CGD SEMINAR

NCAR

DATE: Tuesday 18 February, 2020

TIME: 11 am – 12 pm

LOCATION: NCAR, Table Mesa Drive
Main Seminar Room

TITLE: **"Observed patterns of jet stream influence on phenology as captured by tree-rings, satellites, and the migration of the monarch butterfly"**

SPEAKER: **Amy Hudson, University of Arizona**

Atmospheric circulation patterns are the primary mechanism by which energy is distributed in the midlatitudes across terrestrial ecosystems. Plant and animal phenology reflect the influence of seasonal atmospheric circulation patterns on weather events. As these drivers of climate variability change, and are projected to change, it is important to quantify the observed response of ecosystem growth and processes to drivers of climate variability across scales. In this dissertation, I merge phenology, climatology, and dendroclimatology disciplines, novel data availability, and computation power, to quantify and visualize the influence of jet stream variability on phenology across scales: from individual species to the hemisphere, and from seasons to centuries. This allows us to identify patterns for model benchmarking and prioritize land management and conservation efforts in a warming world. First, I examined the long-term influence of multiple seasonal atmospheric circulation indices on climate as recorded by a network of trees growing at high altitudes in the Bighorn Mountains, WY (Hudson et al. 2019, *Dendrochronologia*; Chapter 1). I then expanded from one region to multiple regions across the Northern Hemisphere, while contracting our temporal scale, to determine for which regional ecosystems the spring and fall Northern Hemisphere Jet stream (NHJ) Indices (Belmecheri et al., 2017 *Earth Interactions*) influence length of growing season. The third chapter of this dissertation focused on North America, where I examined the influence of monthly jet stream position on cross-continental monarch migration, as estimated by annual overwintering acreage in Mexico. I found that spatio-temporal patterns of NHJ influence on growth varied by season and were very much system dependent. In high-latitude semi-arid systems, winter and spring circulation pattern signals in annual rings were modulated by microclimate conditions as they dictate snowpack and water availability into the growing season. Spring and fall NHJ influenced length of season for 30% of our domain, although similar NHJ shifts in the spring and fall resulted in very different LOS response- possibly linked to the seasonal limiting factor of temperature and its modulation on water availability for specific land cover and climate types. Remarkably, multiple months of jet stream position across the continent corresponded with monarch migration, potentially via pathways of monarch physiology, flight conditions, and resource availability. A macrosystem ecology framework of phenology that includes seasonal atmospheric circulation patterns allows us to 1) move beyond trends in mean states to consider the variability and extreme events ecosystems are exposed to in a changing climate, and 2) emphasize the connectivity of the landscape- particularly important for migrating organisms and when aggregating land surface response to change.

Live webcast: https://www.ucar.edu/live

For more information, contact Tracy Baker, tbaker@ucar.edu, 303.497.1366