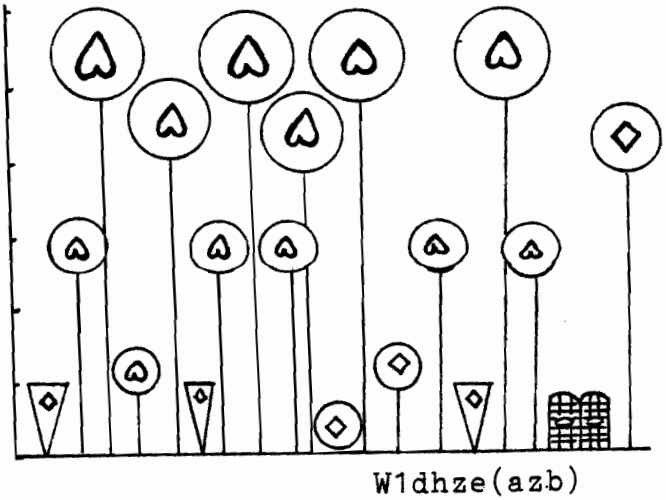
David Snyder

A CURRICULUM GUIDE FOR UNDERSTANDING THE WOODLAND COMMUNITY

(2nd Printing)



A CURRICULUM GUIDE FOR UNDERSTANDING THE WOODLAND COMMUNITY

"In nature's infinite book of secrecy, a little I can read."

I ii, 11 Antony and Cleopatra

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The Center for Field Biology of LBL
Austin Peay State University
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AUSTIN PEAY
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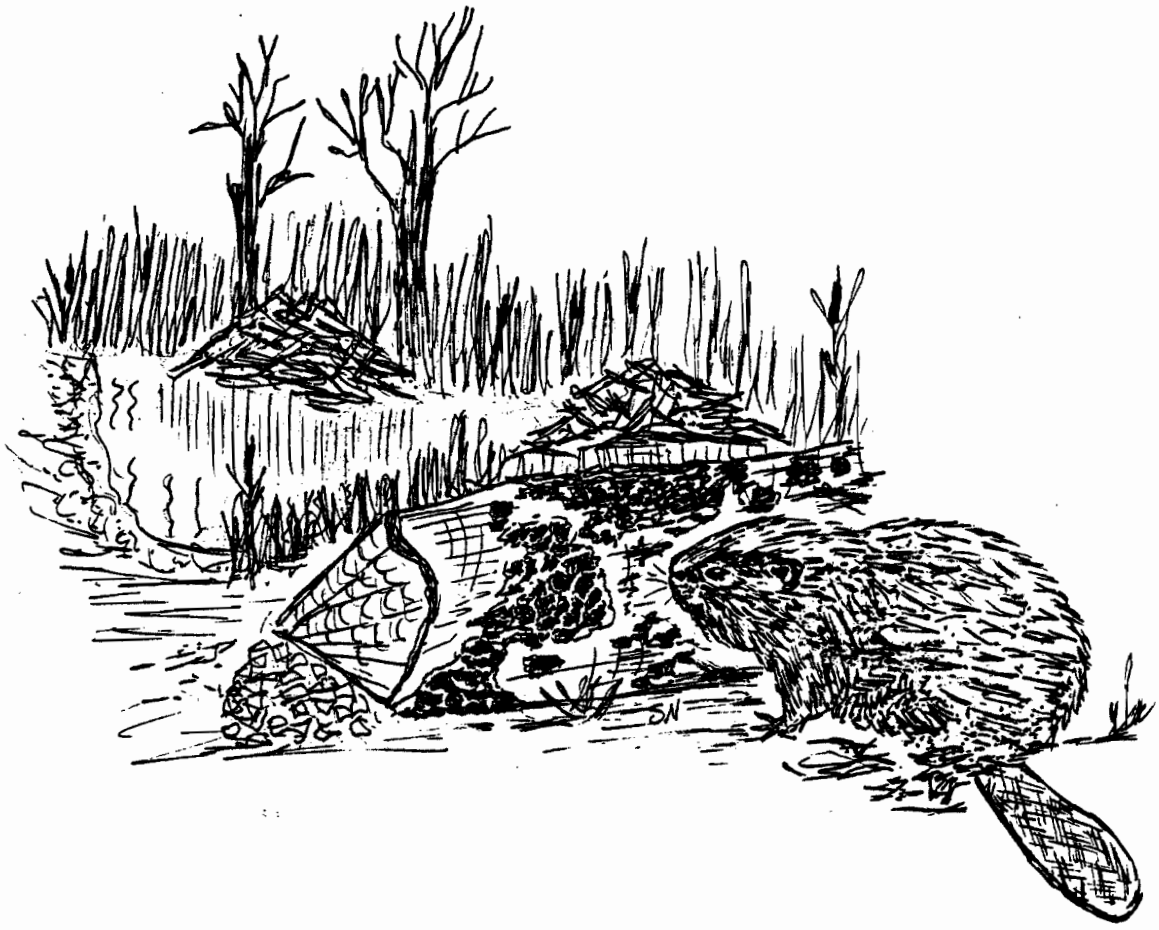


Prepared and illustrated by Sallie M. Noel, Clarksville Academy, under the direction of Dr. Edward W.Chester, Austin Peay State University. AP-774/10-87

INTRODUCTION

An **ecosystem** is an energy-processing and energy-cycling system. Inputs into the system are both **biotic** and **abiotic**. The primary abiotic components are CO_2, O_2, and the nutrients derived from weathering of materials and from precipitation. Biotic inputs include the organisms, **producers** and **consumers**, within the system.

In its simplest form the **terrestrial** ecosystem, which includes the woodland **community**, obtains and recycles energy from the sun. The producers, green plants, also called **autotrophs**, fix the energy from the sun and produce food from simple organic and inorganic compounds. **Metabolism** of this type is greatest in the canopy layer of the forest. Consumers (the animal life in the community) utilize, store, and rearrange these food materials and finally decompose the materials into simpler inorganic compounds once more. In this way they regulate and stabilize the rate of energy flow. Activity by the consumers, also called **heterotrophs**, is most intense where organic matter accumulates--in the upper layer of the soil and litter of the forest floor.

The ecosystem, which is the result of interaction of organisms within the physical framework present, is made up of separate communities. These communities exist because of the "suitable" reactions of individuals within the community. Suitable in this context refers to those reactions which enhance cooperation and mutually benefit all interacting organisms.

How then did the woodland community come to be? It did not come about through random processes. Rather, its development was orderly and predictable. The woodland community developed by a series of stages described as ecological **succession.**

Terrestrial succession, that which occurs in dry areas as on land, is merely one type of succession. Just as the first inhabitants of an unsettled land are called pioneers, certain species of plants and animals play this pioneering role in ecological succession.

Primary succession begins in an area with no established lifeforms, no soil, and full exposure to the sun--an area such as a volcanic island. Secondary succession proceeds in an area in which organisms are already present, such as abandoned cropland, areas disturbed by fire, or those suffering volcanic damage or urban development. By following a barren cliff in a bare rocky area through its successional stages, let us trace the development of a woodland community.

Bacteria and lichens are the hardy pioneers which first tackle the surface. Even they are dependent upon the work of abiotic factors such as water, temperature, and chemical processes. Weathering, the breakdown of rock by mechanical or chemical means, occurs. A tiny crack in a rock fills with water and expands as it freezes and acts as a wedge to split the rock into smaller pieces. This is mechanical weathering. Chemical weathering occurs as carbon dioxide dissolved in rain forms carbonic acid and rapidly dissolves minerals from the rocks.

Tiny mosses, which are able to gain a foothold in these

cracks live and die and become a part of the slowly forming soil at the base of the rocks and within the cracks themselves. Soon a shallow seedbed develops and a seed dropped or stored by a passing mouse germinates and flowers. The plant contributes its substance and its roots, which give off carbon dioxide, contribute carbonic acid to dissolve more minerals as they loosen and further enrich the soil in which they grow. The shade offered by the living plant permits the growth of a more fragile species which requires greater moisture and less direct sunlight to thrive.

Thus over many seasons a constant series of plants live out their lives and are subject to the changing conditions even as they alter the conditions around them as they grow.

The face of the cliff is eventually lichen and moss-covered. The chemical secretions of the lichens continually etch away the cliff's surface and slowly but surely it becomes smaller and smaller and contributes its materials to the ground below. Grasses and annuals (plants which can complete their life cycles in one season) take hold at the foot of the cliff. Perennials move in when the soil is sufficient to sustain their deep roots and bulbs. These plants take two or more seasons to complete their life cycles.

Conditions change. More shade is present. The soil is more moist now from the litter of leaves and decomposing plants. It is richer too, since the spongy humus holds the moisture with its load of minerals and makes it available to plants. Seeds from trees, especially those favored by wildlife, are frequently introduced by their own consumers. Sassafras, persimmon, and red-

cedar are some of the pioneering trees. Their fruits are frequently eaten or stored by animals and often even survive the trip through an animal's digestive tract and germinate where dropped. Many fencerows develop in just this way, planted unwittingly by birds.

Now succession is controlled by a new factor, not the adequacy of the soil, but rather the amount of available light. The hardy pioneers, so able to live in the relatively thin soil and full sun of the open field, give way to plants which can tolerate more shade.

The canopy, composed of tall trees whose tops are in the sun, develops and beneath this layer the shade-tolerant understory takes shape. Herbs, small woody shrubs, and ground cover species cover the woodland floor. These smaller species must be able to tolerate the lowest light intensity of all. In fact many of them actually require shade and would die in full sunlight.

When the community reaches a state of equilibrium with the environment, succession appears to stop and the species present (unless disturbed by outside forces) will persist. This balanced self-perpetuating community is called the climax community. This is the theoretical endpoint of successional stages.

In much of this area the climax community of dry ridges is dominated by oaks and hickories, while the wetter richer areas are dominated by beeches and maples. Often the direction the hillside faces results in enough difference in temperature and sunlight exposure to create one community on the north-facing slope and another on the south-facing slope.

As vegetative succession proceeds the animal life in the area changes dramatically. Insects move in to feed on the plants and in turn serve the plants by pollinating their flowers. As the insect supply becomes plentiful, animals which feed on them are able to establish their **niche** in the community.

The lower branches of trees die, sometimes due to a lack of light, and the scars which are left as they drop off are invaded by insects and fungi and later used as nesting sites by birds. The birds eat the insects and benefit the tree. Larger predators move in and are able to survive by feeding on smaller mammals and birds. The population adjusts itself to the habitats available. Animals which fall prey to disease (microbes are the smallest predators in the community) may die and pass their energy into the soil by means of the organisms of decay, the **decomposers**--the bacteria and fungi.

Within this ecosystem, nutrient cycles occur in a complex network. Carbon, nitrogen, phosphorus, and potassium go through annual cycles based upon the uptake by tree roots and return in the form of leaf litter and weathering by the parent rock.

This Curriculum Guide was designed to acquaint the student with some of the more important aspects of life in the woodland community. Terms shown in bold type throughout the text are contained in the glossary. A leader's page with specific explanations for each activity precedes that activity and additional resources are listed in the back of the manual.

