METER
ENVIRONMENT

COMPLEX SCIENTIFIC QUESTIONS YIELD BETTER SCIENCE IN DESERT FMP PROJECT

The Desert FMP project originated from a discussion between pretty divergent scientists: Rick Gill, a BYU ecologist, another scientist who works on soil microbes, a plant physiologist, and a mammalogist who researches small mammals.

In an interview Gill said, “We started talking one day about the transformations that have occurred in the arid West over the past 100 years. One of the things we are really interested in is fire. How do ecosystems recover after fire? What’s the role of water in rangeland recovery? And the unique piece of this is: what’s the role of small mammals in this process? We may never have thought of that question, or the complexity of researching how all of our questions work together in a system, if scientists from different disciplines hadn’t decided to collaborate.”

As the experiment unfolds it is becoming clear that small mammals play a larger role in ecosystem recovery from fire than originally thought. The Rush Valley research site has five replications with four treatments: burned/unburned and small mammal/no small mammal. Gill said, “What’s interesting for us is that in the burned plots there are strong differences in the amount of the plant—halogeton—that was present, and it is systematically associated with the presence of small mammals. ”

The scientists have used their observations to hypothesize that small mammals eat the seeds and seedlings of two invasive species. This ends up setting the vegetation along a very different trajectory than when small mammals are absent following fire. Gill said, “We have discovered this complex but interesting interaction between water, fire, and small mammals. The first year after the fire, a really nasty range forb moved in called halogeton, which is toxic to livestock. Halogeton also accumulates salts in the upper soil profile that will cause failure in native plant germination. Cheatgrass has also moved in which makes the area more prone to fire as it connects the sagebrush plants with flammable material. But what’s interesting is in treatments where mammals were present, the densities of both halogeton and cheatgrass were much lower than where small mammals were absent.

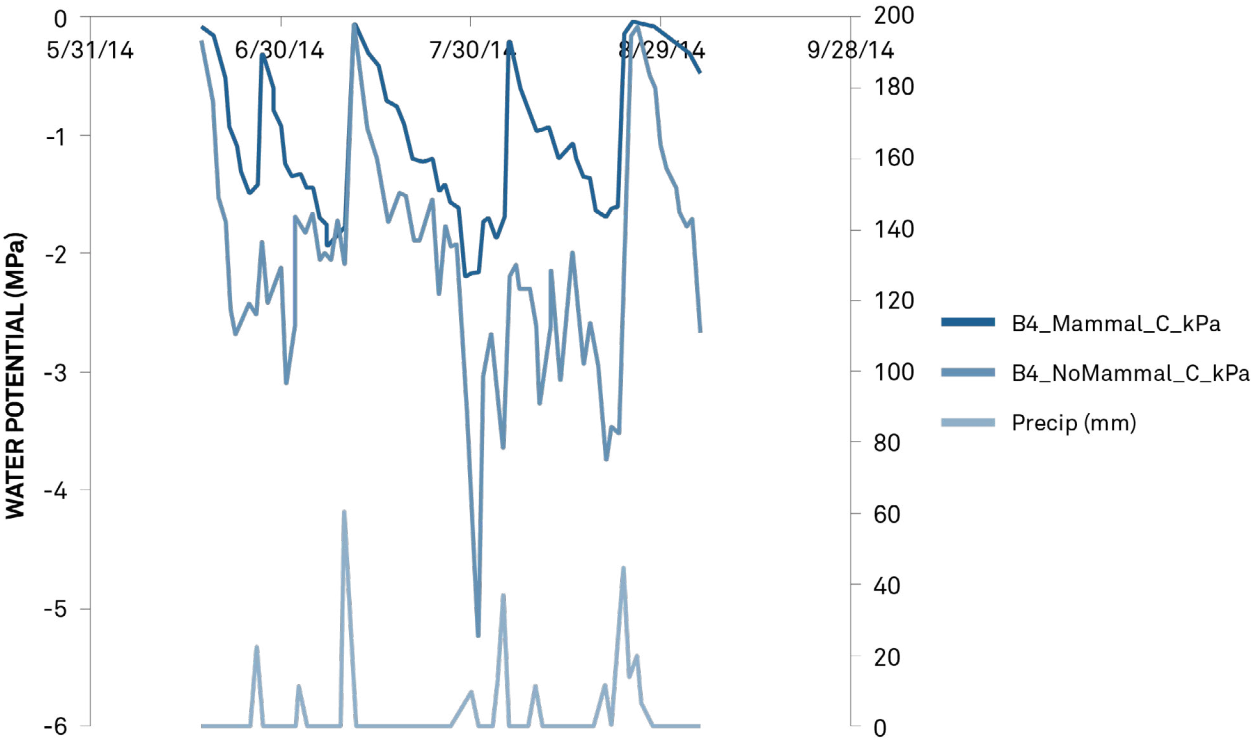

Figure 1. Plot water potential comparison using matric potential sensors between Mammal (blue) and no mammal (red) over time. With no mammals to control cheatgrass, it depleted soil water availability below no mammal treatment and consequently halogeten was not able to grow.

Here is the logic: in the spring, the presence of small mammals suppressed the cheatgrass, and to some extent, halogeton. In the absence of halogeton, cheatgrass ran wild. The cheatgrass transpired away all of the water and the halogeton that had germinated all died before it could flower."

"The other really important thing is that cheatgrass and halogeton have different growth patterns. Cheatgrass germinates in the Fall. It reaches peak biomass early in the growing season and then dies off leaving a blanket of dead, highly flammable vegetation. Halogeton germinates early in the growing season and remains relatively small until early Autumn when it bolts. These are things that will be really easy to pick up using METER SRS NDVI sensors, which are sensitive to the amount of green vegetation within the field of view of the sensor. We are also using a system that we've designed to manipulate precipitation input. This will enable us to connect water availability to the success of two invasive plants that have negative impacts on rangelands. And with these same treatments we're going to be able to tease out when in the year and to what extent small mammals are influencing the ecosystem by eating the seeds or the plant and at what stage."

TEROS 21 water potential sensor measures water availability

Rick added, “Until I saw it in the field, the question of mammals being influential in rangeland fire recovery had never occurred to me. We only discovered that piece of the puzzle because scientists from differing disciplines are working together.”

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