

## Submitted Abstract

ID IMC22-FSAbstr- 185

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<b>Country</b>	United Kingdom
<b>Region</b>	Western Europe
<b>Title</b>	Shrub Expansion Modulates Belowground Impacts Of Changing Snow Conditions In Alpine Grasslands.
<b>Keywords</b>	Shrub Encroachment, Soil Functioning, Soil Microbiome, Biogeochemical Cycles, Winter Climate Change
<b>Type</b>	List Of Focus Session
<b>Focus Session ID</b>	45

## Abstract

Native plant range expansions are a widespread consequence of climate change, particularly in mountain ecosystems where shrublines are rapidly advancing into alpine grassland and tundra. At same time, alpine grasslands are experiencing large reductions in winter snow cover and earlier spring snowmelt. Yet, the combined effects of shrub expansion and changing snow conditions on abiotic and biotic soil properties remains poorly understood. We used complementary field experiments to show that reduced snow cover and earlier snowmelt have effects on soil microbial communities and functioning that persist into summer. However, ericaceous shrub expansion modulates a number of these impacts and has stronger belowground effects than changing snow conditions. Ericaceous shrub expansion did not alter snow depth or snowmelt timing, but did increase the abundance of ericoid mycorrhizal fungi and oligotrophic bacteria, which was linked to decreased soil respiration and nitrogen availability. Moreover, by combining molecular sequencing, enzyme assays, greenhouse gas flux measurements, soil biogeochemical analyses, and <sup>15</sup>N labelling, we show that reduced winter snow cover and shrub expansion alter the seasonal dynamics of plant resource acquisition, which is associated with shifts in the temporal dynamics of soil microbial community composition, functioning, and biogeochemical cycling. Our findings suggest that changing winter snow conditions have cross-seasonal impacts on biotic and abiotic soil properties, but shifts in vegetation will modulate belowground effects of future alpine climate change.