

Plant responses to experimental warming and precipitation alteration on the Colorado Plateau



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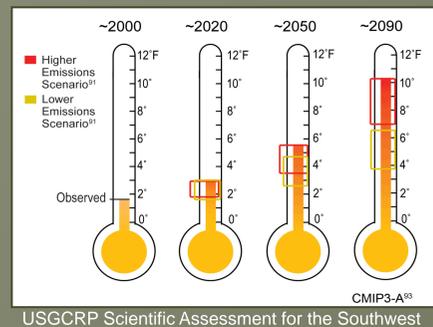
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Introduction:

Arid ecosystems comprise 35% of the land in the western United States and 41% globally. A substantial increase in temperature (4-6°C) and a decrease in summer precipitation are predicted for the CO Plateau, but we know little about how those changes will impact ecosystem processes.

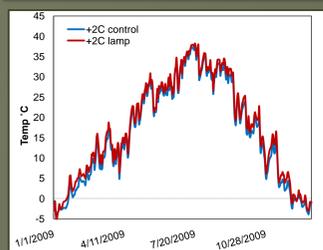
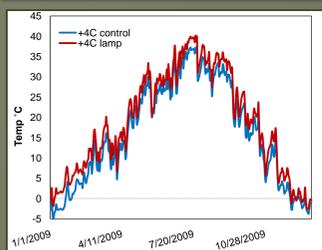


USGCRP Scientific Assessment for the Southwest

Methods:

In a large field experiment near Moab, UT, we are measuring plant responses to temperature and precipitation manipulations. We are imposing two warming regimes: +2°C in C- and D-plots and +4°C in B-plots. Fifty 5m² plots and randomly applied the following treatments:

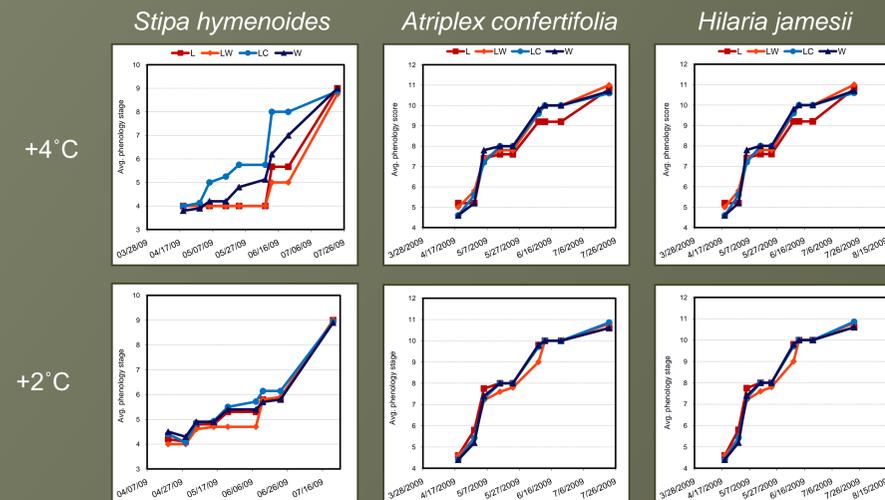
- (1) L (warming)
- (2) LW (warming and additional summer precipitation)
- (3) W (increased summer precipitation)
- (4) LC (control – no warming and no water addition)



Measured plant responses:

- Plant phenology – field observational protocol
- Plant cover and biomass
- Reproductive output – seed counts or allometric relationships
- Physiological responses: photosynthesis (fluorescence and gas exchange)
- Plant leaf nutrient concentrations – ICP analyses
- Plant leaf isotopes

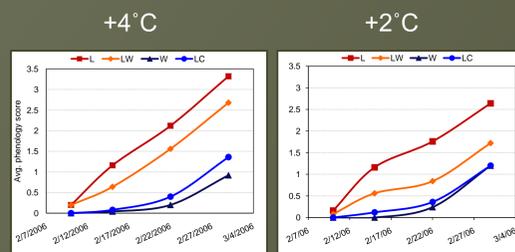
Plant phenology



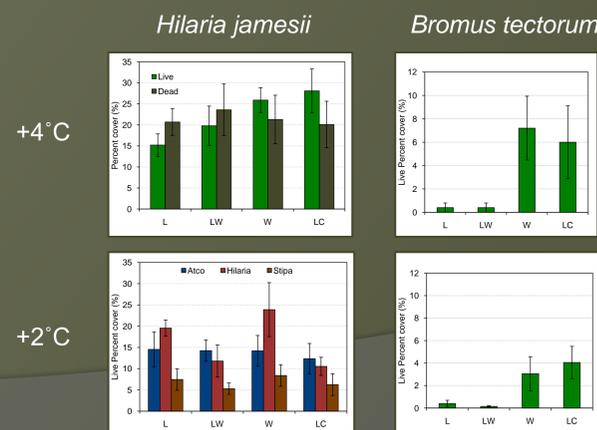
Phenology results:

Plants are starting to respond to warming. Earlier in the growing season, *A. confertifolia* and *H. jamesii* in warmed plots reached phenophases faster than plants in control plots. We saw the opposite trend for *S. hymenoides* – plants in warmed plots are developing slower than plants in control plots. Later in the growing season, all species responded negatively to warming. In 2010, we are already seeing acceleration in plant development in response to warming for *B. tectorum* and *S. hymenoides*.

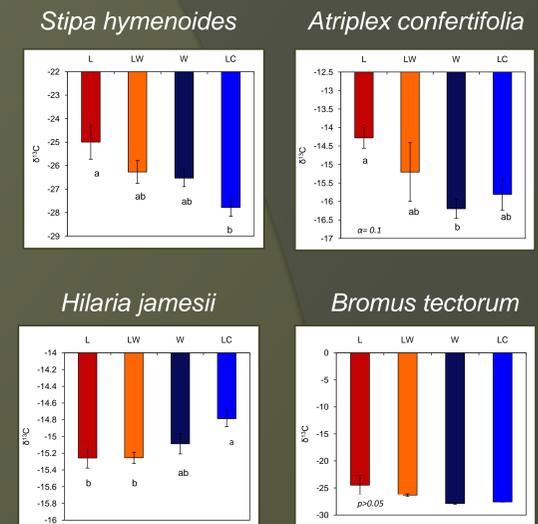
Bromus tectorum Spring 2010



Plant cover



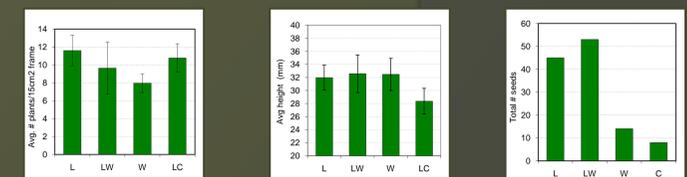
Plant isotopes



Isotopes results:

Based on the isotope measurements, two of the four focal plants are showing signs of water stress in warmed plots.

Bromus tectorum biomass and reproduction



Conclusions: Our results suggest that plants are beginning to respond to warming treatments and these responses range from physiology and biochemistry to growth and reproduction. Taken together, our data are helping to create a conceptual framework for understanding how climate change could affect the above- and belowground components of dryland ecosystems.

Future directions: In 2010, we will examine in more detail the physiological aspects of plant response, focusing on plant gas exchange, photosynthesis, and water use efficiency. We will continue monitoring plant phenology, growth, and reproduction and will begin assessing if the plant responses we see in warmed treatments translate to changes in plant fitness.

ACKNOWLEDGEMENTS

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