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Effects of winter warming events on vegetation ecophysiology on a low-alpine ridge

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Extreme weather events can both influence carbon cycling and sequestration and lead to pervasive changes in ecosystem structure and function. At high latitudes and in alpine bioclimatic zones, the effect of winter warming can be particularly important for vegetation dynamics, even leading to vegetation browning. With climate change, the frequency and severity of these events are expected to increase. Midwinter snow melt that leads to full exposure of vegetation is a strong stressor to some, but not all, vegetation types. Vascular plants break hibernation during such events and become photosynthetically active. Both factors lead to reduced protection against freezing damage. Thus, returning to sub-zero conditions typically results in freeze damage. In addition to snow meltwater, rain-on-snow events can lead to excessive ground-icing causing anoxic conditions for active cells. Hence, plant leaves are killed by the side products of anaerobic metabolism. If such events occur in late winter with much sunlight, but still frost in the soil, plants tend to dry out in response to the leaf activity and the lack of water supply from the roots, and hence, shoots may die from what is referred to as a frost drought. In some cases, freeze damage, anoxic conditions and frost drought all can occur in the same area during the same winter. While the impacts of changing winter climate on plants that rely on an insulating snow-cover in winter have been well explored during the last ten years, the effects on bryophytes and lichens are much less known. Six experimental plots at a lichen and bryophyte-dominated ridge on Finse, a low alpine site in Norway (1200 m a.s.l., N 60.59°, E 7.53°) were heated by infrared lamps in February-March 2021 and a 10 cm layer of ice was experimentally developed in six additional plots. We will repeat this experiment in 2022. These sites are revisited in the following summers for ecophysiological measurements in dominant lichen, bryophyte, and vascular plants species. The results from the first year of the treatment indicate higher resilience against extreme winter warming in lichen species compared to co-occurring vascular plants, however with notable differences between different species and growth forms. I will present the results from the field experiment collected thus far, and discuss implications for biochemical fluxes and ecosystem functioning.