

## Research Experience Placement (REP) Scheme Project

**Project Supervisors:**

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**Host Organization and Department (if applicable):**

Geography Department, Durham University

**Project Title:**

Reconstructing the long-term impact of climate change on Arctic ecosystems

**Project Description:**

The Arctic is experiencing the most acute effects of climate change; temperatures are rising twice as fast as the global average and this warming trend is projected to continue in coming decades. Warmer temperatures have driven abrupt environmental change, such as the expansion of vegetation northwards, which has dramatic consequences for the structure of Arctic ecosystems and biodiversity. Understanding how species and ecosystems will respond to future climate change is essential to identify conservation priorities. One approach to advance insight into the resilience of species and ecosystems is to reconstruct how they have responded to past climate changes.

**Aim:** This project will examine the impacts of climate change on Arctic ecosystems by reconstructing vegetation and climatic changes over the past ca. 6000 years, using lipid biomarkers stored within lake sediments.

Lake sediments accumulate over time and incorporate signals of climate change, landscape change, vegetation composition, and human and animal activity. Samples have been obtained from a lake in the Alaskan interior and molecular fossils (termed lipid biomarkers) have been extracted. The student will analyse these lipid biomarker samples to reconstruct past changes in vegetation and climate. They will compare their data with existing regional records of vegetation change (developed using sedimentary ancient DNA and pollen) and changes in mammalian populations and anthropogenic activity (based on archaeological and molecular records) to characterise the long-term relationship between climate and ecosystem change. This project will suit a student who enjoys lab work and has interests in biology, chemistry, earth sciences and/or archaeology.

**Skills and Career-Development Opportunities:**

The student will learn about the processes that have driven past climate change and the ways in which climate influences species distributions and ecosystem change. The student will develop a detailed understanding of how to reconstruct environmental change using sedimentary archives and will be introduced to a range of methodologies applied within palaeoenvironmental science.

The student will be trained in lipid biomarker laboratory analyses and the computational and statistical analyses required for data processing. The student will also gain direct experience of surveying sites and obtaining samples. The student's research network will be expanded through their integration within the fieldwork team and Durham's Physical Geography research group. The supervisory team will support the student to develop the required skills to pursue a research career, including designing and organising a research project and producing a short report and presentation on the research findings of this study.

**Wider context of research:**

The student will have the opportunity to join a fieldwork campaign to Scotland to learn how to survey lakes (water geochemistry, bathymetry and sediment profiles) and obtain sediment cores. Whilst this location differs from the study site of the placement project, all fieldwork skills developed are transferrable to any lake site across the globe. Training on sediment core subsampling, laboratory analyses and data processing and presentation will be provided by the supervision team. The student will be embedded within the 'Sea Level, Ice and Climate' (SLIC) research group, which is made up of a mix of research students and academic staff. Participation in the SLIC reading group as well as the Physical Geography meetings will facilitate informal discussions on new publications and research and provide the opportunity to present and receive feedback on preliminary research findings. The student will work alongside current research students and technicians in the Geography labs and gain direct insight into organic geochemical research as well as its diverse application.

**Project Timeframe:**

The project work is expected to take around 8 weeks but the timeframe over which the research is carried out is flexible.