



## **ALSO KNOWN AS...**

**Focus:** To sharpen observation skills necessary for plant identification and to appreciate the diversity of plant life in the forest.

**Group Size:** entire class

**Time Required:** 45 minutes- 1 hour

**Materials:** *Also Known As...* worksheet  
pencils  
optional:  
• *Plants of the Covell Creek Trail*  
• *A Guide to the Trees of Cispus*

**Physical Setting:** The Braille Trail or any other trail at Cispus.

**Process:** 1. What plants can you notice? On this short walk, students must be keen observers of their natural surroundings. Ask them to spend a few minutes quietly noticing as many different kinds of plant life, noting them down on the worksheet. Then gather together, and discover how many plants the entire group has identified. What do you come up with? Do you have trees, ferns, mosses, mushrooms, lichen, flowers, and liverworts? (Don't worry about the technical names at this point.)

2. Noticing the differences: Salal and Oregon Grape In order to identify plants, we must be aware of the smallest details and differences between plants. Lead the group to a spot off the side of the trail where both Salal and Oregon Grape are growing. Both of these plants are low, evergreen ground cover. At first glance, these plants may seem the same. They are both about the same height, both have leaves, flowers, and berries, and both grow in the same places. But what are some differences? What about leaf-shape? Are the flowers or berries the same? (Salal has ovate leaves, white to pink flowers, and black berries. Oregon Grape can be distinguished by its sharp, "holly-like" leaves, bright yellow flowers, and waxy blue berries.)

Find a nurse log and look closely at the carpet of moss growing on it. Is this one kind of moss or can the class find different species of moss? How do they tell that there are different kinds of moss? Then look at any

ferns that may be growing on the log. Are they different species? How can you tell?

3. Discovering the distinguishing characteristics Instruct each student that they must now use the same skills that scientists and botanists use in order to tell two plants apart. Those skills are careful observation and description of the differences in what they see. Each student may find a place on the trail where they can easily compare two or more plants on the activity sheet. Use written and/or drawn descriptions to distinguish the two plants. Challenge your students by encouraging them to pick two plants within the same family, such as two mosses or two fungi.

Remember: The clearer and more detailed a description, the more accurate it is for others to use. Be specific! It isn't just "green"; is it "electric lime-green" or "silvery grey-green"? What shape is the leaf? Is it thin and "tissue-papery" or is it "leathery" with pointed tips?

4. How much did you notice? When you "key" a plant, you are simply noticing the same things that another person noticed in a particular plant. After everyone has completed this activity, have each student exchange their descriptions with another person. Now comes the challenge: Were your examinations careful enough that another person can find the plants you observed by your descriptions? If students are having trouble, have them group up to find the plants. Remember: a good key is only as good as the ease with which it allows you to identify particular plants. It doesn't matter if you don't identify your plant with a Latin name, just so long as the description gives you a confident match to the live plant!

# ALSO KNOWN AS... ACTIVITY SHEET

1. What are the different plants you notice growing in this area?

2. **Identify your plants!** Chose two or more plants and use written and/or drawn descriptions to tell them apart. What to notice: *color, size, bark, leaves, flowers, structure, where it's located, sun- or shade-tolerance, et cetera.*

PLANT #1

PLANT # 2

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# As the World Turns: The Drama of Plant Adaptation

## FOCUS:

To gain an understanding of the evolutionary concepts surrounding the basic structures of vascular plants. Students will be led on a walk to discuss the functions of particular plant parts in different habitats, tracing the evolutionary sequence of plants, which moved from water to land environments .

## Group size:

10 students (at most) per group leader.

## Time required:

Approx. 1 hour, depending on how long you may want to extend the discussion topics.

## Materials:

The Cispus Hike Plant Guide, clipboard, pen and paper.

## Setting:

Any of the hiking trails at Cispus, preferably starting the discussions at the site of a stream or body of water (the Study Shelter is a great place to start with the discussion).

## Process:

On a day with nice weather, lead students on a hike to a body of water to start out, get comfortable, then begin discussing plants using the following set of questions and ideas to guide your inquiry.

1.) What do we know about what plants need to survive? How do they get their energy? You may guide your students to think not only about the soil, but about the minerals and moisture that the soil offers, and not only about the sun, but the quality of light which the plants receive in different environments. (Is the light filtered through water or is it received directly in the upper canopy?)

2.) Since plant life on earth first began in water, what types of environmental conditions might these species have encountered? Have your group *imagine* the ocean scene in great detail, from the tossing waves to the coral reefs, and the weather that effects the waters from above. The following variables may enrich the list you produce, but your group may also think up items that are not listed.

Variables for plants living in the ocean: motion of the waves, minerals, temperature variation, amount of light, competition for resources from other organisms, and the threat of consumers in the area.

3.) From what we know about the basic structures of the plant (that it has roots, stems, leaves, and some type of seeds to reproduce), what types of structures might these plants have needed to survive in the ocean? Think of water plants that you already know about. The list you form should mainly be in response to the initial list of variables that you generated.

Here is a sample list: either strong anchors in the ground (or some response to the motion of the waves), leafy structures that will be able to pick up the sunlight coming in through the water (or a response such as a tall stem that will lift them to where they can receive the light), a specialized structure for reproduction in a water environment, etc.

Next, hike to an area that has several varieties of low-growing plants, such as mosses and ferns, and stop for discussion.

4.) What happens to plant structures in a different environment? Explain to the students (if evolution has not already been covered) that plant life originally started in the water and that it gradually moved to land environments. Next, think about what a profound difference this was in the living variables that affected these species. Brainstorm on a set of variables these species might encounter. Pay special attention to new circumstances that arise from the transition to land. For the first time, the plant might face a scarcity of water or an overabundance of sunlight.

5.) You may want to hike to an area with many taller trees to ponder the following questions. Discuss why the first land plants weren't very tall, and why taller plants may have ever come into existence. Think about the resources plants use, as well as the issue of competition from other species in the area. Which structures in the plants may give certain species an advantage over others?

6.) What about when this land environment changes? Brainstorm a series of events that may change the plant's habitat. This list may include: the tallest trees dying out, a volcano eruption, a forest fire, or an introduction of a non-native species. Referring to the pictures in your Guide as well as the plants around you, talk about what types of roots, stems, leaves and flowers/fruit that would be advantageous for a plant to have in each of these scenarios.

Extension:

In any comfortable setting where students can draw, have them (individually or in small groups) each choose a scenario that would change the living conditions in a given habitat. They will design their perfectly "fit" plant for that new situation, referring to the variety of pictures in the Guide and other plant keys, or inventing new mutations of their own. Have them justify the advantages of their plant's structures, and label the names of its parts.

*worksheet for "As the World Turns" plant adaptation lesson*

Imagine an environment that your plant would live in. Does it get a lot of rain? Is it mostly warm or cold weather? What is the elevation? What other plants and animals live nearby? Is the soil very rocky or dry? Write a description below, then design a plant to fit that habitat.



(plant adaptation worksheet cont'd)

Choose one of the following events that would impact the habitat where your plant lives:

- A **volcano erupts**.
- There is a period of **flooding or drought**.
- A **foreign plant species** moves into the area that has 3' long stems and very wide, abundant leaves.
- There is an **overpopulation** of rabbits in the area that eat away most of the lower growing plant leaves.
- There is a **wind storm** that damages many trees and plants in the area.
- If you live in a forest, there is a **clearcut**.
- The water in your area has been **polluted**.

How would the design of your plant need to be changed to survive in this situation? Draw the adapted design below.

What other events can you think of that effect ecosystems?



# THE CISPUS PLANT HIKE GUIDE



*~A helpful guide for teachers and facilitators who wish to get the most out of a combined educational and outdoor activity. Take the Plant Hike Guide along with you and be prepared to share the intricacies of the plant kingdom with your group.~*

*\*Compiled by April West and  
Stacey Leab, Winter 1997\**

## *How to use this guide*

This guide is meant to be a compact way to transport some of the teaching materials found at Cispus. When on the trail, technical questions are impossible to answer if you do not already have the right knowledge. Take this guide on your hikes so that questions can be answered and information can be given at the most opportune time and place.

This guide may allow you to turn a normal hike or nature walk into an easily improvised lesson. Learn about the parts and function of plants, their life cycles, and their niche while on the trail. However, this guide may best serve you as an accompaniment to any lesson on plants that leads you out-of-doors. Use it to extend your lesson or enrich your hike.

The *Cispus Plant Hike Guide* does not contain all the information you may need, so it is also a directory for other plant resources at Cispus and where they can be found. Now.....

*Take a hike!*

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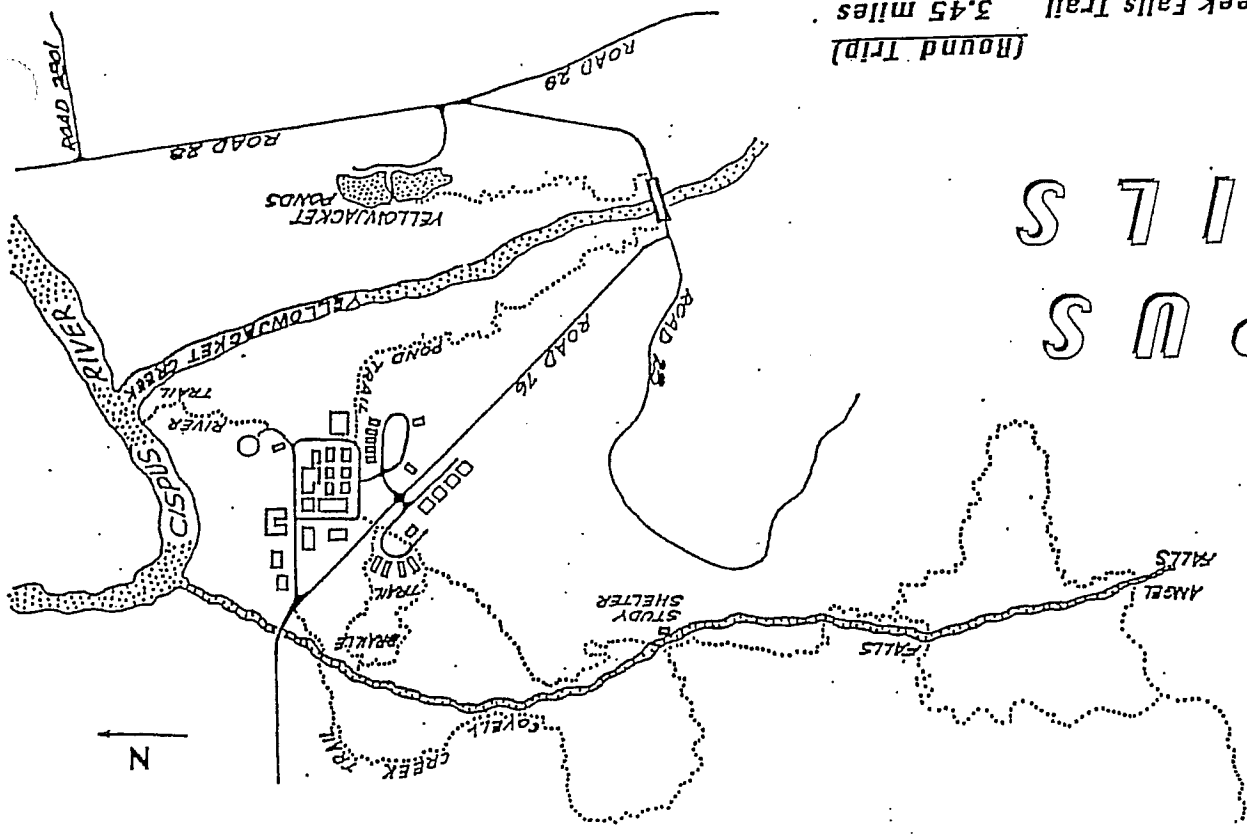
## Plant Resources at Cispus Where to look for plant information...

- I. The Plant Room: extensive displays on how plants function, the plant kingdom, mushrooms, and trees in a classroom setting. Includes the Plant Collection, a delicate but valuable collection of dried plants from the area.
- II. The Library: located in the Education Building, the Cispus library has a solid collection of books on mosses, ferns, wildflowers, trees, mushrooms, plant functions, and keying. The books are available for your use.
- III. Curricular Materials: These are special papers and guides that have been compiled by various authors for use in the Cispus area. Ask for them in the office. They include:
  1. *A Learning Guide to the Macrofungi of the Cispus River Drainage*
  2. *A Guide to the Trees of the Cispus Learning Center*
  3. *Plants of the Covell Creek Trail*
  4. *Forest Pharmacy: Medicinal and Edible Plants at Cispus*
  5. *A Learning Guide to the Covell Creek Old-Growth Forest*
  6. *Sketching a Nature Journal: A Visual Approach to Experiencing Nature and Conceptual Learning*

