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Incorporation of black carbon into soil organic matter of forested high-elevation soils in Switzerland

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Wildfires yield large amounts of CO_2 and NO_x to the atmosphere whereas a considerable portion of severely or partly charred necromass is incorporated into the soil. It is expected to increase the passive soil organic matter (SOM) pool. The intention of the present study was to elucidate the impact of fire on soil properties and the stability of SOM.

The soils derived from Cambisols and Leptosols under spruce and larch located at Leuk in the Swiss Alps, from a mountain slope which was affected by a wild fire two years before sampling. This fire, occurring in 2003 was reported as the greatest wild fire of Switzerland in the last 30 years. An area of 300 ha was affected starting at an elevation of 800 to 2100 m a.s.l. Three transects at different altitudes and with varying fire intensity were investigated (1100 m, 1500 m, and 1900 m a.s.l.). From each sampling site, two burnt soils and controls were taken in 2004 and 2005.

First results show an fire-induced increase of pH($CaCl_2$) from 3.6 to 5.7 in the Ah horizons, of the carbonate-free soils after one year. This pH change lasted over the 2 years until the second sampling. The deeper horizons showed no pH change. In soils with carbonate contents alterations of the pH were buffered. The fire enhanced the soil electrical conductivity indicating the release of inorganic ions from the combusted organic matter into the top and deeper horizons. An input of OC in the Ah horizons after the fire was observed. At one site at 1500 m a.s.l. the organic C enrichment amounted to 15%. This increase was attributable to input of new POM (20%). Here, input of OC was also identified for the deeper horizon. In most, the Ah horizon of the fire-affected soil color is darker than the control. This is explainable with a higher organic mat-

ter rich in aromatic structures which was caused by incorporation of charred residues within 2 years. However, some fire-affected soils showed no soil darkening, possibly due to loss of char by erosion at the steep slope ranging from 35 to 80%.

Our results show that 2 years after the fire event charred residues were already incorporated into the Ah horizon and that erosion processes are an efficient means for removal of char from the top horizons. This mechanism may contribute to the gap between observed and expected BC in soils. Further NMR spectroscopic analyses will provide additional insights into qualitative changes of the SOM caused by the fire.