

## **FORESTRY 5-DAY UNIT**

### **SURVEYING & CLASSIFYING FOREST TYPES IN WHITING FOREST**

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**TARGET GRADE/SUBJECT:** Biology classes, grades 9-12

#### **UNIT OVERVIEW:**

The overall goal of this unit is threefold : 1) students use of resource books and knowledge of measurements to classify and record trees, shrubs, and plants on a forest plot, including diameter at breast height, merchantable height, density, and volume measurements 2) analyze data to determine the forest type each individual group studied, and 3) explain the interrelationships that exist in their individual forest plots, including abiotic and biotic features using findings and resource books for help. This unit will correlate to our wetland ecology unit but relate, instead to the forest community which we do not presently study. This will broaden and strengthen our ecology unit which our curriculum presently needs to improve.

**BOOKS/SOURCES CONSULTED:** Refer to back page.

**OBJECTIVES:** At the end of this unit students will be able to:

- 1) Use resource books and keys to identify organisms, plant or animal.
- 2) Determine forest types through tree, shrub, and plant identification.
- 3) Create an energy flow web of a research plot area and explain the relationships between the abiotic and biotic factors.
- 4) Create tables from information collected on forest plots, including determining volume and density.
- 5) Measure diameter at breast height of trees of appropriate size, along with tree height, in a forest plot, using diameter tapes and hypsometer and use this information to determine density and volume of plots.
- 6) Create a poster presentation, using a rubric, utilizing all of the information collected on the forest plot.

## **MICHIGAN CONTENT STANDARDS MET BY UNIT:**

### **1) SCIENCE CONTENT STANDARDS:**

#### **a) Strand III. Using Scientific Knowledge in Life Science.**

Standard III.5 - Ecosystems

- b) Benchmark 1.** Describe common ecological relationships between and among species and their environments.
- c) Benchmark 2.** Explain how energy flows through familiar ecosystems.
- d) Benchmark 5.** Describe how carbon and soil nutrients cycle through selected ecosystems.

### **2) Constructing New Scientific Knowledge Benchmarks**

- a) Benchmark 1.** Ask questions that can be investigated empirically.
- b) Benchmark 3.** Recognize and explain the limitations of measuring devices.
- c) Benchmark 4.** Gather and synthesize information from books and other sources of information.

### **3) MATH CONTENT STANDARDS:**

#### **Strand III. Data Analysis and Statistics.**

Standard III.1 Collection, Organization and Presentation of Data

**OVERALL UNIT ASSESSMENT:** Please refer to 2nd to last page.

## DAY 1 - CLASSIFYING TREES AT MIDLAND HIGH SCHOOL

**ANTICIPATORY SET:** Have a potted spruce tree in room. Hand out keys. Ask students what type of tree is in pot, using keys given. (ASSUMPTION - basic use of taxonomic keys has already been covered) Discuss with students HOW they came up with tree type, going through the process VERBALLY with the class.

**OBJECTIVE:** To identify 5 marked trees on the front lawn correctly and measure and determine dbh, height, and basal area.

**A. LESSON NOTES: HOW DO YOU MEASURE THE BIOMASS OF A TREE? WHY?**  
**\*Pose this as a question on the board to be answered by each student upon entering the room, in their notebook. (a sort of 'question of day')**

1. Discuss this with students bringing in the terms *diameter* and *height*.
2. *Define* the terms on the board.
3. **DIAMETER:**
  - a) indicates tree volume
  - b) measured by DIAMETER TAPE at gradations 3.14 inches apart
  - c) measured at a height of **4.5 feet** in U.S.
  - d) also called Dbh
4. **MERCHANTABLE HEIGHT:**
  - a) used to calculate tree volume or biomass that can be used for sale for pulp or hardwood
  - b) height to an upper stem diameter limit:  
**HARDWOODS - Dbh >12" up to 10" stem**  
**JACK/RED PINE - Dbh >5" up to 4" stem**
  - c) measured in a variety of methods - we will use a **MERRITT HYPSONETER** - a wooden stick w/ height to be read at certain distance - 66 '  
d) must be read w/ stick 25" from eye
  - e) **moving only your eyes,**  
LINE BOTTOM of hypsoneter w/ tree bottom,  
then measure top of tree on stick **directly** to find logs
5. **BASAL AREA:**
  - a) indicates importance of species, and correlated w/ volume and growth and how to manage the stand
  - b)  $BA (ft^2) = .005454 \times dbh^2$  (dbh in inches)

*EXAMPLE: If a tree's dbh is 12 inches, what is its basal area?*

$$BA = .005454 \times (12in)^2$$

Students will be placed into groups of 4 and will be given a tree chart which they will fill out using 5 marked trees on the front grounds.

**B. LESSON OUTSIDE:** Students will taken outside to a special marked tree where they will practice using diameter tapes and figuring height using hypsometer. The answers will be marked on the tree card so that each group knows they are measuring correctly. After correctly determining marked tree's diameter and height, they will move on to the 5 trees to be identified and measured.

