**Final publishable summary**

This proposal was based around the following question, and one that is of significant societal interest: What happens to plant communities when climate warms rapidly? Ecologists modelling the biotic responses to climate warming predict changes in species’ geographic ranges, and a general movement of plants towards higher latitudes and higher elevation as individual plant species track climates conducive for their survival. But what happens to plant communities if climate warms very rapidly and cascades beyond a plant species’ ability to track climate? Ecologists predict extinction. But this debate is contentious.

A particular concern is the response of tropical vegetation caused partly through man-made changes in land-use which prevent geographic range changes. This is further exacerbated because such diverse vegetation types (a) have very highly tuned life-cycles with climate, (b) have strong co-evolutionary linkages with animals for pollination and seed dispersal, and (c) tend to have plants with very specific ecological requirements. The same can be argued for tundra vegetation which is also at critical extinction risk under modelled climate warming scenarios. Arguably, tropical and tundra biomes are therefore not well buffered against extinction. The main driver to this project is that the long-term impact on biodiversity of rapid warming is actually unknown and wholly speculative. The degree to which humans directly drive biodiversity loss – through forest clearance for example – is also difficult to disentangle from the effects that warming may exert independently on vegetation in different biomes. Hence, an independent model is desired that can (a) discount the “human” factor as an influence on biodiversity, and (b) allow an assessment of vegetation turnover (extinction, invasion and geographic range-changes) on timescales that exceed the lifespan of our current civilisation. The geological record preserves intervals of past rapid climate warming (“hyperthermals”) in which the response of plant communities can be studied in detail and on many different time-scales. This proposal aimed at geographically mapping and statistically assessing the extinction susceptibility of plants from different vegetation types (or biomes) across an interval of past greenhouse warming on a continental scale.

The Paleocene-Eocene Thermal Maximum (PETM) at 55.8 Ma represents a natural experiment in rapid global warming with transient temperature increases on land of more than 6 °C lasting about 170 Ky. A model proposed by the Scientist in Charge was that the PETM would result in significant extinction and Dr Dašková studied this proposition in depth. Specifically, she (1) assembled the largest and most rigorously scrutinised database of late Paleocene and early Eocene floral occurrences across Europe and North America to date and in doing so constructed a powerful research tool allowing us to test the role of the PETM in forcing plant extinction, (2) she analysed plant turnover across the P/E boundary, (3) she identified a key geographic area in need of primary data collection and collaborated to collect and analyse pollen samples, and (4) she manipulated the results in GIS and using the R program to understand the data and statistical patterns. The raw dataset included >80 localities and a list of over 1500 different taxa. We synonomised this dataset and focussed on the angiosperms to create in a more manageable dataset of c. 750 taxa that are free from redundancy and duplication. This has been a non-trivial, time-consuming task. The results demonstrate that neither extinction nor immigration are key factors in the Paleocene-Eocene global warming event and that c. 10 taxa go extinct out of >750 taxa and that movement between continents is low. Within region turnover (immigration and extinction) ranges between 20-50% but very few extinction taxa are shared between regions. This implies that regionality is essential to understanding environmental turnover in this interval of time and may have implications for projected plant responses to global warming. Throughout this project Dr Dašková has learnt new skills and interacted with new sets of collaborators in Europe and North America. The results from this project will result in further and deeper collaboration between Prague and Birmingham and the fellowship has allowed Dr Dašková to gain employment back in Prague in a move that has been facilitated mainly by this research project and the training opportunities that it has offered.