Tapping Soil Survey Information for Rapid Assessment of Sagebrush Ecosystem Resilience and Resistance

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On the Ground

- Emerging applications of ecosystem resilience and resistance concepts in sagebrush ecosystems allow managers to better predict and mitigate impacts of wildfire and invasive annual grasses.
- Widely available soil survey information can be harnessed to spatially depict and evaluate relative resilience and resistance from regional to site scales.
- New products and tools illustrate how managers can use soils data to inform rapid risk assessments, determine appropriate management strategies, and prioritize resources to maintain and restore functioning sagebrush ecosystems.

Keywords: sagebrush ecosystems, sage grouse, resilience, resistance, soils, cheatgrass.

A new ecologically-based approach to risk abatement has emerged that can aid land managers in grappling with escalating impacts of large-scale wildfire and invasive annual grasses in sagebrush ecosystems, particularly in the Great Basin. Specifically, ecosystem resilience and resistance (R&R) concepts have been more fully operationalized from regional to site scales to help reduce fire and invasive species risks in priority habitats for sagebrush-dependent species, like the greater sage-grouse (Centrocercus urophasianus).

Resilience refers to the ability of ecosystems to reorganize after disturbances like wildfire without crossing thresholds to alternative states with different structure and function, while resistance is the capacity of an ecosystem to remain largely unchanged despite disturbances or pressure from invasive species, like cheatgrass (Bromus tectorum). Resilience and resistance concepts help managers better understand key drivers of ecosystem change, identify relative risks of crossing thresholds to undesired states, and design appropriate management actions to promote desired ecosystem trajectories.

Climate, soils, topography, and vegetation are the primary biophysical factors that determine the potential ecosystem R&R for any given area. Maps and other geospatial products depicting these environmental factors are invaluable for helping agency leadership and field practitioners assess relative risks, prioritize allocation of limited resources, and determine appropriate management practices to most efficiently address wildfire and invasive species. While many standalone products exist, from remote-sensing to on-the-ground inventories, one free and widely available source of relevant information integrating many biophysical factors is the National Cooperative Soil Survey. In this paper, we describe new products and tools recently assembled using existing soil survey data to aid rapid assessment of potential resilience and resistance across sage-grouse habitats and sagebrush ecosystems in the western United States.

Landscape Indicators of Resilience and Resistance

Soil temperature and moisture strongly influence the kind and amount of vegetation, and consequently, are closely tied to sagebrush ecosystem R&R. A recent breakthrough in the practical application of resilience and resistance concepts has been linking soil temperature and moisture regimes to sagebrush ecosystem responses to disturbance and cheatgrass invasion. In soil taxonomy, temperature regimes reflect the mean annual soil temperature at a depth of 20 inches below the soil surface or at a restrictive feature if the soils are shallower, while moisture regimes indicate the length of time plant-available moisture is present during the growing season. Soil temperature and moisture regimes are a way of classifying a continuous gradient of conditions, from hot to cold and dry to wet, that affect plant community...