Evaluating the effects of climate warming on wild bee communities

Victor Scharnhorst[1], Katharina Thierolf [1], Johann Neumayer[6], Esther Ockermüller[3], Herbert Formayer[2], Barbara König[2], Benedikt Becsi[2], Paolo Biella[4], Stefan Dötterl[5], Philipp Meyer[1], Julia Lanner[1], Christina Rupprecht[1], Felix Gaulhofer[1], Harald Meimberg[1], Bärbel Pachinger[1]

[1]Institute for Integrative Nature Conservation Research, University of Natural Resources and Life Sciences, Vienna (BOKU); [2]Institute of Meteorology and Climatology, BOKU; [3]Biology Centre Linz of the Upper Austrian State Museum; [4]University of Milano-Bicocca; [5]Paris-Lodron-University Salzburg; [6]Obergrubstraße 18, 5161 Elixhausen

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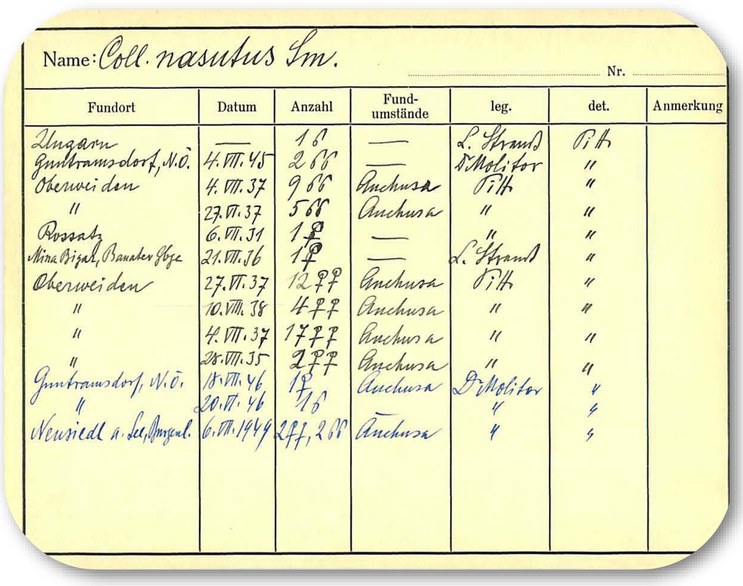
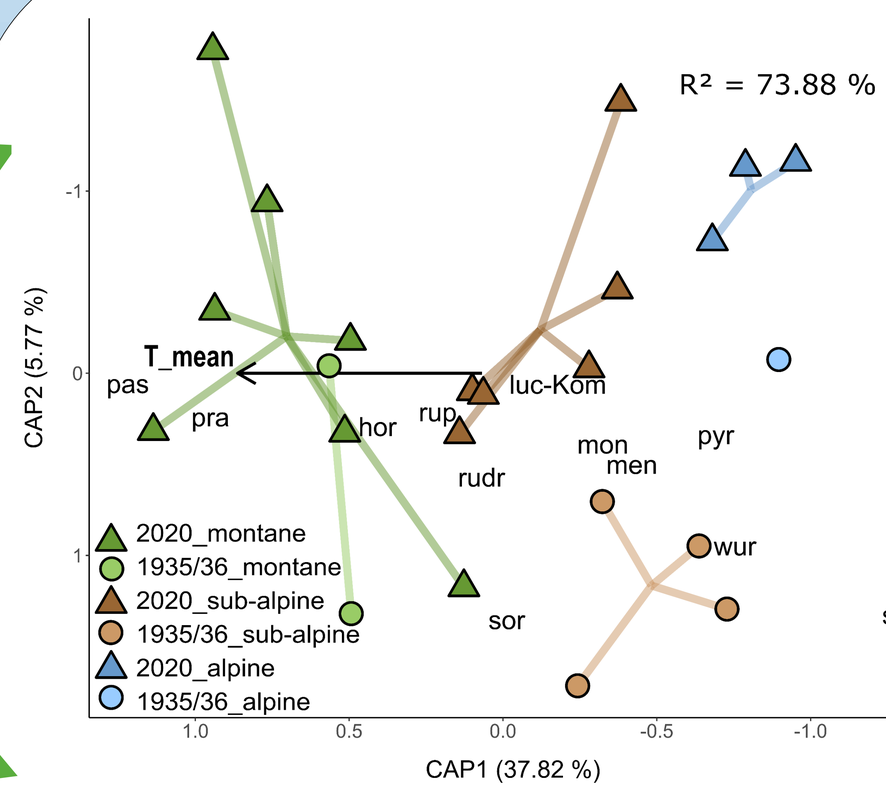


