EDITOR'S CHOICE FROM RANGELAND ECOLOGY AND MANAGEMENT

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Fungal facilitation in rangelands: do arbuscular mycorrhizal fungi mediate resilience and resistance in sagebrush steppe?

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The soil is often considered the "stomach" of the earth because it is where most organisms are ultimately consumed and digested into nutrients that are acquired and used again by plants and animals in cycles. Soils are loaded with micro-flora, such as bacteria, fungi, algae, and protozoa, and live with an amazing array of soil micro-fauna, like earthworms, nematodes, and mites. One-tenth of an ounce of soil can have 3 billion bacteria alone. Most soil bacteria have not even been discovered and named yet. Some soil bacteria need oxygen that is in the soil atmosphere that fills many interspaces among soil particles, while others live in areas of the soil without oxygen. Soil micro-flora is regulated by the kind and amount of food that is available in soil. In addition, microorganisms interact with one another and with plants and animals of the environment where they live. These interactions can help or hinder various ecological processes, which in turn, can alter the rate and magnitude of the development of various processes, cycles, and/or determine specific ecological conditions. One common example is nitrogen-fixing bacteria that fix nitrogen from the air and release it in plant available forms when they die. In trade, the plant provides the bacteria with carbon for energy that the plant collects from the air and converts to a form useful to microbes. Microorganisms are important in creating the soil environment and can even control vegetation dynamics in some cases.

One very large group of soil micro-fauna are fungi, who exist with many shapes, colors, sizes, and mechanisms for avoiding or interacting with plants. Mycorrhizal fungi form symbiotic interactions with plants. These interactions between fungi and plants can be negative, positive, or any combination of negative-positive relationships (eg., mutualistic, commensalistic, or parasitic). Arbuscular mycorrhizas (AMF) are found in 80% of vascular plant families in existence today. They are a kind of mycorrhizal fungi characterized by the formation of unique structures, arbuscules, and vesicles that help plants to capture nutrients from the soil, such as phosphorus, sulfur, nitrogen, and micronutrients. This symbiosis is a highly evolved mutualistic relationship found between fungi and plants, and is the most prevalent plant symbiosis known.

An excellent group of scientists took on the challenge of reviewing the role AMF play in mediating resilient and resistant sagebrush steppe ecosystems. These authors are the recipients of the Editor's Choice award for Volume 72, Issue 4 (July 2019) of Rangeland Ecology and Management. They highlight the nature of AMF ecology as it relates to rangelands, and discuss the methods used to measure mycorrhizal responsiveness. Their review found compelling evidence that AMF mediation of resilience to disturbance and resistance to invasion varies with plant and fungal community composition, including plant mycorrhizal host status, plant functional guild, and physiological adaptations to disturbance in both plants and fungi. They concluded by outlining a framework to advance knowledge of AMF in rangeland invasion ecology. Understanding the role of AMF in semi-arid sagebrush steppe ecosystems will likely require multiple study approaches because of the highly variable nature of plant-AMF interactions, the complex mechanisms of resilience conference, and the unknown thresholds for responses to environmental stressors. This, they say, may require shifting away from the plant biomass paradigm of assessing mycorrhizal benefits in order to obtain a more holistic view of plant dependency on AMF, or lack thereof, in sagebrush steppe and other semi-arid ecosystems.

Please take the time to read this interesting and valuable review in Rangeland Ecology and Management, 72(4):July 2019. (Some of this note was lifted directly from the Editor's Choice article).

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Editor-in-Chief, Rangeland Ecology and Management

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Rangeland Ecology & Management
Volume 72, Issue 4

Table of Content

Potential Spread of Cheatgrass (Bromus tectorum) and Other Invasive Species by Feral Horses (Equus ferus caballus) in Western Colorado
Sarah R.B. King, Kathryn A. Schoenecker, Daniel J. Manier

Home on the Digital Range: Ranchers' Web Access and Use
Shayan Ghajar, Mara E. Fernández-Gimnez, Hailey Wilmer

Influence of Ecosystem Services on Management Decisions by Public Land Ranchers in the Intermountain West, United States
Elisabeth C. York, Mark W. Brunson, Kristin B. Hulvey