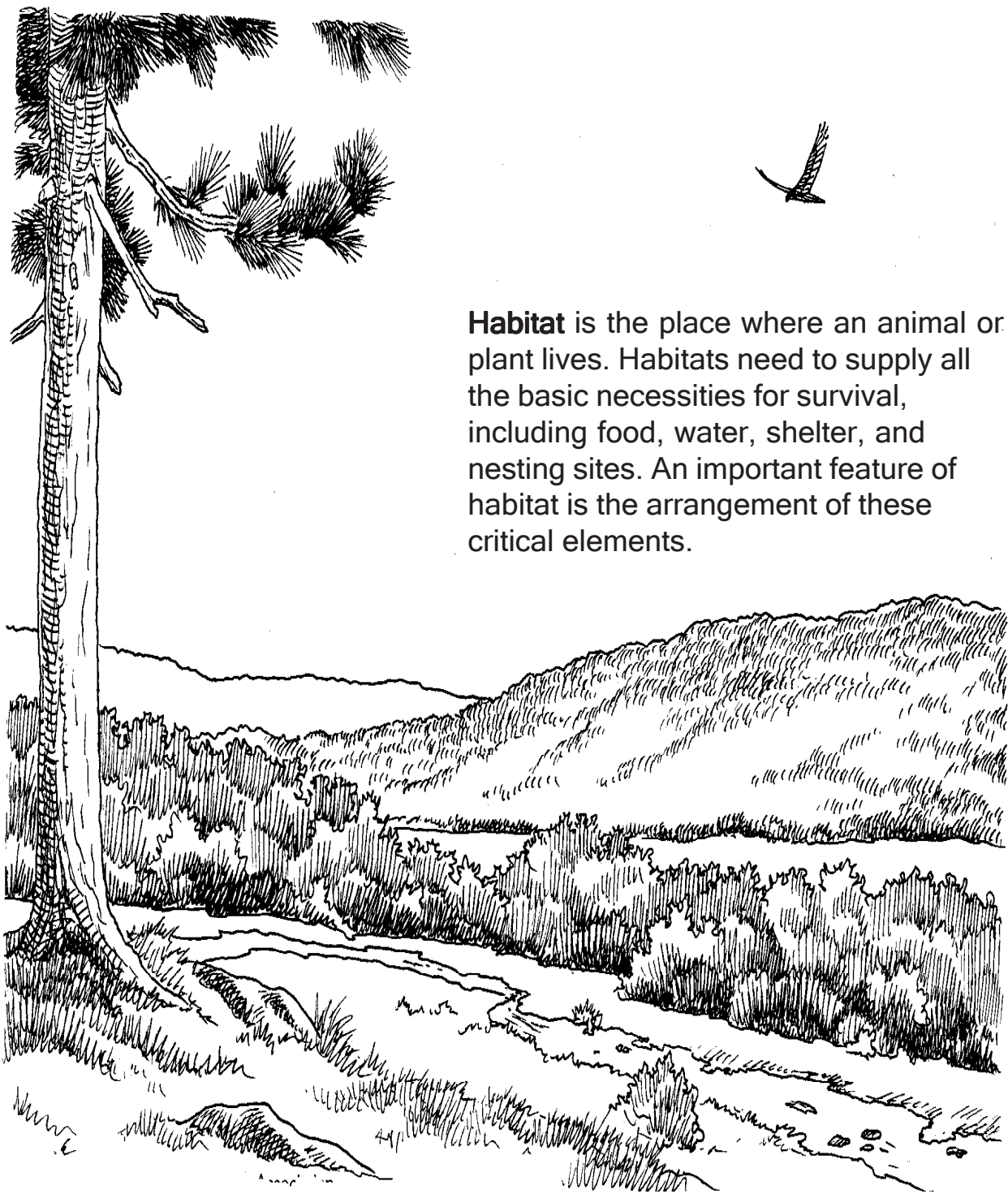


The Forest

What is Habitat?	F-2
Forest Habitats	F-5
Forest Type at Hawk Mountain	F-6
What is a Tree?	F-7
Why are Trees Important	F-8
Identification of Eastern Trees	F-9
Getting to Know a Tree	F-17
Forest Conservation	F-20
Litter	F-24
Forest Word Search	F-25
Mushrooms	F-26
Native Wildflowers.....	F-29

Topic
Page

What is Habitat?



Habitat is the place where an animal or plant lives. Habitats need to supply all the basic necessities for survival, including food, water, shelter, and nesting sites. An important feature of habitat is the arrangement of these critical elements.

What is Habitat?

continued ...

*Topic
Page*

The area that an animal travels day-to-day is called its **home range**. Food, water, and cover all must be within an animal's home range for it to be a good habitat. Different animals require different habitat types. Red-tailed hawks need open meadows for hunting, and tall trees for roosting and nesting. Barred owls prefer old-growth forests. The habitat of a brook trout is a cool, clean, running stream. That same trout stream may be part of an eagle's habitat, and one day a trout may be its meal. Both animals depend on clean, clear water. Some animals require smaller habitats than others do. For example, the habitat size of a chipmunk is about half an acre while that of a black bear is about 50,000 acres. Many different kinds of animals share habitats and **resources** within habitats.