The eight activites, several containing two or more parts, introduce many concepts which will bring about a deeper under-

standing of the woodland "oikos" or home. Hence, the study of ecology (derived from the Greek word above), is the study of how nature keeps its house in order.

LEADER'S PAGE: **LEARNING THE LANGUAGE OF LEAVES**

OBJECTIVES:

(1) To demonstrate to the student that all green plants have certain characteristics in common and have certain differences which allow them to be identified as species.

(2) To encourage students to examine their surroundings carefully.

(3) To enable students to apply definitions of structures to an actual field identification of plants.

(4) To encourage students to appreciate the important role of green plants in our lives and in the woodland community.

The following activity includes four pages of background information for the student, a field worksheet, a page illustrating all features discussed, and a "Summing Up" page to help the leader evaluate the success of the activity.

The activity in the Curriculum Guide on keying trees is designed to follow this activity and makes use of the terms learned. It enables the student to identify 16-18 trees with only the knowledge gained in this exercise. Using the two activities together reinforces and strengthens the student's grasp of the terms and provides a practical application of the terminology.

ACTIVITY: **LEARNING THE LANGUAGE OF LEAVES**

All green leaves share the ability to use **chlorophyll** to convert carbon dioxide and water into sugar in the presence of sunlight. They also release oxygen into the atmosphere when this process occurs. The sugar (**glucose**) which is formed is used by the plant itself to produce new cells or is stored and later used by whatever organism happens to feed on the plant. Glucose is actually packaged energy from the sun itself and serves to warm the body of any animal which consumes it.

In spite of these similarities, leaf structures and shapes are quite different from each other. In fact, each plant species has a leaf shape and structure different in some ways from any other.

Many terms are used to describe these differences. In this activity you will learn to recognize a few of these differences and will find out the name for some of the shapes and textures of the plants along the trail. The characteristics you will be observing make it possible for a **taxonomist** (one who classifies organisms) to recognize different species of plants.

First let's decide what a leaf is. "That's easy," you say. "A leaf is one of those flat green things on a tree." Are you sure? How many leaves are shown in A, B, and C on the next page?

1. In the space provided, write the number of leaves in each of the following illustrations. Answers at bottom of page 4.

A._____

B._____

C._____

2. Look carefully at the drawings A, B, and C once more. What feature do you notice in the area of attachment to the stem? _____ This area of the stem is called a **node**. If you noticed that a bud occurs in the **axil** or angle of the leaf, you are correct. If there is no bud, you are probably looking at a **leaflet** (a sub-division of a leaf).

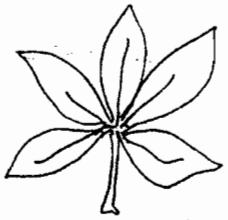
Many trees on the trail you are on have simple leaves, several have compound leaves and even a few have decompound leaves. Be prepared, these decompound leaves are quite large.

If these three leaf shapes were all you needed to learn, your job would be easy, but get ready for a few more descriptive terms.

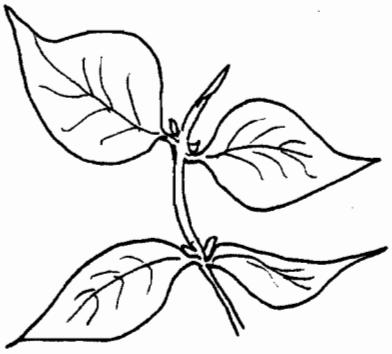
A compound leaf may be

A. pinnately compound

B. palmately compound



These terms refer to the arrangement of the veins in the leaf. A pinnately compound leaf may have its leaflets arranged opposite each other (C) or alternate to each other on its rachis (D). Simple leaves may also be opposite or alternate on the stem. Are the leaves illustrated below simple or compound? _____ How can you tell?_____



C. oppositely arranged

D. alternately arranged

The most variable feature of all may be the edges or margins of leaves. Margins may be described as entire, toothed, notched, undulate, or lobed or any combination of these. The following page illustrates these margin types as well as some of the other features you will want to be able to recognize.

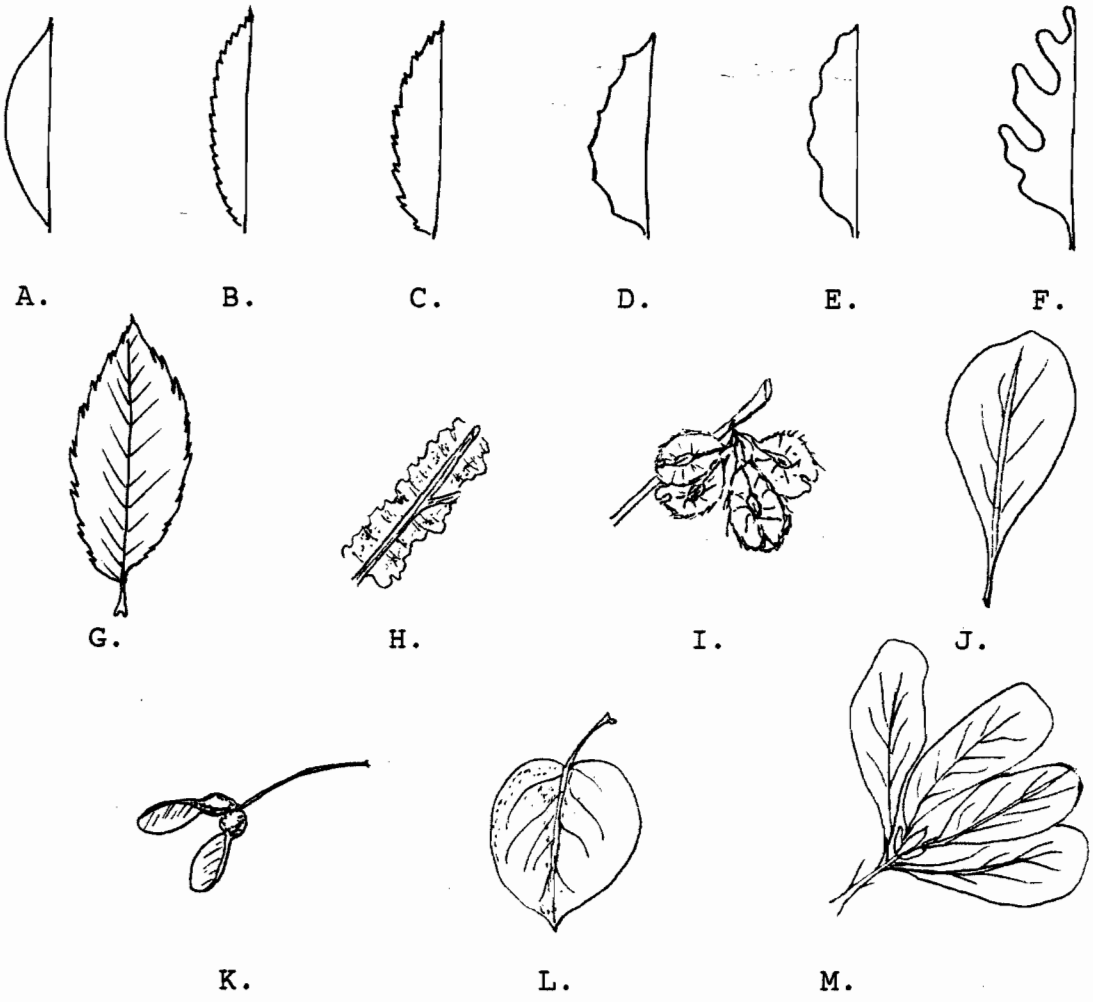
If you enjoy leaf terms, there are entire books of terms telling whether a leaf is smooth, shiny, fuzzy, or

hairy. Let's see if you can identify some of the characteristics found on the trees and other plants on the trail.

Before starting, be certain you can identify poison ivy. "Leaves of three, leave it be!" To apply your newly learned plant vocabulary. . . poison ivy has a leaf made up of three leaflets and is pinnately compound. The leaf margins are entire or sometimes slightly notched. Frequently the **rachis** and **petiole** have a reddish color, but not always.

Answers to page 2. A is a simple leaf, B is a compound leaf, and C is a decompound leaf. A, B, and C each are one leaf.

Leaf Characteristics used in Tree Identification



A. an entire leaf margin
B. a singly toothed (serrate) leaf margin
C. a doubly toothed leaf margin
D. a notched margin
E. an undulate leaf margin
F. a lobed leaf
G. a lopsided leaf with an acute apex (tip)
H. a winged twig
I. fruit of an elm, a type of samara
J. an oval or obovate shaped leaf
K. a maple fruit, a type of samara
L. a cordate leaf shape
M. whorled (clustered) leaves

STUDENT ACTIVITY: **LEARNING THE LANGUAGE OF LEAVES**

Using the page of illustrations included in this activity, locate plants which illustrate the following features. Do not break leaves and branches from the plants. After you locate the structures below let your leader confirm your identification. **BE SURE YOU CAN IDENTIFY EACH OF THE STRUCTURES BELOW. YOU WILL BE USING THESE TERMS IN THE NEXT ACTIVITY.** Place a check beside each when you feel confident that you can recognize it.

_____1. a simple leaf

_____2. a compound leaf

_____3. a decompound leaf

_____4. a palmately compound leaf

_____5. a pinnately compound leaf

_____6. a leaf with opposite leaflets

_____7. a leaf with toothed (serrate) margins

_____8. a leaf with an entire margin

_____9. a leaf shaped like a heart (cordate)

_____10. a leaf divided into lobes

_____11. a plant with leaves or buds in a whorl (more than 2 at a node)

_____12. an oval or obovate leaf

_____13. a winged twig

_____14. a simple leaf with pinnate venation (arrangement of veins)

_____15. a tree with alternate leaves

_____16. a simple leaf with palmate venation

SUMMING UP:

1. What are two ways in which all green plants are alike?

2. What are some differences in plants which help a taxonomist identify them?

3. How do plants and animals depend on one another in the woodland community?

4. What is the most important thing that a plant can do that an animal is unable to do?

5. Why is it useful to be able to identify plants in our environment?

LEADER'S PAGE: **Keying Trees**

OBJECTIVES:

(1) To apply descriptive terms in a practical way and to reinforce recognition of the features these terms describe in actual plants.

(2) To demonstrate ability to follow directions and use a "key" as an aid in plant identification.

(3) To learn a few of the tree species found in the Land Between the Lakes area.

The following **dichotomous** key was made specifically to identify many of the species on the Pawpaw Trail at Brandon Springs. If used at another site, be certain the selected tree is included in the key. Several trees in the key are identified to **genus** only, such as Quercus sp., which means a **species** of oak. This is done since several species in that genus are present in the area and the separation is more involved than necessary in a beginner's key. There are over 30 species of trees along the Pawpaw Trail and this key will identify 16 of the genera represented.

It is strongly suggested that the leader be able to identify the trees selected for keying. The key uses only the most general structural features to separate species and for this reason could incorrectly identify a tree not included in the key.

