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Climate-hydrology-ecology interactions in glacierized river systems

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High climatic sensitivity and low anthropogenic influence make glacierized river basins important environments for examining hydrological and ecological response to global change. This presentation is based on previous and ongoing research in glacierized river basins (located in the French Pyrenees, New Zealand and Swedish Lapland), which adopts an interdisciplinary approach to investigate the climate-hydrology-ecology cascade. Data are used to advance hypotheses concerning impacts of climate change/ variability on glacier river system hydrology and ecology. Aquatic ecosystems in high latitude and altitude environments are influenced strongly by cryospheric and hydrological processes due to links between atmospheric forcing, snowpack/ glacier mass-balance, river runoff, physico-chemistry and biota. In the current phase of global warming, many glaciers are retreating. Shrinking snow and ice-masses may alter spatial and temporal dynamics in bulk basin runoff with significant changes in the relative contributions of snowmelt, glacier-melt and groundwater to stream flow. The timing of peak snow- and ice-melt may shift; and proportion of stream flow sourced from rainfall-runoff and groundwater may increase. In this presentation, the influence of changing water source contributions on physico-chemical habitat and, in turn, benthic communities is assessed using an alternative alpine stream classification. In the future, this model predicts more rapid downstream change in benthic communities as meltwater contributions decline; and, at the basin-scale, biodiversity may be reduced due to less spatio-temporal heterogeneity in water sources contributions and, thus, physico-chemical habitat. Integrated, long-term research into the climate-hydrology-ecology cascade in other glacierized river basins is vital because interdisciplinary science is fundamental: to predicting stream hydrology and ecology under scenarios of future climate/ variability, to assessing the utility of alpine river systems as indicators of global change, and to developing conservation strategies for these fragile ecosystems. Future research imperatives and directions are outlined.