Biologists study the many habitat requirements of animals. All parts of the habitat must be taken into account to answer such questions as: What kinds of food items are necessary for this animal during each season? How much of a certain kind of food is necessary to ensure the health of this animal? What kinds of plants provide cover for this animal? The research conducted by wildlife biologists provides information that helps conserve animal populations.

Habitat is critical for animal survival. One of the main causes of declining wildlife populations is the loss of habitat. Growing human populations put a great strain on wildlife as more and more natural areas are cleared for housing, or industry. Historically, the loser in this competition for space between humans and wildlife has been wildlife. Besides physically taking up wildlife habitats, humans also damage the quality of natural areas with a variety of pollutants. Environmental **toxins**, including pesticides, waste dumped into waterways, and acid rain, all contaminate the environment and harm wildlife.

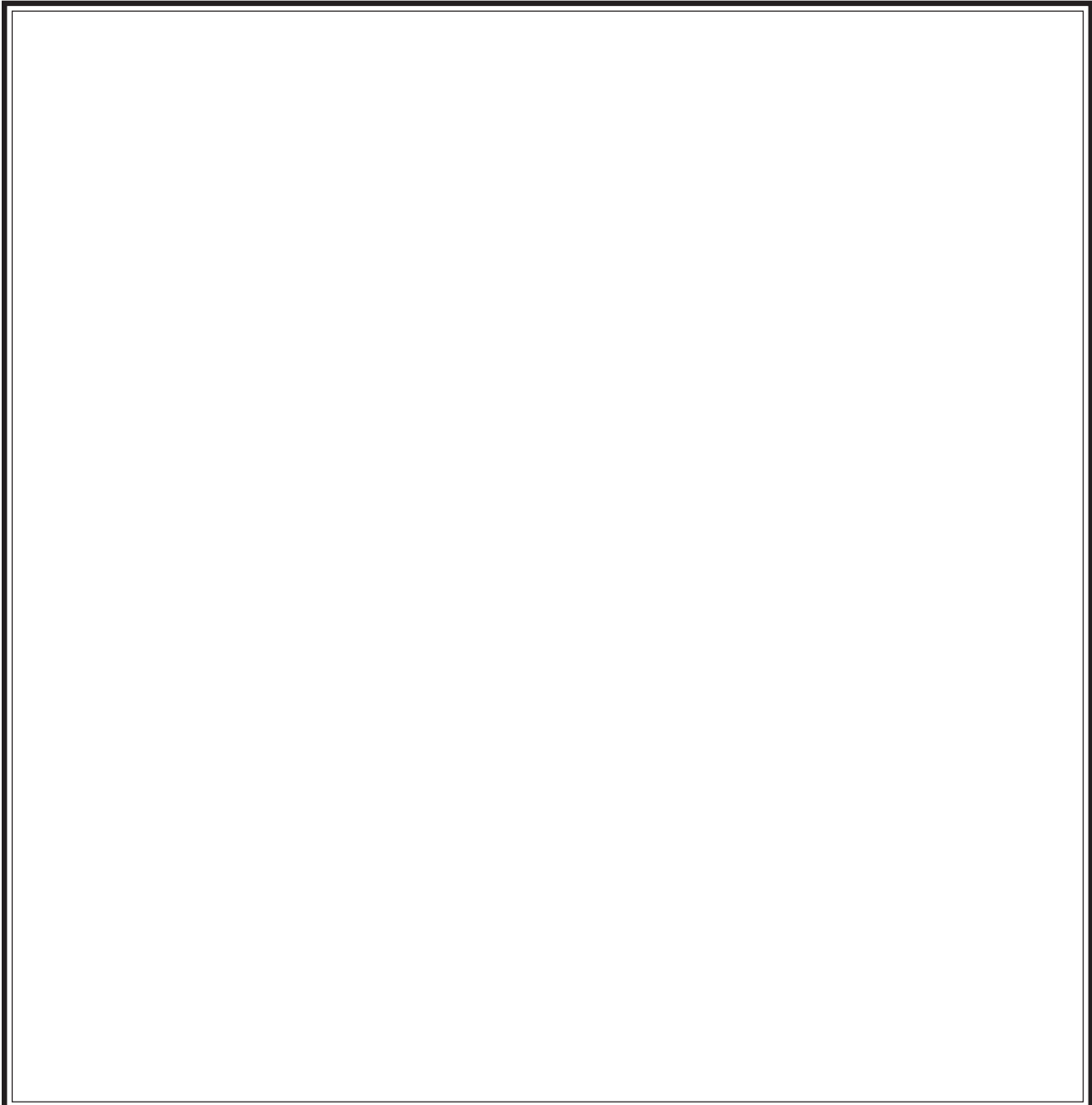
To protect wildlife, humans need to protect wildlife habitats. By studying wildlife, biologists can determine particular species' needs and use this information to manage areas for wildlife. Habitats can be created or manipulated to become more suitable for certain species, if needed. Critical areas like Hawk Mountain can be set aside as **sanctuaries** or preserves. Pollutants can be removed. You can help wildlife by creating appropriate habitat in your backyards, local parks, and schoolyards. By putting up nest boxes and providing native plants that wildlife can use as food or shelter, individuals can make a difference in the success of some wildlife species.

*Activity
Page*

What is Habitat?

