areas with suitable climatic conditions; yellow, still suitable; green, new suitable conditions (Rasmont et al.).

increasing species abilities to keep track with changing climates and to establish viable populations in new climatically suitable areas (i.e. at the northern range margins).

Microclimatic heterogeneity could help to increase the survival probabilities at the southern range margins when average conditions get worse, since such areas would still provide a certain amount of suitable conditions. Such heterogeneity is given in mountains and deep valleys, which could conserve a highly diversified fauna, but it should also be targeted in agricultural areas by careful management, and thus would require concerted new actions through instruments such as the Common Agricultural Policy of the EU.

At the northern range margins, natural dispersal can be facilitated by increasing connectivity and quality of semi-natural areas. Agri-environment schemes appear as an effective measure in this context and their implementation in a climate change context should be fostered through policy support.

## Reference

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