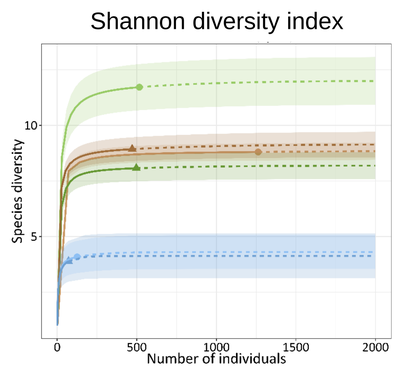
Wild bees provide important ecosystem services by pollinating crops and wild plants. However, they are threatened by habitat loss and climate warming. To assess the effects of climate warming on wild bee communities and functional traits, historical records prior to warming are essential. Collections such as those of Prof. B. Pittioni (1906-1952), from Austrian provincial museums and other sources provide an adequate database with several thousand records e.g. on index cards, the digitization of which is our completed first work package.

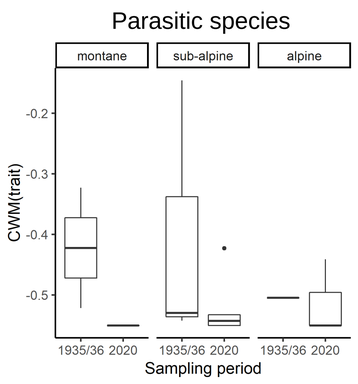
Digitized historical records are compared with the results of field sampling conducted at historical record sites that still provide valuable wild bee habitat. Based on historical information, we can assume a semi-quantitative sampling method and therefore sample wild bees with net catches one day per month between April and August in the lowlands and between July and August in the alpine region. All bees are either identified in the field or brought to the laboratory for species identification.