\*\* THIS LESSON WILL NOT BE FINISHED TODAY AND MUST BE COMPLETED IN DAY 2.

## **DAY 2 - CONCLUSION OF TREE MEASUREMENTS AT MHS**

**A. FINISH TREE MEASUREMENTS OUTSIDE.** Students will need to finish tree measurements outside.

**B. COMPLETION OF TREE EXERCISE -** Students will move into classroom to calculate *basal area* and finish filling in chart.

**C. CONCLUSION:** At completion of classifying trees students will return to class and check results compared to a key in the classroom. Corrections will be made using a different colored marker provided and papers will be turned in, stapled together as a group for a grade of 20 points, graded on completion, corrections, showing of work and good time use in the field.

**MHS TREE SURVEY**                      **GROUP NAMES:** \_\_\_\_\_

\*SHOW WORK FOR BASAL AREA

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

TREE	TREE NAME	DBH (INCHES)	HEIGHT (FT)	BASAL AREA
1				
2				
3				
4				
5				

### **DAY 3 - WHITING FIELD TRIP PREPARATION**

**\* THE BUSES WILL LEAVE SCHOOL AT 8:30 A.M. AND LEAVE WHITING FOREST AT 12:00. LUNCH WILL A BAG LUNCH ON THE BUS.**

1. Set students up in groups of 4 or 5, with a total of 7 groups. (This was determined due to the fact that Whiting Forest has 7 types of forest.) Each group will be assigned a forest plot.
2. Discuss particulars for trip - permission slips and school excuse forms turned in, time to leave on buses, when return time is, attire, etc.
3. Each group will split themselves into 2 groups with 1/2 doing the WEST side of the plot and the other 1/2 completing the EAST side of the plot so that all students perform all of the surveys.
4. Pass out activity sheets. Go over Whiting Forest Activities one by one, demonstrating when possible in the classroom. Have students highlight, underline, ask questions.
5. Have each group cut 3 plot strings, one **37.2 feet**, and two **2.63 feet** . These will be put into bags and group names labeled, to be retrieved at Whiting Forest. the bags will already have **identification books** and **4 flags** in them.
6. Each group will then write a list of activities, in order, they will perform on field trip.

### **DAY 4 - WHITING FOREST FIELD TRIP** (4 HOURS)

#### **WHITING FOREST PLOT ACTIVITIES**

The Whiting Forest is a unique environment which includes seven forest types, all vegetation being indigenous to Midland County within fifty miles. During your field trip you will be asked to measure overstory, sapling layer, seedling layer, and ground flora in one of the seven forest types. The information you will gather will be used to determine forest type and give you practice in determining dbh, height, and ground cover. This information will also allow you to determine basal area and board feet of each tree type per plot, then extrapolate per acre. Observation, correct measurements, use of instruments and computers, and mathematical skills will be necessary to complete this task. The project will culminate in a poster presentation including tables of all findings, pictures of plants and/or organisms found, and a written paragraph stating the type of forest your group studied with facts used to determine your choice.

#### **A. PLOT LAYOUT**

Plots are based on a circular pattern a specific measurement from a center point marked with a blue flag. These will be placed in your plot before you arrive.

**YOUR GROUP WILL MARK THE CIRCLE WITH 4 FLAGS AT EACH COMPASS DIRECTION (N,S,E,W) AT A DISTANCE 37.2 FEET FROM**

THE CENTER FLAG and 2.63' with a string.

N  
X

\* X'S INDICATE FLAG  
PLACEMENT

W X 37.2' X E

\*37.2 ' indicates overstory/sapling and  
ground flora survey

2.63'

\*2.63 ' indicates seedling survey area

X  
S

**B. PROCEDURE:**

- \_\_\_\_\_ 1. Upon arriving at the Whiting Forest Center, obtain your bag of forest survey items and move with interpreters to your forest plot.
- \_\_\_\_\_ 2. Use your 37.2' line and compass to place your 4 flags in N,S, E, and W position.
- \_\_\_\_\_ 3. **GROUP A** of your group will measure W side, **GROUP B** the E side.  
Groups A and B will coordinate measurements on Day 5.
- \_\_\_\_\_ 4. When plot tasks are completed, gather all flags **but the center flag**, all strings \_\_\_\_\_ and measuring tools. Place flags in bag.
- \_\_\_\_\_ 5. Notify instructor your group is finished and the group will get a tour of the \_\_\_\_\_ whole Whiting Forest. Groups will meet at the Whiting Forest Center \_\_\_\_\_ at **12:00 P.M.** to leave on the bus and return to MHS.
- \_\_\_\_\_ 6. There is a **20 point grade for PARTICIPATION in this field trip, given by \_\_\_\_\_ the instructor. During the field trip everyone must be on task, attentive, \_\_\_\_\_ and helping the group. 20 - perfect, 18-good, 15 - had to kept on task, \_\_\_\_\_ 12 - did not work in group or complete jobs, 8 - very poor participation**





