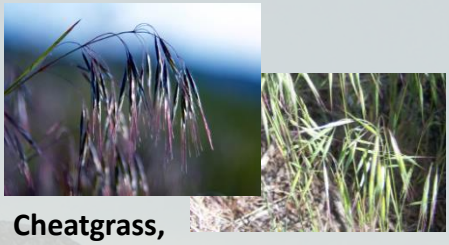
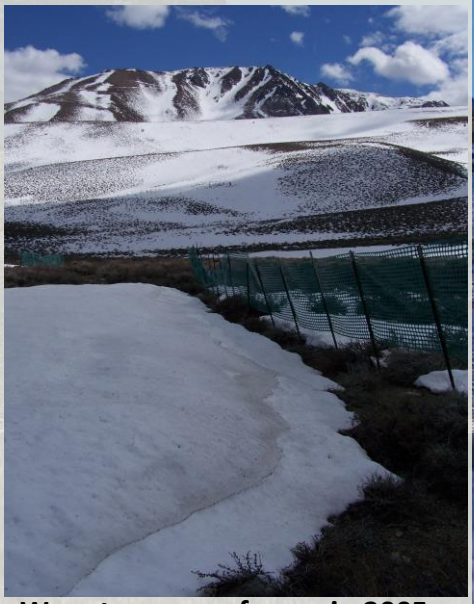
Cheatgrass and Climate Change

Climate change in the Eastern Sierra Nevada

The sagebrush-steppe of eastern California is an arid, montane system where even small changes in precipitation may have significant effects on plant communities. Currently, most precipitation falls in the form of snow and snowmelt is an important source of soil water for plants throughout the dry summer season. With predicted temperature increases in the Sierra Nevada, more precipitation is expected to fall as rain instead of snow and a decrease in late season snowpack is expected over the next century. The effects of these anticipated changes on plant communities and ecosystem processes are largely unknown. However, type and timing of precipitation and snowmelt can be important influences on plant growth and phenology, particularly in arid, montane ecosystems. Cheatgrass is currently limited at high elevation, likely due to cold winter temperatures. Since 2005, we have been testing cheatgrass response to changes in precipitation.



Cheatgrass, *Bromus tectorum*



We set up snow fences in 2005 to test the effects of increased and decreased snow on cheatgrass population growth

Cheatgrass response to changing precipitation

We used a series of *in-situ* field manipulations to determine how cheatgrass might respond to changing precipitation at the high elevation edge of its invaded range. We have been monitoring cheatgrass response to snowpack since 2005 using snowfences (see photo right) to simulate increased and decreased snow. For 3 years (from 2009 to 2011) we irrigated plots in the spring to simulate increased frequency and magnitude of springtime precipitation.

We found that cheatgrass generally responded negatively to increased snowpack and positively to springtime rain. Thus, predicted shifts from snow to rain could facilitate expansion of cheatgrass at high elevation. Notably, cheatgrass response to changing precipitation was most pronounced in the spaces between the shrubs, where it grew three times as much with just a 10% increase in springtime precipitation. Build-up of fuels in inter-shrub spaces can lead to increased fire frequency and subsequent conversion from a shrubland to annual grass-dominated system. Thus, indirect effects of altered precipitation could include loss of native perennial grasses and shrubs and the ecosystem services that they provide, including habitat for native species and dependable sources of forage for livestock.

Of note, during the drought over the last several years, cheatgrass has been reduced substantially. We are continuing to monitor it over the long term on an annual basis in the same plots that we set up in 2005 to determine whether and how it recovers after the drought, and under what conditions it is most liklely to spread.

We irrigated plots to test effects of simulated spring rain.

For more information about our research, contact Amy Concilio at alconcilio@fortlewis.edu.