

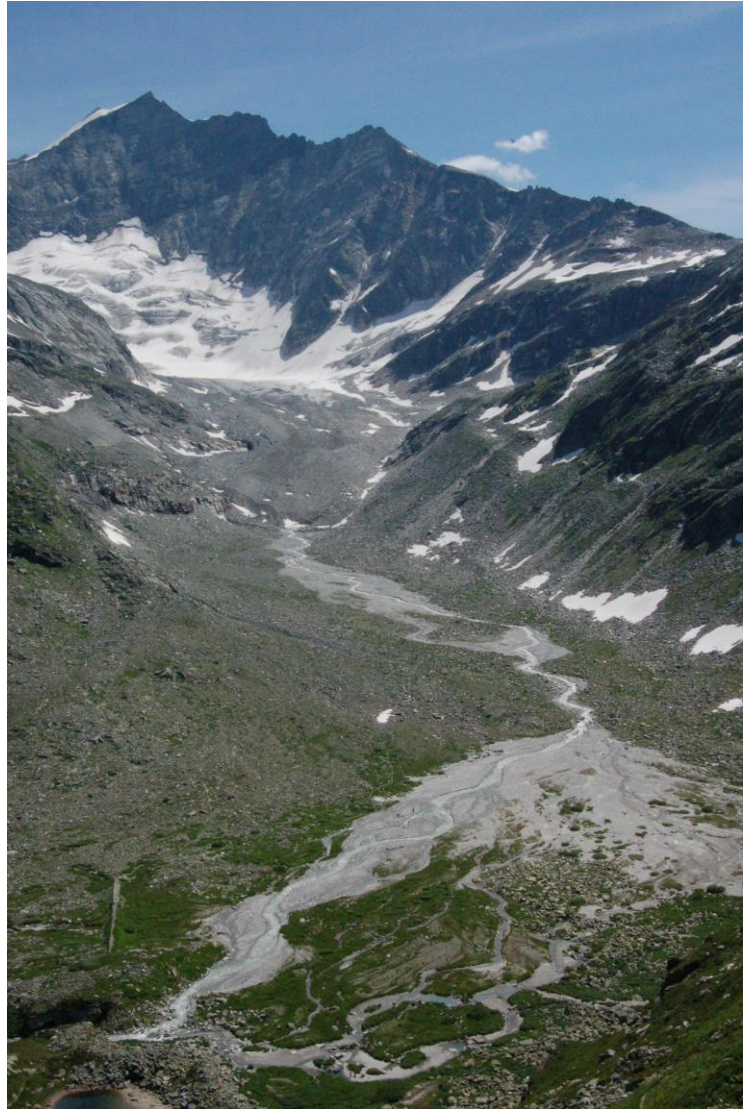
# Arctic and alpine river food web response to glacier retreat

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## Project outline

Climate change poses a considerable threat to the biodiversity of high altitude ecosystems, with Arctic alpine regions across the world already beginning to show clear responses to warming (Milner et al., 2017). Glacier mass-balance studies show consistent decreases over the last century in most regions and it has been suggested that retreat may even be accelerating in many locations. Continued negative glacier mass-balance will lead to glacier- and snow-melt reductions (Barnett et al., 2005), proportionally greater groundwater contributions (Brown et al., 2006) and changes in proglacial riverscape dynamics (Malard et al., 2006). These hydrological changes will dramatically alter alpine river communities (Brown et al., 2007; Brown & Milner, 2012; Jacobsen et al., 2012) but to date there have been no detailed assessments of responses at higher levels of organisation (i.e. whole food webs; Clitherow et al., 2013; Fell et al., 2017) or what the effects will be for important ecosystem processes such as primary production or respiration. These are major research gaps because the potential for emergent properties in complex systems means it is difficult to predict ecosystem responses, and therefore to accurately inform conservation and management strategies, by simply extrapolating from lower levels of organization (i.e. population responses; Woodward et al., 2010).

Of interest in this study will be how food webs are linked to glacier retreat and associated changes in water sourcing both spatially and temporally. A continuum of rivers will be analysed from those draining highly glacierized basins to those with no glacial influence. By examining rivers fed by different water sources, a major output from this project will be predictions about how alpine river ecosystems can be expected to change in response to future climate change. The project will benefit from an ability to make comparisons against food web data that have recently been assembled from 12 rivers in the Austrian alps (e.g. Fell et al., in press), for example via comparative studies in other mountain ranges such as those in Scandinavia, New Zealand or the Arctic.



## Project Goals

This research is anticipated to allow detailed assessments of: (1) macroinvertebrate and algal community composition, (2) stream food web structure including comparisons of both taxonomic and individual-based interactions (see Woodward et al., 2010; Clitherow et al., 2013). A combined approach of descriptive and experimental approaches may be utilised. The study provides an opportunity to build on datasets that we have assembled from several glacier-fed rivers worldwide. **The successful applicant will have opportunities to undertake fieldwork to collect primary datasets from**

**glacier-fed rivers.** This study design will allow comparisons of glacier-fed rivers from different basins and potentially different mountain ranges, and analyses of seasonal dynamics from more intensively monitored rivers.

### **Benefits**

The successful candidate will benefit from inter-disciplinary training in hydrology and aquatic ecology as part of the River Basin Processes and Management research cluster in the School of Geography, and as part of the wider water@leeds network (i.e. water@leeds: ecology group) and the Leeds NERC DTP. The nature of the project means that the student will be trained in project specific research methods including river water quality analysis, algal/macroinvertebrate identification, food web construction, measuring respiration in situ/with microcosm chambers and applied statistics for analysing biological data, both internally and at external workshops. An additional important part of the training will be to attend national and international conferences to present results and gain feedback. **The student will be encouraged to submit high quality papers for publication during the project.**

Informal enquiries should be directed to Lee Brown [l.brown@leeds.ac.uk](mailto:l.brown@leeds.ac.uk). Further details about postgraduate research degrees at the School of Geography, University of Leeds can be found [here](#).

### **References/Key reading**

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