The Italian Alps Expedition 2022

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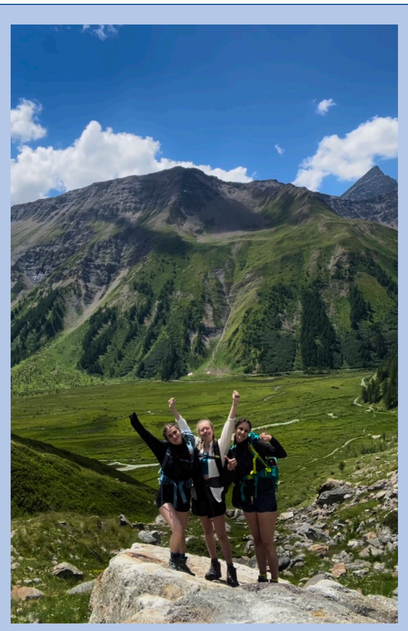


Introduction:

Mountain glaciers are **key climate change indicators**, shrinking **rapidly** in response to global warming, and they provide a habitat for **~⅓ of the world's terrestrial plant species** (Körner, 2007). Enhanced glacier recession threatens species survival, but debris-covered glaciers, like the Miage Glacier, can provide a habitat for high-altitude species, as the **debris layer inhibits** glacier ablation (Pelfini *et al*., 2007).

In the last 50 years, the European Alps have **experienced double the mean air temperature warming** compared to the global average (Cannone *et al*., 2008). When compared to other alpine glaciers in mid-latitude and tropic regions, **greater melt rates** can be seen in the Valle d'Aosta region. **Smaller glaciers**, such as the Lex Blanche, are much more susceptible to warming (Diolaitui *et al*., 2012).

Understanding the effect of glacial retreat on invertebrates is **crucial** to predicting future freshwater **biodiversity**. As glaciers retreat and habitats evolve, generalist species migrate upstream (Castella et al., 2001) and vegetation development is increasingly disrupted by proglacial channels in the forelands (Matthews, 1992). Investigations into these invertebrate theories have been carried out in the Alps previously, because of its high sensitivity to rising temperatures (Debiasi *et al.,* 2022,) however, these investigations have **not been carried out at this study site**.

Lucy's Study:

Soil conditions as a control on vegetation composition on the Miage Glacier

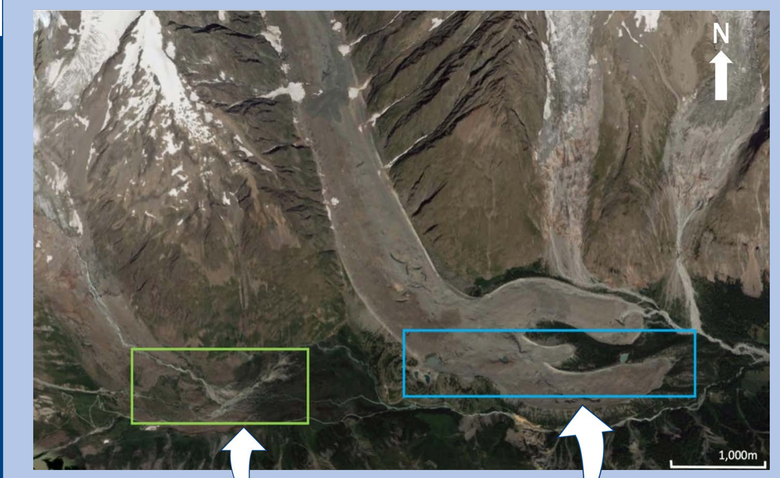
AIM - To assess how soil conditions influence the composition of vegetation on the Miage Glacier.