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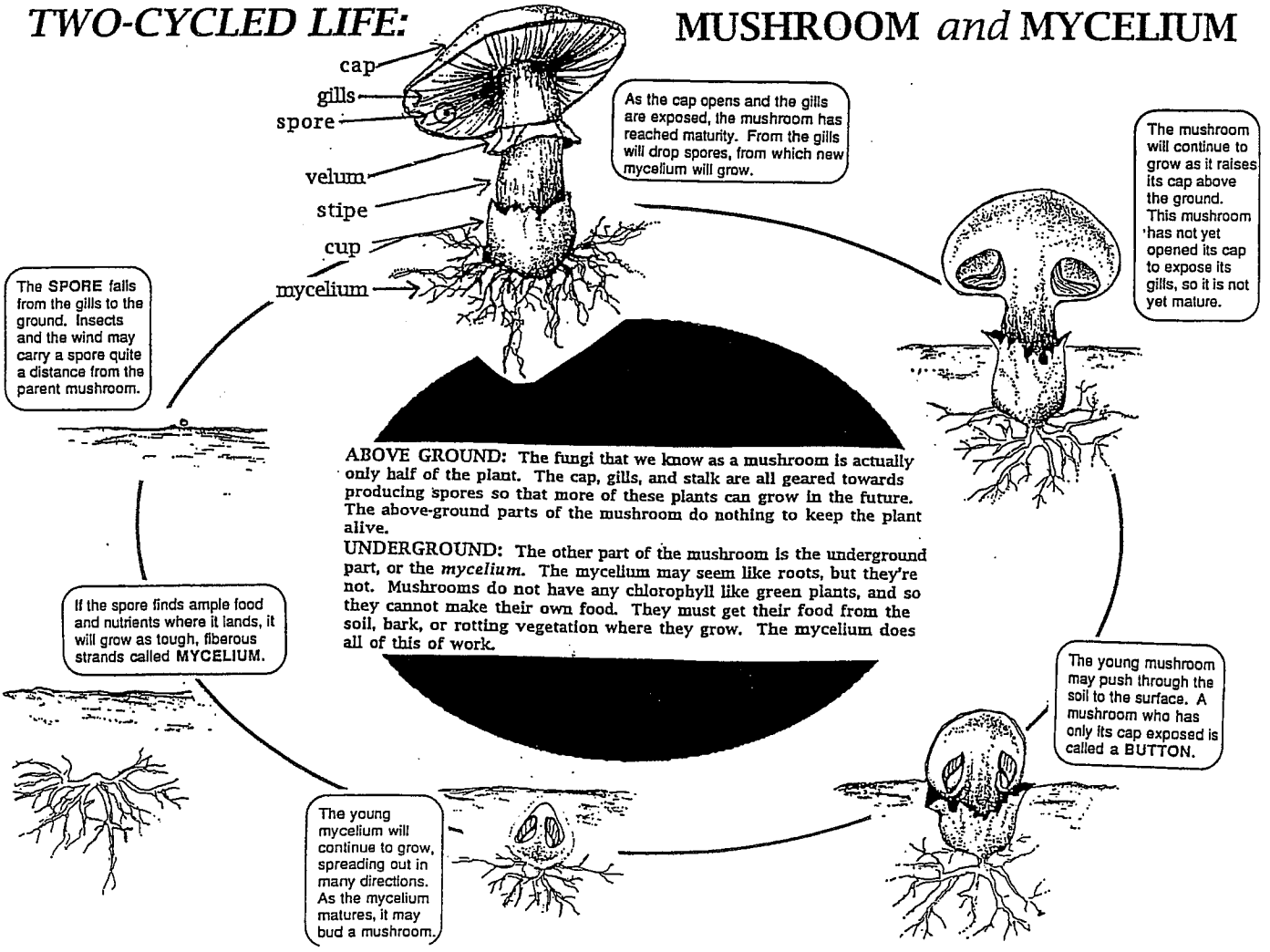
Angel & Covell Creek Falls Trail 3.45 miles  
 Covell Creek Trail 1.25 miles  
 Braille Trail .50 mile  
 Pond Trail 2.25 miles  
 River Trail .40 mile  
 (Round Trip)

# C I S P U S T R A I L S



## TWO-CYCLED LIFE:

## MUSHROOM and MYCELIUM



*What is the life cycle of a mushroom?*

Mushrooms have a two-stage life cycle. The above-ground mushroom is only the reproductive organ of the plant. Under the soil is the **mycelium**, fibrous strands that make up the real body of the organism. When spores are dropped from a mushroom, they germinate into strands of mycelium. If conditions are right, a mature mycelium may bud a mushroom. Mushrooms are where new spores will grow; this is their only function. the only reason they push through the soil is to spread spores.

*What does the mycelium do?*

It is the root-like mycelium of a mushroom that does the work of changing organic matter into food. They release digestive enzymes that break the complex molecules of organic matter down into simpler molecules. Some of these are then absorbed by the mycelium in order to feed the plant. Others are released into the soil. In this way, mushrooms are essential decay organisms. As they gather food, they speed up the decomposition of organic matter.

Mycelium are useful in another way. The fast-growing, fibrous strands have a very large surface-to-volume ratio with the soil they contact. Because of this, they are also helpful organisms in the prevention of erosion. They are not reliant on the sun, and can therefore grow in places where green plants can't.

## ***Cispus Trail Descriptions***

### ***Angel and Covell Creek Falls Trail- 3.45 miles***

This is the most stunning of the Cispus trails, but also the hardest to climb! Take an entire afternoon and discover two waterfalls, deciduous stands of trees giving way to a conifer forest, and plants thriving in many seemingly harsh settings (along rock faces, underneath a waterfall, on steep elevations). This is also a fine way to see noticeable changes in the plants of the forest the higher you climb and the farther you get from Cispus center.

### ***Covell Creek Trail- 1.25 miles***

This is the first leg of the Angel Falls trail, which will also take you through deciduous and conifer trees. Much of this trail follows Covell Creek, providing a good opportunity to compare plant life on the water's edge to that on drier ground. Use the study shelter as an alternative to a classroom. (You may also continue upstream a short distance from the shelter to the lower falls.)

### ***Braille Trail- .50 mile***

This is a short trail that is very rich for its size. Underneath the evergreen canopy, see lush ground cover, nurse logs, and macrofungi. Use the wide trail for a trust walk or take a stop along the creek.

### ***Pond Trail- 2.25 miles***

On the Cispus-side of Yellowjacket Creek, travel through coniferous forest. Move to the pond-side of the creek, however, and the trees are deciduous. Discuss the creek's ability to shape, transform, and destroy the plant life and ponds within its reach.

### ***River Trail- .40 mile***

The shortest of the Cispus trails, this will take you directly to the Cispus River. Again, see how plants struggle and survive as the waterways change.

## Things to Notice on Your Hike:

### 1.) *Ecological relationships between the plant and the different organisms that surround it.*

An **autotroph** is an organism that can make its own energy (e.g. any green plant).

A **heterotroph** is an organism that gets its energy from organic matter outside its own body (e.g. humans, mushrooms, bracket fungi).

- A **saprophyte** is an organism that gets its energy from dead or decaying organic matter (e.g. humans, mushrooms, rabbits).

- A **parasite** lives in or on the body of another organism (called a host). They get their food from the host, which may be harmed or killed by this relationship.

**Symbiosis** is the relationship in which two organisms mutually benefit each other, by giving and receiving energy and/or nutrients (e. g. algae and fungi in lichen).

### 2.) *The resources available for the plant to make energy.*

What qualities of light, water, and minerals is the plant receiving in its location? How is this effected by the organisms that surround the plant? Is there high competition for resources?

### 3.) *How well have the plant's physical structures adapted to this particular environment?*

For example, has it needed a tall stem to reach above other species? Does it have a special root system to anchor it into the ground on a steep hillside? Are the leaves arranged so that it will receive the maximum amount of sunlight?

Have students become familiar with the names of the basic parts of the seed and spore producing plants. Feel free to refer to the illustrations of plant structures available in the glossary. Drawing plants in a "field journal" is an activity that ensures careful observation. Once students have become familiar with some structural adaptations of plants, they may design their own ideal plant structures for a given environment.

# The Mushroom Fact Sheet

## *What kind of plants are mushrooms?*

Mushrooms are very unique plants- in fact, they are not even really plants at all. Some scientists refer to them as the "Third Kingdom" because they share certain qualities with both plants and animals. Mushrooms have no chlorophyll and thus do not get their energy for food from the sun like green plants do. Because of this, they do not have the same structural parts. They do not have roots, stems, or leaves. Such an organism is called a **thallus**.

## *How do mushrooms get food?*

Mushrooms cannot make their own food. Such an organism is called a **heterotroph**. Humans, animals, and mushrooms are all heterotrophs. They rely on a food source outside their own bodies in order to receive energy.

Mushrooms and other macrofungi are either **saprophytes** or **parasites**. They get their food directly from the soil, vegetation, or host that they are living on. **Saprophytes** feed off of non-living organic matter, such as a rotting tree, the forest floor, or old vegetable matter. **Parasites** feed off of a living host. Many bracket fungi attach themselves to living trees, where they will feed off of the tree until they kill it.

# MUSHROOMS

## 4.) How does the plant spread its offspring?

Determine if the plant is spreading seeds or spores. If it has seeds, refer to the "Experts in Seed Spreading" page.

If it has spores, there are several different methods of dispersal, a few of which are described below. One is simply to rely on the wind to carry the spores that fall from the gills. Some mushrooms exude a pungent smell that attracts insects, who will carry the spores to a different location. "Bird's nest" fungi have caps that blow off when mature, leaving a cloud of spores to be carried by the wind.

Again, drawing and designing from these dispersal structures will help students get deeply involved with the material.

## Parts of a Mushroom

The **cap** is the top-most part of the mushroom and protects the gills as the budding mushroom grows.

The **gills** are where spores are produced.

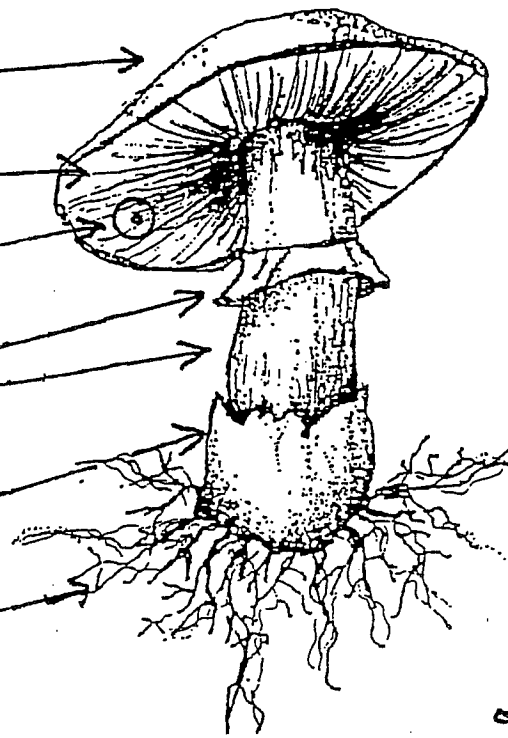
**Spores** drop from the mature mushroom and grow into young mycelium.

The **velum** is where the immature cap was attached to the stipe.

The **stipe** is the stalk of the mushroom.

The **cup** is the veil that protected the budding mushroom before it pushed through the soil.

**Mycelium** are the tangled fibers that keep the plant alive. They absorb all the nutrients the plant needs to live from its surroundings.

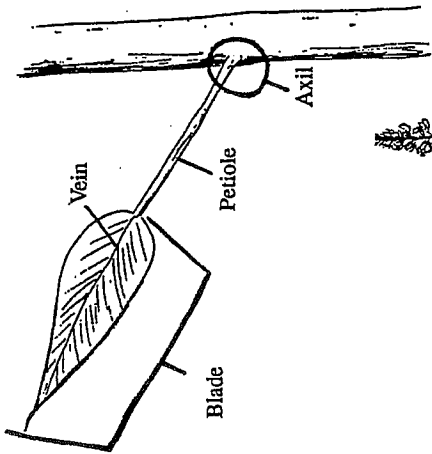




# Glossary

## Leaf Parts

**Axil**- the angle formed by the junction of a leaf petiole and a stem.  
*Think of the image of an axe cutting into a tree, the axe as the petiole and the trunk as the stem. The place where they meet would be the axil.*



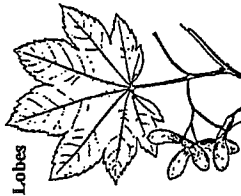
**Blade**- the leafy, or "wide" part of the leaf.  
*Think of the blade of a knife. Leaf blades also have "teeth" like a knife.*

**Cuticle**- a thin waxy film that covers the epidermis of a leaf.  
*Think of the way nail cuticles protect the skin.*

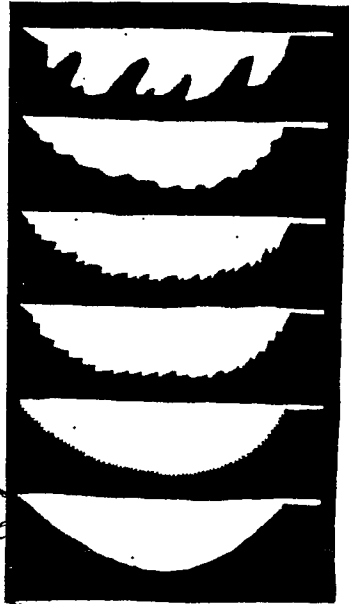
**Epidermis**- the outer tissue of a young root, stem, or leaf.  
*epi = above, upon      derma = skin*

**Leaflet**- in a compound leaf, one of the separate divisions of the blade.

**Lobes**- Extending segments of the leaf margin. See illustration.  
*Think of ear lobes.*



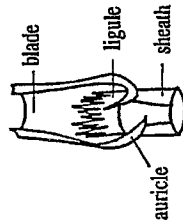
**Margin (leaf)**- the outer edge of a leaf. It may be toothed, lobed, or entire (plain), depending on the species.



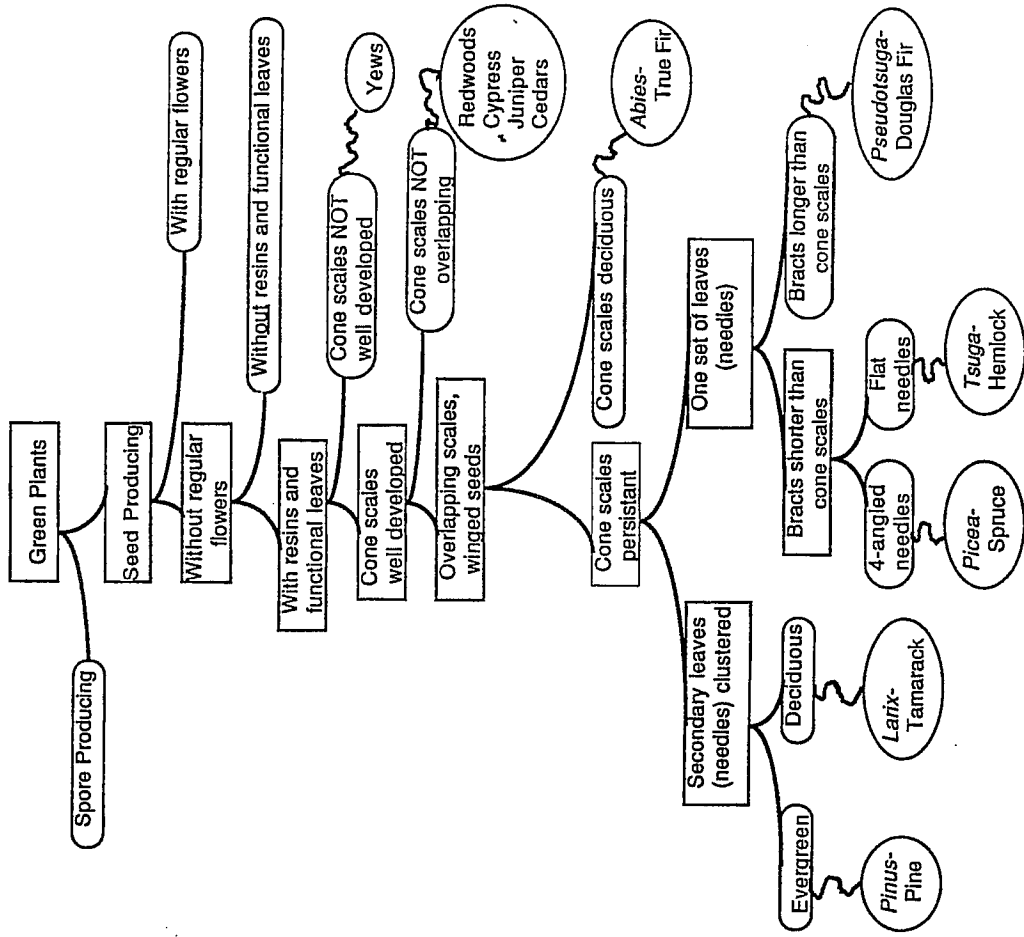
Leaf margins



## Grass Parts

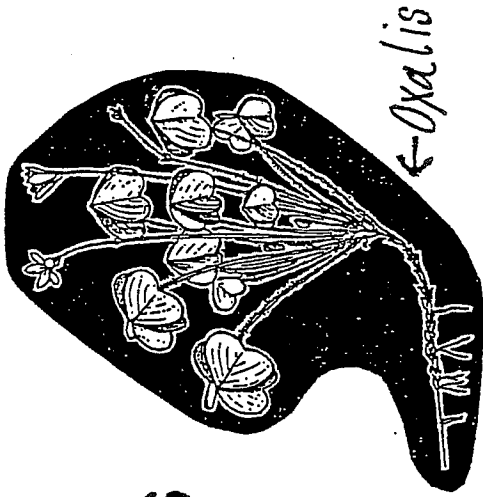


# A Simplified Key to Conifers



\*Key the most common local conifers to the family

# Spring Wildflowers of the Braille Trail



## 1. Wood Sorrel or Oxalis (*Oxalis oregana*)

The giant clover-shaped leaves are on a horizontal plane to better catch the sparse sunlight filtering down through the forest canopy. They have a white, peppermint striped flower about an inch in diameter.

