



Cheatgrass Moving Higher in Elevation: A Troubling Trend

The Question: What factors are driving Cheatgrass (*Bromus tectorum*) to high elevations?

Cheatgrass, an exotic annual grass, transforms habitats and reduces native species diversity in the areas it has invaded. Expanding its influence beyond rangelands, cheatgrass is increasing in abundance at higher elevations including montane and sub-alpine ecosystems like those at Rocky Mountain National Park. Concerns prevail about the loss of valuable winter habitat for wildlife due to cheatgrass and its ability to out-compete native perennial grasses and to increase fire frequency and intensity.

Possible explanations for the spread of cheatgrass in high elevations include (1) changes in climate that create conditions that are more favorable for cheatgrass than they were in the past; (2) increased local disturbance such as high grazing pressure due to over-population of elk; (3) increased nutrient enrichment resulting from regional nitrogen deposition; and (4) genetic factors that induce local adaptation, enhancing the plant's opportunistic survivability. Researcher Cynthia Brown at Colorado State University's Department of Bioagricultural Sciences and Pest Management analyzed environmental factors that may contribute to the success of cheatgrass.



Cheatgrass: An unwelcomed guest.

The Project: Investigate the germination characteristics of seeds along an elevational gradient and analyze the effects of temperature and light treatments.

Two separate experiments explored cheatgrass germination characteristics. In the first, seeds from 11 different cheatgrass populations of varying elevations planted and monitored in a greenhouse provided the differences among populations in germination percentage. The second experiment utilized temperature and light controls. Scientists placed seeds of four populations (1385 m, 1406 m, 2670 m, and 2682 m) on moist germination paper and either subjected them to 10 days of two degrees C before initiation of tests (pre-chilled) or placed directly into incubation chambers (non-chilled). They held chilled and not-chilled treatments at 25 degrees C and exposed either to eight hours of light or no light during each 24-hour cycle. Scientists used statistical analyses to evaluate the data.

The Results: The germination response to environmental conditions differs among populations, suggesting genetic differentiation and local adaptation.

Results show that patterns of cheatgrass seed dormancy correspond, on average, to seed source elevation: there may be selection for seed dormancy among low-elevation populations but not among high-elevation populations. However the germination response to pre-chilling and light did not suggest that dormancy was related to seed source elevation. While the germination patterns were not always consistent, the strong differences among populations indicate the potential for local adaptation. Continuing research suggests that environmental change may be a greater factor than genetic adaptation. The results have implications for the continued success of cheatgrass at high elevations and with varying climatic conditions. With this knowledge the park can more effectively understand the invasiveness of cheatgrass and how restoration techniques may vary from site to site.