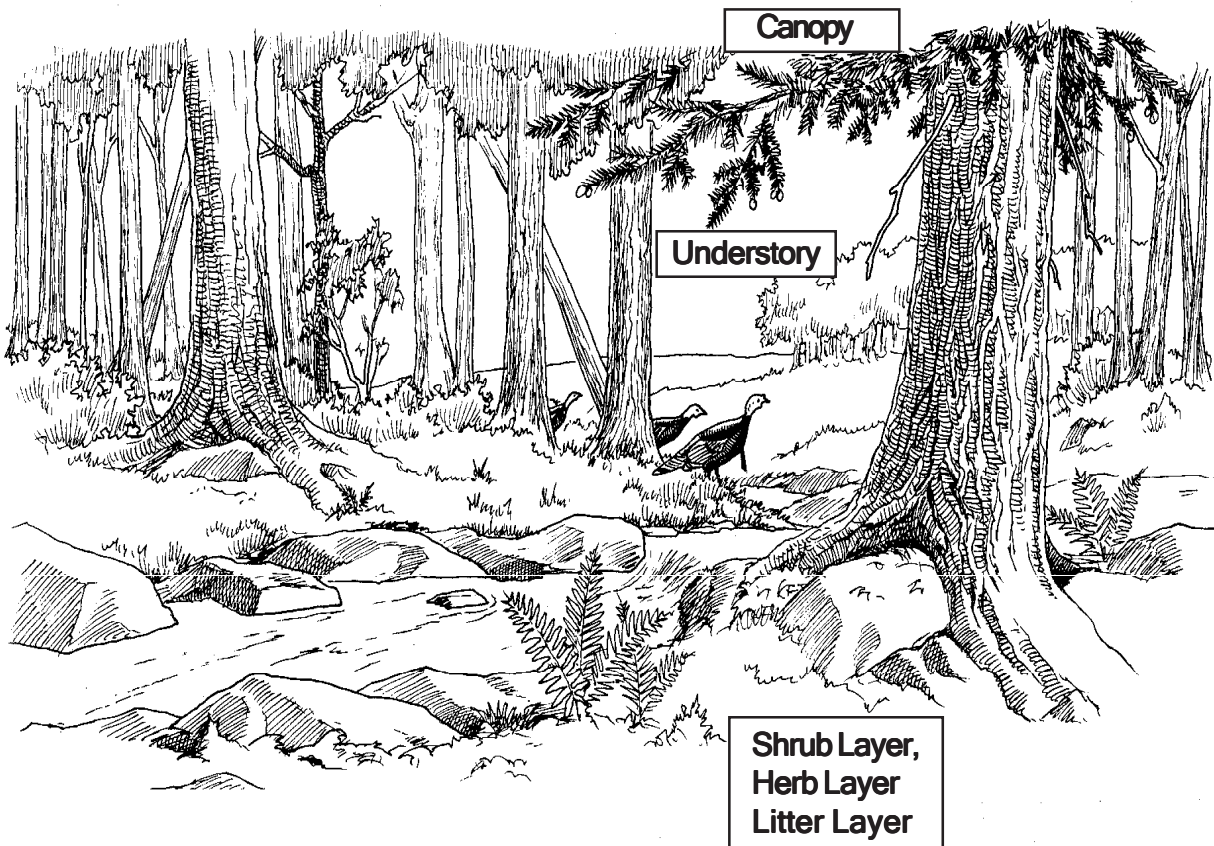
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Research the habitat needs of an animal of your choice. In the space below or on a separate piece of paper, draw a picture of this habitat. Draw the animal, and the places it might make its nest or raise young. Include the plants and/or animals that your animal might feed on and where it might get water.



Forest Habitats

Topic
Page



Forests are important habitats for many plants and animals. Plants are an important component of all forests. Within the forest, plants are arranged in vertical layers. The tallest trees form the **canopy**. Beneath the canopy is a layer of smaller tree species called the understory or **sub-canopy**. The next lower level is the shrub layer, and beneath that, the herb layer. Last is the **litter**, a layer of dead, decaying leaves and wood. This layering is especially evident in older forests. Moist forests have more layers than dry forests.

Mammals, birds, reptiles, amphibians, and arthropods are some of the many animals that live in forests. Here they find shelter, food, water, protection from predators, and

a place to raise their young. Humans also depend on forests. Forest plants are used to make books, pencils, firewood, baseball bats, furniture, and medicines. Forests also provide hiking areas, clean water, oxygen, beautiful scenery, camping areas, wildlife watching opportunities and solitude. Foods supplied by forests include nuts, fruits, and maple syrup.

Plants in the forest change as distance from the equator (latitude) as well as distance above sea level (altitude) change. Both of these factors have an effect on the average temperature, and temperature, in turn, determines the species of trees that can live in an area. The amount of rainfall in a particular area also has an effect.

Forest Type at Hawk Mountain

Forest Type at Hawk Mountain

The forests of Hawk Mountain Sanctuary are typical of those in the Central Appalachians. Hawk Mountain forests are in a **biome** that ecologists call the **mixed deciduous forest**. This term refers to the mixture of deciduous tree species that make up most of the forest; in comparison, the number of evergreen or conifers within the forest is low. Hawk Mountain is a Chestnut Oak forest.

Forests at Hawk Mountain look differently now than back in the 1700s. These forests have been cut several times for lumber, mine timber, and fuel for the charcoal industry. So, what we see today at Hawk Mountain is not an old-growth forest but maybe a **fourth-growth** forest.

