Submitted Abstract

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Title	Effects Of Snow Cover Change On Freezing Induced Xylem Dysfunctions In Subalpine Woody Species.
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Abstract

Climate change is expected to affect snow cover dynamics at high elevation sites, leading to changes in both height and duration of the snow cover. While earlier snow melt and later snow fall may affect positively the length of the growing season, plants would also be less protected from climatic extremes, and suffer more severe winter drought and frost stress. In woody species, such as shrubs and trees at the alpine treeline, reduced snow cover may lead (besides drought due to transpirational losses) to more frequent freeze-thaw cycles in the plant xylem, and thereby affect living and dead xylem cells and impair their hydraulic function. Freeze-thaw cycles can induce the formation of embolism that block water transport in the conduits and thus impair the water supply of distal tissues. Plants must cope with such hydraulic limitation by repair of dysfunctional xylem or formation of new xylem tissue, which in turn can be impeded by frost-induced damages on living cells.

To better understand freeze-thaw-induce embolism, how plants overcome xylem dysfunction, and the potential trade-offs with plant growth and survival, five contrasting woody species are studied in the project “AcouFollow” by a snow-manipulation experiment at a high elevation field site in Tyrol (Austria). Species were selected according to their leaf phenology (evergreen/deciduous), growth form (shrub/tree) and wood anatomy (vesselless/diffuse porous) and include Juniperus communis, Larix decidua, Picea abies, Acer pseudoplatanus, and Sorbus aucuparia. Young trees were monitored under limited and extended snow cover duration through high resolution dendrometer measurements, ultrasonic acoustic emission analysis, and various complementary parameters (e.g., leaf phenology, soil and xylem temperature, water potential, and hydraulics).

Monitoring and snow manipulation approaches are expected to unravel the complex spatio-temporal dynamics of embolism formation during freeze-thaw cycles under varying snow depth situations and the potential for embolism repair under highly constrained environmental conditions. We hypothesize that the duration and height of snow cover influences both winter damages and recovery and that snow removal has overall negative impacts on plant hydraulics and growth. Species-specific differences in vulnerability to freeze-thaw-induced embolism and the potential for recovery will be discussed in the context of growth form, wood anatomical traits, and leaf phenology. Results will contribute to an improved knowledge of freezing tolerance and resilience of high mountain woody species and to enable projections of xylem dysfunction risks under future climatic and snow cover conditions.