

Sensitivity of ecosystem properties to winter climate anomalies

LTET Synthesis Working Group Meeting Report

First meeting: March 22 – 25, 2013 Sevilleta LTER
Second meeting: June 7 – 10, 2013 Cedar Creek LTER
Third meeting: August 5 – 9, 2013 Minneapolis, MN (location of the 98th ESA meetings)

PRINCIPAL INVESTIGATORS

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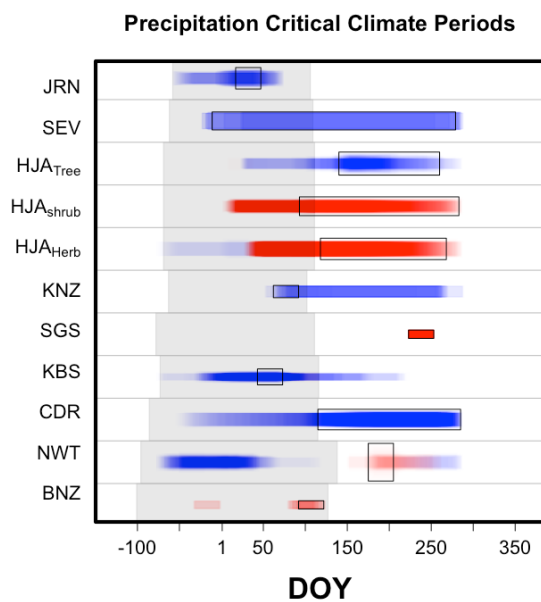
SUMMARY

Climate is predicted to change in many seasons, yet outside the arctic and alpine, most ecological research focuses on climate change during the growing season or uses annual averages of climate variables (e.g. mean annual precipitation). This research pattern disproportionately neglects the impact of winter climate on ecological processes. The current, incomplete view of the influence of winter climate is problematic and a broader, more comprehensive understanding of ecosystem responses to winter climate is needed. The main objective of this synthesis project was to assess the influence of winter climate on growing season dynamics across a range of temperate ecosystems. Specifically, we evaluated links between winter climate (precipitation, temperature) and growing season plant physiology, ecosystem structure, and function. To our knowledge, this is the first assessment of the influence of winter climate across a variety of North American temperate systems; therefore, we examined large-scale trends and patterns to serve as a guide to focus future investigations.

This synthesis project resulted from a workshop during the graduate student symposium at the 2012 LTER All Scientists Meeting. During our first synthesis meeting (March 22 – 25) we gathered and formatted datasets and also began analysis (detailed below). At our second meeting (June 7 - 10) we added additional datasets to the analysis, outlined a manuscript, and set deadlines for continued work after the meeting. A third meeting was aligned with the Ecological Society of America meetings (August 5 – 9) where we met to discuss and interpret

results and further define the direction of the manuscript. As a group, we presented a poster at ESA. Our poster was well attended and our project well received by the ecological audience.

For our methods, we analyzed climate (daily precipitation and air temperature), bud break, plant species richness, and annual net primary productivity data from 11 LTER sites (AND, BNZ, CDR, HFR, HBR, JRN, KBS, KNZ, NWT, SEV, SGS). Long-term (>10 yr) climate and biological response datasets were compared using the Critical Climate Period analysis technique (developed by T. Ocheltree under an 2012 LNO-funded post-doctoral project). By running correlations between climate and response variables during many different time periods, this analysis indicates the time of the year when climate is most related to a particular biological response (ie, bud break, ANPP). Our findings suggest that winter climate is related to growing season dynamics in many of the sites.



For example, the figure denotes the Critical Climate Periods (CCP) associated with plant species richness at several sites. Colored bars are the CCPs and indicate that precipitation during those days of the year is significantly correlated with species richness. Blue indicates a positive correlation and red a negative correlation. The black box outlines the strongest CCP. The grey shaded region shows when winter occurs. A CCP that falls within winter indicates that winter climate is related to the response variable, in this case, growing season species richness. Winter precipitation can be positively (e.g., KBS, SEV, JRN) or negatively (e.g., herbs and shrubs at AND) correlated with species richness. Sometimes the strongest CCP occurs during winter (e.g., JRN, KNZ, KBS), outside of winter (e.g., AND, CDR) or is

shared between winter and other seasons (e.g., SEV). Across all the biological responses, the relation with winter climate is variable, but in many cases, winter is related to growing season dynamics and warrants further investigation.

PRODUCTS

- A manuscript titled "Beyond arctic and alpine: The influence of winter climate on temperate ecosystem structure and function" is in preparation. The second draft is currently with co-authors and scheduled to be submitted in fall 2013.
- A poster presentation at the 98th Ecological Society of America meetings in August 2013. PS 1-8: Winter ecology: The surprising influence of winter climate on temperate ecosystem structure and function
- An entry on the LTER Graduate Student blog (<http://longtermresearch.blogspot.com/>) written by A. Churchill which details our first meeting and acts as a how-to guide for other graduate student synthesis working groups.