Before the 1900s, the American chestnut was the dominant tree species in these forests. A fungus called the chestnut blight was accidentally introduced from Chinese chestnut trees imported to New York. The fungus attacks the tissues beneath the tree bark, destroying the tree's nutrient transport system. The American chestnut had no defense against this new disease, and by 1935 most American chestnuts were gone—victims of the blight. Even today, young

chestnuts continue to sprout from the roots and stumps of dead trees, but eventually the blight succeeds in killing these young trees. Trees seldom grow larger than about 15-20 feet.

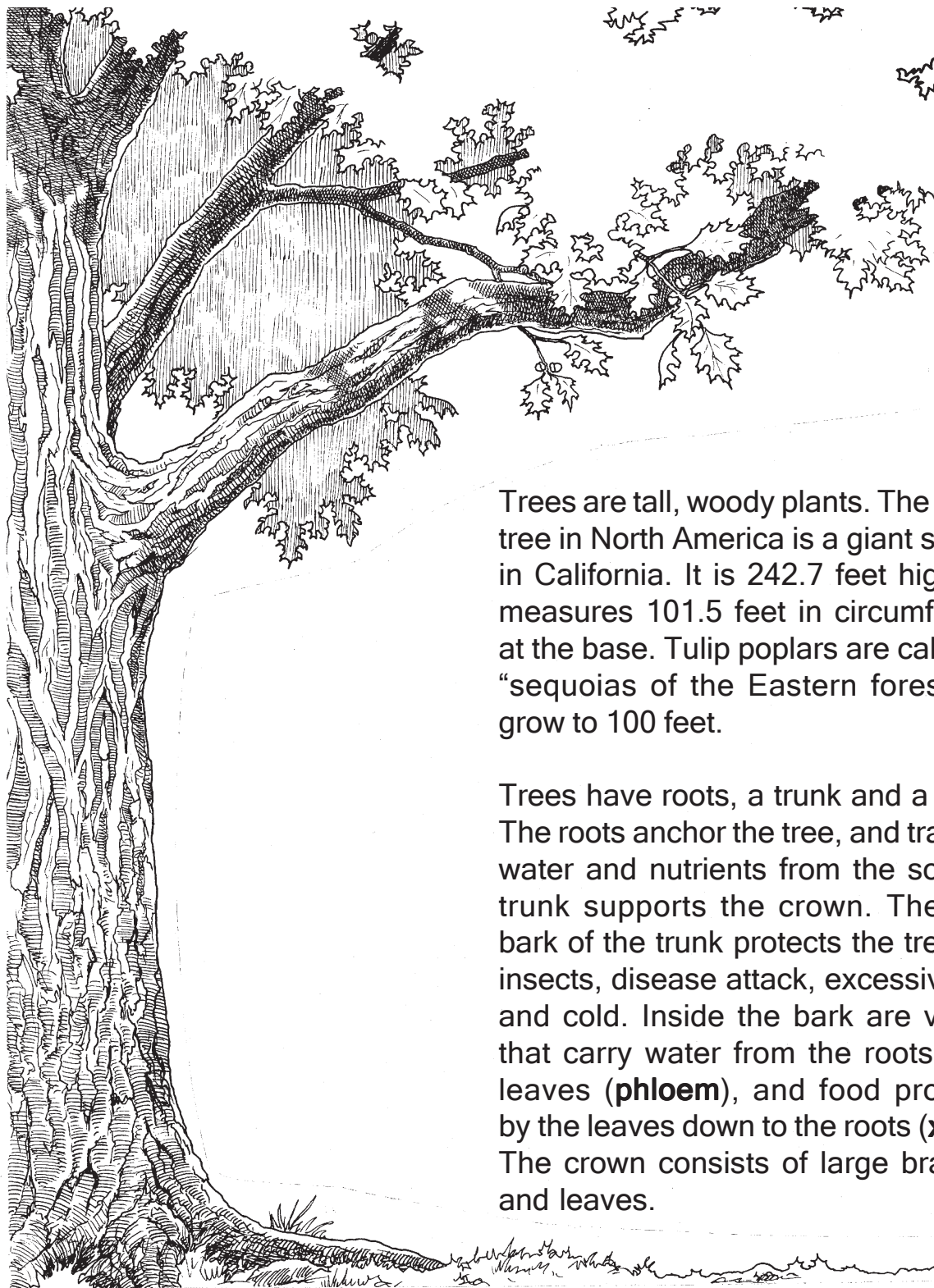
Some small chestnut trees do bear nuts, and some grow to produce seedlings. Over time, natural selection may produce a blight-resistant strain of the American chestnut. If so, the chestnut once again may dominate our forests.

When the American chestnut vanished, the canopy layer of the Chestnut-Oak mixed deciduous forest came to be dominated by a mixture of red oak, white oak, and chestnut oak. At Hawk Mountain, oaks are most dominant on the ridgetops where the soil is dry. In the lower, wetter areas, oaks give way to tulip poplars (on warm south-facing slopes and lowlands) and eastern hemlocks (in the cooler, north-facing ravines). Evergreen species found in the canopy include white pine, pitch pine, and eastern hemlock.

