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Long-term ecosystem and biogeochemical research at the LTER site“Istituto Scientifico Angelo Mosso” (NW Italian Alps)

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The vast majority of studies in the ecological literature last less than three years, and only a small number of research works capture unusual events. To detect changes in high-mountain ecosystems, long-term research is mandatory, as these areas are important bellwethers of climate change. The LTER macrosite “Northwestern Italian Alps” includes the research site “Istituto Scientifico Angelo Mosso”, located in the alpine tundra close to the Monte Rosa Massif (NW Italy). The core of the LTER site is the Research Institute Angelo Mosso (2901 m a.s.l.), founded in 1907 by Angelo Mosso, professor of human physiology at the University of Turin. Over the years, the Institute has given support to scientists and scholars from all over the world, who could stay there even for long periods, while conducting their research activities in different research fields. At present times, it includes permanent plots, where different variables are constantly monitored, such as snow cover duration, vegetation composition and phenology, soil temperature, soil water content, and C and N forms. Moreover, the chemical characteristics of rainwater and snowfall are measured, as well as the water chemistry in ponds, focusing for example on how the soil properties control several hydrochemical properties such as the C and N content in water, following the critical zone paradigm. Research is also being carried out in order to investigate the hydrochemical characteristics of ponds and streams fed by different cryospheric features such as rock glaciers, glaciers, and permafrost, with a focus on the main associated weathering processes. Other permanent plots have been established in order to carry out investigations on paleoclimate through the information that could be derived from soils, integrating the information obtained in the same study area by ice core drilling. There is evidence that the paleoclimate influenced the cycling of soil carbon through shifting biomes and by altering soil physicochemical properties. The current distribution of soil carbon stocks thus contains footprints of the paleoclimate at timescales ranging from centuries to millennia. New research lines, aimed at investigating the most recent environmental challenges, have been added to the previous ones. Investigations on sources and routes of atmospheric nitrogen species, on the scarcely known biodiversity hosted in the glacial meltwater, and on the microplastic content in snow are ongoing, thus further extending the range

of environmental processes investigated at this high-elevation site.