Improving marginal habitat restoration in Western rangelands: spatial variation in seed germination of target species

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Introduction

Ecological restoration commonly requires the reintroduction of plants to degraded sites, and long-term vegetation establishment is a critical component of reclamation success. In recent years, restoration protocols have experienced a shift in emphasis from non-native to native seed sources (National Native Plant Materials Development Program; http://www.blm.gov/wo/st/en/prog/more/fish_wildlife_and/plants/1.html). However, native plant seeds are scarce, and when supplies are available, seeds are often derived from populations either 100s of miles distant or with unknown origin. Non-local seeds may not be suited to site conditions due to adaptive variation among populations within a plant species. As a result, the geographic origin of selected seed sources can have significant consequences for restoration outcomes.

Propagation requirements can differ among seed sources of a single plant species, with significant consequences for recruitment success. For example, in a recent study of true mountain mahogany (*Cercocarpus montanus*), researchers at New Mexico State University and the USDA Natural Resource Conservation Service determined that requirements for cold stratification, or pre-chilling, varied with the latitude and the altitude at which seeds were collected. As a result, it is unlikely that use of northern seed sources that require a long period of cold stratification for germination would result in successful revegetation of mountain mahogany at warmer, southern sites. Given the widespread differentiation in adaptive traits among populations of native plants, knowledge of species-level germination requirements across altitudinal and latitudinal gradients will improve seed selection and vegetation success at reclamation sites.

Objectives

My objectives for this study are to:

1. Collect 20 population samples of >10,000 seeds representing 5 or more plant species targeted for reclamation along a north-south transect of their geographic range.
2. Characterize propagation requirements for each species based on latitude and altitude of origin to

establish effective germination protocols for reclamation.

Materials and Methods

Under an assistance agreement with the Wyoming Bureau of Land Management to collect native seeds according to the Seeds of Success protocol, seed collections made during summer 2011 will be sent to the Bend, OR Seed Extractory Seed (USFS) where 10,000 seeds of each species will be processed and archived in the Agricultural Research Services National Germplasm Resources Information Network for genetic preservation as well as additional research and development. Remaining seeds of each species will be incorporated into germination studies.

Germination studies will be completed at the University of Wyoming Research and Experiment Station in Laramie. Namely, samples of 100 seeds representing each population and each species will be tested for germination potential in trials of different cold stratification periods (e.g., 0, 10, 30, and 60 days) and incubation temperatures. Data will be analyzed for significant differences in germination percentages among populations within species. Analyses will determine spatial patterns of variation in germination requirements and also the range of temperatures within which populations of each species can establish successfully. Results will be published and made available through the University of Wyoming Reclamation and Restoration Center.

Discussion

Given the widespread differences in adaptive traits among populations of native plants, knowledge of germination requirements across altitudinal and latitudinal gradients will not only improve revegetation success, but also contribute to conservation of plant communities in changing climates. An upslope and pole-ward shift in the range of North American species is likely as a result of increasing temperatures. The ability of plant species to germinate and establish in warming climates may therefore be key for survival in their present range, and data to describe germination differences among populations are needed to assist both present-day and future reclamation and restoration programs.

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