Beneath the canopy layer in the understory, witch hazel, striped maple, and service berry are common deciduous shrubs. Evergreen shrubs include mountain laurel and rhododendron, blueberries, sheep laurel, etc.

What is a Tree?

Topic
Page



Trees are tall, woody plants. The largest tree in North America is a giant sequoia in California. It is 242.7 feet high, and measures 101.5 feet in circumference at the base. Tulip poplars are called the “sequoias of the Eastern forest” and grow to 100 feet.

Trees have roots, a trunk and a crown. The roots anchor the tree, and transport water and nutrients from the soil. The trunk supports the crown. The outer bark of the trunk protects the tree from insects, disease attack, excessive heat and cold. Inside the bark are vessels that carry water from the roots to the leaves (**phloem**), and food produced by the leaves down to the roots (**xylem**). The crown consists of large branches and leaves.

Why are Trees Important?

Life on Earth depends on a photo-chemical process called **photosynthesis**. Only green plants (which include trees) can photosynthesize.

Here is how photosynthesis works: Water is taken in through the roots of the plant, then transported to the leaves; carbon dioxide is taken in through pores (stomata) on the surface of the leaves; light energy is absorbed from the sun into the green chlorophyll pigment in the leaves. As a result of chemical reactions that occur in the **chloroplasts** of the leaves, plant food (sugar) is produced, while oxygen and water are released as by-products.

Plants begin all food chains. Through photosynthesis, the sun's energy is converted into plant food, which may later be eaten by animals.

Although you may not think of a tree as part of your diet, many parts of trees are eaten by both people (fruits and nuts) and wildlife (leaves, buds, twigs, and bark of trees). Trees begin many food chains.

One of the by-products of photosynthesis is oxygen (O_2), a gas that humans and animals need for survival. Trees producing a large portion of the Earth's oxygen supply and are critical to human existence.

Trees also make our planet a more wonderful place to live. We seek trees for shade, for shelter, to admire their strength and their beauty.

Identification of Eastern Trees

Topic
Page

More than 800 different species of trees grow in North America. More than half are found in the eastern United States. How is it possible to identify one particular from these many species?

Here are some clues to help you.

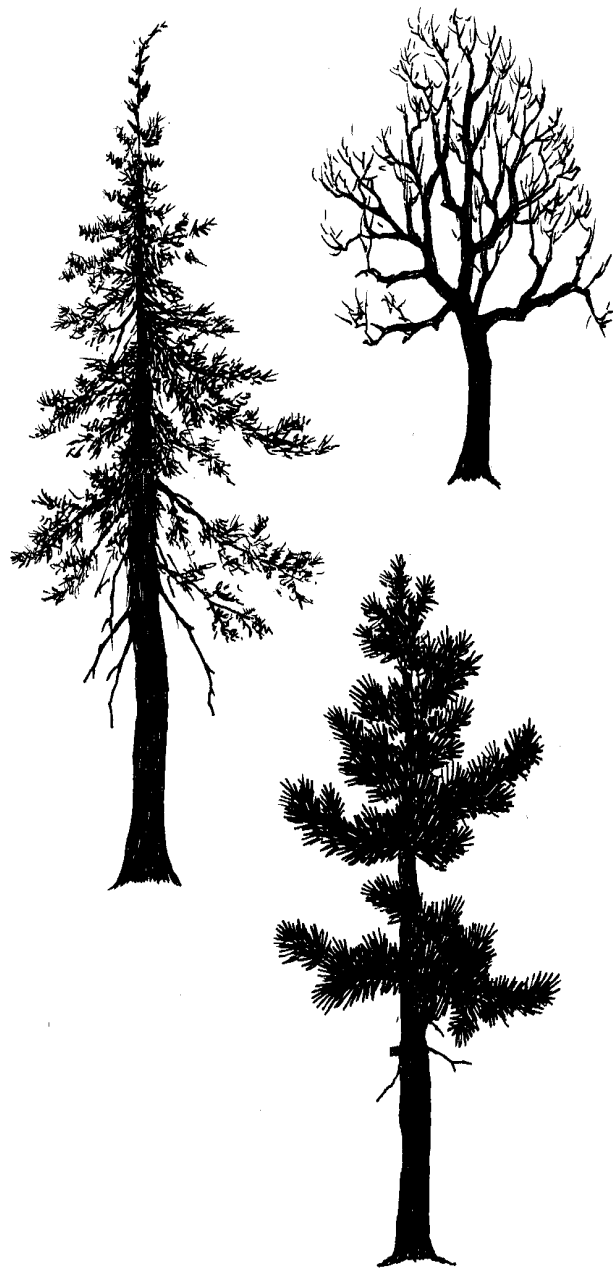
The leaves or needles are good identifying clues. Leaves or needles have characteristic shapes and sizes. Some trees have other unique qualities that make identification easy in certain seasons--like their flowers in the spring, or their fruits or seeds in late summer or fall.

The overall shape of the tree, and color and texture of the bark are characteristics you can use for identification throughout the seasons. The habitat where you find the tree is another clue.

Identifying Some Tree Species at Hawk Mountain: Trees with Leaves, Trees with Needles

If a tree has leaves and not needles, it is called a broadleaf tree. In North America most broadleaf trees are deciduous, which means that they lose their leaves in the fall and grow new leaves again in the spring. Broadleaf trees produce flowers, which later become seed-bearing fruits.

