

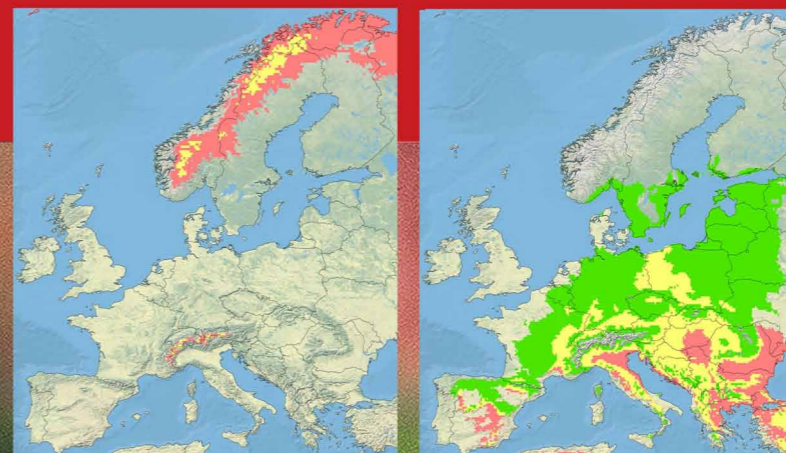


Bumble bees represent one of the most important groups of pollinators. In addition to their ecological and economic relevance, they are also a highly charismatic group which can help to increase the interest of people in realizing, enjoying and conserving natural systems. However, like most animals, bumble bees are sensitive to climate. In this atlas, maps depicting potential risks of climate change for bumble bees are shown together with informative summary statistics, ecological background information and a picture of each European species.

Thanks to the EU FP7 project STEP, the authors gathered over one million bumblebee records from all over Europe. Based on these data, they modelled the current climatic niche for almost all European species (56 species) and projected future climatically suitable conditions using three climate change scenarios for the years 2050 and 2100. While under a moderate change scenario only 3 species are projected to be at the verge of extinction by 2100, 14 species are at high risk under an intermediate change scenario. Under a most severe change scenario as many as 25 species are projected to lose almost all of their climatically suitable area, while a total of 53 species (77% of the 69 European species) would lose the main part of their suitable area.

Climatic risks for bumblebees can be extremely high, depending on the future development of human society, and the corresponding effects on the climate. Strong mitigation strategies are needed to preserve this important species group and to ensure the sustainable provision of pollination services, to which they considerably contribute.

Climatic Risk and Distribution Atlas of European Bumblebees



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On the front cover:
Bombus hyperboreus, an Arctic bumblebee species that is threatened by global warming.
 © Photo: Goran Holmström.

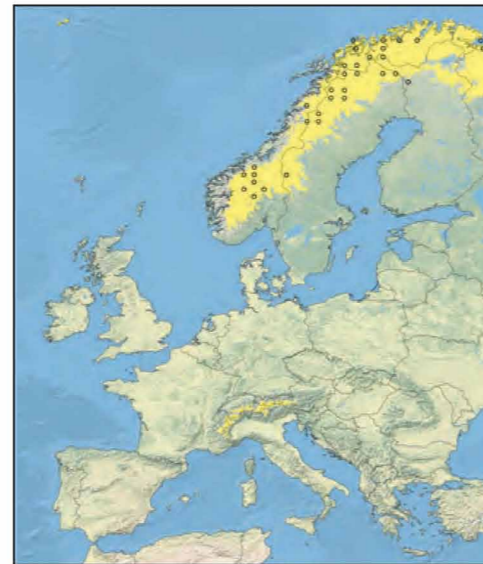
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Bombus hyperboreus SCHÖNHERR, 1809 = *Bombus (Alpinobombus) hyperboreus*



© Photo: P. Rasmont



Dots: actual distribution 1970-2000; yellow areas: modelled suitable climatic conditions in 2000

Bombus hyperboreus is a very large bumblebee. The coat colour is constant and very typical: with 3 yellow bands and a black tail. It is a social parasite of *B. polaris*, *B. jonellus* and probably other *Bombus* species. It is a generalist forager. It lives in the Scandinavian mountains and along the northern tundra, reaching the Novaya Zemlya in Russia towards the north. It is a circumpolar species, present also in Russia, Alaska, Canada and even the north coast of Greenland where it reaches 84° N. The species is considered to be threatened: Vulnerable

Present distribution can be very well explained by climatic variables (AUC = 0.99)
Climate risk category: HHRH
IUCN Red List status: Vulnerable

	Scenario	Full dispersal	No dispersal
2050	SEDG	-1382 (-51%)	-1384 (-51%)
	BAMBU	-1311 (-48%)	-1313 (-48%)
	GRAS	-1496 (-55%)	-1496 (-55%)
2100	SEDG	-2217 (-81%)	-2217 (-81%)
	BAMBU	-2584 (-94%)	-2584 (-94%)
	GRAS	-2688 (-98%)	-2688 (-98%)

Changes in climatic niche distribution (in 10' x 10' grid cells)

in the IUCN Red List of European Bees. Its modelled distribution includes the Alps where the species has never been observed. All scenarios project a strong reduction of suitable areas in the lowlands. Only the coldest areas of the Scandinavian mountains would remain suitable. All three scenarios project severe losses of areas with suitable conditions by 2100. Since *Bombus hyperboreus* shows a specialised way of life and as it is already rare, has a patchy distribution and is restricted to cold areas, it would lose a considerable amount of suitable area which could lead to its extinction in Europe.

