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## Evaluating sediment source contributions in a river catchment impacted by glacial melt and land use change, the Rio Santa, Peru

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The water-food-energy security nexus faces significant challenges from both climate change and growing populations, particularly in glacier-fed mountainous catchments. Sediment generation is driven by both natural and anthropogenic factors, exacerbating the pressures on the nexus; with increased erosion contributing to sedimentation of river systems that in turn endangers crucial river functions, such as drinking water availability, crop irrigation and hydroelectricity. Identifying sediment sources is of great importance to enable better understanding of sediment dynamics and thus, inform our management of water resources. Here we focus on the glaciated Rio Santa catchment in the Peruvian Andes, an important river for agriculture, energy, and domestic water supply.

Using sediment fingerprinting tools, this study assesses the glacial contribution to in-channel sediment along the Rio Santa, whilst investigating the contribution of anthropogenic factors such as land cover change in the Cordillera Blanca. A distributed approach along the two major sub catchments of the study catchment was taken to investigate natural and anthropogenic contributions to sediment generation for this Andean system. The Rio Santa catchment study focused on the contributions to sediment from the cordilleras, whilst the smaller Ranrahirca sub catchment study focused on land cover contributions to sediment. The distributed approach permitted quantification of source dynamics throughout the catchment and sub-catchment. To develop geochemical fingerprints, all source and mixture samples were analysed using Wavelength Dispersive X-ray Fluorescence (WD XRF). The MixSIAR mixing model was used to apportion sediment sources for both catchment scales. Our results indicate that the non-glacial zone (Cordillera Negra Mountains) was the greater contributor to sediment in the upper Rio Santa, possibly due to mining activities and lithological factors, whilst further downstream the glaciated zone (Cordillera Blanca) became the larger contributor. Sediment monitoring in remote mountainous catchments such as the Rio Santa is not without challenges. Sediment fingerprinting evidence has the potential to fill knowledge gaps and inform local resource management policy.