**3. TABLE 2 - SUMMARY OVERSTORY, SAPLING AND SEEDLING DATA FOR ANY FOREST.**

a) Columns for strata ( overstory trees, saplings, and seedlings), species, density (stems/acre), basal area, and volume.

b) YOU MUST CONVERT YOUR PLOT LEVEL DATA TO A PER ACRE BASIS! Since your **overstory** plot is 1/10th of an acre, you must **MULTIPLY BY 10**. For your **seedling plot**, which is 1/500 acre, you must **MULTIPLY BY 500 for the jack and red pine**. For the **hardwood forest** which is 1/2000 acre,, you need to **MULTIPLY**

**BY 2000**. The basal area and bd ft/ac can be obtained from GRAPH number 1.

**4. TABLE 3 - SUMMARY OF GROUND FLORA PERCENT COVER BY SPECIES.**

a) Columns for species and cover (%).

b) Descending order for # of species present.

**B. POSTER SPECIFICS** - Go over with students poster presentation to be finished and turned in along with the rubric to be followed. Due date will be on the fourth day after **1 more day of computer time and 1 work day** for students to polish up tables and energy flow web chain. The poster must be on a regular size piece of poster board.

**WHITING FOREST PRESENTATION**

GROUP: \_\_\_\_\_

**GRADING RUBRIC**

YOUR POSTER MUST INCLUDE THE FOLLOWING:

- 1. MATERIALS LIST - A list of everything you used. 5 pts \_\_\_\_\_
- 2. PROCEDURE - What you did and how. 5 pts \_\_\_\_\_
- 3. FINDINGS in table format and/or paragraph summary
  - a) scientific names of organisms 5 pts \_\_\_\_\_
  - b) pictures of all organisms 5 pts \_\_\_\_\_
  - c) major goal & achievements of group 5 pts \_\_\_\_\_
  - d) forest type with explanation 5 pts \_\_\_\_\_
  - e) overstory table - correctly done 10 pts \_\_\_\_\_
  - f) summary table - correctly done 10 pts \_\_\_\_\_
  - g) ground cover table - correctly done 5 pts. \_\_\_\_\_
  - h) original field survey tables 10 pts \_\_\_\_\_
- 4. ENERGY FLOW WEB DIAGRAM
  - a) picture/drawings of 5 organisms found/typical included 5 pts \_\_\_\_\_
  - b) proper use of flow lines 5 pts \_\_\_\_\_
  - c) abiotic elements included 5 pts \_\_\_\_\_
  - d) short explanation of how energy flows 5 pts \_\_\_\_\_
- 5. POSTER PRESENTATION
  - a) neat 10 pts \_\_\_\_\_
  - b) correct spelling & grammar 3 pts \_\_\_\_\_
  - c) typed 2 pts \_\_\_\_\_

**TOTAL OF 100** \_\_\_\_\_

## **RESOURCES**

- Baughman, Melvin J., Alvin A. Alm, A. Scott Reed, Thomas G. Eiber, Charles R Blinn, Woodland Stewardship, University of Minnesota Extension Services, St. Paul, Minnesota, 1993, pgs. 7-19, 39, 49-69.
- Barnes, Burton V., Warren H. Wagner, Jr., Michigan Trees - A Guide to the Trees of the Great Lakes Region, University of Michigan Press, Ann Arbor, MI, 2004.
- Borror, Donald J., Richard E. White, Peterson Field Guides - Insects, Houghton Mifflin Company, NY, NY, 1970.
- Burt, William H., Richard P. Grossenheider, Peterson Field Guides - Mammals, Houghton Mifflin Company, NY, NY, 1980.
- Lantagne, D.O., J.B. Hart, C.R. Blinn, Nutrients, Cycling and Tree Growth - Unit Four, Michigan State University Extension, Lansing, MI, 1998.
- Martin, Alexander C, Weeds, Western Publishing Company, Inc., Wisconsin, 1987.
- Murie, Olaus J., Peterson Field Guides - Animal Tracks, Houghton Mifflin Company, NY, NY, 1982.
- Opler, Paul A., Vichai Malikul, Peterson Field Guides - Eastern Butterflies, Houghton Mifflin Company, NY, NY, 1992.
- Peterson, Roger Tory, Peterson Field Guides - Eastern Birds, Houghton Mifflin Company, NY, NY, 1980.
- Petrides, George A., Peterson Field Guides - Herbs and Shrubs, Houghton Mifflin Company, NY, NY, 1986.
- Tekiela, Stan, Trees of Michigan, Adventure Publications, Inc., Cambridge, Minnesota, 2002.
- Zim, Herbert S., Clarence Cottam, Insects, Golden Books Publishing Company, NY, NY, 1987.
- Zim, Herbert S., Alexander C. Martin, Flowers, Western Publishing Company, Inc., Wisconsin, 1950.