Imperial College London

Natural Environment Research Council

2024_43_DoLS_RG: Climate impacts on Arctic plant-pollinator networks: a population trait-based framework

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How ecological interactions, such as plant-pollinator networks, are being impacted and re-shaped by climate change is a surprisingly poorly understood question. This is primarily due to our limited knowledge of the underlying mechanisms determining how populations and interacting partners respond to climatic variation. Addressing this for plants and pollinators requires better quantification of how functional traits mediating interactions are responding, particularly about how susceptible certain traits are to environmental change. We must therefore be able to map trait response data to detailed observations of individual-level interactions across environmental gradients. Bringing such data together will improve understanding of how environmentally driven changes to functional trait frequency distributions and levels of spatiotemporal functional redundancy can determine plant-pollinator network architecture, turnover, and partner co-extinctions. Ultimately, understanding these outcomes can better inform targeted conservation efforts to safeguard 'at risk' interactions, and improve accuracies in predicting pollination provision.

This project will study a plant-pollinator community located in Arctic Sweden with 6-years of high-resolution data already collected. Taking advantage of a transect spanning an elevational gradient (see https://doi.org/10.1111/1365-2435.14253), the student will study plant-pollinator interactions across a microclimatic gradient using a space-for-time approach. The project will involve collecting field data at a stunning Arctic location (3 months per year), processing of samples in the lab (techniques in microscopy, morphometrics, molecular analysis), data analyses, and modelling. The student will determine how the population dynamics of plants and pollinators respond to environmental factors, how this underpins trait frequency distributions and carry-over effects, and how these processes restructure plant-pollinator networks.

The student will have flexibility in what specific ecological and evolutionary questions will be addressed, but current questions of interest are:

- how is climate shaping the taxonomic and functional trait assemblages of plants and their pollinators (phenologically & morphologically)
- is warming leading to the gain or loss of trait and phylogenetic diversity, and how does this impact the structure of the plant-pollinator network
- what can niche modelling tell us about species distribution responses, and are we seeing cold-adapted (alpine) specialist species being outcompeted by generalists
- to what degree do past year or early season conditions shape population dynamics and interaction probabilities, and which species are vulnerable
- how plastic are plant and pollinator responses to climatic variation and what determines the degree of plasticity between species