- At each sample site surface elevation and GPS coordinates were collected using an EMLID Reach and a GPS tracker
- Vegetation cover and both species richness and evenness were studied within a vegetation plot using a quadrat and plant identification guides
- Within the vegetation plot, an array of soil conditions were assessed including temperature, conductivity and pH, followed by a collection of soil samples for laboratory analysis
- In the laboratories at Newcastle University, soil organic matter (SOM) was calculated using the Loss-On-Ignition (LOI) method and both phosphate and nitrogen concentrations were measured using the HACH machine.

Our Study Sites:

The debris covered Glacier du **Miage the 3rd largest Italian glacier** (Pelfini *et al.*, 2007). The supraglacial debris layer has greatly **reduced ice surface ablation**, causing the glacier to retreat at a considerably lower rate than the other debris-free glaciers located in the Alps (Leonelli & Pelfini, 2013). The glacier surface has been **colonised** by over 40 vascular plant species, particularly in the **heavily forested** Jardin du Miage (Pelfini *et al*., 2012).

In recent years, the Lex Blanche has experienced **enhanced retreat** to **higher elevations**, exposing glacial foreland terrain which can be influenced by **physical factor**s, like drainage networks (Matthews, 1992; Cerutti, 2013). Between 1975-2005, the glacier retreated 756 metres (Pelto, 2015), meaning the proglacial forelands are highly subjected to glacial **meltwater influences**; thus it is an ideal location to investigate the **proglacial channels** and variables associated with **richness/composition of invertebrate** taxa along a latitudinal gradient.

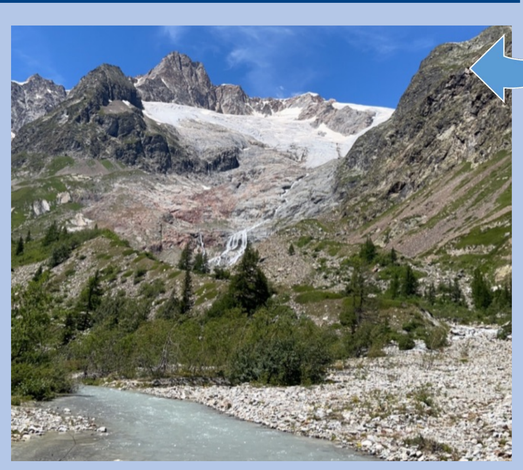


Location of the Lex Blanche Glacier (45°46' N, 6° 49' 30' E) and *Glacier de Miage (45˚47' N, 6˚52' E) in the western Italian Alps. Blue highlights vegetation communities in the Miage forelands, and green shows the Lex Blanche glacier forelands and proglacial streams (Google Earth, 2021).*

Emily's Study:

Quantification of vegetation patterns in the Lex Blanche Glacier forelands in relation to fluvial activity

- Fluvial activity was mapped using ArcGIS Earth tracks, and will be further investigated using secondary data, aerial images to study the evolution of the fluvial activity in the forelands on ArcMAP
- Vegetation composition was studied across transects parallel to the glacial snout, recording species count and EMLID reach survey points. 10 quadrats were then randomly selected for more in depth study of the vegetation composition and soil laboratory analysis
- The relationship between the river positions, within the Lex Blanche drainage network, and individual species clusters can then be mapped and statistically analysed; to produce models and diagrams that represent these proglacial interactions



Molly's Study:

Macroinvertebrate richness and composition along the Lex Blanche Glacier's proglacial stream, during July 2022.

Aim: To investigate whether invertebrate abundance and composition changes with distance from the snout of the Lex Blanche Glacier.

- Invertebrate abundance was gathered through kick sampling along 3 transects along the proglacial stream
- Transects were identified by Milner and Petts (1994) as Kyral and Glacio-rhithral, with a further transect selected downstream
- A Hanna Combo Metre was used to record water temperature and pH.
- Chlorophyll *a* was collected by filtering stream water through a filter and kept frozen until analysis can be done
- Channel Stability was assessed in the field through according to Pfankuch (1975)
- GPS locations and elevation were recorded using a handheld GPS device

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