Mixed-Oak Forest On A Fine-Textured Alfisol

Radrick Forest is typical of many of the hardwood forests that occupy dry-mesic to wet-mesic sites in southern Michigan, Ohio, and Indiana. A large proportion of the mixed-oak forest was cleared during European settlement, because the "rich" soils they occupied were valued for agriculture. Few, if any, undisturbed mixed-oak forests remain today, because of agricultural conversion and the removal of large maples and oaks for sawwood and veneer. Areas once cleared that have reverted to forest are often dominated by red oak, white oak, black cherry, and hickory, as well as sugar maple. Radrick Forest is a good example of this situation.

Mixed-oak forests typically occurred on ground and recessional moraines or on areas near the margin of morainal features. Topography in these areas ranges from nearly-level conditions on ground moraines to the gentle slopes of the recessional moraines. Although the landscape the mixed-oak forest occupies is relatively young (less than 14,000 years), the soils beneath them are particularly well developed and fertile; textures typically range from sandy loam to clay loam. These soils, termed Alfisols, are typified by light colored surface horizons (i.e., E), well-developed structure, and an accumulation of clay colloids in subsurface (Bt) horizon.

Today you will sample and describe the soil of a mesic mixed-oak forest, collect forest floor material, and inventory the overstory tree species to understand how soil properties relate to the distribution of forest ecosystems. Specific issues we will address include:

1. The glacial history of the area: What is the parent material, landform, and topography?

2. The relationships between parent material, soil development, and forest composition: How deep is the soil developed? How does parent material affect drainage, nutrient availability, and depth of rooting?

3. Thickness of the forest floor and litter decomposition rates: How rapid is nutrient cycling? How do oak and maple leaves differ in rates of decomposition?

Procedure

I. Soil Profile Description and Site Description

A. Each team will be assigned to a soil pit. Please work as a team to complete the Soil Profile Description Form using the Guide for Preparing Soil Profile Descriptions from Lab #2.

B. Complete the Site Description Form, making notes on landform, topography and vegetation, nutrient regime, drainage, and ecological moisture regime. Also note dominant understory and groundcover species. Make your notes as complete as possible, because you may need this information later if you use this site for your project paper.

II. Overstory Sampling

A. We have marked out a 15 x 30 m plot (0.045 ha), centered around the soil pit. Look for a flag at each corner and one flag in the center of each 30 m side (i.e., there are six flags total!). Working systematically from one end of the plot to the other, survey the overstory vegetation. One person can record species and diameters on the **data sheet** (see last page), while the others measure diameters and identify species of each tree greater than 10 cm diameter at breast height. "Breast height" is considered to be 1.3 m above the ground. See the next page for calculation instructions.

III. Soil Sampling and Forest Floor Sampling

A. Randomly collect **12 soil cores** (3 from each edge of your plot) from the *surface mineral soil horizon (0 to 10 cm)* with the 1" soil core. Avoid collecting forest litter (O horizon). Remember to *label the bag* with your team name and the site name (e.g. Mixed-Oak). Give this sample to your GSI at the end of the lab.

B. Collect *two* **forest floor** (i.e., Oi, Oe, and Oa) samples at equally spaced intervals along the long axis of your plot. Place the 2809 cm^2 PVC sampling frame on the forest floor and collect all organic material down to the surface of the mineral soil. Place all material into the paper bag you have been provided. The moist forest floor samples will be oven dried by your instructor, and we will use these samples to calculate the amount of nutrients contained within the forest floor of our mixed-oak forest.

C. Collect *two* **bulk density** samples from the surface horizon using the 2" soil core in your tool kit. Transfer *all soil* from the two cores into one plastic bag. Label the plastic bag and give your sample to the GSI at the end of lab.

Assignment

Working as a team, compile a detailed soil profile description based on the style and format of the sample profile description provided. Include a paragraph briefly describing the site conditions, including forest type, landform, parent material, slope, drainage, and other notable qualities of your site. Again, pay close attention to the details of format. Append to the description an overstory summary in *tabular form*, including the basal area of each species, the relative dominance of each species, and total stand basal area in units of $m^2\ ha^{-1}$. A typed copy of your group's profile description and overstory summary is due at the beginning of next week's laboratory.

Calculations for Overstory Data

Use the basal area table below to estimate the basal area (m^2) of each tree. Calculate the basal area (m^2 ha^{-1}) for each tree species by dividing the sum of the basal areas of all trees greater than 10 cm DBH by the area of the plot sampled (0.045 ha, one hectare=10,000 m^2). Total stand basal area is the sum of all species' basal areas in units of m^2 ha^{-1}. Please calculate the relative dominance of each overstory species using the following formula:

$$\text{Relative Dominance} = \frac{\text{Total Basal Area of a Species}}{\text{Total Basal Area of All Species}} \times 100$$

Table of Basal Areas ($BA = 0.00007854 * D^2$):

Diameter (cm)	Basal Area (m^2)	Diameter (cm)	Basal Area (m^2)
10	0.008	40	0.126
11	0.010	41	0.132
12	0.011	42	0.139
13	0.013	43	0.145
14	0.015	44	0.152
15	0.018	45	0.159
16	0.020	46	0.166
17	0.023	47	0.173
18	0.025	48	0.181
19	0.028	49	0.189
20	0.031	50	0.196
21	0.035	51	0.204
22	0.038	52	0.212
23	0.042	53	0.221
24	0.045	54	0.229
25	0.049	55	0.238
26	0.053	56	0.246
27	0.057	57	0.255
28	0.062	58	0.264
29	0.066	59	0.273
30	0.071	60	0.283
31	0.075	61	0.292
32	0.080	62	0.302
33	0.086	63	0.312
34	0.091	64	0.322
35	0.096	65	0.332
36	0.102	66	0.342
37	0.108	67	0.353
38	0.113	68	0.363
39	0.119	69	0.374
40	0.126	70	0.385

SITE DESCRIPTION FORM

Team Name: _____

Lab Day: _____

Investigator(s): _____

Site Location: _____

Stand Description: _____

Landform: _____

Aspect:_____ Slope:_____ % (Note: 45^{o} = 100% slope)

Physiographic position:
☐ crest
☐ upper slope
☐ mid slope
☐ lower slope
☐ colluvial slope
☐ plain
☐ ravine

Site surface shape:
☐ concave
☐ convex
☐ straight

Topographic position diagram
(cross-section of slope and surrounding area)

D.R. Zak

Soil Profile Description Form

Horizon	Depth (cm)	Structure	Texture	Color	% Coarse Fragments	pH	Boundary	Special Features

DBH (diameter at breast height, cm)

Overstory Species																								
