

## **Lab 2: The Effects of Prescribed Fire II**

### **Objective**

To evaluate the effects of prescribed fire and stand/site conditions on fuel moisture and loading.

### **General Procedures**

Students will compare and contrast fuel conditions in areas with and without prescribed burning, and in different stands/sites, by collecting field data in fuel transects. These conditions will be discussed relative to the objectives of prescribed burning programs and fire ecology.

### **Background**

Prescribed burning is the deliberate use of fire under specific controlled conditions to meet management objectives. The most common objectives for prescribed burns include:

1. Hazardous fuel reduction
2. Wildlife habitat improvement
3. Site preparation for forest regeneration
4. Perpetuate fire dependent species
5. Exotic/invasive and native plant/pest management
6. Improve access or enhance appearance

Prescribed burn managers set very specific objectives for prescribed burns relative to what resources or vegetation are to be altered, by how much, and when. They then prescribe detailed weather, timing, fire behavior, fuel moisture, ignition patterns, and many other variables and conditions under which the burn will be conducted. A wide range of fire intensity is possible. Very intense fires that are conducted under dry and warm conditions will maximize plant mortality and downed dead fuel consumption. Cool burns under wet conditions may have little impact on vegetation and surface fuels. An integral part of the prescription and burn operation management is to monitor the outcome(s) of the prescribed fire. This monitoring and assessment process is the basic exercise that students will be doing. Providing as much detail on the actual prescription, its objectives, and the predicted/desired conditions by comparison to those actually occurring during the burn will help students connect the objectives with the operation and, in turn, the outcomes of the prescribed burn.

### **Specific Procedures**

1. Establish four sets of perpendicular transect lines (actually planes up to 6" tall) that will be 50 feet long. Do two sets in unburned areas and two in burned areas. Determine the slope percent of these transects using a clinometer.
2. Count the number of intersections of these sampling planes with dead woody twigs, branches, and logs in 1-hr (< ¼") and 10-hr (¼ - 1") on the first 10' of the transect. Count the number of 100-hr (1-3") on the first 25' of transect and 1000-hr (> 3") fuel category along the entire 50' transect. Segregate the 1000-hr fuel by whether it is sound (not easily broken apart) or rotten (can be dissected with little effort). Tally each piece of downed woody fuel only if the central axis of the piece is bisected by the plane and the piece at its intersection is above the duff layer (in and above the litter layer). A curved piece that intersects the plane more than once is counted every time it crosses the plane.

3. Measure the mean depth of the duff and litter layers (in inches) at 6', 12' and 25' from the transect start. Recall that the litter layer has leaves that can be identified; the duff is brown matter without discernible parts.
4. Collect a 1' x 1' section of litter and a 1' x 1' section of duff and bag it for moisture determination at 25' along the transect.
5. Collect 25 pieces of 1-hr, 10 pieces of 10-hr, 5 pieces of 100-hr, and 1 piece of 1000-hr rotten and sound fuel samples along each transect and bag it for moisture and specific gravity determination. Collect pieces that are 6"-12" long, if possible.
6. Label all collection bags with a stand/transect identifier, a contents identifier, and a crew name/number.
7. Determine the wet weight and dry weight of all fuel samples. Dry weight is determined after drying to a constant weight at 65°C. % MC = (wet – dry) / dry.
8. Determine the specific gravity (g/cc) of 10-hr, 100-hr, and 1000-hr fuels by measuring the volume of displaced water during immersion of dried samples. Note dry weight and specific gravity.
9. Determine the fuel loading on your transects using the following calculations (after Brown et al. 1982):

1-Hour Fuels ( $\leq 1/4''$ ):	tons/acre = $(0.09533 * n * [1 + (\text{slope}/100)^2]^{0.5})/L$
10-Hour Fuels ( $>1/4'' - 1''$ ):	tons/acre = $(1.825 * n * [1 + (\text{slope}/100)^2]^{0.5})/L$
100-Hour Fuels ( $>1''-3''$ ):	tons/acre = $(14.52 * n * [1 + (\text{slope}/100)^2]^{0.5})/L$
1000-Hour Sound Fuels ( $> 3''$ ):	tons/acre = $(4.656 * \sum d^2 * [1 + (\text{slope}/100)^2]^{0.5})/L$
1000-Hour Rotten Fuels ( $> 3''$ ):	tons/acre = $(3.492 * \sum d^2 * [1 + (\text{slope}/100)^2]^{0.5})/L$
Litter:	tons/acre = (depth * density) * 1.8
Duff:	tons/acre = (depth * density) * 1.8