After the students have spent some time keying, you may wish to have them fill out the SUMMING UP page at the end of the activity. Item 7 asks the students to analyze the construction of a key. If your group has the skill to do so, have them actually make a key for their shoes and demonstrate its use.

This activity should be used after the activity on vegetative terms, Learning the Language of Leaves. It is assumed in the key that the students are familiar with basic anatomical terms.

ACTIVITY: **Keying Trees**

In this activity you will become a **taxonomist** and use terms learned in the preceding activity to actually identify many of the **species** along the trail. This key is composed of a series of questions arranged in twos. As you look at the plant to be identified, select the best of the two questions. At the end of that question you will find a number. This number will be your next question set. Perhaps your leader will "key" through the steps for identifying a selected tree to let you see exactly how it is done.

A KEY TO SELECTED TREES ALONG THE

PAWPAW TRAIL AT BRANDON SPRINGS

1. leaves simple. 3
1. leaves compound or decompound. 2
    2. leaves pinnately or palmately compound, not decompound 4
    2. leaves decompound, bark spiny. . **Aralia spinosa**, **DEVIL'S-WALKINGSTICK**
3. leaf margins entire, not toothed or lobed. 6
3. leaf margins notched, toothed or lobed, not strictly entire 8
    4. leaflets 3-7, coarsely toothed, twigs green. . **Acer negundo**, **BOXELDER**
    4. leaflets usually more than 5, seldom 3. Margins entire or finely toothed, twigs not green. . . . 5
5. leaflets often paler (sometimes whitish) beneath

than above, leaves opposite on stem. . **Fraxinus sp., ASH**

5. leaflets not noticeably paler beneath, bark sometimes loose and peeling, leaves alternate on stem. . **Carya sp., HICKORY**

6. leaves fragrant or strongly scented when crushed.9

6. leaves not noticeably fragrant or strongly scented when crushed 7

7. leaves opposite on stem, main veins curving upward along leaf margins, bark broken into small squares . . .**Cornus florida, FLOWERING DOGWOOD**

7. Leaves alternate on stem 13

8. leaves notched or variously toothed, not lobed .10

8. leaves clearly lobed 11

9. leaves on same tree may have up to 3 different shapes, obovate or mitten with one or two thumbs, leaves have spicy smell when crushed . . . **Sassafras albidum, SASSAFRAS**

9. Leaves on same tree basically same shape, large with objectionable smell when crushed . . . **Asimina triloba, PAWPAW**

10. leaves singly toothed 15

10. leaves doubly toothed 14

11. leaves opposite on stem, never in a **whorl** at tip of stem 12

11. leaves or buds often clustered at tip of stem in a whorl, fruit an acorn. . . . .**Quercus sp., OAK**

12. lobes usually 3, petiole may appear reddish,

often growing near a stream, veins in leaf are palmate. . **Acer rubrum, RED MAPLE**

12. lobes usually 5, petiole not red, veins palmate . . **Acer saccharum, SUGAR MAPLE**

13. leaves cordate, 3-5 inches across, fruit a bean, trees small, under 30 feet at maturity . . **Cercis canadensis, REDBUD**

13. leaves obovate, scarlet in fall, may cluster at tip of branches, trees may reach 60-90 feet at maturity . . ***Nyssa sylvatica, BLACK GUM**

14. Bark shaggy in appearance, fruit a hoplike bladder. See illus. A. Tufts of hair in axils of veins of leaves, trees rarely over 20-30 feet tall. . **Ostrya virginiana, HOPHORNBEAM**

14. On mature tree, bark in flat ridges separated by a diamond pattern. Leaves rough, often lopsided at base, fruit wafer-like. See illus. B. Twigs on some species winged. . **Ulmus sp., ELM**

Illustrations

A. B. C. D.

* **Diospyros virginiana, PERSIMMON** closely resembles black gum, but is less frequent in the woodland. It is common in open fields and fencerows. Black gum leaves have a more noticeable shoulder and are more tapered at base of leaf blade. See illus. C and D above.

15. teeth on margins of leaves closely spaced. 16

15. teeth on margins of leaves widely spaced, more than 4 mm, bark very smooth and gray, terminal bud on twig long and tapering. . **Faqus grandifolia, BEECH**

16. bark gray and warty, leaf tips acute and curved to one side, leaf margins sometimes almost entire, sometimes variously toothed. . **Celtis laeviqata, HACKBERRY**

16. bark of young tree smooth and marked with horizontal raised lines. Leaves alternate on stem and shiny. . **Prunus serotina, BLACK CHERRY**

SUMMING UP: How much were you able to unlock with your "key"?

1. What is a "plant key" ?

2. What plant characteristics did you find hardest to recognize?

3. What plant characteristics did you find easiest to recognize?

4. Which trees identified in this exercise seem to be quite common on the Pawpaw Trail?

5. Which trees were quite scarce on the Pawpaw Trail?

6. Did you find an example of each of the trees in the key?

7. How would you go about making a key to identify the different types of shoes the students in your group are wearing? List some of the characteristics you would use to separate them into "shoe species."

LEADER'S PAGE: **Is a Picture Worth 1000 Words?**

This activity and the one following it deal with **stratification** in the forest. An inventory of the plant types found in the study plot is both interesting and useful. This inventory can be accomplished without a knowledge of the individual species of plants present. The structural differences in plants which become evident as this activity is carried out are important adaptations to the environment. The **transect** (provided by the stretched string) is a useful means of sampling vegetation. Use the following suggestions to classify plants according to the five bases shown on pp 2-3.

(1) Trees are separated from shrubs on the basis of height and number of stems. Shrubs are woody plants under 8 meters tall and with several stems rather than one trunk.

(2) Item 7 under Stratification can be further subdivided if necessary.

(3) The seasonal function of the plant's leaves, whether deciduous or evergreen determines the role it plays in its environment.

(4) In determining leaf shape and size, needles and scales describe evergreen leaves. A compound leaf is distinguished from a simple leaf by the presence of a bud in the angle between the leaf stem and its branch. These buds are absent from the leaflets of a compound leaf.

(5) Papery leaves include the great majority of leaves such as oaks, maples, elms, herbs and grasses, etc. Evergreens are described as tough and leathery. A new category may be formed if needed.

If a height meter is not used, students will need help in estimating tree height. If a height meter is available, it would be advisable to assign one team of students the job of measuring tree height for all groups.

OBJECTIVES:

(1) To learn to conduct a vegetative survey that is not based on a knowledge of individual plant species.

(2) To learn that a plant's life form (structure) has much to do with its role in its environment.

(3) To improve observational skills.

(4) To evaluate data and gain skill in the use of symbols as decriptive tools.

ACTIVITY: **Is a Picture Worth 1000 Words? A Vegetative Study**

It is possible to describe the vegetation in a woodland without being able to name the **species** of plants present. The description is based on the life form of the plants present and gives a graphic picture of the type of plants and the amount of space they occupy. This method is adapted from a technique developed by Dansereau in 1958.

Procedure:

Step 1. Observe the entire study area before beginning. Try to decide how many life forms are represented in the plot. See page 2 for the five life form categories. Check with your leader if in doubt. The entire class should use the same symbol for each type of plant.

Step 2. Divide into groups of two or three and select a section of the study area for your own area. Stretch a 30 foot length of string between two stakes driven in the ground. Only the plants along the string will be represented in your study. Try to select a typical portion of the forest for your study.

Step 3. Begin with the lowest vegetation in your plot. Using the symbols on page 2, describe each plant along the line by selecting a symbol from the five categories which best represents it. Draw symbols on the graph paper to represent your study area.

Symbols for Study of Vegetative Life Forms

1. **LIFE FORM**

   W  upright woody plants (trees)

   L  climbing woody plants (grapevine or honeysuckle)

   E  woody shrubs

   H  herbs (non-woody small plants)

   M  mosses and ferns

2. **STRATIFICATION** (height)

   1 more than 25 meters

   2 10-25 meters

   3 8-10 meters

   4 2-8 meters

   5 0.5-2 meters

   6 0.1-0.5 meters

   7 0.0-0.1 meters

3. **FUNCTION OF LEAVES**

   d  deciduous, leaves lasting one season

   e  evergreen

4. **LEAF SHAPES AND SIZE**

   o leafless

   n  needles or scales

   g  grasslike

   a  small to medium leaves

   h  broadleaf

   v  compound leaves

5. **LEAF TEXTURE**

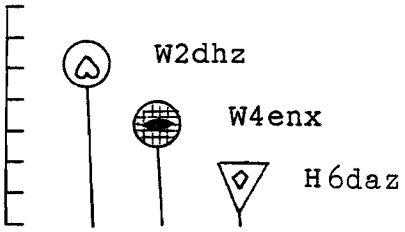
o leafless

z membranous leaves (papery)