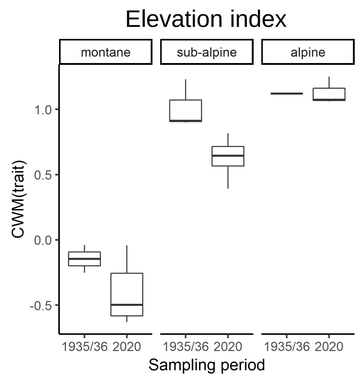
WP1: Digitization of historical data

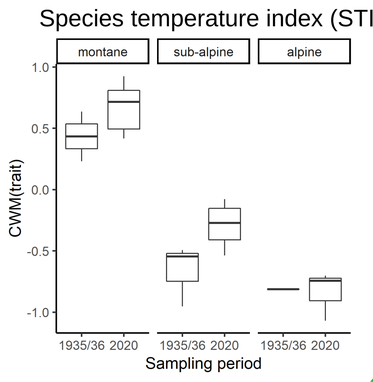
WP3: Climate modelling







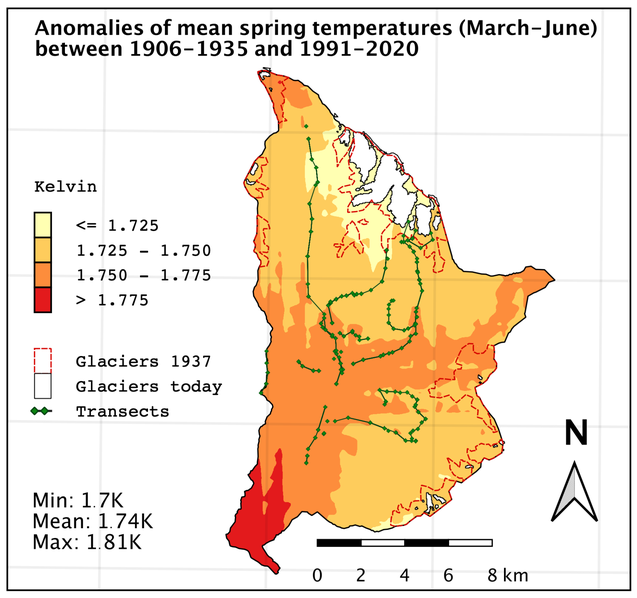




Ecological modelling already conducted for the alpine Kalsbachtal study area, shows a significant warming of spring temperatures between the two periods of 1.74 K and a correlated shift of wild bee communities along the altitudinal gradient. In this context, the proportion of lowland species (elevation index) increased at montane and sub-alpine altitudes which correlates to significantly more warm loving species (species temperature index). Further, species diversity has decreased significantly at montane elevations with a dominance towards generalists that correlates to a loss of parasitic species. The current diversity hotspot is now spatially higher than in the 1930s and located at sub-alpine elevations.

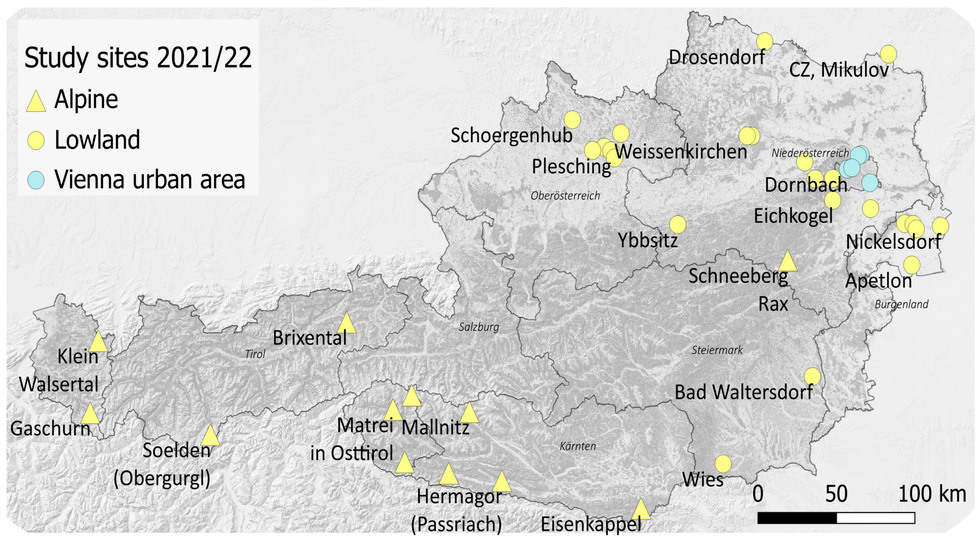
WP2: Field surveys & species determination

WP4: Project management



Trends of mean spring temperatures were calculated for the periods 1901-1980 and 1981-2014 from the long-term dataset HistAlp (ZAMG). They were used to extrapolate mean spring temperatures from the high-resolution observational dataset SPARTACUS (ZAMG) to the period 1906-1935. The resulting data was localised via its elevation dependency to 10m horizontal resolution in the study area Kalsbachtal.

In 2021, we conducted sampling at the majority of study sites in the lowlands including the Vienna urban area. The focus of the 2022 survey year will be sampling of alpine regions. Over the next year, we plan to quantify the intensity of land use change using a GIS-based analysis of historical and recent aerial imagery and incorporate the results into our ecological models.



Acknowledgements

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13 CLIMATE ACTION

15 LIFE ON LAND