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Coherent response of Alpine lakes to combined global warming and airborne contamination as revealed by sediment records

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Alpine lakes are considered as sentinels of climate change and ideal research-objects to investigate the ecological effects of global warming combined with anthropogenic airborne contamination. Nonetheless, the evaluation of long-term environmental and ecological lake evolution is hampered by scarce monitoring data and must rely on the palaeolimnological approach. We present the results of a sediment study, conducted on a set of mountain lakes of the southern Central-Eastern Alps, aimed at investigating the effects of the current Alpine deglaciation on lake habitat and biodiversity, and at revealing signs of airborne contamination. Radiometrically dated short cores were analysed for lithological (water and organic content), biogeochemical (C and N stable isotopes and CN content of bulk organic matter) and biological (subfossil diatoms) proxies. Lake productivity and biodiversity show clear responses to the end of the Little Ice Age and to the warming acceleration since the 1980s. The isotopic signature of sediment organic matter outlines a coherent increase in nitrogen atmospheric deposition during the last 100-150 years, in agreement with results from many lakes in the northern hemisphere. The results suggest a possible synergy between global warming and nitrogen enrichment in driving the biological changes recently observed in all the study lakes.