k fungus

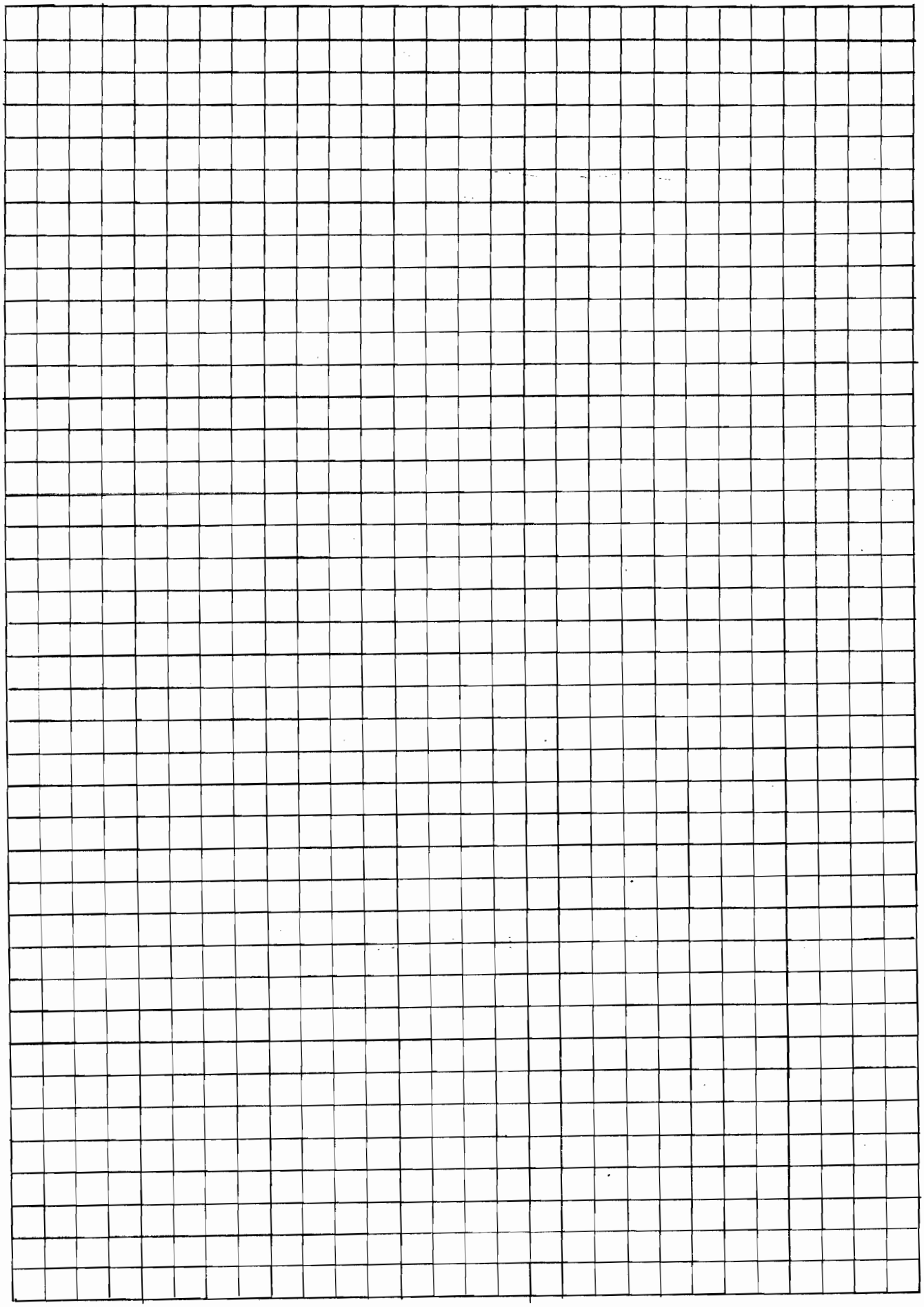
x tough and leathery

Below is an example of what a 10 meter maple tree and a 3 meter cedar tree and an 0.5 meter herb would look like. The symbols may be written beside the plant they represent if there is space, or they may be written below the graph.



Before beginning your graph, see if you can tell why the symbols at the left were used.

If a height meter is not available (illustrated on p 4), the heights of trees will need to be estimated as accurately as possible. Herbs and small shrubs should be measured with a meter stick.



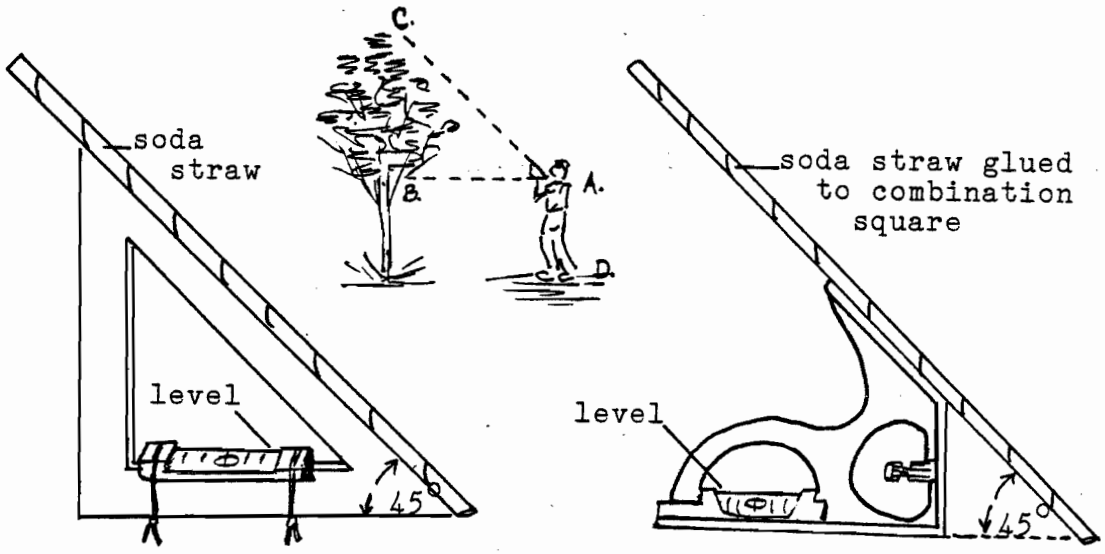
4 Squares
to the Inch

Making a Simple Height Meter

The easily constructed height meter illustrated below can be used to measure the heights of tree in this activity. Holding the lower edge of the height meter horizontal (the edge to which the level is mounted) and sighting through the soda straw, walk backwards until the top of the tree is visible. The bubble in the level should be centered.

While the top of the tree is visible through the straw, have someone measure the distance between the observer and the tree. This distance is then added to the distance from the eye level of the observer to the ground. The sum of the distances A to B and A to D equals the tree height.

A carpenter's combination square can be modified by having the ruler portion removed and replaced by a soda straw to create a very efficient height meter. Both types of height meters are illustrated below.



LEADER'S PAGE: **STRATIFICATION**

OBJECTIVES:

1. To have students learn to conduct a vegetational analysis using quantitative procedures.

2. To familiarize the student with terms and concepts relating to succession and stratification.

3. To use a method of "random sampling" in a vegetative study.

4. To learn to recognize the trees which compose the canopy of a typical forest of the Land Between the Lakes.

The leader should give background information on plant succession if the students are to gain full value from this exercise. Succession and the factors which control it are basic concepts for understanding the woodland community.

If possible walk the trail before the activity is presented and select a good area with both north and south-facing slopes. Have a good tree guide handy if needed. The exercise is more valuable if the species are identified.

Further analysis would be useful if time permits. Ask the students to determine the total basal area of each canopy species studied to see which tree dominates the canopy by size.

Stratification in the Woodland Community

Most woodland communities are composed of four clearly identifiable strata or layers. The four layers are:

1. large trees (canopy)
2. smaller trees (understory)
3. herbs and woody seedlings
4. ground cover (mosses, etc.)

Because different species of plants can tolerate different conditions of light and moisture, the species of plants within each of the strata are fairly predictable in any particular geographical location.

The canopy layer has the greatest exposure to the sun and produces the greatest amount of **biomass**. There may be one or several species of trees in the canopy, called the dominants or co-dominants. In most of the Land Between the Lakes region the canopy is composed chiefly of oaks and hickories on the hotter drier ridges (south-facing slopes). Maples and beeches compose the canopy on the somewhat cooler more moist lowland or north-facing slopes.

The understory trees are smaller and must tolerate more shade since they receive only filtered sunlight. Dogwoods, redbuds, and hophornbeams are common understory species in the LBL area.

Many of the woody seedlings are the same species as the canopy trees and may eventually replace them. There are also many seedlings of trees "planted" by birds and mammals which will not survive in the woodland due to insufficient sunlight. One such species frequently found as a seedling but rarely reaching

maturity in the woodland is the persimmon. Its habitat is the open field or fencerow in full sunlight.

The herb layer is very varied, but plants in this layer share the ability to tolerate medium to dense shade and have a rather high requirement for moisture. Many of the woodland herbs would not survive in a sunny garden. Requirements of light and moisture are of great importance in causing the succession of plant species in a given area.

ACTIVITY: **STRATIFICATION IN THE WOODLAND**

Materials:

tape measure
calculator with pi key
paper and pencil
compass
blindfold and frisbee

Procedure:

Observe the portion of the woods in which your study will be conducted. Can you identify all four strata? This activity will deal with the canopy species only. The relative size and frequency of the canopy species will be determined for a selected area of the woodland.

Determine the area to be studied and have a blindfolded student toss a frisbee (or other suitable object) in any direction in the woods. The canopy tree closest to the frisbee should be measured with the tape to determine its dbh (diameter at breast height). Measure its circumference and divide by pi. Record the tree's species if it can be determined.

Record data for 20-25 trees and rank them in the following size classes according to their diameters:

1 5-10" dbh
2 11-15" dbh
3 16-20" dbh
4 21-25" dbh
5 above 25 inches dbh

Calculate % frequency of each class by dividing the number in any class by the total number and multiplying by 100.

The basal area of the tree, area of the tree's base, can be calculated by $A = \pi r^2$ or $(\text{diameter} \div 2)^2 \times \pi$.

DATA SHEET: **STRATIFICATION ACTIVITY**

TOSSES	SIZE CLASS & SPECIES	DBH	RADIUS	BASAL AREA
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				

DATA SHEET: **STRATIFICATION ACTIVITY**

% Frequency of Classes

1. _____
2. _____
3. _____
4. _____
5. _____

Total Basal Area of Canopy Species

Maple _____

Beech _____

Oak _____

Hickory_____

SUCCESSION QUESTIONS

1. What conditions did the early pioneers have to endure when they settled this area?

2. What conditions do the pioneer plants have to be able to tolerate to survive?

3. What characteristics do pioneers of all kinds share?

4. Name a few plant pioneers which are the first to settle in an abandoned field?

LEADER'S PAGE: **ANSWERS TO SUCCESSION QUESTIONS**

1. What conditions did the early pioneers have to endure when they settled this area?

Answers will vary

2. What conditions do the pioneer plants have to be able to tolerate to survive?

(1) low nutrient availability
(2) little organic matter in soil
(3) dry conditions
(4) strong sunlight
(5) widely varying surface temperature

3. What characteristics do pioneers of all kinds share?

Answers will vary.

4. Name a few plant pioneers which are the first to settle an abandoned field.

(1) annuals and grasses (weeds)
(2) first trees are frequently sassafras, persimmon, and redcedar

You may wish to use the material in the Curriculum Guide Introduction to give the students some background relating to plant succession before they do the stratification activity. If so this page could help to reinforce their understanding of the concepts.

LEADER'S PAGE: **Studying the Forest Floor Community** (2 parts)

OBJECTIVES:

(1) To examine the variety of living organisms which occupy a small portion of the forest floor and to try to determine their relationship to each other.

(2) To learn the origin of soil and the effect different types of soil have on the organisms which live in it.

(3) To apply the meaning of defense strategies to the predator-prey relationship.

The following two activities are quite different but are closely related. The first, Studying the Forest Floor Community, is more active and the students are directly involved in analyzing and collecting. This activity teaches the student to observe and discover what is actually taking place around him/her.

Containers for collecting insects or other small organisms are suggested since something often turns up in an activity such as this which would be of interest to all the students. Any organism captured in this activity should be examined and released. It is often possible to determine an organism's lifestyle by its appearance and structure. The collecting is included for that reason.

It is the responsibility of the leader to see that the students do not do extensive damage to the habitat. Responsible behavior can be taught well in such an activity by reminding students to return logs and rocks to their original position if they move them and to refrain from the actual destruction of habitat by carelessly pulling bark from dead trees, etc.

The second activity, Predator-Prey Relationships, is a much quieter activity and would be most effective if the students were seated in a wooded area after having previously discussed some of the relationships within a woodland community.

It is important to point out to the students that natural communities function quite well and can be very stable. Alteration of habitats by man can disrupt the balance severely, however. Loss of suitable habitat is probably the most severe problem facing wildlife today.

Answers are not provided for Part 1, but concepts involved are discussed in the introduction of the Curriculum Guide. Suggested answers for "What's for Lunch" in part 2 are included. The crossword puzzle using terms learned in these activities could be used as an evaluative tool after the lessons have been completed.

