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Large & deep perialpine lakes: a paleolimnological perspective for the advance of ecosystem science

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Large perialpine lakes represent important components of the Alpine landscape. Due to their piedmont location in the most densely populated regions of the Alps, they play a crucial socio-economic role as resource for drinking water, irrigation, industry, tourism, hydroelectric production, and biodiversity conservation. These uses expose perialpine lakes to multiple human pressure, while the extension of their catchment to the glacial Alpine range make them particularly exposed to the consequences of global warming. Limnological surveys outlined coherent responses by perialpine lakes to the massive nutrient enrichment during the 1950s-1970s, while recent development is rather heterogeneous. Past and ongoing paleolimnological studies confirmed the coherence of the lakes' evolution within a secular perspective, but outlined individual trends as resulting from local management policies, lake morphology, and superimposed effects of climate change. A review of the paleolimnological literature published from 1975 to April 2017 on perialpine lakes of different lake districts north and south of the Alps, was performed aiming at reviewing current knowledge of large and deep perialpine lakes due to sediment studies, and at summarizing how paleolimnological studies can contribute in defining past ecological status and in outlining lake sensitivity to current and future human impacts. This is particularly important when defining reference conditions, as inappropriate restoration targets might prove to become unachievable within the present context of global change. The review outlined an heterogeneous distribution of amount and topics of sediment studies among perialpine lake districts as well as knowledge gaps on the long term evolution of perialpine lakes.