

Summary Report

A Data Synthesis Working Group: Disappearing Snow in the Western US: Ecosystem Implications for the Rain-Snow Transition Zone

Workshop held on May 5-6, 2011; Sevilleta LTER

Convener:

Anne Nolin Oregon State University

Participants:

Peter Adler Utah State University
Dominique Bachelet Conservation Biology Institute
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Robert Crabtree Yellowstone Ecological Research Center
Kelly Gleason Oregon State University
James Gosz University of Idaho
Kathleen Kavanagh University of Idaho
Catherine Keske Colorado State University
Tim Link University of Idaho
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Jessica Lundquist University of Washington
Roger Ruess University of Alaska Fairbanks
Mark Williams University of Colorado

Description of outcomes:

The main conclusions of the May 2011 workshop were:

- 1) Winters are critically important for biotic processes in the terrestrial cryosphere and in turn, biotic processes influence the abiotic processes that define winter.
 - a) Cold winter air temperatures maintain critical water storage as snow, preserve carbon-rich permafrost soils, and limit endemic and invasive pathogens and insects.
 - b) Rising winter air temperatures and changing patterns of precipitation are modifying snowpack dynamics, melting permafrost, and altering the length of the growing season thus directly impacting biotic processes
 - c) This reduction in winter controls amplifies the effects of warming by decreasing surface albedo, changing soil temperatures and increasing soil moisture stress, thereby compounding impacts to carbon storage, phenology, pest life history, and fire frequency
- 2) While the “press” of climate change affects biotic processes in ecosystems at decadal time scales, the “pulse” of episodic disturbances such as fire and pest outbreaks can interact with climate change to force a sudden shift from one community structure to another.
- 3) Synchronicity of multiple interacting disturbances may compound into “the perfect storm” disrupting biotic feedbacks within ecosystems that normally maintain resilience against structural and functional change.

- 4) The spatial character of transitional snow zones affects biogeographic processes such as dispersal and gene flow, and the spread of disturbance and invasive species represent cross-scale dynamics that will determine the ecological trajectory of these zones.

We next developed a whitepaper entitled ***“When Winter Wanes: Biotic Impacts of Changing Climate and Disturbance Regimes on Seasonally Snow-covered Ecosystems from the Watershed to Continental Scale”*** which we shared with interested colleagues and submitted to Henry Gholz and Liz Blood for comment.

Graduate student, Kelly Gleason, acquired data for over 40 cold lands ecosystem sites. Using the Budyko AET/P and PET/P relationships as a starting point, we modified this approach specifically to address cold lands ecosystems where snow plays a fundamental role in ecosystem health. She used temperature, precipitation, snow water equivalent and biome information to create graphical representations of a state-space that identifies each site in terms of energy and moisture availability and the role of snow and growing season precipitation.

Following this, we developed a Macrosystems Biology (Type 2) proposal entitled “Collaborative Research: Waning Winters: Biotic Impacts of Changing Climate and Disturbance Regimes on Cold Lands Ecosystems from Stand to Cross-regional Scales”. See attached for details.