ACTIVITY: **Studying the Forest Floor Community (Part 1)**

MATERIALS:

4 wood stakes per group of 2-3 students
string
a trowel or spade
jar with a lid
small can or bucket
plastic bags

PROCEDURE:

The students should be divided into teams of 2-3 students for this activity. Using 4 stakes and a length of string, set up a study area on the forest floor about 4 feet on each side. Remember as you study your area you do not want to do any permanent damage to the habitat. Leave it as nearly like you found it as possible.

Step 1. Gently lift leaves from a small portion of the plot. Describe the different layers of materials as you remove them layer by layer until you reach the soil. _____

_____

Step 2. Pick up a handful of the soil and look at it closely. What processes formed the soil? _____

_____

What evidence to you see of the materials from which the soil was formed?_____

Step 3. Describe the soil in your plot. Is it moist or dry? Does it contain any organic material? Can you find any parts of once living organisms?_____

_____

Dig a few inches into the soil in one area. Does its color and texture seem to change as you dig deeper? _____

_____

Step 4. Describe the plants in your plot. Is there a tree in it? What is the vegetation like in your plot? _____

_____

Where is your plot located in the woodland? Is it on a ridge or at the bottom of a slope?_____

_____

How much light does it get as compared with the rest of the woodland? Is it in dense shade or in bright sun? Which direction does your plot face if it is on a hillside?_____

_____

What effect could this have on the type of plants and animals which might be found there? _____

_____

Step 5. Using the plastic bag or jar to store them, capture any insects or other small organisms you find in the plot. Carefully examine them and try to figure what their role is in the woodland environment. Are they predators or are they prey?

Organism	Description	Role
1.		
2.		
3.		

Step 6. Do you see evidence of changes in the soil made by larger organisms that are not there now? Describe them. Is there a tunnel made by a mouse or shrew? Is there a half-eaten acorn or other evidence that a squirrel has been there? Describe any evidence of life you find._____

_____

_____

Step 7. If someone came and "cleaned up" the forest floor by raking it and clearing away the underbrush, what effects would it have on the forest floor community? _____

_____

What effect would it have on the soil? _____

_____

What would be the effect after a year? _____

_____

ACTIVITY: Studying the Forest Floor Community (Part 2)

PREDATOR-PREY RELATIONSHIPS

"My what big teeth you have Grandmother," said Little Red Riding Hood. "The better to eat you with, my dear," grinned the wolf.

What types of organisms make their homes on the forest floor? You will find very few wolves anymore. Name a few of the large animals you would expect to find in such a woodland as this. _____

_____

The predator-prey relationship is an interesting and a necessary one. What would happen if a prey species had no predator to control its numbers? What would happen to the habitat? _____

_____

Do animals live close to each other if they have a predator-prey relationship? If you said no, think again. How many of the creatures you might find under a dead log would like to have each other for lunch? Well, why don't they?

What are some of the ways prey manage to protect themselves? These methods are called defense-strategies. A strategem (collectively called strategy) is a trick of war used to evade the enemy.

Some example of defense strategies that work for some prey are:

1. Feeding at a different time than their predator.

2. Having a frightening pattern or color.

3. Being very still and blending in with the environment.

4. Protective coloration (camouflage).

5. Producing enough offspring that many can be spared and some will survive.

6. Having a stinger or actually being poisonous if eaten.
Can you think of some others?_____

_____

What's for lunch?

Match the following predators with their prey by drawing a line from the predator to any of the prey it might eat.

In the space beside the prey, list the number of the defense strategy from the list on page 3 which might help it escape a predator.

In the space beside the predators, suggest a characteristic of the predator which makes it especially able to capture its prey. Examples are speed, good vision, good sense of smell, sharp teeth and claws, etc.

PREDATORS		PREY	
_____	1. Owl/Hawk	A. Grub	_____
_____	2. Songbird	B. Beetle	_____
_____	3. Frog/Toad	C. Butterfly	_____
_____	4. Snake	D. Mouse	_____
_____	5. Skunk	E. Shrew	_____
_____	6. Fox	F. Salamander	_____
_____	7. Shrew	G. Earthworm	_____
		H. Frog	_____
		I. Songbird	_____
		J. Snake	_____

How can some of the animals listed above be on both predator and prey lists?

What's for lunch? : KEY

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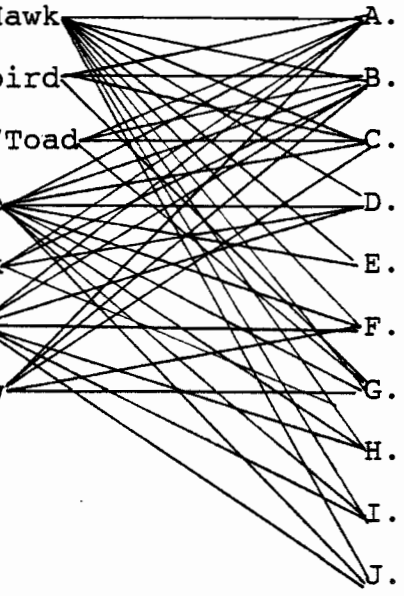
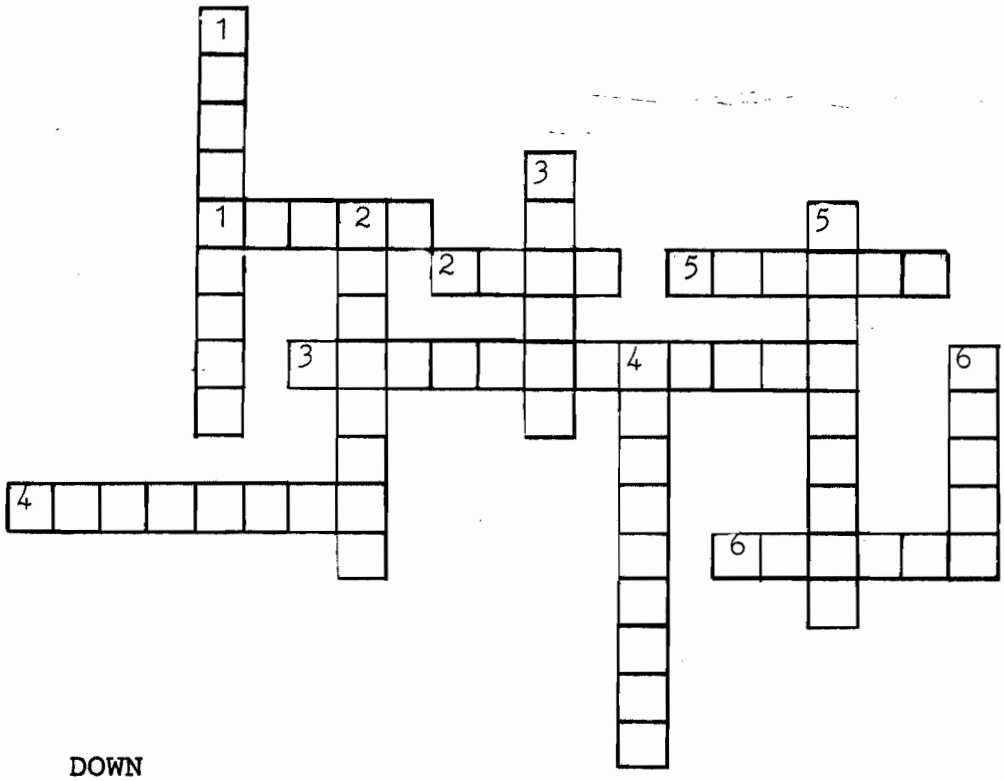
PREDATORS			PREY	
good vision	1.	Owl/Hawk	A.	Grub 2,3,4
vision, speed	2.	Songbird	B.	Beetle 2,3, 4,5
vision, speed	3.	Frog/Toad	C.	Butterfly 2,4,5,6 or bad taste--Monarch
sense of smell	4.	Snake	D.	Mouse 1,3,4,5
sense of smell	5.	Skunk	E.	Shrew 1,3,4,5
sense of smell	6.	Fox	F.	Salamander 1,2,3,4,5,6
sense of smell, sharp teeth	7.	Shrew	G.	Earthworm 5
			H.	Frog 3,4,5
			I.	Songbird 5
			J.	Snake 2



How can some of the animals listed above be on both predator and prey lists?

LIFE ON THE FOREST FLOOR



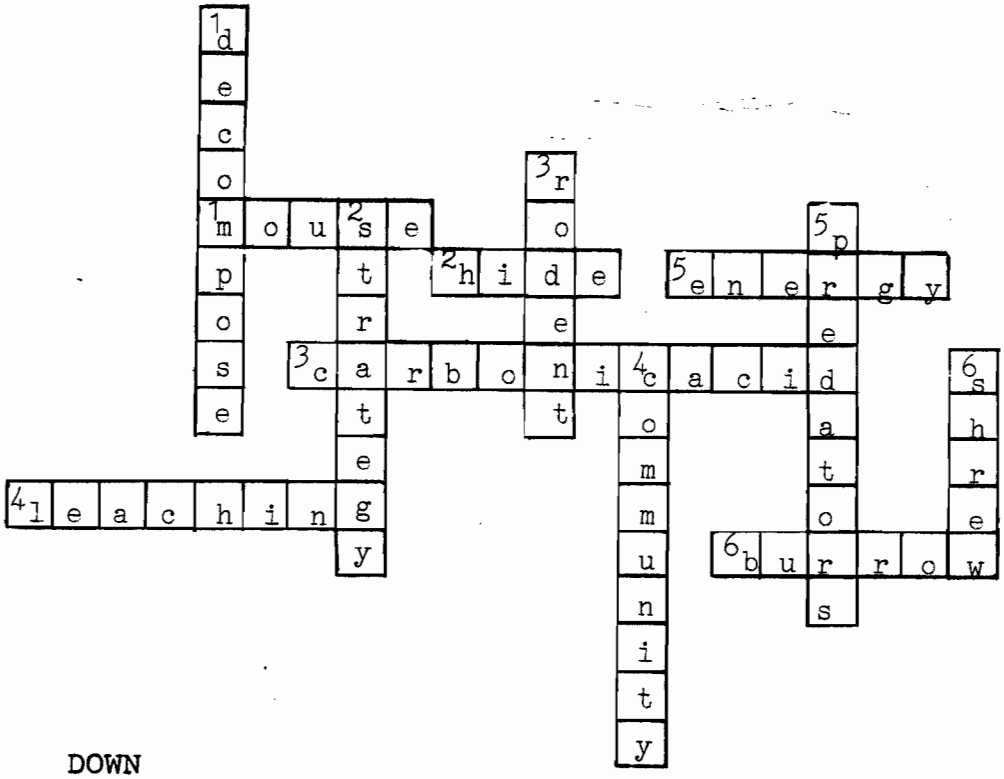
DOWN

1. To break down into simpler organic parts.
2. Any method used by prey to avoid being captured.
3. A gnawing mammal.
4. A group of organisms living together in a mutually beneficial relationship.
5. They capture and feed on prey.
6. A nocturnal mouse-sized mammal which tunnels beneath the leaf-litter to find insects and earthworms.