*mixed in with the oxalis are:*

## 2. Anemone (*Anemone deltoidea*)

Here found interspersed with the Oxalis, is the Anemone's flower spike. The white 1-2 inch flower stands up above the broad Oxalis leaves and competes for sunlight. Its leaves are also horizontal to the ground. The three oval, tooth-edged leaves form a ring around the stalk.

## 3. Inside-Out Flower (*Vancouveria hexandra*)

The small (half-inch) white flowers hang over off of a spike above the oxalis level. The leaves are shaped like a duck's webbed foot. Why do you think this flower is called "inside out"? What advantage might there be in this position? Facing upward, the flowers might be more easily found by pollinators, or catch moisture in the flower "cup".

## 3. Vanilla Leaf or Bat Flower (*Achlys triphylla*)

These large (6-10 inch) leaves are shaped somewhat like a moose's antlers and stand above the oxalis level. The leaves are horizontal groupings of three that are spread to catch the sparse sunlight. The flower spike, with its tiny white flowers, stands 1-1 1/2 feet above the forest floor to be visible to pollinators.

Think of paper margins.

Mesophyll- photosynthetic tissue located between the upper and lower epidermis of a leaf.

meso = middle      phyll = leaf

Petiole- the stalk of a leaf.

Phloem- the tissue in leaves, stems, and roots that conducts dissolved food substances.

Think of "food flow" to go with the "ph" sound.

Sheath- the lower portion of a grass leaf that is rolled or folded around the stem.

Think of the sheath of a sword.

at regulate the passage of air and water to and from a leaf.

stoma = mouth

Teeth (leaf)- when the margin of a leaf is jagged (like the "teeth" of a knife).

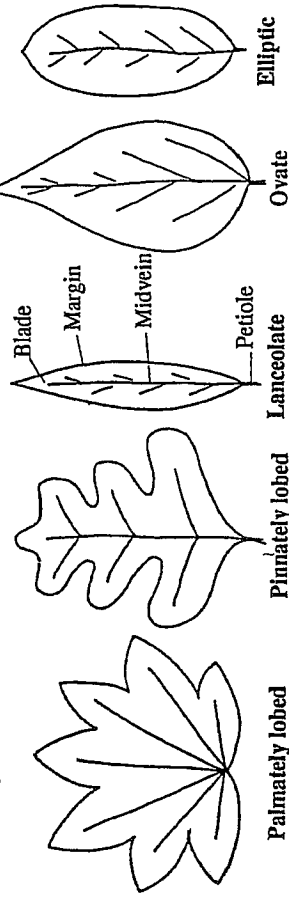
Veins- the strengthening and conducting structures in leaves.

Xylem- the tissue in leaves, stems, and roots that conducts water and minerals.



## Leaf Shapes

## Leaf Shape



**Acute:** pointed; used to describe the tip of a leaf or leaf-like structure.  
*Think of a small, or acute, angle.*

**Compound leaves:** leaves that are distinctly divided into leaflets.

**Elliptic:** describes a leaf having roughly the shape of an ellipse.

**Lanceolate:** describes a dagger, or "lance"-shaped leaf.

**Oblong:** an elongated circular leaf.

**Ovate:** describes a leaf that is roughly egg-shaped in outline.

**Palma** of a leaf that arise from a common point, similar to the bones in the human hand.  
*Think of the palm of a hand or a palm tree.*

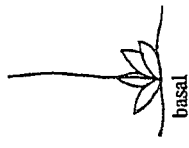
**Pinnate:** with two rows of opposite branches or leaflets, organized like a feather.  
*pinna = feather*

**Sessile:** a term used to describe leaves lacking a stalk or petiole.

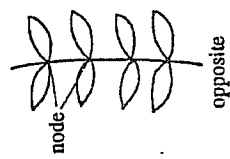
**Simple leaves:** leaves not divided into leaflets.

**Leaf Arrangement**

**Leaf Arrangement**

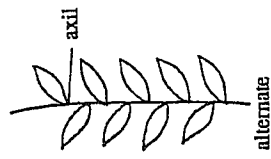


basal



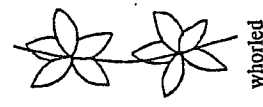
node

opposite

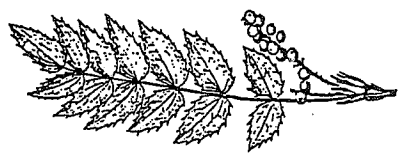


axil

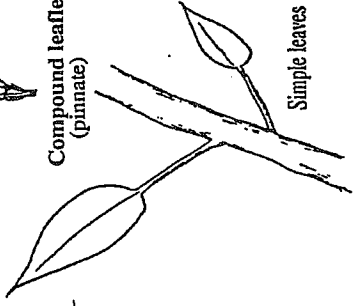
alternate



whorled



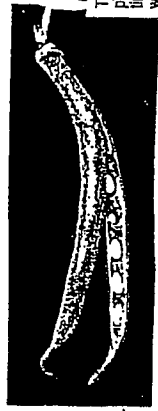
Compound leaflet (pinnate)



Simple leaves

# Seed Plant Life Cycle

As the season turns cold and the plant ages, the bean plant will turn brown and die. The bean pods then drop to the ground, releasing their seeds.



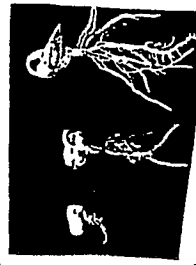
The bean is the seed of the plant. Inside the bean is a tiny embryo plant, complete with two small leaves, stem, and root.



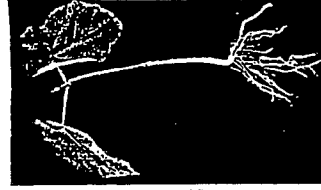
The flower is where the bean will develop. Pollen from the anthers falls on the stigma and reaches the ovules. This is called *pollination*. The flower petals drop away and the ovule becomes the bean pod, the fruit where new seeds will grow.



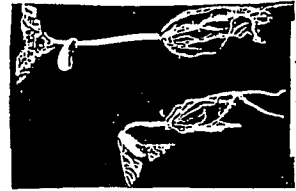
If the bean finds adequate moisture, warmth, and light in the soil where it lands, it will begin to germinate.



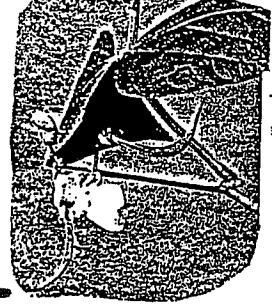
The young plant will grow in two directions: up towards the light and warmth and down towards moisture and nutrients. The plant leeches off of the stored food in the bean until it can make its own food by *photosynthesis*. For photosynthesis to occur, the plant needs proper sunlight and green leaves.



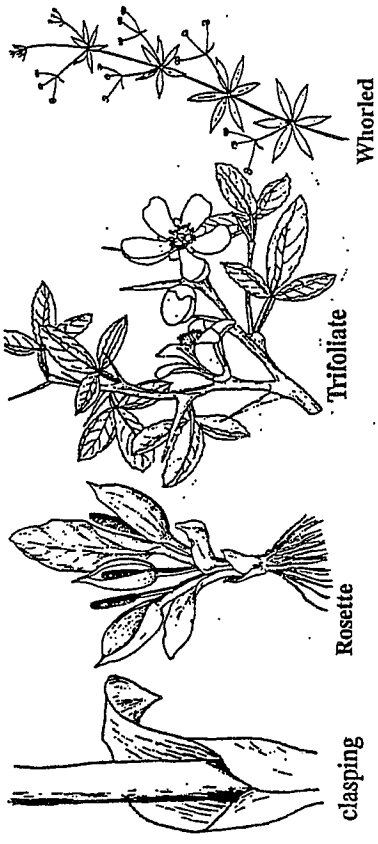
The stem straightens and lengthens, while the leaves develop and stretch out broadly to make use of the sun's energy.



Once the embryo leaves emerge from the bean and turn green, the plant is ready to get BIG!



The plant will push up towards the sun from its terminal buds, increasing in size until it is able to produce flowers.



**Clasping** - leaves arranged one leaf per node, alternating on either side of stem.

**Basal leaves** - leaves found at the bottom of the stem, near the ground.  
*Think of base, for bottom.*

**Clasping** - describes the condition where the lower portion of a sessile leaf wraps around the stem.

**Opposite** - leaves situated directly opposite one another.

**Rosette** - a compact cluster of leaves, with a roughly circular outline.

**Trifoliate** - a term in plant keys that indicates having three leaves.  
*tri = three Think of foliage (leaves).*

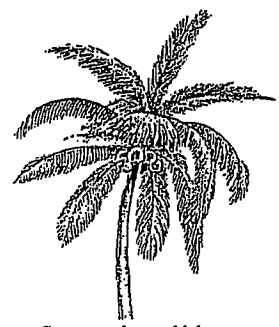
**Whorled** - describes the leaf arrangement where several leaves arise from a single node, usually surrounding the stem.

**Stem Terms**

**Cambium** - the soft tissue inside roots and stems of plants that produces new xylem and phloem.

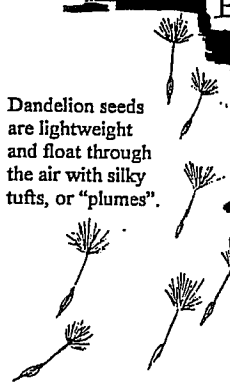
**Cortex** - a storage tissue in roots and stems.

**Epidermis** - the outer tissue of a young root, stem, or leaf.  
*epti = above, upon*  
*derma = skin*

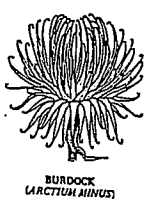


Coconuts have thick, waterproof rinds that enable them to travel in water for long distances.

Dandelion seeds are lightweight and float through the air with silky tufts, or "plumes".

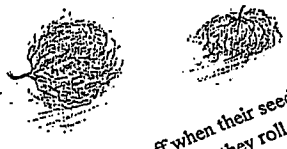


Burdock disperses its seeds by attaching to fur or feathers with its bristly spines.

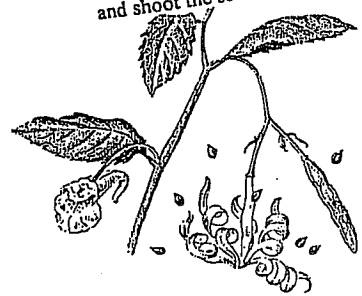


BURDOCK (ARCTIUM MINUS)

Tumbleweeds break off when their seeds are ripe and spread them as they roll.



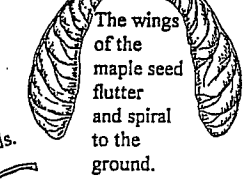
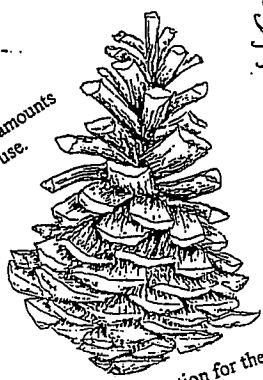
Touch-me-nots shoot their seeds into the air. The valves of its capsules separate suddenly, and shoot the seeds for some distance.



Squirrels often hide greater amounts of nuts than they actually use.



Pine cones offer sturdy protection for their seeds.



The wings of the maple seed flutter and spiral to the ground.

Many fruits are brightly colored to attract birds and mammals. These organisms eat the fruit while the

## EXPERTS in SEED SPREADING

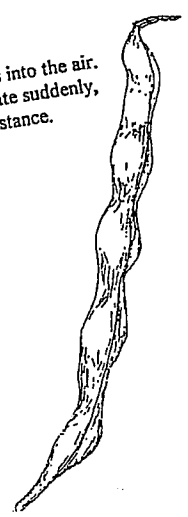
There are four main ways that seeds are dispersed. The most common is to be carried by the wind. Other methods include travelling via water, other organisms or from structures in the plant that propel the seed through the air.

"For seeds must have some way of setting out on their own. If they all dropped to the ground under their parent plants, there would be too many plants in one place for the amount of sunlight, water and soil there. The contest among the young plants for these things would be so great that most of the plants would die."

-from *The First Book of Plants*, by Alice Dickenson, 1953



Capsules and legumes shed their seeds at maturity.



**Fibrovascular bundle**- a strand containing xylem and phloem.

*Think of fibers (from "fibro"), running in strands. vas = vessel*

**Node**- on the stem, the point of attachment of a leaf.

**Phloem**- the tissue in leaves, stems, and roots that conducts dissolved food substances.

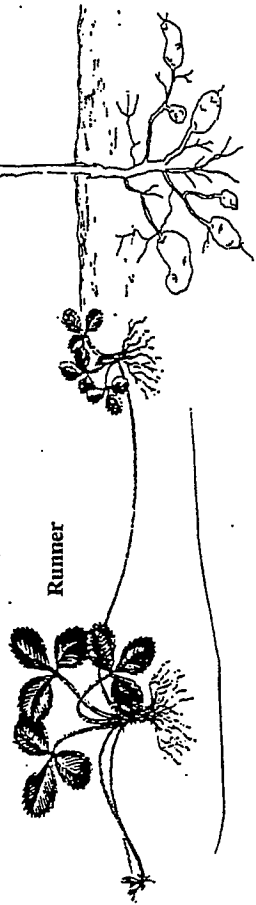
*Think of "food flow" to go with the "pit" sound.*

**Pith**- storage tissue in the center of the stem or roots; may be spongy, soft, or hollow.

**Resin**- a sticky, shiny liquid that is secreted from trees from cracks in the bark.

**Xylem**- the tissue in leaves, stems, and roots that conducts water and minerals.

### Root Terms



**Bulb**- an underground stem with a bud surrounded by layers of thick, fleshy leaves.

**Cambium**- the soft tissue inside roots and stems of plants that produces new xylem and phloem.

**Cortex**- a storage tissue in roots and stems.

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More to know  
about...

