

Shrub Encroachment and Bi-Stability Working Group Report

Organizers: Zak Ratajczak (KNZ), Jesse B. Nippert (KNZ), Scott Collins (SEV)

Attendees: Nicole Barger (non-LTER), Spencer Bissett (VCR), Paolo D’Odorico (SEV, VCR), Jennie DeMarco (ARC), Laura Ladwig (SEV), Rebecca McCulley (non-LTER), Sheri Shifflett (VCR), and Heather Throop (JRN, SEV)

Location: Sevilleta LTER, May 4th to 8th

Summary: The meeting began with site overviews, recap of mechanistic experiments, and discussion of theoretical properties of bi-stability in ecosystems. Through these presentations and following discussions, we found that there is evidence for abrupt shifts to higher shrub cover in almost all of the long-term US grassland sites with data available. The consensus was that the rapid nature of these transitions is due to shrub-related positive feedback mechanisms and the relaxing of important demographic barriers. The group used a stable-state interpretation to create a framework that separates local management from global pressures, which should be useful for land-managers and policy makers (Fig 1). During the second half of the meeting, we began data-analysis and created an outline for a manuscript. Zak Ratajczak and Jennie DeMarco will lead the writing; other members of the group are in the process of summarizing data from ARC, KNZ, JRN, NWT, Santa Rita Experimental Range, and VCR. We are also meta-analyzing a number of studies from other continents. We will submit a request to present our results at this year’s ASM and anticipate submitting a synthesis manuscript to “Ecology” by the end of the year. The primary points of this manuscript will be to highlight: 1) declining resilience in grasslands; 2) the rapid nature of woody encroachment relative to forest succession and biome transitions over geologic timescales; and 3) presenting our conceptual framework (Fig 1). The group is also working to test several different types of “early warning signs” that are thought to precede abrupt shifts. We envision finishing these analyses within the year and beginning writing in the spring. The group is now awaiting cost estimates from the first meeting to decide on the number of participants for a second meeting.

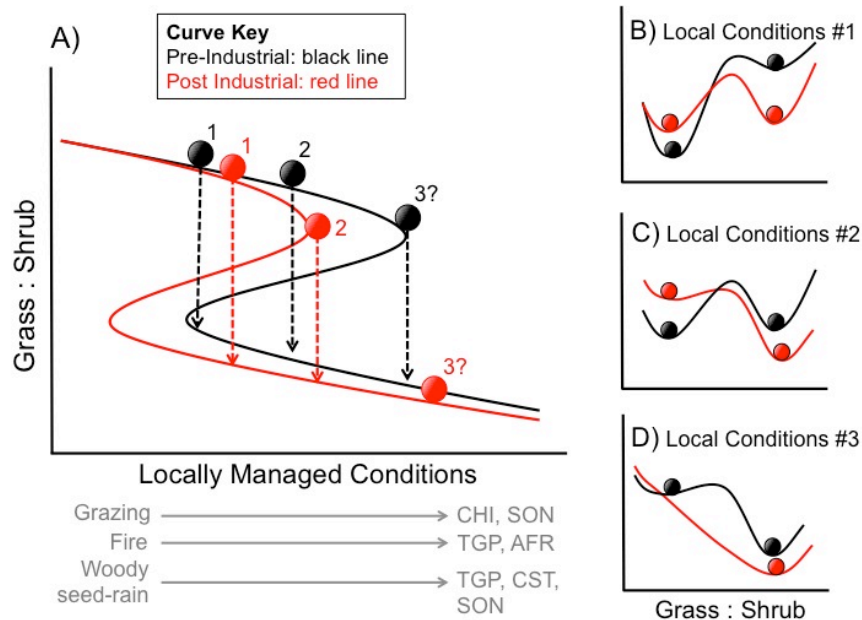


Fig 1. A stable-state interpretation of woody encroachment that separates the relative changes in resilience due to changes in locally manageable variables (i.e. ignition events, grazing) and global-scale variables (atmospheric chemistry, climate, N-deposition). In this framework, changes in local management and/or global-scale pressures can result in a shift to an encroached state.