ACROSS

1. About the size of a shrew, this rodent gnaws on roots and stores grain for future use. They are often found nesting in empty birdhouses.
2. A defense strategy used by small helpless animals.
3. This compound forms when water and carbon dioxide combine. It helps dissolve minerals and decompose rocks. (two words)
4. The washing away of dissolved soil minerals.
5. This is stored in roots of plants. It came originally from the sun.
6. An underground passage made by small organisms.

LIFE ON THE FOREST FLOOR : KEY



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LEADER'S PAGE: **OH DEER!**

See if the students can name the things essential to an animal's survival. Review these essential **habitat** components; food, water, shelter, and suitable space. Tell them that this game will deal with the first three of these components.

An easy way to divide the students is to have them count off in 4's. The 1's will be the deer and the 2's, 3's, and 4's are the habitat.

Make certain the students have their backs turned to each other before they make their signs for food, water, or habitat and that they do not turn until told to do so. Stress the fact that they may not change their sign until the next round.

Sometimes the students may confer as the game proceeds and all assume the same sign. That is permitted but is not encouraged. It could represent a drought year with no food or water available, etc.

When a deer successfully meets its needs by capturing the food, water, or shelter necessary for life, the population of deer increases--since that habitat component becomes one of the deer. If a deer fails to have its needs met it logically becomes part of the habitat.

Any habitat component not selected in a given round remains where it is but may assume a different sign in the next round.

The game is usually enjoyable for 15 rounds or so if the pace is kept brisk. A brief summing up by the students after the game will indicate their understanding of the ecological principles involved.

Oh Deer! is adapted from Project Wild produced by the Western Regional Environment Education Council in 1982.

OBJECTIVES:

1. To illustrate in an enjoyable way the relationship between wildlife and the available habitat.

2. To reinforce in the students' minds the essential elements of wildlife habitat.

OH DEER!

This game can be enjoyed by any number and any age. It clearly demonstrates the relationship between **habitat** and wildlife.

To Play:

Divide the students into two groups. Place one fourth of the students in one group and three fourths in the other. Separate the two groups into two lines about 10-15 paces apart. The large group represents the habitat and the small group is deer.

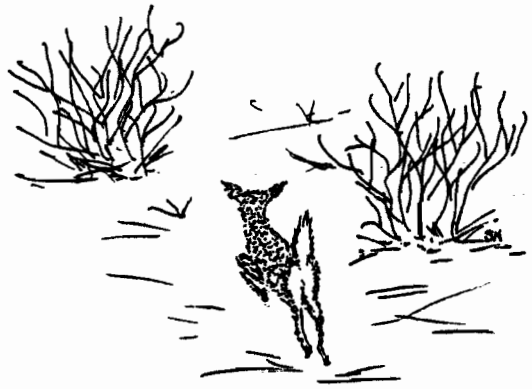
Signs used: Hands held in a teepee over the head represent shelter. Hands held folded over stomach represent food. Hands held cupped in front of mouth represent water.

Lines turn their backs to each other and both "habitat" and "deer" make a sign for water, food, or shelter. When the leader says turn, they turn and face each other and keep their poses.

The deer may now run to catch their needed food, water, or shelter. The deer must retain their sign until they catch the habitat component with the matching sign. The habitat must stand still.

Once claimed, the captured habitat becomes one of the deer. If a deer happens to be unable to capture its particular need on any round, it becomes habitat.

The game ends when either the deer or habitat is wiped out, or after a set number of rounds.



LEADER'S PAGE: **WHAT GOES AROUND COMES AROUND**

OBJECTIVES:

1. To permit the students to think about the relationships within the woodland community as the seasons change.

2. To teach students that most anatomical structures of plants and most animal behaviors are functional and play a role in their survival.

3. To reinforce the idea that the **community** must function in all seasons if it is to survive.

4. To encourage thinking and reasoning rather than rote memorization of facts relating to nature study.

This activity would be most interesting in the fall when preparations for winter are most evident in the woodland. The students will not readily see or even be able to recognize the adaptations discussed below. You will need to prepare them carefully for this exercise.

Spending a few days before the activity discussing fall adaptations, why leaves change color, and the facts which influence these changes would be excellent background.

Answers to student activity sheet:

1. (1) day length

   (2) temperature

Be sure to point our that abiotic factors are non-living influences on an organism's survival.

2. Annuals flower and produce seed in one season. The plant will die but its seed will guarantee its survival as a species. The seed of many annuals must pass through a period of cold dormancy before sprouting. This prevents early fall germination when the seedlings would not survive. Perennials have several survival strategies. In addition to seed production, many lose their leaves and survive by means of roots and bulbs deep beneath the surface of the ground. They withdraw the energy from their leaves for storage in their roots if the portion above the ground dies. Buds grow rapidly in spring by drawing from this stored energy source. Perennials which retain their leaves during the winter

are equipped with an "anti-freeze" (ethylene) which prevents damage in freezing temperatures. A blanket of snow further insures their survival since it prevents the ground from getting colder when bitter winds howl in winter. Yes, snow keeps the ground warm.

3. Evergreen trees conserve energy all year by replacing their needles a few at a time rather than all at once in the spring. They also lower their metabolic rates. A waxy coat and small leaf surface assure water retention in leaves as the drying winds of winter blow.

Deciduous trees withdraw energy in the form of carbohydrates from their leaves and store it in roots for the winter. Hormones stimulated by the cooler temperatures and shorter days result in the breakdown of chlorophyll and the construction of a corky layer at the base of the leaf stem (petiole). This abscission layer helps break the dead leaf from the tree and seals the wound as it does so. The loss of chlorophyll reveals the other pigments which have been in the leaf all the time and brings about the fall colors. Loss of leaves is a benefit to the tree since it conserves water during a season then it could not be readily replaced.

4. They grow heavier coats, alter their diets and store food for winter use. Rabbits for example, feed on bark, twigs, etc. when green foliage is not available.

5. Animals which have fed on green vegetation all summer must change diet or store seed or hibernate. They also must provide shelter for themselves in underground nests or tree cavities.

6. 1) squirrels build leafy nests high in trees for winter protection and store food.
2) many birds migrate to warmer climates.
3) some birds from colder climates migrate here for the winter. Examples are juncos, white-throated sparrows, and many grosbeaks.

4) woodchucks put on layers of fat by fall feeding before their winter sleep. Theirs is not a true hibernation which involves a greatly suppressed metabolism (such as a ground squirrel's), for they will venture out on warm winter days.

5) snakes and amphibians go deep into the ground to escape freezing. They can survive near-freezing temperatures and sometimes may be uncovered stiff and frost-covered but alive and well.

7. Yes, See answer to 2. Snow is translucent and also permits the grass beneath it to carry on photosynthesis.

ACTIVITY: **WHAT GOES AROUND COMES AROUND - A Study of Adaptations to Seasonal Change**

To remain a part of the woodland community through the years, plants and animals must be able to change with the changing seasons. Those organisms which adapt most successfully will survive. Those which fail to adapt will die out. This activity is one in which your ability to reason and think creatively will come in handy.

As you walk along the woodland trail visualize the changes which occur as the seasons pass. What changes must the plants and animals be able to make if they are to survive? Think in terms of the following problems as you answer the questions below. Some problems are late spring freezes, too much or not enough rain, hot and cold temperatures, too many insects, need for constant supply of food, water and shelter by all animal members of the community.

1. Name two **abiotic** cues which cause plants and animals to begin preparations for fall.

2. Locate an annual and a perennial plant. Compare their adaptations to survive the winter.

3. How do the winter **adaptations** of evergreens differ from those of deciduous trees?

4. How do animals which remain in cold areas for the winter and do not hibernate change their lifestyle in the winter?

5. How do adaptations of plants affect the lives of animals in the winter?

6. Name 5 ways specific animals adapt to winter in the woodland community.

(1)

(2)

(3)

(4)

(5)

7. Is it true that snow keeps the ground warm?

LOST IN THE WOODS

See how many of the words below you can find lost in the alphabetical habitat.

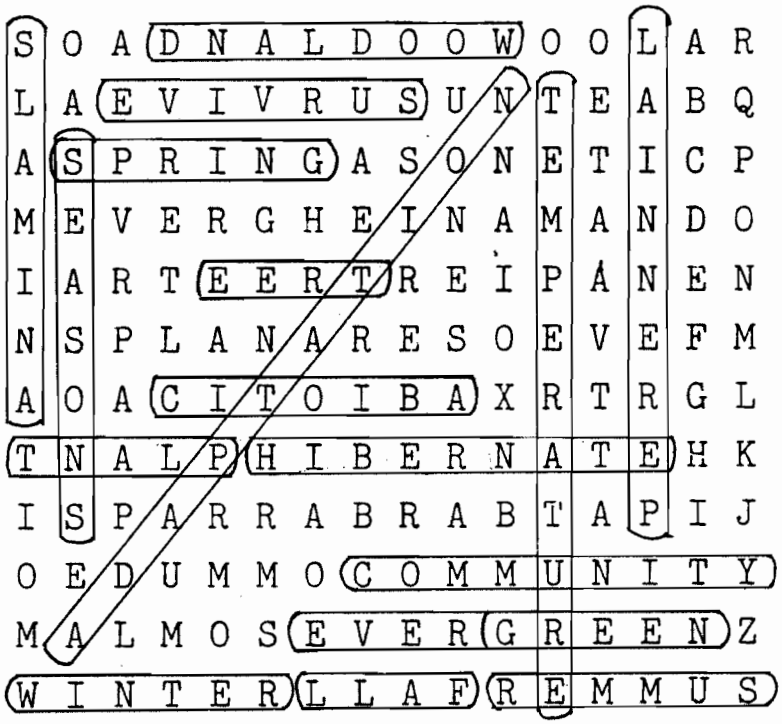
adaptation	temperature	woodland
animals	seasons	winter
abiotic	community	fall
hibernate	spring	summer
tree	perennial	evergreen
plant	survive	green

S O A D N A L D O O W O O L A R
L A E V I V R U S U N T E A B Q
A S P R I N G A S O N E T I C P
M E V E R G H E I N A M A N D O
I A R T E E R T R E I P A N E N
N S P L A N A R E S O E V E F M
A O A C I T O I B A X R T R G L
T N A L P H I B E R N A T E H K
I S P A R R A B R A B T A P I J
O E D U M M O C O M M U N I T Y
M A L M O S E V E R G R E E N Z
W I N T E R L L A F R E M M U S

LOST IN THE WOODS: KEY

See how many of the words below you can find lost in the alphabetical habitat.

adaptation
animals
abiotic
hibernate
tree
plant
temperature
seasons
community
spring
perennial
survive
woodland
winter
fall
summer
evergreen
green



LEADER'S PAGE: **FUN WITH FUNGI**

OBJECTIVES:

(1) To encourage the student to observe carefully.

(2) To stimulate an interest in a neglected but essential life form--the fungi.

(3) To give the student rudimentary skills in collecting and studying fungi.

(4) To present the mushroom and its allies as the **decomposers** of the woodland community and to demonstrate to the student the importance of that role.