If a tree has thin, needle-like leaves or needles, it is called a **conifer**. Most needle-leaved trees are evergreen; they do not lose their needles at once, but only some each year, remaining "ever green". Conifers do not produce true flowers or fruits; their seeds are produced in cones.



Following are some general identifying characteristics for common trees at Hawk Mountain Sanctuary. The guide also includes flash cards that illustrate and list additional characteristics. There are several good field guides published to Eastern trees that are helpful.

Broadleaf Trees

Oaks are a group of broadleaf trees found in many eastern forests. Oaks produce acorns. Most oaks can be identified by the shape of their leaves. The chestnut oak, white oak and red oak are the three common oaks found here.

The leaves of the American chestnut look similar to those of the chestnut oak (which is how this oak got its name). The leaf edges are toothed on the chestnut and rounded on the chestnut oak. Mature American chestnuts do not produce acorns, but chestnuts that form inside burs.

Maples are also common eastern trees. Maple seeds have “wings” that aid their dispersal. Red maple is a common tree in Hawk Mountain’s forest. Red maple has reddish twigs, reddish buds, and the leaves turn scarlet red in the fall.

With tulip-shaped leaves and tulip-shaped flowers, it is not hard to imagine how the tulip poplar got its name. The tuliptree is tall, with a very straight trunk.

Sassafras is easy to identify, with deeply furrowed bark and three leaf shapes found on a single tree—unlobed, mitten-shaped, and 3-lobed.

Conifer (Needle-leaved) Trees

The needles on a conifer can be short or long. A conifer at Hawk Mountain that has very short, flat needles (about 1/2 inch long) and small, hanging cones is the Eastern Hemlock.

Two long-needled conifers found on the Sanctuary are the Eastern white pine and the pitch pine. The white pine has needles in



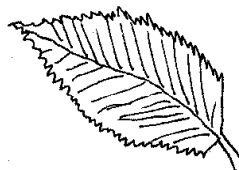
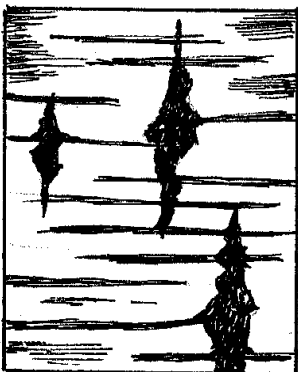
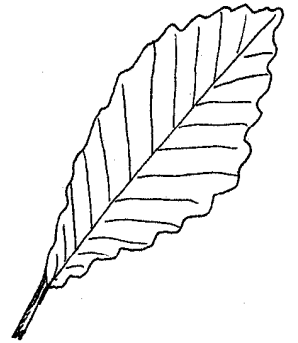
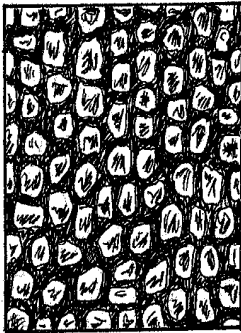
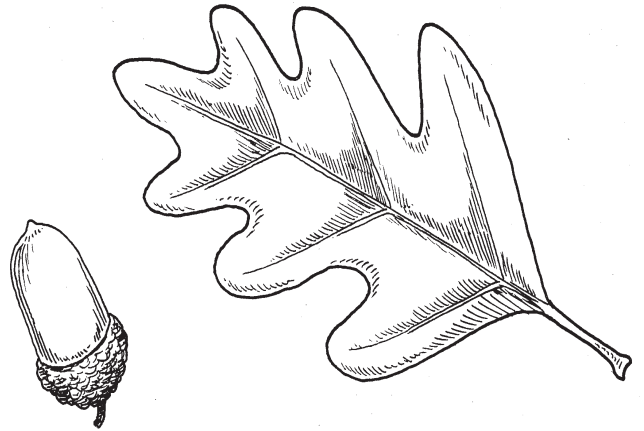
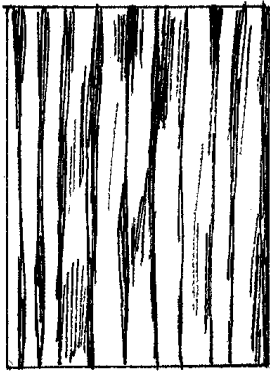
bundles of 5, and cones as long as 10 inches. The pitch pine has needles in bundles of 3, and smaller more rounded cones.

Tree Identification Cards

DIRECTIONS:

Photocopy front and back of this handout; be sure to align drawings with descriptions; make enough copies for each student or pair of students. Cut along dotted lines to make flash cards.

Each student can work with a friend to test their skills at identifying tree barks and leaves.



REDMAPLE

Leaves: 3 to 5-lobed; whitened beneath; 2-8"; reddish; maples are only trees with opposite, lobed leaves

Bark: smooth gray young bark (gray beechlike upper branches); broken darker older bark

Tree Shape: short trunk; broad oval head

Habitat: moist woods

Other: dry, double winged fruits; fruit, twigs, inner bark as wildlife food

Uses: wood sometimes used for furniture; syrup made from sap, planted as an ornamental

WHITE OAK

Leaves: evenly lobed, hairless leaves; 3-9"

Bark: light gray in color; narrow, vertical blocks of scaly plates

Tree Shape: short trunk; wide-spreading crown (wider than high)

Habitat: dry to moist woods

Other: all oaks with clustered end buds; acorn cup bowl shaped with warty scales, covering 1/3 or less of acorn

Uses: acorns eaten by squirrels, wild turkey; tea made from bark; wood excellent for furniture, flooring and fuel

NORTHERN RED OAK

Leaves: moderately lobed, hairless, thin, dull above; 4" wide-10" long

Bark: dark in color (dark brown to black); shiny ridges and furrows—but not as deeply as Chestnut oak

Tree Shape: rounded crown

Habitat: woods

Other: all oaks with clustered end buds; acorn cup saucer shaped, acorn ovoid shaped.