# Green Plants

**Vascular tissue**- fluid-conducting tissue.

*vas = vessel*

**Winged**- with one or more thin, flat appendages attached to the side of a structure.

**Woody**- a term applied to plants made up of tough, hard, fibers, such as trees and shrubs.

### Biological Plant Processes

**Adaptation**- the process in which a species slowly or rapidly becomes better suited to survive in an environment.

**Germination**- the growth of a seed in favorable conditions.

**Photosynthesis**- the process by which chlorophyll transforms energy from the sun into stored chemical energy within a sugar molecule.

*photo = light*  
*synthesis = to put together*

**Pollination**- the transfer of pollen in a flower from an anther to a stigma.

**Symbiosis**- the relationship in which two organisms live together in close association.

**Transpiration**- the process in which water is lost from plants.

*trans = across*  
*spiration = breath*

**Rhizome**- a creeping underground stem.

*rhizo = root*

**Root cap**- a tissue at the tip of a root that protects the tissues behind it.

*Think of the way a helmet protects.*

**Root hair**- a tiny finger-like extension in a young root.

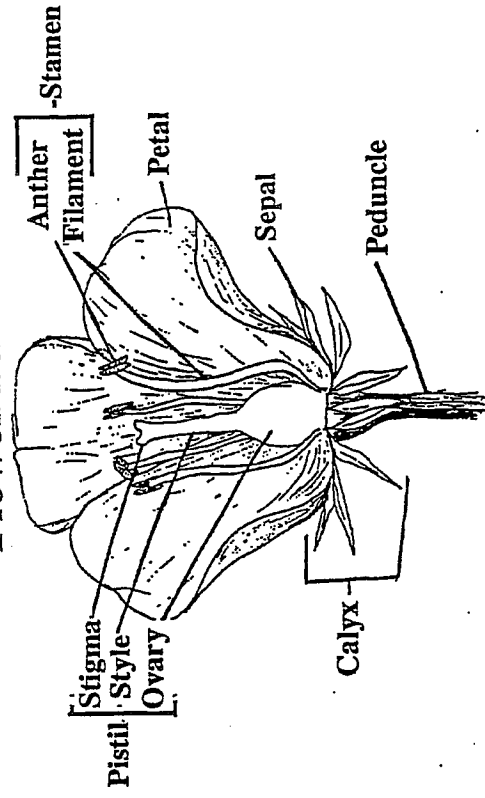
**Runner (Stolon)**- stem that runs along the ground, rooting and forming new plants at intervals.

**tuber**- a swollen area of an underground stem, (also called a nodule).

**Xylem**- the tissue in leaves, stems, and roots that conducts water and minerals.

### Flower Terms

## Flower Parts



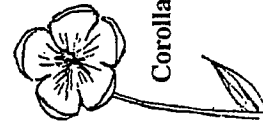
**Anther**- the portion of the stamen in which pollen is produced.

*Think of antennae and powder.*

**Bract**- a modified leaf-like structure growing at the base of a flower or cone.

**Calyx**- the collective term for the sepals of a flower.

**Capsule**- a type of fruit that has more than one "chamber", is dry and splits open to release the seeds.



**Corolla**- a circle of petals, whether they are united or not.

*Word derives from "corona", meaning crown.*

**Inflorescence**- a cluster of flowers.

**Ovary**- swollen area at the base of the pistil, which contains seeds. The fruit is a mature ovary.  
ovum = egg

**Panicle**- a branched cluster of flowers (a type of inflorescence).

**Peduncle**- the stalk of a flower.

*Think of it as the "pedestal" for the flower.*

**Pistil**- the female part of a flower concerned with seed production.

**Sepal**- an outer set of leaflike structures of a flower, usually in a ring, at the base.

**Stamen**- the male part of a flower concerned with production of pollen.  
*Think of stamen, therefore male.*

**Stigma**- the sticky tip of the pistil of a flower on which pollen lands.

**Style**- the slender stalk that connects the stigma of a pistil with the portion that will eventually enlarge to form the fruit.

### Cone Terms

**Chaffy**- covered with very small, dry scales.

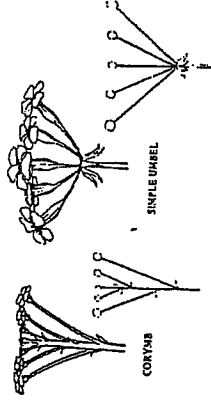
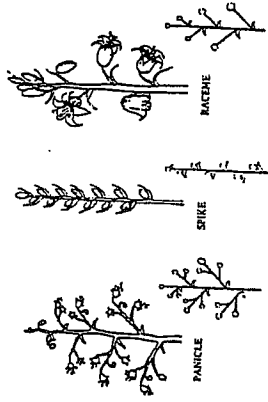
\***Recurved**- refers to the scales being curved backward or downward.

**Scales**- thin, flat, overlapping rigid plates which protect the bud of a seed plant.  
*Think of fish scales or armor.*

**Stalked (cones)**- a term in keys that refers to the length of the attachment from the stem or branch to the base of the cone.

### General Plant Terms

**Annual**- a plant that lives one year.  
annus = year



Common Inflorescences

**Autotroph**- an organism capable of organizing organic molecules from inorganic molecules (such as oxygen, carbon dioxide, and water).  
*auto = by oneself*  
*trophos = one who feeds*

**Biennial**- a plant that lives two years.

*bi = two (as in bicycle)*  
*ennial = year, like annual*

**Bud**- an undeveloped shoot of a plant.

**Chlorophyll**- the green pigment found in chloroplasts that is a necessary catalytic agent in photosynthesis.

*chloro = green*

*phyll = plants*

**Chloroplast**- a cell organelle (plastid) containing chlorophyll.

*From "plast", think of plastic, and associate this with a plastic container. Think of the chloroplast as a container for the chlorophyll within the cell.*

**Deciduous**- applied to plants that lose their leaves in autumn.

*Sounds like "descend", to fall.*

**Dicot**- a seed plant with two seed leaves.

*di = two*

**Herbaceous**- a term applied to plants that are soft rather than woody, such as wildflowers, grasses, and herbs.

*Think of luscious, (rhyming with -aceous) and softness.*

**Mesic**- describes plant habitats with adequate, moderate moisture.

**Monocot**- the flowering plant that develops a single seed leaf.

*mono = one*

**Perennial**- a plant that lives for more than two years.

*per = year*  
*ennial = year, like "annus"*

**Sessile**- a term used to describe leaves lacking a stalk or petiole.

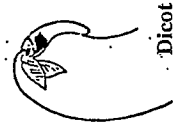
**Spines**- term used for thorns or spikes in plant keys.

**Sporo-** an asexual reproductive cell, capable of developing into an adult without fusion with another cell.

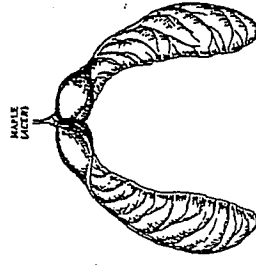
**Sporangium**- a hollow structure in which the spores are produced.

**Thallus**- the body of a lower plant such as fungus, alga, moss, or liverwort.

**Terminal**- the end, or tip of an organ.



Dicot



Winged seeds

## *Leaf Matching*

- Focus** To identify and learn tree types through creating a field guide.
- Group Size** Entire class (works best with groups of 15 or less)
- Time Required** 3-4 hours
- Materials** A collection of leaves from the area  
Paper  
Crayons  
Pencils
- Physical Setting** Field guides  
A trail that courses through diverse forest communities
- Process**
1. Have the group examine all of the leaves in your collection. Talk about their shapes, sizes and what tree they could possibly have come from.
  2. Start your hike. Along the way the group should be looking for leaves that match the ones in the collection.
  3. When one is found each child in the group should make a crayon rubbing of it.
  4. Then find which tree the leaf came from and talk about its shape and size. Have the children write down distinguishing characteristics about the tree on the page with the rubbing.
  5. If you need, look the tree up in the field guide and record its name and any other important features.
  6. Return the leaf to where it was found.
  7. Continue this process until you have found all or most of the leaves in your collection.



## Spore Trek & Seed Search

### FOCUS:

To understand the various structures that plants have developed to disperse seeds and spores. To discuss the benefits and drawbacks of different structures.

### Group Size:

Small groups of ten students per teacher.

### Time Required:

Approximately one hour.

### Materials:

Magnifying glasses, the accompanying worksheet, and drawing materials.

### Setting:

Any one of the trails at Cispus, preferably in autumn. The class then moves to the plant room for the second part of the lesson.

### Process:

In small groups, have each guide lead their group to a different area along the trail. Each group should be spaced far enough apart so that they have room to explore and are able to focus on their own group's discussion.

As they walk along the trail, each student is to look closely at their surroundings for seeds or spores. If the students are having trouble finding these, you may want to give them the following hints:

- What kinds of plants produce spores?
- Where have you seen seeds in the foods you eat?
- How do seeds travel to the ground so that they can grow into new plants?

These hints should lead them to the ideas that the seeds and spores may be hidden from view, still attached to a plant, somewhere on their way down to the ground, or at varying distance from the parent plant. Remember that there are always cones and ferns along these trails.

Once you have found your specimen, discuss the following.

-Where was this found? Is it close to the parent plant? How far along is it on its journey from the parent plant to the ground?

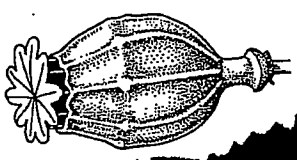
-What is the purpose of its physical structure? Does it protect the new plant? Does it make it more aerodynamic? Does it attract animals?

-If it is near the parent plant, can you see where the seed or spore first grew? Was it in a safe place?

Next, have all of the groups reunite in the Plant Room. Give students the handout accompanying this lesson and provide them with drawing materials. Working in either small groups or individually, they will review the various structures of seed and spore dispersal (provided in the worksheet). They will then design their own seed or spore structure in relation to the parent plant and the surrounding ecosystem. You may want to discuss the benefits of each design in one large group as a way of debriefing.

# EXPERTS in SEED SPREADING

CAPSULE  
(CAJAPAYER SOMNIFERUM)



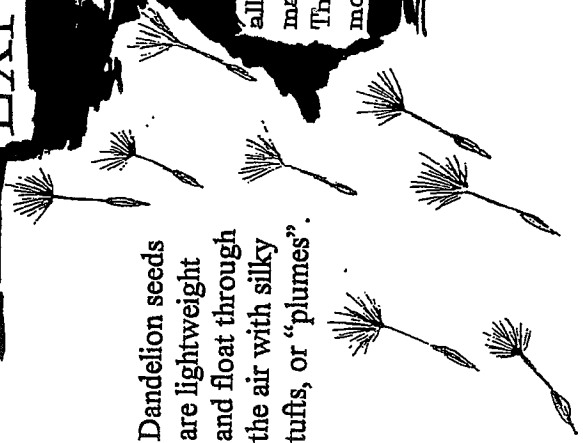
Capsules and legumes shed their seeds at maturity.

There are four main ways that seeds are dispersed. The most common is to be carried by the wind. Other methods include travelling via water, other organisms, or from structures in the plant that propel the seed through the air.

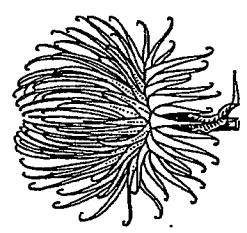
"For seeds must have some way of setting out on their own. If they all dropped to the ground under their parent plants, there would be too many plants in one place for the amount of sunlight, water and soil there. The contest among the young plants for these things would be so great that most of the plants would die."

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Dandelion seeds are lightweight and float through the air with silky tufts, or "plumes".

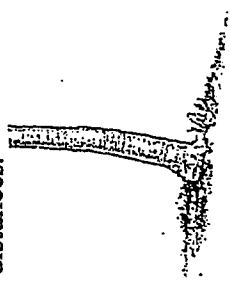
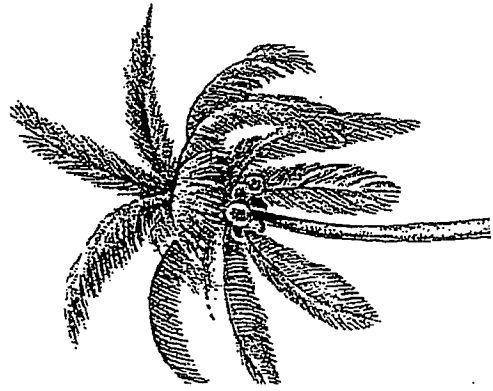


Burdock disperses its seeds by attaching to fur or feathers with its bristly spines.

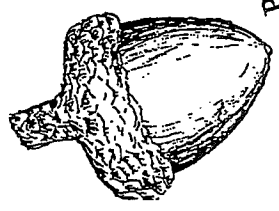
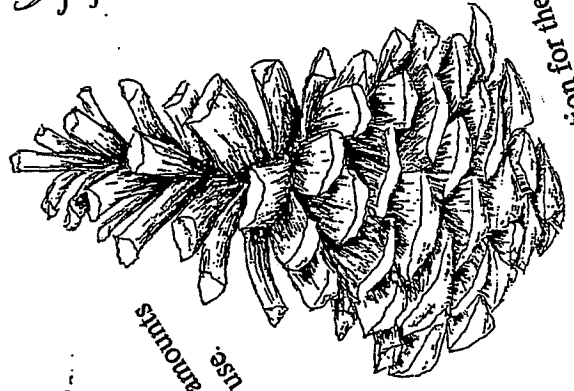


BURDOCK  
(ARCTIUM MINUS)

Coconuts have thick, waterproof rinds that enable them to travel in water for long distances.



Pinets often hide greater amounts of nuts than they actually use.

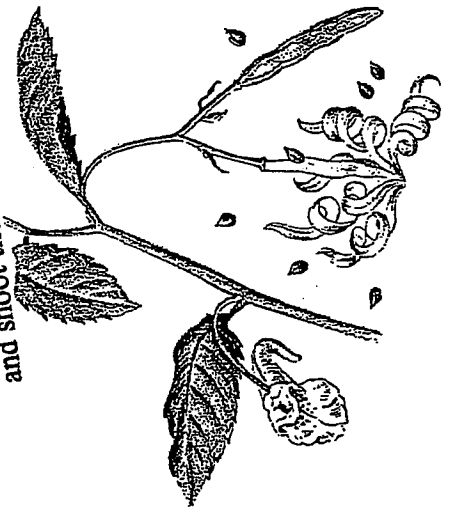


Pine cones offer sturdy protection for their seeds.