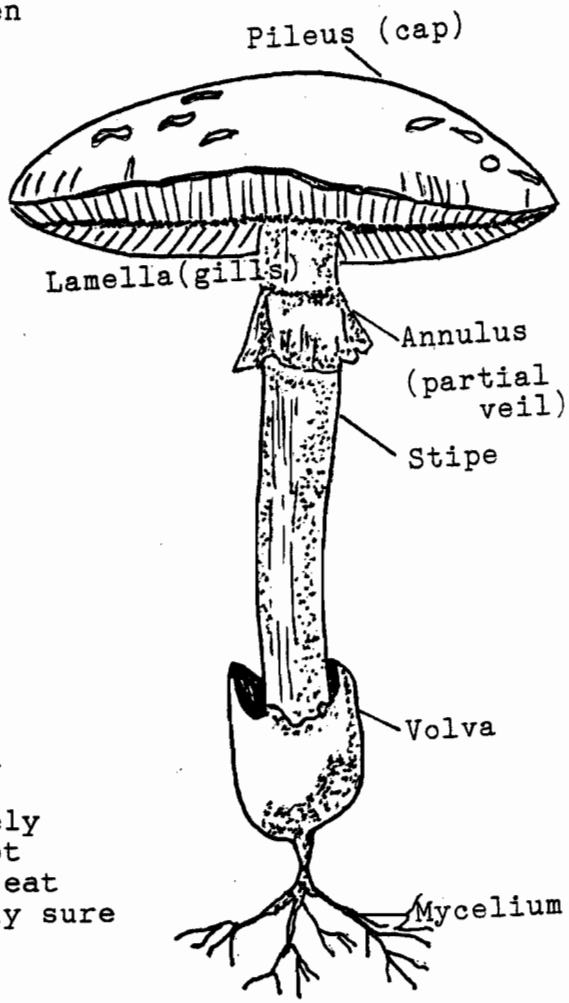
This activity includes a fact sheet on fungi which may be used by the leader as background information or may be photocopied and given to the student as a reference sheet. The two student activities are quite different. The first, a survey of fungi called "Fun with Fungi" has the student examine and discover the many fungal forms in the woodland habitat. This exercise should only be done when the woodland is damp and fungi are plentiful. Have the LBL guide, **Mushrooms and other Fungi of the Land Between the Lakes** handy if possible.

Sketching and recording data are recommended only to discipline the student and to encourage closer examination of nature. Learning to keep a field notebook is an important part of serious nature study.

The second activity, "Preparing a Mushroom Spore Print," is more successful if done in the classroom after returning from a field trip. It is worth doing and almost always seems to interest students.

A FUNGI FACT SHEET

Did you know that we owe our lives to the humble fungi all around us? Without their work of breaking down chemical compounds and promoting decay and **decomposition**, many essential elements would not be made available to green plants. Without green plants (the **primary producers**), the **secondary producers** and the **consumers**, like us, could not live.



Mushrooms have interested mankind throughout the years. What else can you expect from an organism that was once thought to arise from the footsteps of hobgoblins?

Some mushrooms are so poisonous that a piece the size of a green pea could kill a human in a matter of minutes. Some are **hallucinogenic** and others are known to kill and strangle the **nematode** worms they find in rotting wood.

Others such as the well-known morels are so desirable to eat that some cities hold a spring festival in their honor. There are absolutely no edibility rules on whether or not a mushroom should be eaten. Never eat a mushroom unless you are completely sure of the species!

We know so little about these strange forms, but some of the things we do know are listed below:

1. A fungus is composed of an underground **mycelium** or network of rootlike fibers. It can remain dormant for years and when conditions are right "mushroom" forth in its fruiting body which produces the **spores**.

2. A fungus tends to be **parasitic** or **saprophytic**, that is, feeding on living or dead organic material.

3. Fungi provide plants with carbon, nitrogen, potassium and phosphorus by breaking down organic compounds.

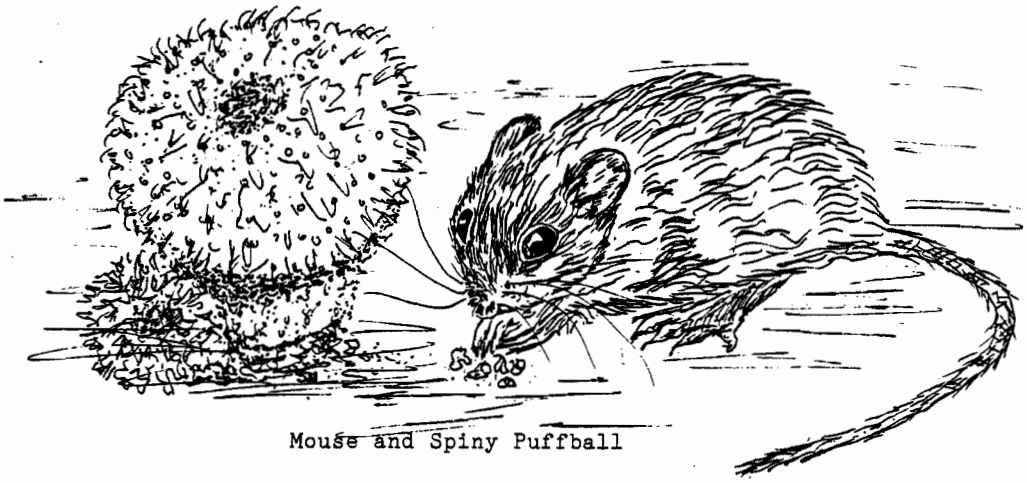
FUNGI FACTS (continued)

4. Fungi have made our lives far easier by our use of the **antibiotics** they produce, for example, penicillin.

5. Fermenting fungi give us cheeses and raised doughs which are produced by yeasts.

6. Edible mushrooms themselves offer a low calorie, high protein and fiber addition to our diet.

7. Best of all fungi are fun to observe and marvel over. Be careful, an interest in fungi is contagious and may stay with you the rest of your life!



Mouse and Spiny Puffball

ACTIVITY: FUN WITH FUNGI

MATERIALS:

a mushroom field guide
a collecting basket
some squares of waxed paper
a knife or spade

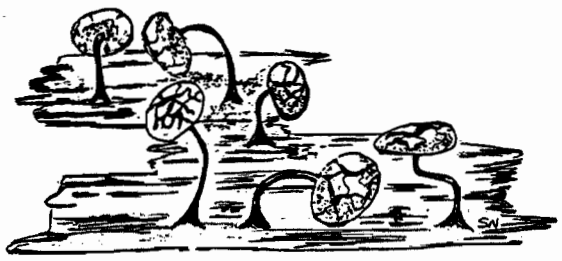
About a week after a good rain, fungi of different kinds are often plentiful in the woods. They are always a source of fascination because of their rapid appearance and their wide variety of forms and colors.

Fungi may grow in the soil, on living or dead trees, or even on you! Athlete's foot and ringworm are both caused by a fungus. Along the woodland trail bracket or shelf fungi are often found on dead logs. Fungi are the **decomposers** of the community and do their job well, sending their fibers deep into the wood in which they grow. Without the work of bacteria and fungi, plants and animals would not decay and return their organic materials to be reused in nature's cycles.

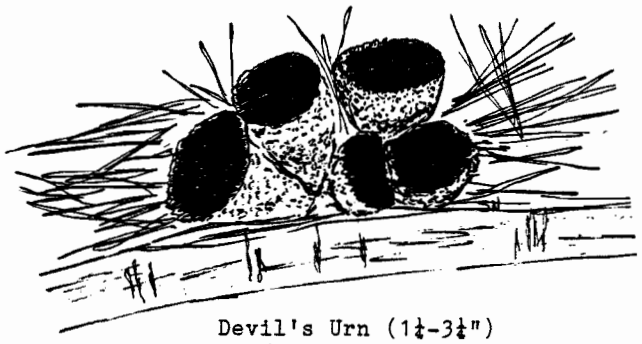
On the next three pages are some common types of fungi you should be able to find in a damp woodland.

COMMON FUNGI IN THE WOODLAND COMMUNITY

1. **SLIME MOLDS** - Often found on logs, these fungi form colorful jelly-like masses and almost appear to move from day to day. One frequently found form is bright lemon yellow.



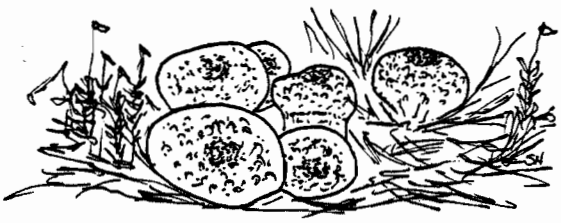
Sporangia of Green Physarum Slime Mold (0.2")



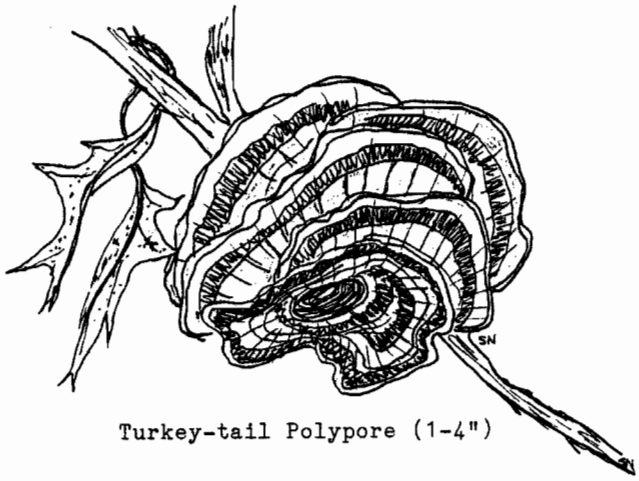
Devil's Urn (1¼-3¼")

2. **CUP FUNGI** - These, as their name implies, look like little cups. They may be almost any color (red, black, and tan are common). One species called the ear fungus looks like grotesquely shaped human ears.

3. **PUFFBALLS** - You've probably stepped on these and seen the puff of spores they send up. They can range in size from about an inch to over a foot wide. Some are covered with what looks like little gems. Many have a small vent on top through which they release their spores.



Gem-studded Puffballs (1-2½")



Turkey-tail Polypore (1-4")

4. **POLYPORES** - Most shelf fungi are of this type. They are so named because of the small pores on their underside. One common species found on rotten logs is the turkey-tail polypore. It looks like a series of fans or turkey-tails in shades of brown and gray.

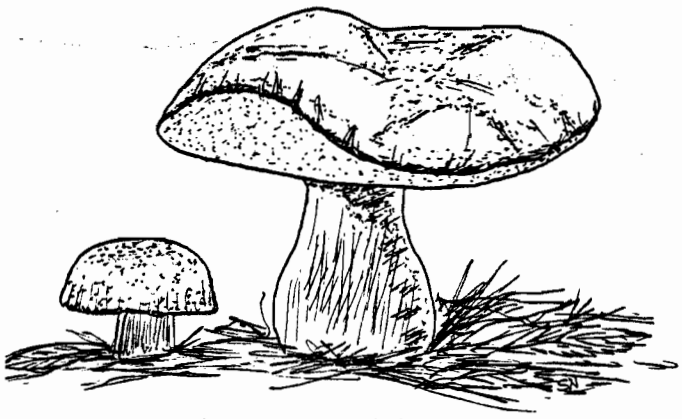
5. **GILLED MUSHROOMS** - There are hundreds of different types of gilled mushrooms. Some call the poisonous ones toadstools. See the sheet on how to prepare a spore print. This is the best way to study gilled mushrooms. Some snow-white mushrooms will yield a surprising green or a chocolate brown spore print.

