

### Title of the symposium:

Disappearing snow and altered ecosystems: Observations, experiments, and outcomes

### Detail of organizer(s):

Details for each person that will be involved in running the symposium (the first one is responsible of the symposium):

Responsible

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### Symposium abstract

Winter snow is a critical component of ecosystem health. It insulates the soil, provides protection from winds, and results in slow water release over the spring melt period. However, climate continues to change rapidly. Snowpack depth, density, and duration are sensitive to small variations in temperature even apart from changes in overall precipitation amounts or timing. Declines in winter precipitation in some areas result in lower snow packs. In others, the warming climate is causing rapid declines in snowpack by causing shifts from snow to rain winter precipitation regimes. The end result is increasing organism exposure to novel winter conditions. Many ecosystems are located near the 00 winter temperature isotherm and vulnerable to this aspect of global change; others are likely to experience shorter snow seasons, resulting in changes in the fall or spring seasons. As a result, some species are likely to decline while others may benefit from the new conditions. In any case, ecosystem change is likely.

The transition from winter snow to low/no snow conditions is a threshold-like phenomena, resulting from only slight warming or declines in precipitation. Yet there are dramatic changes when that threshold is crossed. Soils are not insulated from atmospheric temperature variation, resulting in potential freezing events which alter nutrient availability, damage roots, and can cause widespread mortality. Root damage may lead to increased drought vulnerability. Aboveground communities are exposed to desiccating winds in addition, which can drive dieback or mortality. Vulnerable budding tissue may freeze, resulting in productivity declines over broad areas. These observations are becoming more and more common in a variety of ecosystems.

This symposium brings together a variety of focal systems to look for generalities in the effects of winter snow loss in the European Arctic, Rocky Mountains, Japan, Alaska, and elsewhere. Presentations cover observational data from detailed plot scale analysis to very broad extent remote sensing work, as well as plot to stand size snow manipulation studies. The talks will focus on methods and mechanisms of change from the species to ecosystem level, highlighting generalities which are useful to the global audience. The goal is to showcase regional work and emerging research techniques while providing information that will allow attendees to anticipate upcoming change based on work in other global regions.

### **How your symposia will improve landscape ecology science?**

The proposed symposium addresses a current gap in the literature, which has many examples of the effect of snow loss on specific species or community health, or biogeochemical processes, or mechanisms of injury, but not a global synthesis of emerging patterns. This symposium will explicitly focus on generalities resulting from the individual studies that are presented, incorporating recent experimental data and broad-scale observations into the fine-scale mechanistic plot networks that have long-existed. This will produce insights relevant to a broad-spectrum of scientists, even those not present at the symposium.

Second, because snow pack declines and snow-to-rain transitions are a spatially heterogeneous, it is itself producing new patterns on the landscape. Range contractions have been suggested, along with complex interactions with secondary stressors like drought, further complicating the spatial mosaic. Understanding how these drivers of change interact is extraordinarily important to predicting the response of ecosystems to climate change.

In the end, we will outline a synthesis manuscript built from the ideas and concepts presented in the symposium. This manuscript will outline emerging patterns, experimental and observational methods, implications for future change, and research needs. It is global

in scope. We anticipate the presenters, which represent a range of career stages, to be coauthors.

### **Broad thematic areas**

Broad thematic areas 1st choice: Disturbances in landscapes

Broad thematic areas 2st choice: History, dynamic and transformations of landscapes

### **Free Keywords**

Climate change, snow loss, emerging mortality, warming winters, precipitation regime

### **Notes**

We plan on producing a global review synthesis manuscript for publication as an outcome. The proposed time can be shorter or longer depending on how many extra people are included.