

## **Does mountain permafrost in Mongolia control water availability?**

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In semi-arid Mongolia, continuous and discontinuous permafrost covers wide parts of the mountains, especially in the northwest of the country. Long-term analysis of annual discharge from rivers draining the mountainous parts shows high temporal variability, with some evidence of decreasing trends, accompanied by decreased intra-annual variability. Investigations show that annual precipitation features small changes while annual air temperature significantly increased over the last decades, with warming rates clearly outranging the global average. Widespread and drastic changes in land cover through forest fires in northern Mongolia might have an additional impact on water retention and the stability of permafrost. Hence, there is concern about an increased degradation of mountain permafrost and a possible impact on river discharge and water availability. Decreased water availability from the mountains would have strong socio-economic implications for the population living in the steppe belt downstream the mountains.

Therefore, a monitoring program has been conducted in northern Mongolia that aims to improve the understanding of how climate change and forest fires are influencing mountain permafrost and water resources. The study region, Sugnugur valley, is located about 100 km north of Ulaanbaatar and includes the transition belt between the steppe, the boreal zone and the alpine tundra of the Khentii Mountains. Extensive measurements of soil temperatures, soil moisture, discharge and climatic parameters have been carried out along transects which stretch across the Sugnugur river valley and include steppe, boreal forest as well as burnt forest. First results indicate that the environmental conditions show drastic changes after forest fire, with reduced water retention in the headwaters. After forest fires, changing runoff processes above the permafrost table have been observed, where water drains rapidly along preferential flow paths. This eventually leads to faster runoff responses during and after summer rainfall. As the active layer depth increases, the soil water storage capacity decreases, which may adversely impact forest regeneration. Therefore, permafrost and forest occurrence appears to be a self-regulating system that rapidly degrades after forest fire. How these processes affect water availability on a larger scale however remains a challenging research question in that region.