Little Wood Satyr on Meadow Mushroom (1-4")

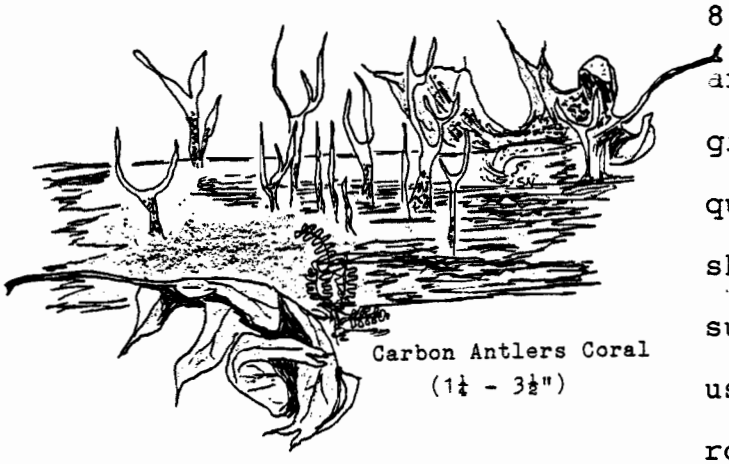
Earth Stars (1½-2¾") and Bird's Nests (¼-½")

6. **EARTHSTARS AND BIRD'S NESTS** - These are small and often found on the bare part of the trail where they are easily stepped on, so keep your eyes wide open.

7. **BOLETES** - Instead of gills these mushrooms have many pores underneath their cap. Often their stipe is thick and stocky and the cap feels like suede or velvet. One unusual bolete has a brown cap and a bright yellow stipe which bruises blue when you touch it.



King Bolete (3¼-10")



Carbon Antlers Coral
(1¼ - 3½")

8. **CORAL FUNGI** - Although these are in the same large group as the gilled mushrooms, they are usually quite tiny and are stalked or club-shaped. Look carefully along the surface of a rotting log. You will usually find a fragile colony of rose, lilac, white, or gray corals flourishing.

Do not collect the fungi unless your leader tells you to. You may wish to prepare a spore print of some of the gilled mushrooms you find.

ACTIVITY: **FUN WITH FUNGI**

Make a sketch of the fungi you find. Try to see if they belong to any of the groups illustrated in this activity. Use the form below to keep a good record of your finds. Be sure to record the date and habitat of each fungus you draw. Mushrooms have seasons and you can often return to the same place at the same season the next year and find more of a certain type of mushroom. In the habitat section make a note of whether the fungus was growing on a living or dead tree or in the soil.

FUNGUS SKETCH	HABITAT	DATE
1.		
2.		
3.		

ACTIVITY: **PREPARING A MUSHROOM SPORE PRINT**

Materials:

a collecting basket
a sharp knife
waxed paper
white paper
a bowl or jar to cover mushroom cap

All mushrooms are very fragile and cannot be collected and stored for long. There are some techniques, however, which permit later examination.

1. A good written record and description of where you saw the mushroom and what it looked like. Include a sketch.

2. A photograph makes an excellent study tool.

3. A well prepared spore print may allow you to identify a mushroom even years later.

Collecting and Transporting:

Mushrooms reproduce by dropping microscopic **spores** on the ground around them. The color of the spores and the pattern of the mushroom's gills will often be all that is needed to identify the mushroom later.

Carefully lift the mushroom from the ground. A knife is often needed since the **volva** (a little cup at the base of stem) sometimes breaks off and remains in the ground. All mushrooms do not have them, but poisonous mushrooms often do and it is important to check for one. If you plan to carry the mushroom somewhere to study it, wrap it loosely in waxed paper (do not use plastic wrap) and lay it gently in a basket. Each mushroom should be wrapped separately so that spores from different species do not become mixed.

Preparing the Spore Print:

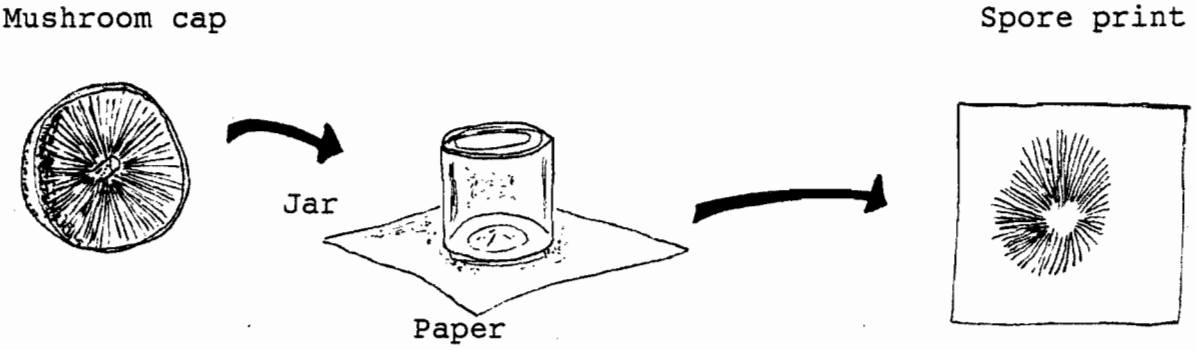
Slice the cap off just below the gills and lay the cap gill-side down on a sheet of clean white paper. Cover with a bowl or widemouth jar to prevent drying out. After a few hours lift the cap to examine. Several prints can be made from the same mushroom.

The spore print can be sprayed with lacquer or some other fixative for permanent record or can be stored carefully between tissue paper sheets so loose spores can be removed for microscopic study.

To study microscopically, simply stir a few of the spores into a drop of water on a glass slide, cover with a coverslip and have a look. Sometimes the shapes and colors of the spores are a real surprise.

Spore prints have saved the lives of some who like to collect and eat wild mushrooms. There are many deadly look-alikes which can only be distinguished from their edible relatives by their spore color and gill pattern. The best rule is to look and admire and leave the sampling to the mice and turtles along the trail.

HOW TO MAKE SPORE PRINTS



GLOSSARY

abiotic - not including living organisms, their effects, or products

adaptation - fitness of an organism for its environment, including the process by which it becomes fit, in order that it may survive and reproduce

annulus - a ring on the stipe of a mushroom formed by the separation of veil (gill covering) from margin of pileus (cap)

antibiotic - an antibacterial substance produced by a living organism, especially by a bacterium or a fungus

autotroph - organism which produces organic material from inorganic chemicals and some source of energy

axil - the angle between the branch and the leaf

biomass - weight of living material, usually expressed in dry weight per unit area

biotic - pertaining to any aspect of life, especially to characteristics of entire populations and ecosystems

chlorophyll - green pigment found in organisms which carry on photosynthesis, capable of absorbing energy from the sun

community - a group of interacting plants and animals inhabiting a given area

consumer - member of an ecosystem that eats other organisms

cordate - heart-shaped

decomposer - organism that obtains energy from breakdown of dead organic matter to more simple substances, refers to bacteria and fungi

decomposition - separation into simpler compounds or elements

dichotomous - cut twice, a key made up of a series of two-part questions

ecology - the study of the relationship between organisms and their physical environment

ecosystem - a biological community together with the associated abiotic environment

genus, pl. genera - a rank of classification just above the species level. Organisms at this level are closely related but

not closely enough to reproduce

glucose - the most common six-carbon sugar

habitat - place where a plant or animal lives

hallucinogenic - producing a perception of objects with no reality and sensations with no external cause

heterotroph - organism which requires a supply of organic matter or food from the environment and is incapable of producing its own food (as green plants are able to do)

lamella, ae - gills of a mushroom

leaflet - one of the divisions of a compound (pinnate or palmate) leaf.

metabolism - all the chemical reactions within a cell including both construction and breakdown of complex organic molecules

mycelium - mass of interwoven threadlike filaments forming the body of a fungus

nematode - a small roundworm, found in roots and soil

niche - functional role (what an organism does) of a species in the community

node - the point of intersection of a leaf and the twig or stem from which it arises, point at which the bud arises

organic - pertaining to any aspect of living matter

organism - an individual capable of carrying on activities of life by means of organs, any living being

parasite - an organism which resides in or on another organism and derives its food from that organism

petiole - the stem of a leaf, a leafstalk

pileus - the umbrella-like cap of a mushroom

primary producer - an organism which produces food by forming organic compounds from inorganic compounds in the environment (green plants and algae)

rachis - the extension of the petiole or "spine" of a compound leaf which bears the leaflets

samara - a dry winged fruit, may be one or two-seeded, examples are elm, maple, and ash

saprophyte - organisms such as bacteria or fungi which break down dead organic matter before absorbing the products

secondary producers - a consumer which produces energy, such as a grazing animal

serrate - notched or toothed on the edge, like a saw

species - a group of similarly constructed organisms that are capable of producing fertile offspring

spore - a haploid (half chromosome number) reproductive structure, particularly of fungi

stipe - the stalk of a mushroom

stratification - division of a community into distinguishable layers on basis of temperature, moisture, light or structure, creating zones for different plant and animal types

succession - replacement of one community by another; often progresses to a stable terminal community called the climax

taxonomist - one who studies plant or animal classification

taxonomy - the science of naming and classifying organisms

terrestrial - belonging to the land, growing in the ground

transect - an elongated sample plot in which vegetational data are recorded as species are encountered in the plot

volva - the portion of the universal veil which remains as a small cup around the base of a mushroom stipe

whorl - the occurrence of more than two leaves or flowers at a node, usually encircling the stem

RESOURCES

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Clarke, G. L. 1954. Elements of ecology. John Wiley and Sons, Inc. New York. 560 pp.

Oosting, H. J. 1956. The study of plant communities. W. H. Freeman and Company, San Francisco. 440 pp.

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Shanks, R. E., and Sharp, A. J. 1963. Summer key to Tennessee trees. The University of Tennessee Press, Knoxville. 24 pp.

Smith, R. L. 1980. Ecology and field biology. Harper and Row, Publishers, Cambridge. 835 pp.

Storer, J. H. 1953. The web of life. The New American Library of World Literature, Inc., New York. 128 pp.

The following field guides are available at Woodland Nature Center and were produced by Austin Peay State University (with the exception of Mushrooms and other Fungi of LBL produced by Southern Illinois University at Carbondale). All would be helpful in any nature study at Land Between the Lakes.

Amphibians and Reptiles of Land Between the Lakes

Mushrooms and other Fungi of Land Between the Lakes

Spring Wildflowers of Land Between the Lakes

Summer Wildflowers of Land Between the Lakes

Trees and Shrubs of Land Between the Lakes