

## How does climate change affect bumblebee diversity?

By

Pierre Rasmont<sup>1</sup>, Baptiste Martinet<sup>1</sup>, Markus Franzén<sup>2</sup>, Alexander Harpke<sup>2</sup>, Jeremy Kerr<sup>3</sup>, Thomas Lecocq<sup>1,4</sup>, Denis Michez<sup>1</sup>, Simon G Potts<sup>5</sup>, Stuart PM Roberts<sup>5</sup>, Oliver Schweiger<sup>2</sup>

<sup>1</sup> Institute of Biosciences, University of Mons, Place du Parc 23, B-7000 Mons, Belgium, pierre.rasmont@umons.ac.be

<sup>2</sup> Helmholtz Centre for Environmental Research - UFZ, Theodor-Lieser-Strasse 4, D-06120 Halle, Germany

<sup>3</sup> Department of Biology, University of Ottawa, Ottawa, ON, Canada, K1N6N5

<sup>4</sup> Research Unit Animal and Animal Product Functionality (UR AFPA), Faculty of Sciences and Technologies, University of Lorraine, Boulevard des Aiguillettes BP 70239, F-54506 Vandoeuvre-lés-Nancy, France

<sup>5</sup> Centre for Agri-Environmental Research, School of Agriculture Policy and Development, Reading, University, Reading, RG6 6AR, UK

Recent international projects (STEP and CANPOLIN) show that climate change rapidly affects the bumblebee fauna across continents. Future projections based on climate change scenarios suggested that most of the species could be driven to regional extinctions before next century. Further results show that 1) the process of range contraction due to climate changes is already underway; 2) only a few species have expanded their distributions under these changes; 3) individuals could suffer lethal hyperthermic stress from heat waves; 4) indirect negative effects could result from flower resource depletion due to heat stress; 5) population phenology could be altered leading to possible disruptions of floral interactions; 6) several southern species extending their northern range limit could potentially outcompete species adapted to cold environments; 7) invading populations from greenhouse escapes have already led to dramatic declines of some cold adapted South American bumblebee species. With such a diversity of pressures related to climate change it is not possible at this time to assign the relative contribution of each of these factors to bumblebee declines.