Sampling Design and Analysis

Tree removal with and without burning

Overall treatment effects: ***Is fire necessary for restoration or is tree removal sufficient?***

Field measurements. Ground conditions, fuels, vegetation, and soil properties were sampled within 32 - 64 subplots (10 x 10 m) per experimental unit (Fig. 28, Table 2).

Table 2. Response variables measured before (2004) and after treatment (2006 = post-logging, 2007 = post-burning).

Variable	Before	After
Ground conditions: cover of mineral soil, CWD, fine litter, and burn severity	2004	2007
Fine fuels: 1-, 10-, and 100-hr	2006	2007
Cover of all species; cover and richness of meadow, forest, and ruderal species (see Appendix 1).	2004	2007
Conifer seedlings (density)	2004	2007
Soil properties (0-10 cm): total C and N, available N, and pH		2007

Statistical analyses. For all response variables, subplot values were averaged to generate means for each experimental unit. Analysis of variance (ANOVA) was then used to assess treatment effects (n = 3 replicates per treatment). Nonmetric multidimensional scaling (NMS) was used to examine changes in plant species composition.

Fig. 28. Sampling of fuels (July 2006) and ground vegetation (July 2007).

Variation in response to treatments: ***Does the potential for restoration depend on the stage of conifer encroachment?***

To test whether responses to treatment depend on the stage of encroachment (i.e., forest age and structure), subplots within each experimental unit were assigned to one of three structural classes: (1) meadow or few trees, (2) young forest, or (3) old forest (see section 3.1.2.1.). Subplot values were averaged for each structural class and responses to treatments were assessed separately by class.

Effects of burn piles

Although slash piles covered only 10% of the ground surface within pile and burn (PB) treatments, intensive burning may have severely altered soil properties and vegetation. Further, burn scars also have the potential to serve as foci for establishment of native and exotic ruderal species that benefit from greater soil disturbance and nutrient availability. With support from the ESA SEEDs program (see section 4), Sheena Hillstrom (Washington State University) designed a study to quantify the magnitude and spatial extent of these effects (Fig. 29).

Ten piles were chosen from each treatment unit. Ground conditions, vegetation, and soils were sampled along transects oriented in a random direction from the center of each pile (C), across the edge (E), into adjacent unburned vegetation (U1 and U2).

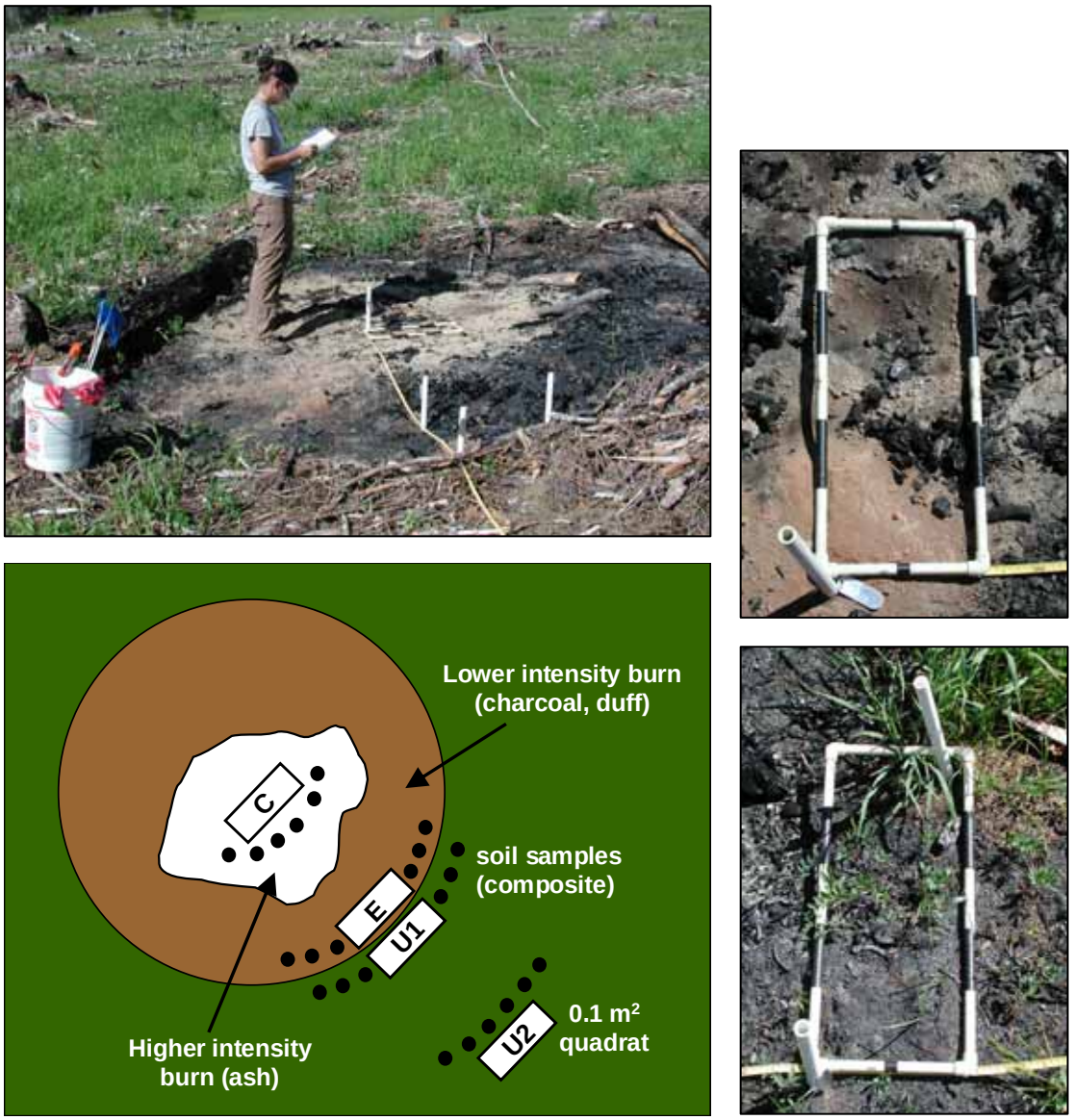

Fig. 29. Left column: Sampling design to assess effects of burn piles. PVC posts mark the corners of 0.1 m^2 quadrats. Right column: Quadrats at the center (C) and edge (E) of a burn scar, illustrating the difference in consumption of litter and exposure of mineral soil.