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Monitoring mountain lakes in a changing Alpine cryosphere: the Lago Nero project (Ticino, Switzerland)

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Mountain lakes and their catchments of the Alpine cryosphere are facing global pressures including climate warming and deposition of atmospheric pollutants. Due to their remoteness, often low buffer capacities and sensitive biotic communities, alpine lake catchments are particularly well suited as sentinels of environmental change. Lago Nero is the object of an intensive survey, aimed at developing predictive models of catchment-wide ecosystem responses to environmental change (Bruder et al. 2016).
Lago Nero is located at the head of Val Bavona (Canton Ticino, southern Switzerland), in a southwest-facing catchment, with altitude ranging from 2385 to 2842 m asl. The substrate is dominated by gneissic bedrock with patches of grassy vegetation and shallow soils. The catchment is snow-covered approximately from November to May. For a similar period, the lake is ice-covered. Lago Nero is an oligotrophic, soft-water lake with a surface of approximatively 13 ha and a maximal depth of 73 m. According to the regional model of potential permafrost distribution in the southern Swiss Alps (Scapozza & Mari 2010), the presence of discontinuous permafrost is probable in almost the entire surface of the catchment covered by loose debris. A direct evidence of permafrost occurrence is the presence of a small active/inactive rock glacier in the south-eastern part of the catchment (front altitude: 2560 m asl).
Monitoring of the site began in summer 2014, with an initial phase aimed at developing and testing methodologies and at evaluating the suitability of the catchment and the feasibility of the monitoring program. The intensive survey at Lago Nero measures a wide array of ecosystem responses, including runoff quantity and chemistry, catchment soil temperature (also on the rock glacier) and composition of terrestrial vegetation. Sampling frequency depends on the parameter measured, varying from nearly continuous (e.g. runoff and temperature) to five-year intervals (e.g. soil and vegetation).
First results suggest that Lago Nero is particularly sensitive to changes in the cryosphere, particularly concerning thickness of snow cover, snowmelt date and duration, and length of ice-free period of the lake surface. Probable storage of ground ice during the 1966-1985 period (deduced from the nearby Basòdino Glacier) and its significant melting in the last decades may explain the high amounts of sulphur measured in the outflow of the rock glacier. High levels of sulphur are likely to have ecological effects on the sensitive biota of the Lago Nero catchment, for instance by retarding the recovery from past acidification.

REFERENCES

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