	**Emily Galarza (2022 – 2025)**
	Identification of spatial-temporal aquatic macroinvertebrates dynamics in high Andean ecosystems impacted by climate change and anthropogenic impacts.
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Due to the limited knowledge on the functioning of high-altitude tropical Andean freshwater ecosystems, it is necessary to characterize the interactions between environmental conditions and aquatic organisms, particularly macroinvertebrates, and understand the ecosystem responses to climate change and anthropogenic impacts.

High Andean freshwater ecosystems are characterised by convergences of streams fed by diverse water sources, including glaciers, lakes, wetlands, and aquifers (Herrera et al., 2021). This complexity results in a mosaic of aquatic communities adapted to harsh conditions linked to high altitudes, such as low temperatures, diurnal melting and nocturnal freezing, and temporal environmental variability (Jacobsen et al., 2014). However, climate change is challenging these ecosystems, accelerating glacier melt, thereby altering hydrological regimes (Jacobsen et al., 2010). At the same time, the increasing anthropogenic activities enhance the contaminant concentrations in the systems (Jiao et al., 2020), affect land cover (Ochoa-Tocachi et al., 2016), and reduce stream flow (Soruco et al., 2015). These combined pressures have significant repercussions in the streams, affecting the hydraulic and physico-chemical conditions, with significant negative consequences for aquatic biodiversity (Meza-Salazar et al., 2020). However, our current understanding of the mechanisms that structure these complex high Andean ecosystems is still limited.

The objective of this thesis is to enhance our understanding of the impact of climate change and anthropogenic activities on the structure and functionality of high Andean aquatic ecosystems based on a quantification of human impacts (land use changes, stream flow alterations, and atmospheric deposition on glaciers).

To accomplish this, we will focus on (1) identifying spatial-temporal patterns and driving forces of water quality that affect the macroinvertebrate structure in high Andean streams, considering both land cover and physico-chemical alterations; (2) developing hydraulic preference models for dominant macroinvertebrate taxa in high Andean streams (Ecuador, Bolivia, and Chile). While previous studies have applied these tools to the alpine macroinvertebrate communities (Becquet et al., 2023), it is necessary to adapt this method to the high Andean streams and macroinvertebrates, taking into consideration the environmental conditions. This will enable us to predict the aquatic ecosystem response to the hydraulic alterations (velocity, depth, substrate) in high Andean streams; and (3) comparing heavy metal bioaccumulation and biomagnification across algae and macroinvertebrate communities from glacier and non-glacier streams affected by direct and diffuse sources of pollution along the altitude gradient.

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