Uses: bark used to make medicinal tea; acorns provide food for wildlife; wood used for furniture, flooring, shelving, fuel

CHESTNUT OAK

Leaves: somewhat leathery, glossy above, slightly hairy beneath; 4-9"

Bark: dark (dark brown to black), deeply ridged, furrowed; quite distinctive

Tree Shape: large tree, with broad, open, irregular crown

Habitat: dry woods

Other: all oaks with clustered end buds; acorn cup deeply bowl shaped with fused scales, covers about 1/3 of oval-shaped acorn

Uses: acorns eaten by squirrels, wild turkey; tea made from bark; wood used for furniture, flooring and fuel

SOURGUM/BLACK TUPELO/BLACK GUM

Leaves: shiny, somewhat leathery, egg-shaped with smooth margins; 3-6"; clustered near ends of branches

Bark: dark (gray-brown), deeply checkered

Tree Shape: dense, conical or sometimes flat-topped crown; slender, nearly horizontal branches

Habitat: moist soils

Other: leaves turn scarlet in fall; fruits used by wildlife

Uses: lumber used for furniture, boxes, crates, veneer, paper pulp; fruits eaten by black bear, ruffed grouse, pheasant, wild turkey

YELLOW POPLAR/TULIP POPLAR

Leaves: alternate; unique long-stemmed, notched-tip, four-lobed hairless leaves; 6-10"

Bark: light gray (gray-brown), often whitened in grooves and in patches on younger bark

Tree Shape: tall, straight trunk; branches often angle upward

Habitat: moist soils

Other: erect, dry seed cones; crushed buds and leaves spicy-aromatic; flowers large, tuliplike, orange and green (May-June); fruits slim, winged, clustered upright in conelike structure (Sept-Nov or longer through winter); not related to true poplars, in magnolia family; one of largest eastern hardwoods

Uses: important commercial hardwood; wood used for furniture, interiors, shingles, boats, plywood, implements, boxes, toys; planted as an ornamental

SWEET BIRCH/BLACK BIRCH/CHERRY BIRCH

Leaves: short-pointed; 1-6"

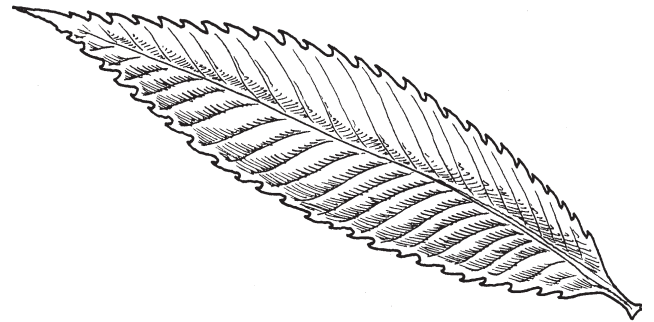
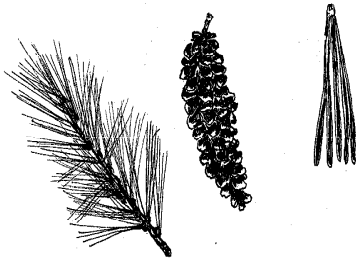
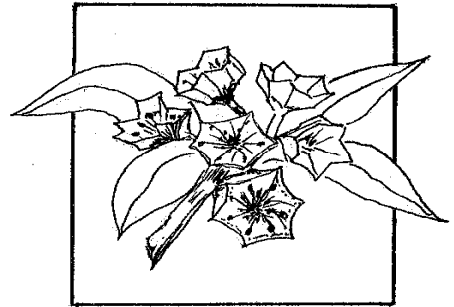
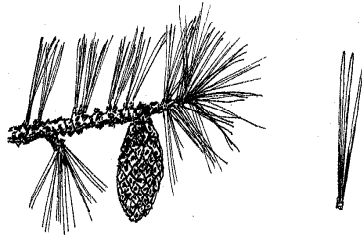
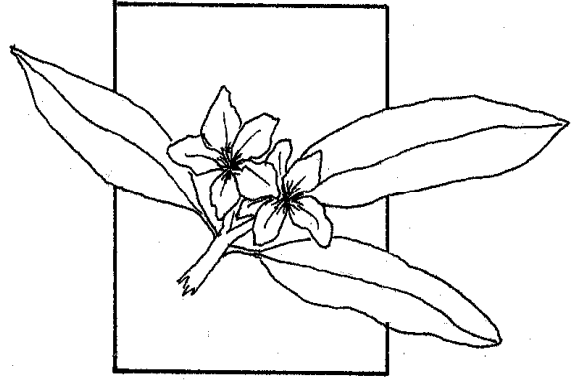
Bark: black; young bark tight, marked by thin horizontal stripes