Tumbleweeds break off when their seeds are ripe and spread them as they roll.

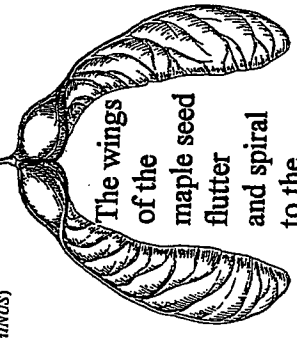


Touch-me-nots shoot their seeds into the air. The valves of its capsules separate suddenly, and shoot the seeds for some distance.

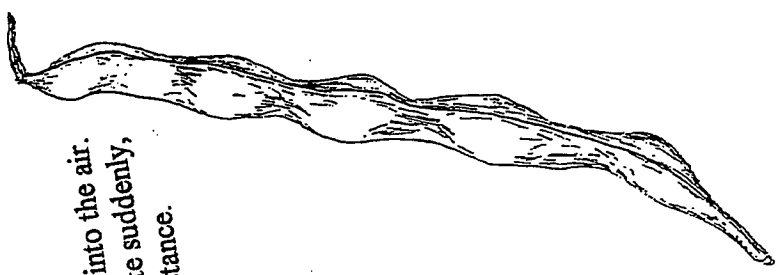
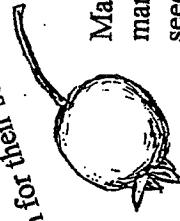


The wings of the maple seed flutter and spiral to the ground.

MAPLE  
(ACER)



Many fruits are brightly colored to attract birds and mammals. These organisms eat the fruit while the seeds pass unharmed through.



## Send Your Seed! 😊

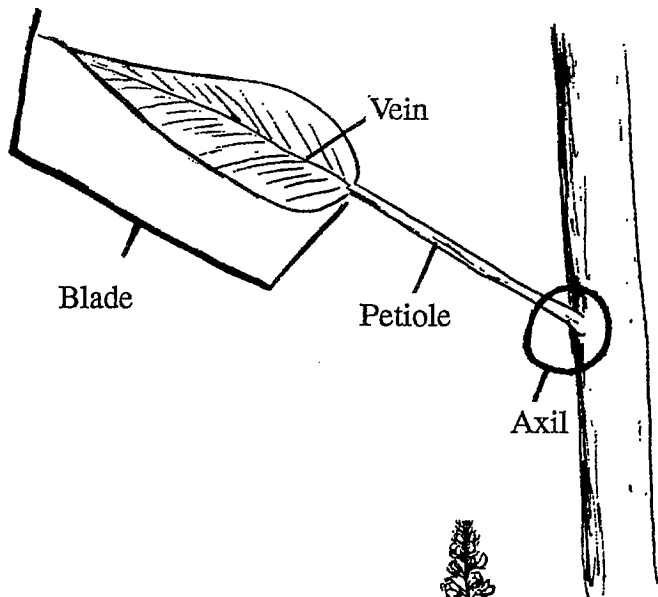
What is the perfect design for sending a seed out into the wild, wild, world? How would you best protect it from danger? Shall it fly or hitchhike on a deer? How can you be sure it makes it into the ground? What are your ideas for a plant living in the woods at Cispus? Play with your brainstorm and designs below.

# Glossary

## Leaf Parts

**Axil**- the angle formed by the junction of a leaf petiole and a stem.

*Think of the image of an axe cutting into a tree, the axe as the petiole and the trunk as the stem. The place where they meet would be the axil.*



**Blade**- the leafy, or "wide" part of the leaf.

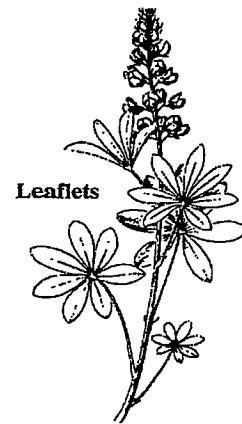
*Think of the blade of a knife. Leaf blades also have "teeth" like a knife.*

**Cuticle**- a thin waxy film that covers the epidermis of a leaf.

*Think of the way nail cuticles protect the skin.*

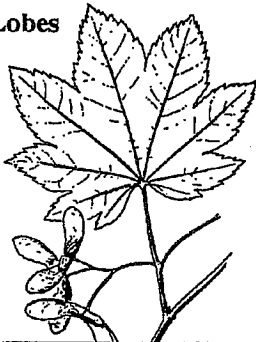
**Epidermis**- the outer tissue of a young root, stem, or leaf.

*epi = above, upon                      derma = skin*



**Leaflet**- in a compound leaf, one of the separate divisions of the blade.

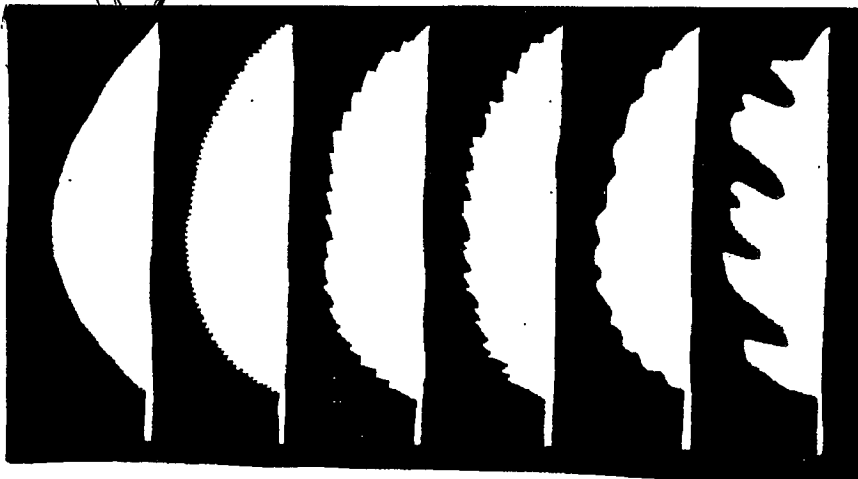
## Lobes



**Lobes**- Extending segments of the leaf margin. See illustration.

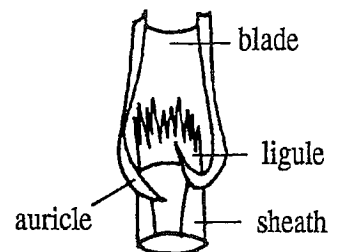
*Think of ear lobes.*

**Margin (leaf)**- the outer edge of a leaf. It may be toothed, lobed, or entire (plain), depending on the species.



Leaf margins

## Grass Parts



*Think of paper margins.*

Mesophyll- photosynthetic tissue located between the upper and lower epidermis of a leaf.

*meso = middle*

*phyll = leaf*

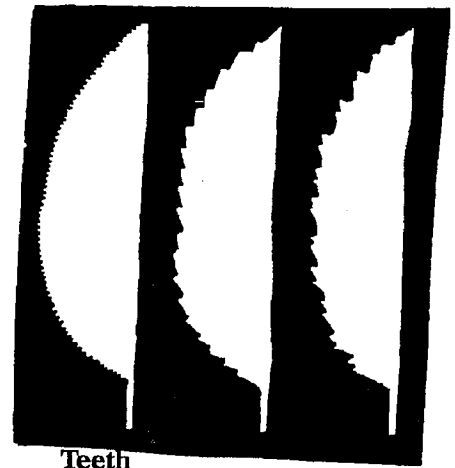
Petiole- the stalk of a leaf.

Phloem- the tissue in leaves, stems, and roots that conducts dissolved food substances.

*Think of "food flow" to go with the "ph" sound.*

Sheath- the lower portion of a grass leaf that is rolled or folded around the stem.

*Think of the sheath of a sword.*



at regulate the passage of air and water to and from a leaf.

*stoma = mouth*

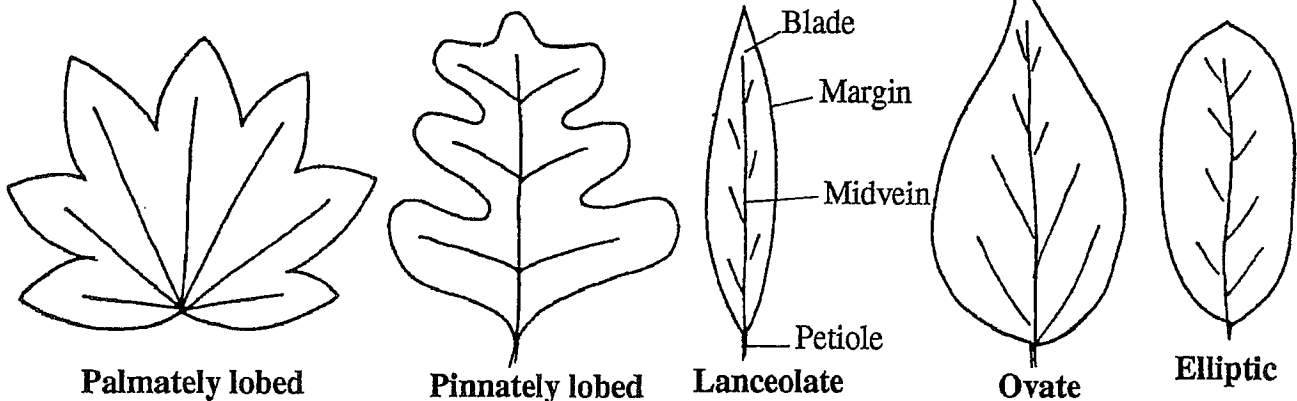
Teeth (leaf)- when the margin of a leaf is jagged (like the "teeth" of a knife).

Veins- the strengthening and conducting structures in leaves.

Xylem- the tissue in leaves, stems, and roots that conducts water and minerals.

## Leaf Shapes

### Leaf Shape



Acute- pointed; used to describe the tip of a leaf or leaf-like structure.  
*Think of a small, or acute, angle.*

Compound leaves- leaves that are distinctly divided into leaflets.

Elliptic- describes a leaf having roughly the shape of an ellipse.

Lanceolate- describes a dagger, or "lance"-shaped leaf.

Oblong- an elongated circular leaf.

Ovate- describes a leaf that is roughly egg-shaped in outline.

Palmate - describes the arrangement of lobes, veins or leaflets of a leaf that all arise from a common point, similar to the bones in the human hand.

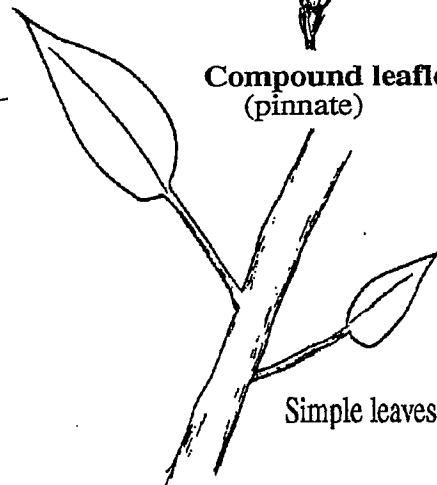
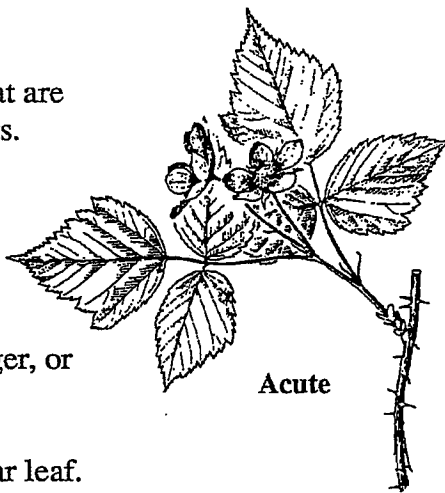
*Think of the palm of a hand or a palm tree.*

Pinnate-with two rows of opposite branches or leaflets, organized like a feather.

*pinna = feather*

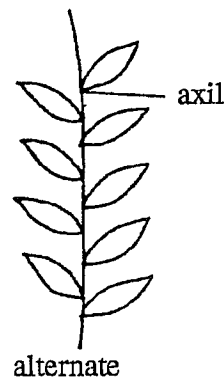
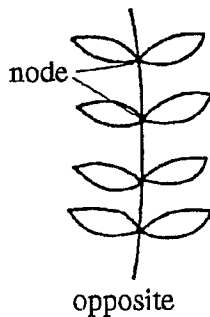
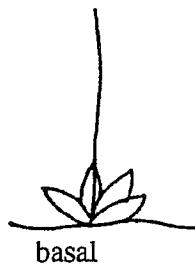
Sessile- a term used to describe leaves lacking a stalk or petiole.

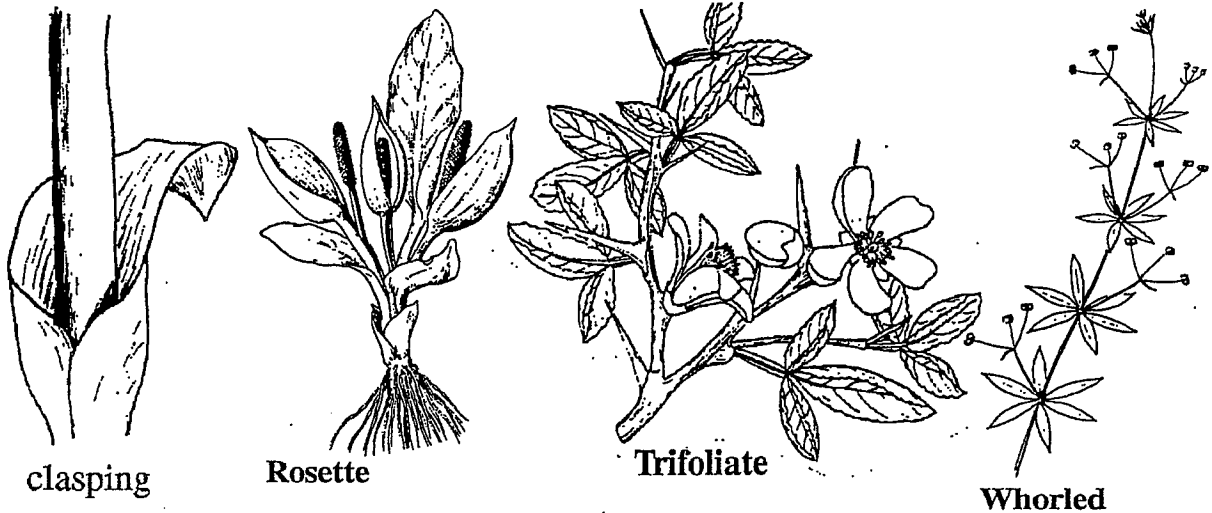
Simple leaves- leaves not divided into leaflets.



