SERDP
Strategic Environmental Research and Development Program

Exotic Annual Grasses in Western Rangelands: Predicting Resistance and Resilience of Native Ecosystems Invasion

Conservation
CS-1144

Background:

With many millions of acres currently dominated by non-indigenous annual grasses and 62 million acres of rangeland habitat highly susceptible to conversion, annual grasses are emerging as a major factor to be considered as the future of rangeland ecosystems is evaluated. The invasion of annual grasses, such as *Bromus tectorum*, into western rangelands has had profoundly negative consequences for native ecosystems. Mediterranean annual grasses currently comprise 50-85 percent of the vascular plant cover in over two-thirds of the western United States. One of these species, *Bromus tectorum*, alone dominates over 100 million acres of the Intermountain West.

Objective:

The objectives of this project are to: (1) determine if the current distribution of *Bromus* and other annual grasses can be predicted on a landscape and regional level using soil chemistry; (2) construct a model that predicts which soils are resistant or susceptible to annual grass invasion for a large watershed; (3) investigate positive feedback loops that may perpetuate annual grass dominance, such as altered soil organic matter, litter, or chemistry; and (4) examine ways to favor native plant reinvasion by altering soil chemistry.

Summary of Process/Technology:

The initial focus of the project will be the random selection and sampling of sites which represent major habitat types within the watershed surrounding Virginia Park in Utah. At each site, the slope, aspect, elevation, soil type, past and present anthropogenic disturbance, and distance to roads will be noted. Vascular and non-vascular vegetation cover will be estimated, and soil depth and stability will be assessed. The soils will then be analyzed for texture, cation exchange capacity, electrical conductivity, pH, percent calcium carbonate, organic matter, and a variety of inorganic constituents (total nitrogen, phosphorus, potassium, etc.). Regression analysis then will be used to determine the appropriate factors to predict the presence of *Bromus*.

Benefit:

This project will aid managers in predicting what soils are susceptible to invasion by alien species and will facilitate planning to reestablish lost habitat. In addition, understanding how annual grass invasion changes natural ecosystem processes, such as nutrient availability, water availability, and soil microbial systems, and how these changes affect reestablishment of native perennial plants, will enhance efforts to restore lost habitat.

Accomplishments:

Using landscape assessments, vegetation and soil chemistry "fingerprints" of invaded and non-invaded areas of *Bromus* were established to determine habitats vulnerable to invasion. A predictive model has been developed to forecast future invasions in the western United States. Greenhouse experiments were conducted for *Bromus, Hilaria* (a native grass), and a *Bromus/Hilaria* mix using a variety of nutrient amendments, and resin products were used to measure plant-available nutrients. Promising amendments that favored *Hilaria* and inhibited *Bromus* (e.g., sodium chloride, magnesium chloride, and zeolite) were further investigated in the field. Additionally, the role of invaded versus non-invaded soils and microenvironments was examined to better understand *Bromus* invasions.

Invasion of *Bromus tectorum* into an ungrazed grassland of the Needles District of Canyonlands National Park, UT.

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