n =	number of fuel intersections for a given size class tallied on transect plane ( <i>If you tallied 27 of the 1-hr fuel intersections on a given transect, then n = 27 in the calculation of 1-hr fuel load.</i> )
slope =	slope in %
L =	length of transect plane for a given size class ( <i>If you measured 1-hr fuels to 10, then L = 10; if you measured &gt;3" fuels to 50', then L = 50.</i> )
$\sum d^2 =$	sum of the squared fuel diameters for all sound or rotten fuels > 3" ( <i>If you intersected a 5" sound fuel and a 6" sound fuel, then sound <math>\sum d^2 = 5^2 + 6^2 = 25 + 36 = 61.</math></i> )
depth =	average depth in inches of either litter or duff layer on a given transect ( <i>If you measured duff depths of 0.8" and 1.2", then depth = 1.0".</i> )
density =	bulk density (lbs/ft <sup>3</sup> ) of either duff (6.0 if hardwood, 8.0 if white pine, 5.0 if yellow pine) or litter (0.9 if hardwood, 1.1 if white pine, 2.5 if yellow pine)

10. Compare and contrast the fuel conditions (average moisture %, fuel loading, specific gravity...) for the 1-hr, 10-hr, 100-hr, litter, and duff in burned and unburned areas by computing the averages of the response variables measured on the two sets of transects and writing a one-page summary of the results.

### Materials and Tools

pin flags	data sheets	bow saw
clinometer	calculator	trowel
yard sticks or rulers	reciprocating saw	flasks/graduated cylinders
cloth tapes	paper bags	dissecting needles

## DATA SHEET – LAB 2

### TRANSECT 1:

Stand/Site Condition: \_\_\_\_\_

Slope: \_\_\_\_\_

Litter Depth	Duff Depth
6' =	6' =
12' =	12' =
25' =	25' =
Average =	Average =

### Woody Debris Planes:

	No. of Intersections	Wet Wt. (g)	Dry Wt. (g)	Moisture Content (%)	Mass (g)	Volume (mL)	Specific Gravity
# 1-hour (<.25")							
#10-hr (.25-1")							
#100-hr (1-3")							
#1000-hr Sound (>3")							
#1000-hr Rotten (>3")							
Duff							
Litter							

### TRANSECT 2:

Stand/Site Condition: \_\_\_\_\_

Slope: \_\_\_\_\_

Litter Depth	Duff Depth
6' =	6' =
12' =	12' =
25' =	25' =
Average =	Average =

### Woody Debris Planes:

	No. of Intersections	Wet Wt. (g)	Dry Wt. (g)	Moisture Content (%)	Mass (g)	Volume (mL)	Specific Gravity
# 1-hour (<.25")							
#10-hr (.25-1")							
#100-hr (1-3")							
#1000-hr Sound (>3")							
#1000-hr Rotten (>3")							
Duff							
Litter							

## DATA SHEET – LAB 2

### TRANSECT 3:

Stand/Site Condition: \_\_\_\_\_

Slope: \_\_\_\_\_

Litter Depth	Duff Depth
6' =	6' =
12' =	12' =
25' =	25' =
Average =	Average =

#### Woody Debris Planes:

	No. of Intersections	Wet Wt. (g)	Dry Wt. (g)	Moisture Content (%)	Mass (g)	Volume (mL)	Specific Gravity
# 1-hour (<.25")							
#10-hr (.25-1")							
#100-hr (1-3")							
#1000-hr Sound (>3")							
#1000-hr Rotten (>3")							
Duff							
Litter							

### TRANSECT 4:

Stand/Site Condition: \_\_\_\_\_

Slope: \_\_\_\_\_

Litter Depth	Duff Depth
6' =	6' =
12' =	12' =
25' =	25' =
Average =	Average =

#### Woody Debris Planes:

	No. of Intersections	Wet Wt. (g)	Dry Wt. (g)	Moisture Content (%)	Mass (g)	Volume (mL)	Specific Gravity
# 1-hour (<.25")							
#10-hr (.25-1")							
#100-hr (1-3")							
#1000-hr Sound (>3")							
#1000-hr Rotten (>3")							
Duff							
Litter							