**Leaf Arrangement**

**Leaf Arrangement**





Alternate- leaves arranged one leaf per node, alternating on either side of stem.

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*Think of fibers (from "fibro"), running in strands. vas = vessel*

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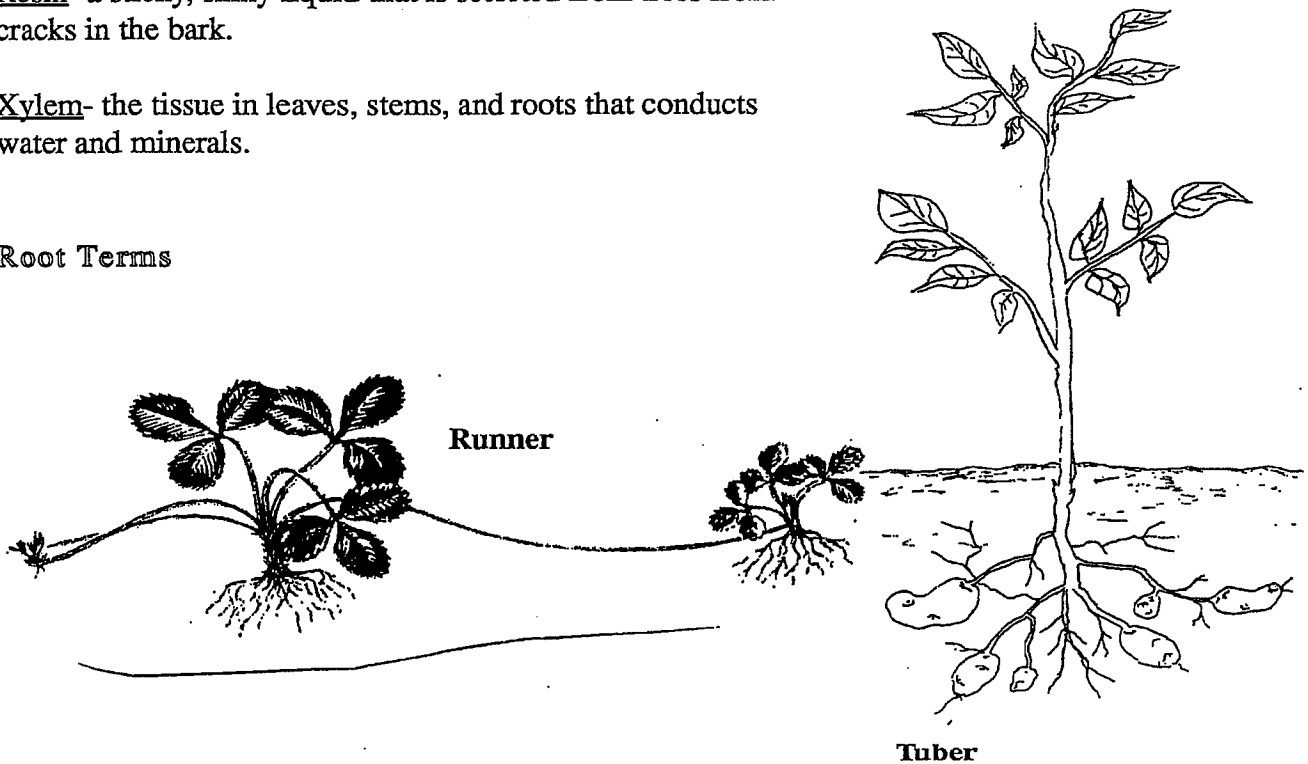
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**Pith**- storage tissue in the center of the stem or roots; may be spongy, soft, or hollow.

**Resin**- a sticky, shiny liquid that is secreted from trees from cracks in the bark.

**Xylem**- the tissue in leaves, stems, and roots that conducts water and minerals.

### Root Terms



**Bulb**- an underground stem with a bud surrounded by layers of thick, fleshy leaves.

**Cambium**- the soft tissue inside roots and stems of plants that produces new xylem and phloem.

**Cortex**- a storage tissue in roots and stems.

**Epidermis**- the outer tissue of a young root, stem, or leaf.

*epi = above, upon                      derma = skin*

**Phloem**- the tissue in leaves, stems, and roots that conducts dissolved food substances.

*Think of "food flow" to go with the "ph" sound.*

**Pith**- storage tissue in the center of the stem or roots; may be spongy, soft, or hollow.

Rhizome- a creeping underground stem.

*rhizo = root*

Root cap- a tissue at the tip of a root that protects the tissues behind it.

*Think of the way a helmet protects.*

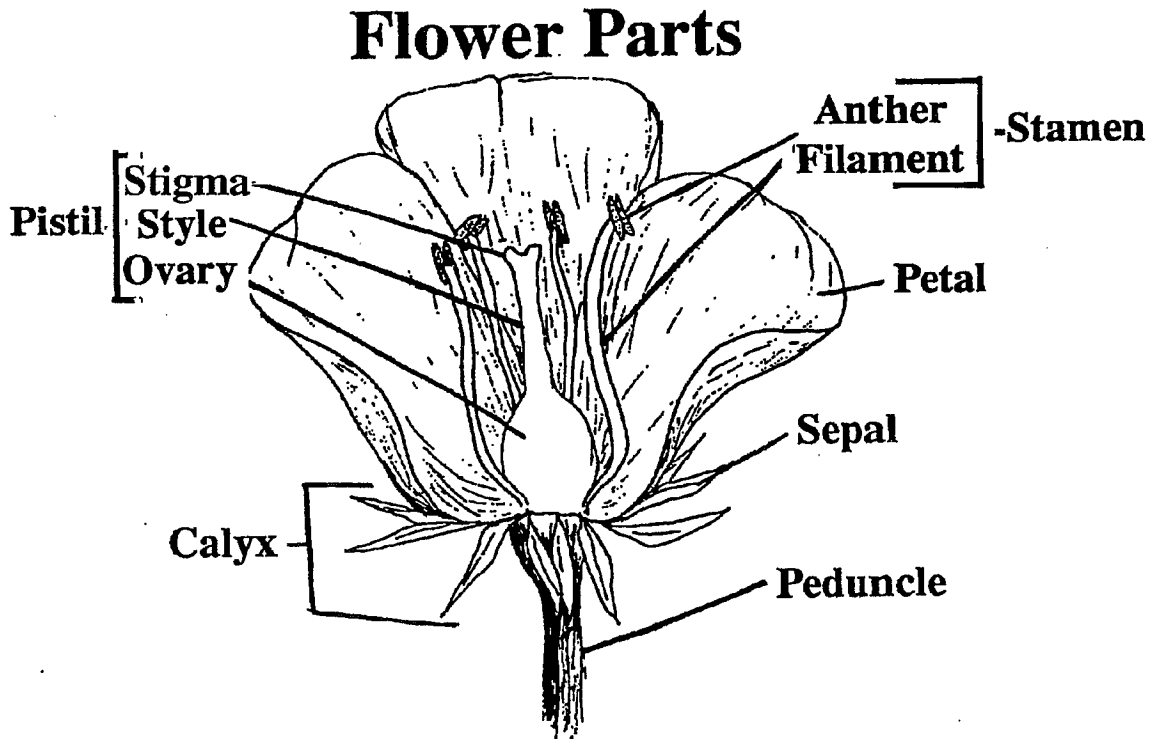
Root hair- a tiny finger-like extension in a young root.

Runner (Stolon)- stem that runs along the ground, rooting and forming new plants at intervals.

Tuber- a swollen area of an underground stem, (also called a nodule).

Xylem- the tissue in leaves, stems, and roots that conducts water and minerals.

### Flower Terms

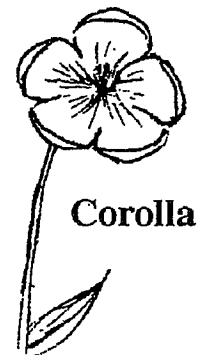


Anther- the portion of the stamen in which pollen is produced.  
*Think of antennae and powder.*

Bract- a modified leaf-like structure growing at the base of a flower or cone.

Calyx- the collective term for the sepals of a flower.

Capsule- a type of fruit that has more than one "chamber", is dry and splits open to release the seeds.



re-

Corolla- a circle of petals, whether they are united or not.

*Word derives from "corona" , meaning crown.*

Inflorescence- a cluster of flowers.

Ovary- swollen area at the base of the pistil, which contains seeds. The fruit is a mature ovary.

ovum = egg

Panicle- a branched cluster of flowers (a type of inflorescence).

Peduncle- the stalk of a flower.

*Think of it as the "pedestal " for the flower.*

Pistil- the female part of a flower concerned with seed production.

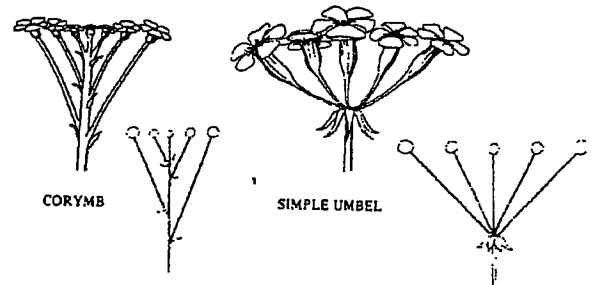
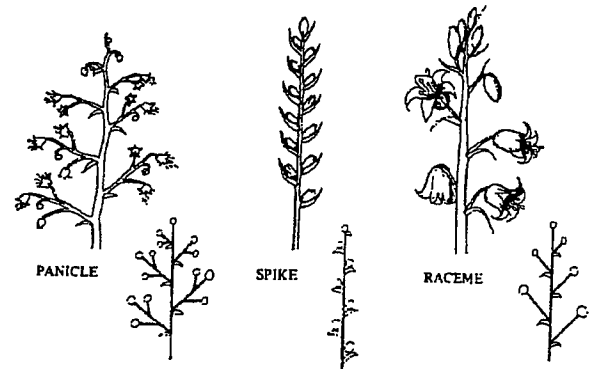
Sepal- an outer set of leaflike structures of a flower, usually in a ring, at the base.

Stamen- the male part of a flower concerned with production of pollen.

*Think of stamen, therefore male.*

Stigma- the sticky tip of the pistil of a flower on which pollen lands.

Style- the slender stalk that connects the stigma of a pistil with the portion that will eventually enlarge to form the fruit.



**Common Inflorescences**

## Cone Terms

Chaffy- covered with very small, dry scales.

\*Recurved- refers to the scales being curved backward or downward.

Scales- thin, flat, overlapping rigid plates which protect the bud of a seed plant.

*Think of fish scales or armor.*

Stalked (cones)- a term in keys that refers to the length of the attachment form the stem or branch to the base of the cone.

## General Plant Terms

Annual- a plant that lives one year.

*annus = year*

**Autotroph**- an organism capable of organizing organic molecules from inorganic molecules (such as oxygen, carbon dioxide, and water).

*auto = by oneself*

*trophos = one who feeds*

**Biennial**- a plant that lives two years.

*bi = two (as in bicycle)*

*ennial = year, like annual*

**Bud**- an undeveloped shoot of a plant.

**Chlorophyll**- the green pigment found in chloroplasts that is a necessary catalytic agent in photosynthesis.

*chloro = green*

*phyll = plants*

**Chloroplast**- a cell organelle (plastid) containing chlorophyll.

*From "plast", think of plastic, and associate this with a plastic container. Think of the chloroplast as a container for the chlorophyll within the cell.*

**Deciduous**- applied to plants that lose their leaves in autumn.

*Sounds like "descend", to fall.*

**Dicot**- a seed plant with two seed leaves.

*di = two*

**Herbaceous**- a term applied to plants that are soft rather than woody, such as wildflowers, grasses, and herbs.

*Think of luscious, (rhyming with -aceous) and softness.*

**Mesic**- describes plant habitats with adequate, moderate moisture.

**Monocot**- the flowering plant that develops a single seed leaf.

*mono = one*

**Perennial**- a plant that lives for more than two years.

*per = year*

*ennial = year, like "annus"*

**Sessile**- a term used to describe leaves lacking a stalk or petiole.

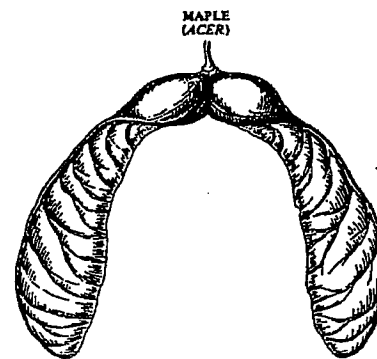
**Spines**- term used for thorns or spikes in plant keys.

**Spore**- an asexual reproductive cell, capable of developing into an adult without fusion with another cell.

**Sporangium**- a hollow structure in which the spores are produced.

**Thallus**- the body of a lower plant such as fungus, alga, moss, or liverwort.

**Terminal**- the end, or tip of an organ.



**Winged seeds**

Vascular tissue- fluid-conducting tissue.

*vas = vessel*

Winged- with one or more thin, flat appendages attached to the side of a structure.

Woody- a term applied to plants made up of tough, hard, fibers, such as trees and shrubs.

### Biological Plant Processes

Adaptation- the process in which a species slowly or rapidly becomes better suited to survive in an environment.

Germination- the growth of a seed in favorable conditions.

Photosynthesis- the process by which chlorophyll transforms energy from the sun into stored chemical energy within a sugar molecule.

*photo = light*      *synthesis = to put together*

Pollination- the transfer of pollen in a flower from an anther to a stigma.

Symbiosis- the relationship in which two organisms live together in close association.

Transpiration- the process in which water is lost from plants.

*trans = across*      *spiration = breath*

# LAYSER CAVE - A GLIMPSE INTO THE PAST

## OBJECTIVES

- \* Students will learn and tell about an amazing discovery of ancient artifacts that occurred in the hills right here at Cispus.
- \* Students will understand, discuss and analyze the impact of vandalism on artifacts.
- \* Students will ponder the unanswered questions of why the ancient peoples left the cave, and why and how Tim Layser found the cave.
- \* Students will discuss the impact of modern man's activities on manmade and natural items of the past.
- \* Students will draw, describe and imagine using an ancient weapon.
- \* Students will reenact the feeling of a dark cave in a game.

### Materials Needed:

2 Blind folds (or 1 for each student)  
Flashlights  
Field Study Guide Book  
Pencils or pens  
Camera (optional)  
Sense of Wonder

Location Needed: The Layser Cave on Layser Cave Road, near Cispus Learning Center; and the artifacts display case at Cispus Ed. Bldg.