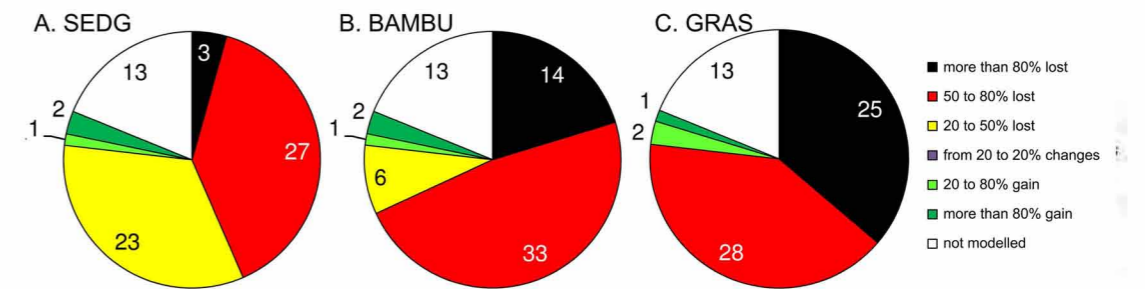
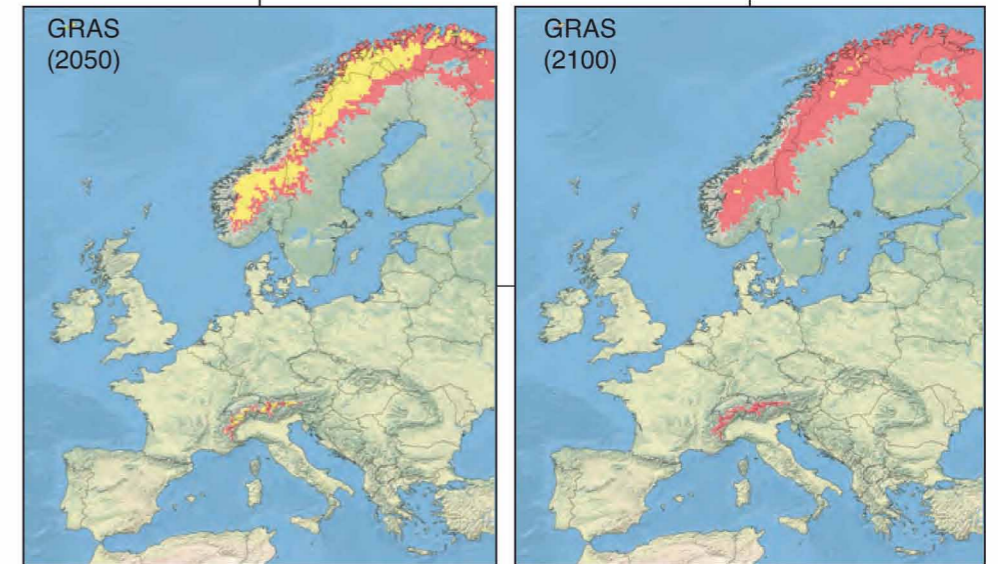


Figure 13.2 Severity of projected changes in 2100 for the 69 studied European bumblebee species. For 21 species we assumed full dispersal, for the remaining no dispersal (see Appendix 3). Thirteen species have not been assessed (white background). Dark green background indicates a large expansion (more than 80% gain in suitable area); light green indicate expansion (between 20 and 80% gain in suitable area); yellow background indicates regression (between 20 and 50% loss of suitable area); red background indicates strong regression (from 50 to 80% loss of suitable area); dark background indicates very strong regression with extinction risk (more than 80% loss of suitable area). A. SEDGE scenario; B. BAMBU scenario; C. GRAS scenario.

13.2. Potential mitigation strategies

As mentioned in chapter 11, the actual response of species to changing climatic conditions depends on whether the species will be able to colonise new climatically suitable areas or can survive, at least for a while, in areas of increasingly unsuitable climatic conditions. These two ways of responding render different conservation actions possible. In principle they should aim at (i) guaranteeing the unrestricted, or even aid, movement of the species through the landscape to new areas, (ii) facilitate the colonisation success in the new areas, (iii) improve habitat conditions and microclimatic protection in the areas indicated to become unsuitable at average.