Prescribed Fire and Herbicides Modify Soil Processes During Barrens Ecosystem Restoration

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Prescribed fire has become a common tool of natural area managers for removal of invasive species and maintenance of barrens grassland communities. Certain target species however, resist fire and may require additional removal treatments. An effective option for removal of *Festuca arundinacea* (tall fescue) from areas that previously supported native warm season grasses combines spring prescribed fire and post-emergent herbicides. We studied changes in soil N and C dynamics following prescribed fire and herbicide application in a remnant barrens in westcentral Kentucky. Fire and herbicide effects were compared in a 2 way factorial design with 5 replicates. Fescue cover decreased and bare soil increased from near 88 and 2% in no-burn/noherbicide control plots to 12 and 28% in burned/herbicide plots. During the month following the fires, soil N movement measured with *in situ* exchange resins was 1.4-fold higher in burned compared to unburned soils. Net N mineralization was 2.8-fold higher in burned compared to unburned soils. Burned/herbicide soils mineralized more N than non-herbicide soils. Fire increased soil temperature and decreased soil moisture and CO2 efflux. Removal of non-native plants modify chemical, physical and biologic soil conditions that control availability of plant nutrients and influence plant species performance and community composition

Experimental Studies of Oak Seed Responses to Fire Temperature in Appalachian Mixed-oak Litter

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The relationship between wildland fire intensity, fire temperature, and the response of plant and animal populations is complex. Few studies have examined the relationship between fire temperature at fine spatial scales and oak seed germination. To examine temperature patterns, we exposed aluminum tags painted with temperature-sensitive paints (38-427°C) and placed them at –1, +2, and +12 cm relative to the soil surface, in 1 x 1 m grids with 20 cm spacing distances, and burned in oak litter. Belowground (<30°C) and 12 cm (range: 150-225°C) sensors were spatially homogeneous across the experimental burn plots. Sensors in the leaf litter experienced the hottest and most variable temperatures (95-375°C) and greatest spatial variability. A subsequent study of 432 *Quercus prinus* seeds varied seed position (above- or below-ground), temperature (control, 38, 66, 150, 204, and 260°C), and exposure time (5 or 15 min). Time and temperature were highly significant (P<0.001). Seed exposure to temperatures above 150°C for more than 5 min yielded decreased germination. Temperatures at 204°C for 15 min usually resulted in complete mortality. Caching of *Q. prinus* seeds by gray squirrels may potentially increase seed survival during wildland fires. Further studies are underway to evaluate temperature and its effect on weevil *(Curculio)* populations.