## "THE CAVE GAME"

TO PLAY WHEN RETURN TO CISPUS or at the parking area by the cave  
<if time>

1. "We're going to play a short game to help us know what it might feel like to be in total darkness in the cave. Although the native Americans who lived and worked in the Laysen Cave probably had fire light most of the time, it's fun to wonder if they ever had to feel their way around in total darkness."
2. "Everyone study each other very carefully. Look at height, overall size, hair length, jewelry, clothing, eyes, ears, nose. Learn each others' names if you don't know them already".
3. Two people are going to be blindfolded and have to find and name 3 people correctly.
4. Once the 2 people have their blind folds on, the rest of the group moves around and gets all "mixed up", but stays within a reasonable boundary.
5. The blindfolded searchers find the non-blindfolded people and feel their hair, height, hands, jackets, ears, nose, eyes, to see if they can identify the person correctly.
6. Once the 2 blindfolded people find 3 people, they take off their blindfold and let another person get blindfolded and start to try to find 3 people. One blindfolded person doesn't have to wait for the other blindfolded person to finish.
7. The game goes on like this until everyone has had a turn or time runs out.
8. The group sits down together to discuss how it felt to be in total darkness.

## LAYSER CAVE - A GLIMPSE INTO THE PAST

Bring with you to this study:

Flashlight

Field Study Guide

Pencils or Pens

Cameras (optional)

Sense of wonder

1. (A) Why is the cave called Layser Cave?

(B) How long ago do scientists think people lived here?

2. (A) Is the cave bigger or smaller than you thought it would be?

(B) What do you think might be at the far, small end of the cave (opening? dirt? rocks? treasures? etc.?)

(C) Why do you think that?

3. Sketch what you imagine the cave might have looked like while the native people were using it and using the tools found there. Label some of the activities and items in your sketch.



4. How do you suppose Tim Layser thought there would be a cave there? (What made him think that?)

5. Sketch and label the view from the viewpoint on the walk on the way to the Layser Cave.

6. What do YOU think made the ancient people's who lived in the cave leave? Why do you think that?

7. Sketch an Aitl and briefly describe how it was used.

**8. DISCUSS WITH YOUR GROUP:**

Why do you think people stole the native American artifacts from the cave?

How does this make you feel?

What do you think should happen when someone finds an ancient site like this?

9. Think how you would describe the Layser Cave trip to your classmates. List some of the things you would tell about (so that you can remember what to tell them next week).

10. Make a brief presentation to your classmates about the cave when you get back to school. Have your teacher or several students sign here that they heard you speak.

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# NO TRACE LIVING

## Objectives

- \* Students will notice and collect manmade traces inappropriately left in the natural environment.
- \* Students will discuss and debate the impact of man's traces on nature.
- \* Students will understand and explain what no trace living is.
- \* Students will predict before/after (ODS) collection rate of traces left at Cispus.
- \* Students will work as a team to use the found items in an artistic manner, to aid in a future presentation of their learning.
- \* Students will present their findings to an appropriate audience.
- \* Students will play a game that reinforces the idea of no trace living. ("Do you love your environment?")

## **Materials needed for this study:**

Vinyl kitchen gloves

Plastic Collection Bags

A room to start and end in if weather is bad

Glue, glue gun, tape, poster board, felt markers or puff paints

No Trace Game items:

enough "garbage spots" for each player

a sign necklace that says: NoTrace Garbage Collector.

Kids need to bring: Field Study books and Pencils or Pens

# **NO TRACE LIVING**

## **BRING WITH YOU TO THIS STUDY:**

Field Study Book  
Pencils, Pens  
Sharp Eye, Creative Spirit

1. What does no trace camping or no trace living mean?

2. Look (if outside, or "guess-speculate" if inside) around as far as you can see. Does it look like there's much garbage or "traces" of humans around?

PREDICT: What are some traces we might find as we begin to walk?

_____	_____
_____	_____
_____	_____
_____	_____

3. What would be the difference of us leaving a piece of plastic, versus an animal leaving part of his meal or droppings?

4. Why would leaving no traces be important or valuable? (What are some of the harmful effects?)

5. If we were to walk in a certain area the first day of Outdoor School and then another group walked the same path the last day of Outdoor School, which time do you think we would find the most human traces left?

Why do you think that?

6. Let's take our walk now. Get your vinyl gloves and baggie. Keep a sharp eye out for human traces and collect items that shouldn't be there.

7. In teams of 2 or 3, create a cool poster with the items you find. (Possible ideas: a beautiful tree, a crying face, and animal, a sun, star, mountains, a "don't" sign.)

8. Label your poster in such a way that other students could learn from it or get the idea of keeping the no trace beauty of Cispus and/or our own community at home. (Your teacher will display it somewhere.)

9. Discuss/debate with your group how no trace camping or living here at Cispus relates to no trace living at home, school, our community.

Does it matter?

Why or why not?

10. Play the "No Trace Game"

## THE "NO TRACE" GAME

### materials needed:

enough "garbage spots" for the group  
one sign that says, "No Trace Garbage Collector".

Step 1: Everyone except 1 person gets in a big circle, sitting or standing by their specific garbage "spot".

Step 2: The person in the middle is the No Trace Garbage Collector and he is trying to get all the garbage by stealing a seat from them.

He points to one other person in the group, says that person's name, and asks them if they like the environment.

For example: (looking at James) "James, do you like your environment?"

Step 3: James can then say "NO", or "YES, except when people leave \_\_\_\_\_" (candy wrappers, gum, beer cans, pop lids, etc. - choose one).

If James says, "NO", everyone has to move to a new garbage spot, even the No Trace Garbage Collector in the middle. He is trying to get a place in the circle.

If James says "YES, except when people leave (for example) candy wrappers," all the candy wrapper people have to move and the No Trace Garbage Collector tries to get one of their places.

If he succeeds in getting one of their places, that person now moves to the middle and becomes the No Trace Garbage Collector.

Step 4: The game keeps going until most or all have had a turn to be the No Trace Garbage Collector in the middle (or until time runs out).

## *Forest Scavenger Hunt*

**Focus** To encourage the children to explore the forest in a safe and respectful manner.

**Group Size** Entire class (works best with groups of 20 or less)

**Time Required** 30-45 minutes

**Materials** Slips of paper listing the scavenger hunt items

**Physical Setting** This activity can take place a variety of locations. For example, along a trail or in a meadow. The area should be moderately impacted.

- Process**
1. Before beginning stress the importance of not picking living plants. Anything not attached is quite OK though! Also, point out any hazards in the area such as Devil's Cub and Stinging Nettle.
  2. Pair up the students.
  3. Pass out slips of paper listing the items that the children should be scavenging for.
    - 3 examples of food
    - 3 animals
    - 3 animal homes
    - 2 things you don't know
    - 1 sign of humans
  4. Allow the group about 10 minutes to search before bringing the group back together.
  5. Have the group share their findings. Have the pairs lead you to items they found that were either alive or too large to bring back to the group. Discussions can and will lead in many directions.
  6. Once all sharing and discussing is finished have the pairs return the items to the places that they were found.

## *Meet A Tree*

<b>Focus</b>	To identify with a tree using the senses of touch, sight, hearing, and smell.
<b>Group Size</b>	Entire class (works best with groups of 20 or less)
<b>Time Required</b>	30 minutes
<b>Materials</b>	Blindfolds
<b>Physical Setting</b>	Relatively impacted wooded area that contains a variety of trees
<b>Process</b>	<ol style="list-style-type: none"><li>1. Ask the students to find a partner.</li><li>2. Explain that one student from the pairs will be blindfolded. The other student will carefully and gently lead the blindfolded partner to a nearby tree.</li><li>3. The seeing partner will then instruct the blindfolded partner to "meet the tree" by encouraging him or her to explore the tree as high and as low as possible, to hug it, smell it, knock on it etc. The blindfolded student should get to know the tree as well as possible using all senses but sight.</li><li>4. The seeing partner will then lead the blindfolded partner back to the starting point where they can then remove the blindfold.</li><li>5. The formerly blindfolded partner now tries to find his or her tree. *Hopefully the seeing partner has taken them in a circuitous route so that they can not walk directly to the tree.</li><li>6. The roles are then switched and the game is played again.</li><li>7. A discussion following the activity can lead many directions: senses, identification of trees, diversity among forest communities, etc...</li></ol>



**MUSIC and NATURE:**  
**A discussion and experiential exercise.**

- Focus:** To discuss the origins of music and engage in deep listening of natural sounds.
- Group size:** Entire class, then breaking into smaller groups of at most 10 students.
- Time required:** Between one and two hours, depending on how long you wish to extend discussions or the experiential section.
- Materials:** Clipboards (or any hard material to write on), pens/pencils, paper. If it is a wet day, dry things to sit on (such as mats, fabrics, or spare fabric). Make sure the students wear weather-appropriate clothing.
- Physical Setting:** For discussion, anywhere your group can comfortably sit and talk. For the experiential exercise, an area where your group can be immersed in natural sounds where you can easily walk to areas that have a dramatic shift in sounds. For example, from a path in the woods, to a creek, to an open field and then to a pond.
- Process:** Start out in the setting where your discussion is to be held. This discussion will be open ended, since the topic is based upon speculation about the past. It is meant to help students discover links between their own musical interests and the where these might have originated in the lives of people long ago. Below are some guiding questions for the discussion. You may want to have someone recording main ideas as they come up so that you can later link common themes together.
- Stress to the students that there are no definitive right answers that this discussion is leading toward, and that it may end up generating some debate, which is welcomed. The facilitator should encourage the group to be critical in their inquiry, yet receptive to different perspectives. They should know that it is okay to disagree with someone, but each person should be trying to identify definite evidence which supports their argument. Encourage them to be specific, and to draw from personal experience as well as technical knowledge.
- Guiding questions:**
- (1) What types of qualities do you think music needs in order to be considered "really good"? What elements do you enjoy most in music?
  - (2) What inspires people to make music?
  - (3) Where do you think music first came from? What may have been the first instruments?
  - (4) What do you think were the original inspirations for making music?
  - (5) What makes a sound something that can be considered music? Are bird songs music? What about the sounds waterfalls make?
- Next, lead the group on a silent walk. It should include at least three major transitions in the natural sounds. It is recommended that you break off into smaller groups to help the students to focus on being as silent as possible. At several points during the walk, have your group stop, get comfortable, and listen deeply to their surroundings. Then ask them to write any thoughts or feelings that came up as they listened, as well as draw any images they got from the experience. Repeat this process at each new distinct area of sounds.
- At the end of the walk, have discussions in the smaller groups and then have them share their major thoughts/insights/conclusions with the larger group.
- Extension:** Allow the group opportunities later on to refine their ideas in a medium of their choice, such as: formal writing, drawing, dance or musical composition.

## *Sound Maps*

**Focus** To recognize the sense of sound in observing the forest.

**Group Size** Entire class

**Time Required** 30 minutes

**Materials** Paper  
Pencils  
Portable writing surfaces (clipboards, pieces of cardboard etc.)

**Physical Setting** This activity can take place in a forest, meadow, school, yard, etc.

- Process**
1. Each student will be given a piece of paper, pencil and writing surface.
  2. They will place an "X" in the center of the paper to represent themselves.
  3. The students will disperse and find a spot to sit and listen.
  4. As they listen they should draw pictures or write a few words describing the sounds that they are hearing in corresponding spots on their map.
  5. After 5-10 minutes bring the group back together to share their maps. The students may have some of the same sounds, but in different locations on their maps, etc.

## TRUST WALK

**Focus:** Experiencing a blindfolded walk guided by a partner. To experience a heightened awareness of the senses other than vision. To build trust and communication skills between both partners.

**Group size:** Entire class.

**Time required:** Approximately one hour. Can vary according to the limits you set.

**Materials:** Blindfolds for half of the number of people in your class. Extra wristwatches.

**Physical setting:** An area that is familiar to the students and teachers, preferably with varied physical features to provide for interesting experiences. The teacher will set borders according to the size of the group, the time you would like to spend on the activity, familiarity with the area, and safety considerations.

**Process:** (1) Explain the purpose of the walk to your group. The main goal is to get reacquainted with the senses that we usually don't rely on as heavily as we do vision. The second goal is to pay close attention to your partner and to practice communicating nonverbally. The role of the guiding partner is to sensitively and imaginatively allow their partner to have a safe and interesting sensory experience. The role of the partner being led is to pay close attention to the directions and input from the guide, as well as to their own senses and the associations that may come up during sensory experiences. Both partners should be primarily communicating nonverbally, but may obviously speak aloud to ensure safety.

(2) Set the boundaries that the pairs may explore within. It is recommended that you choose an area with varied terrain where all pairs can remain within earshot.

(3) Have students pair up. Give out a blindfold to each pair and make sure each pair has a watch.

(4) Synchronize watches and set a time limit as well as a final meeting place. Thirty minutes of exploring is recommended, giving each partner a fifteen minute blindfolded experience. Set 'em loose.

(5) At the meeting place, give each partner about five minutes to talk with the other about their experiences. Allow them to share important points and insights with the larger group.

**Extension:** Have drawing, painting, writing, or other creative materials available for students after the discussion, in order to expand and reflect upon their sensory experiences.

## Animal Skins

Red Fox  
Muskrat  
Badger  
Bobcat  
Striped Skunk

Black Bear  
Coyote  
Raccoon  
Weasel  
Mink

Spotted Skunk  
Beaver  
Lynx  
River Otter

1. \_\_\_\_\_ is a seldom seen cat. It is nocturnal, and prefers dense coniferous forests. This cat preys on small mammals, particularly snowshoe hares.
2. \_\_\_\_\_ is the most common wild cat in the state of Washington, but it is also seldom seen. It is smaller than #1 and prefers forests or semi-arid land. It preys on small mammals.
3. \_\_\_\_\_ is a "cousin" of the dog. It is very adaptable, and is common in all of Washington state. This animal has a very distinctive voice. It yips, barks, howls, and wails, sometimes alone, but often with "friends". 25% of its diet is decayed meat, but it eats whatever it can find, including small mammals, birds, and fruit.
4. \_\_\_\_\_ is a small member of the dog family. It is found throughout Washington state in open woods and brush land. This animal eats small mammal, birds, and fruits.
5. \_\_\_\_\_ is usually found near water. It is becoming a pest in towns and suburban areas. This animal is noted for its black face mask and ringed tail. It is curious and mischievous and eats frogs, crayfish, insects, eggs, and fruit.
6. \_\_\_\_\_ is a member of the weasel family. It prefers to live in the drier climate of Eastern Washington. This animal is a powerful digger and a fierce fighter. It eats rodents dug out of the ground, birds, eggs, snakes, and frogs.
7. \_\_\_\_\_ is found in a wide variety of habitats throughout Washington. It has a very slim body and is an excellent hunter. It is one of the few animals that will kill more than it can eat. This animal eats small mammals and birds.

# ***THE MUSHROOM NICHE***

**Focus:** To gain an understanding of the role and function of mushrooms and other macrofungi through guided inquiry and discussion.

**Group Size:** entire class

**Time Required:** 1-1.5 hours

**Materials:** *The Cispus Hike Plant Guide* or handout *Two-Cycled Life... Teacher's Mushroom Fact Sheet*  
*\*A Learning Guide to the Macrofungi of the Cispus River Drainage*  
(available in the office)

**Physical Setting:** The Covell Creek or Braille Trail, or any wooded place that has a good crop of mushrooms. (A mushroom display can be found in the Plant Room that diagrams many points of this lesson.)

**Process:** 1. Begin your walk on one of the trails, and have the entire group on the lookout for mushrooms and other macrofungi (such as the bracket fungi that grow off the side of old stumps and some trees). Play with this! Both children and teachers can have a fun time as you begin looking more closely at life in the woods. When a good crop of mushrooms has been spotted, stop for a short investigation. **REMEMBER: SOME MUSHROOMS ARE EXTREMELY POISONOUS- WARN STUDENTS OF THIS!**

2. Introduction and Parts of the Mushroom: It may be best to begin with a short talk about mushrooms. (The *Teacher's Mushroom Fact Sheet* may assist you) Look at the mushrooms and compare them to a nearby vascular plant, such as a fern. Ask the following questions:

- What are some major differences that we can see between a green plant and a mushroom? (Do they both have leaves, are they both the same color?)

- Plants are green because they contain a substance called chlorophyll which allows them to change the sun's energy into food. What does the color of these mushrooms tell you? If they don't get their food from the sun, where might they get it? Where do we get our food?

Learning about the parts of a mushroom may help students answer these questions. (You may wish to refer to the handout "*Two-Cycled Life...*") Point out the above-ground parts of the mushroom. Can the class guess what different parts do? Refer to the diagram on the *Two-Cycled Life...* and explain that the above-ground part of a mushroom is only the reproductive body. The underground mycelium is actually the real plant and mushrooms are only spore-producers. How does this compare to the life of a green plant?

3. Mushrooms are heterotrophs: If there seems to be an abundant number of mushrooms in season, you may wish to continue on the trail and look for another colony of fungi. Find some that are growing out of old organic matter or bracket fungi on a stump or tree. Explain the meaning of a *heterotroph*. Explain the differences between a *saprophyte*, a *parasite*, and a *symbiotic* relationship. Look again at the mushrooms and fungi near you. Which are they? Most mushrooms are saprophytes, but can the class find a bracket fungi growing on a live tree as a parasite? What are some other heterotrophs that they can think of? (i.e.- any animal, including themselves!)

4. Mushrooms are decay organisms: What does the class think about this statement? Carefully scoop up a handful of soil from the side of the trail and take a close look at it. Notice that it is composed of dead organic matter, including old fir needles, rotting wood, and decaying leaves from trees and plants. Explain the role mushrooms have in the decomposition process. Find some mushrooms on an old log. Are there signs that the mushrooms are breaking the rotting wood down? What about the human body? How does it get the nutrients it needs?

5. Mushrooms can prevent erosion: Continue until the trail reaches the creek. Can you find a place where erosion has occurred, exposing the roots of trees and plants? What is preventing the bank from collapsing all the way? Explain that the mycelium of mushrooms, although not roots, can anchor soil in place and keep it from eroding. Where are some unusual places that mushrooms often grow that vascular plants don't (or can't)? What are other benefits that mushrooms may have over green plants?

*\*This lesson may be extended by taking along a copy of A Learning Guide to the Macrofungi of the Cispus River Drainage, which will provide a simplified keying guide for mushrooms and fungi on your walk.*

# THE TEACHER'S MUSHROOM FACT SHEET

## *A Teacher's Reference for the Parts, Life Cycle, and Niche of Macrofungi*

Mushrooms are very unique plants- in fact, they are not even really plants at all. Some scientists refer to them as the "Third Kingdom" because they share certain qualities with both plants and animals. Mushrooms have no chlorophyll and thus do not get their energy for food from the sun like green plants do. Because of this, they do not have the same structural parts. They do not have roots, stems, or leaves. Such an organism is called a **thallus**. Below are the parts of a mushroom and their functions:

The **cap** is the top-most part of the mushroom and protects the gills as the budding mushroom grows.

The **gills** are where spores are produced.

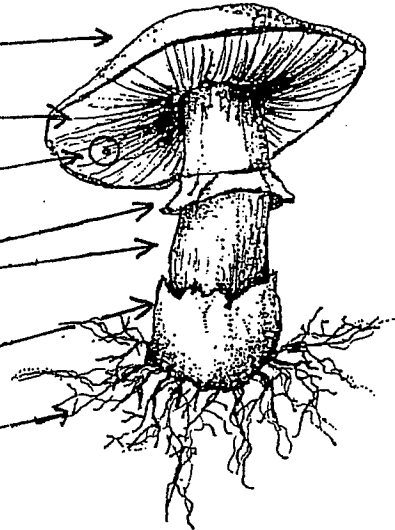
**Spores** drop from the mature mushroom and grow into young mycelium.

The **velum** is where the immature cap was attached to the stipe.

The **stipe** is the stalk of the mushroom.

The **cup** is the veil that protected the budding mushroom before it pushed through the soil.

**Mycelium** are the tangled fibers that keep the plant alive. They absorb all the nutrients the plant needs to live from its surroundings.



### *How do mushrooms get food?*

Mushrooms cannot make their own food. Such an organism is called a **heterotroph**. Humans, animals, and mushrooms are all heterotrophs. They rely on a food source outside their own bodies in order to receive energy. Mushrooms and other macrofungi are either **saprophytes** or **parasites**. They get their food directly from the soil, vegetation, or host that they are living on. *Saprophytes* feed off of non-living organic matter, such as a rotting tree, the forest floor, or old vegetable matter. *Parasites* feed off of a living host. Many bracket fungi attach themselves to living trees, where they will feed off of the tree until they kill it.

### *What is the life cycle of a mushroom?*

Mushrooms have a two-stage lifecycle. The above-ground mushroom is only the reproductive organ of the plant. Under the soil is the **mycelium**, fibrous strands that make up the real body of the organism. When spores are dropped from a mushroom, they germinate into strands of mycelium. If conditions are right, a mature mycelium may bud a mushroom. Mushrooms are where new spores will grow; this is their only function. The only reason they push through the soil is to spread spores.

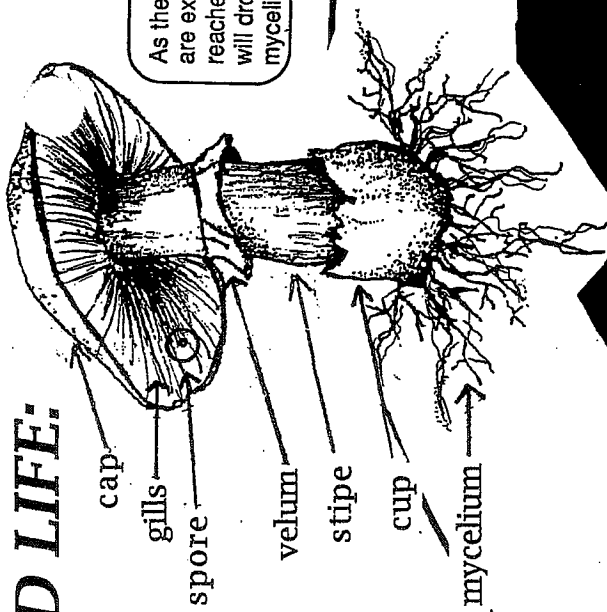
### *What does the mycelium do?*

It is the root-like mycelium of a mushroom that does the work of changing organic matter into food. They release digestive enzymes that break the complex molecules of organic matter down into simpler molecules. Some of these are then absorbed by the mycelium in order to feed the plant. Others are released into the soil. In this way, mushrooms are essential decay organisms. As they gather food, they speed up the decomposition of organic matter.

Mycelium are useful in another way. The fast-growing, fibrous strands have a very large surface-to-volume ratio with the soil they contact. Because of this, they are also helpful organisms in the prevention of erosion. They are not reliant on the sun, and can therefore grow in places where green plants can't.

# TWO-CYCLED LIFE:

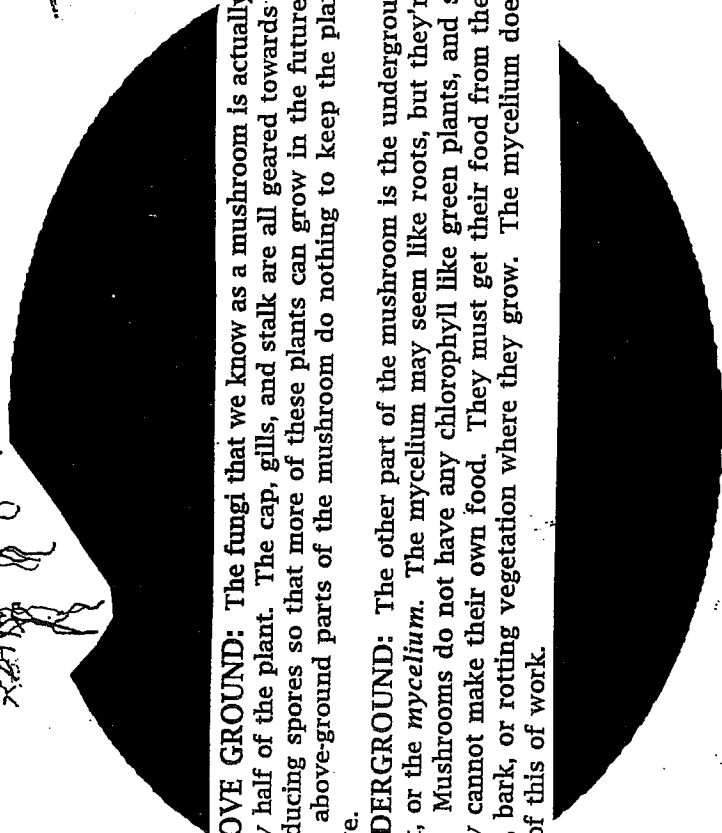
# MUSHROOM and MYCELIUM



The **SPORE** falls from the gills to the ground. Insects and the wind may carry a spore quite a distance from the parent mushroom.

As the cap opens and the gills are exposed, the mushroom has reached maturity. From the gills will drop spores, from which new mycelium will grow.

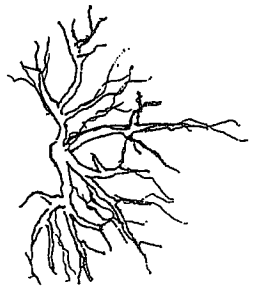
The mushroom will continue to grow as it raises its cap above the ground. This mushroom has not yet opened its cap to expose its gills, so it is not yet mature.



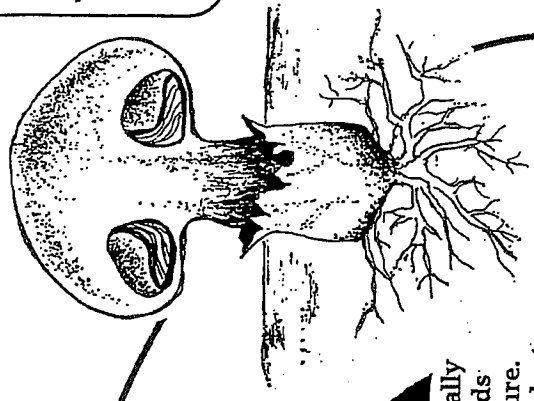
**ABOVE GROUND:** The fungi that we know as a mushroom is actually only half of the plant. The cap, gills, and stalk are all geared towards producing spores so that more of these plants can grow in the future. The above-ground parts of the mushroom do nothing to keep the plant alive.

**UNDERGROUND:** The other part of the mushroom is the underground part, or the *mycelium*. The mycelium may seem like roots, but they're not. Mushrooms do not have any chlorophyll like green plants, and so they cannot make their own food. They must get their food from the soil, bark, or rotting vegetation where they grow. The mycelium does all of this of work.

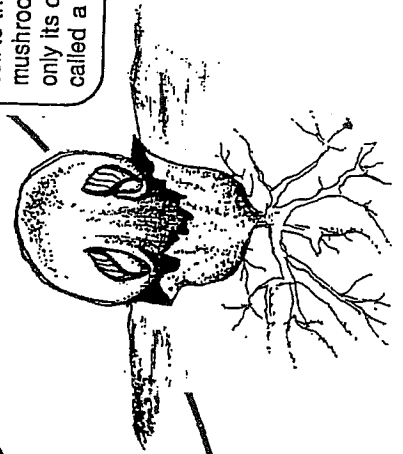
If the spore finds ample food and nutrients where it lands, it will grow as tough, fibrous strands called **MYCELIUM**.



The young mycelium will continue to grow, spreading out in many directions. As the mycelium matures, it may bud a mushroom.



The young mushroom may push through the soil to the surface. A mushroom who has only its cap exposed is called a **BUTTON**.





# WHAT'S FOR DINNER?

## AN ECOLOGICAL ROLE PLAY

**FOCUS:** To understand how different organisms in the forest get their energy by acting out different ecological relationships.

**Group size:** Whole class

**Time required:** 30 minutes

**Materials:** A copy of the definitions on this page, to refer to during the role play. Willingness to be creative and silly.

**Setting:** The Plant Room or any other place where your students will have enough space to act out their roles.

### Process:

Have your group divide into thirds. Inform them that they have now been magically transformed into a forest ecosystem, and that they each will be acting out different roles and playing out how they inter-relate.

The big question of this role play is:

*How do you get your energy to survive?*

Assign each group the title of autotroph, saprophyte or parasite. Review the terms below, noting that the saprophytes and parasites are in a larger group, called the heterotrophs, but have different roles within that category.

An **autotroph** is an organism that can make its own energy (e.g. any green plant).

A **heterotroph** is an organism that gets its energy from organic matter outside its own body (e.g. humans, mushrooms, bracket fungi).

- A **saprophyte** is an organism that gets its energy from dead or decaying organic matter (e.g. humans, mushrooms, rabbits).

- A **parasite** lives in or on the body of another organism (called a host). They get their food from the host, which may be harmed or killed by this relationship.

**Symbiosis** is the relationship in which two organisms mutually benefit each other, by giving and receiving energy and/or nutrients.

Next, have each of the groups brainstorm on how they will act out each of their roles. You may guide them with the following questions:

- What kind of noise would a parasite make?
- How does your character move?
- How does your group interact with the other groups?

You may want to get more specific with the roles that are assigned. For example, in the autotroph group you could assign a certain number of trees, ferns, shrubs, wildflowers, etc.

After a while of playing out these roles, you may have the groups switch their categories and work on new roles.