Tree Shape: tall, straight

Habitat: moist soils

Other: broken twigs have spicy wintergreen odor; fermented sap makes birch beer; buds, seeds, twigs eaten by wildlife

Uses: wood used in furniture; oil of wintergreen extracted from sap and leaves; fermented sap used to flavor birch beer



RHODODENDRON

Leaves: evergreen; 4-10" long, 1-3" wide; oblong, short-pointed at both ends; thick and leathery, with edges rolled under; shiny and dark above, whitish and covered with fine hairs below

Bark: red-brown; scaly

Tree Shape: thicket-forming shrub or tree; short, crooked trunk; broad, rounded crown with many stout, crooked branches

Other: honey from flowers is poisonous

Uses: used in landscaping; wood used to make tool handles; leaves used in home remedies

MOUNTAINLAUREL

Leaves: hairless, flat, leathery, toothless, light green beneath; 2-5"

Bark: dark reddish-brown, with long, narrow ridges and shredding

Tree Shape: gnarled shrub or small tree with compact, rounded crown and stout, spreading branches

Other: leaves poisonous to cattle, sheep, and deer

Uses: planted as an ornamental; wood used for tool handles; burls (knotlike growths) used for briar tobacco pipes

AMERICAN CHESTNUT

Leaves: long narrow; coarse-toothed; 5-8"

Bark: dark brown on mature trees, with numerous wide-topped shiny ridges; smooth on young trees

Tree Shape: broad, rounded crown

Other: was dominant tree in dry Eastern forests; soon after 1900 a fungal bark disease of Asiatic origin became epidemic, wiped out trees; sprouts continue from old stumps; when reach moderate size, blight girdles them near their bases; lumber was valuable, nuts were marketed and used by wildlife; rounded nuts are in husks (burs) covered with stiff, branched, prickly spines; husks split open when nuts mature

Uses: wood used for furniture, musical instruments, interiors, caskets, fences; nuts sold as food

EASTERN HEMLOCK

Leaves: short, flat needles; attached to twigs by slender stalks; 5/16 - 9/16"

Bark: dark purplish brown; rough (scaly and deeply furrowed)

Tree Shape: loose, irregular, feathery; more round-topped tree than firs or spruces; drooping tip

Habitat: mature forests and wooded ravines; cool, moist locations

Other: tall; twigs rough when needles removed; cones small (5/8 - 1"; .5-.8"), pendant, hang from tips of branches; seeds and needles eaten by wildlife

Uses: wood used for paper; planted as an ornamental

PITCH PINE

Leaves: 3 needles per cluster; stiff, yellow green needles; 3-6"

Bark: scaly, peeling, square patches

Tree Shape: usually low, irregular, scraggly; many dead branches; coarse foliage in rigid tufts

Habitat: mainly dry sites

Other: 1-3" stout cones, cone scales tipped with thorns; branches in whorls around trunks; tree topped by new whorl each year; seeds (less twigs and needles) used by wildlife; produce trunk sprouts, especially after fires

Uses: not much used

WHITE PINE

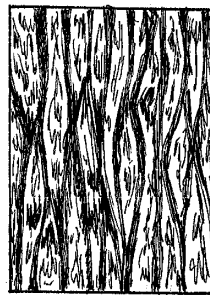
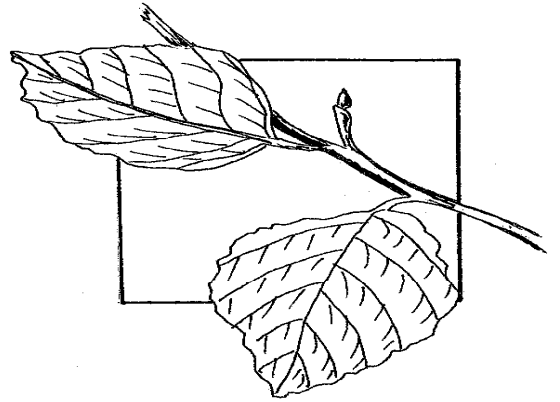
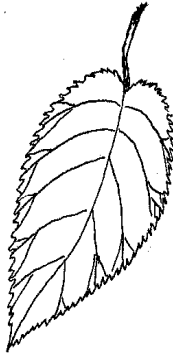
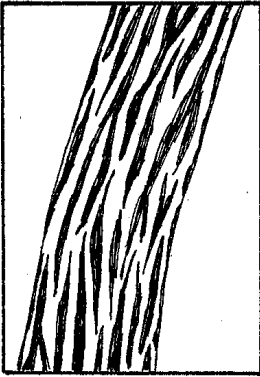
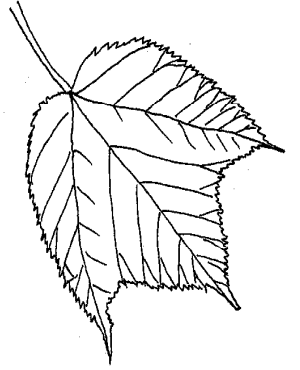
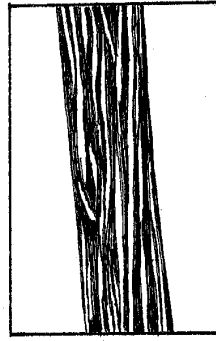
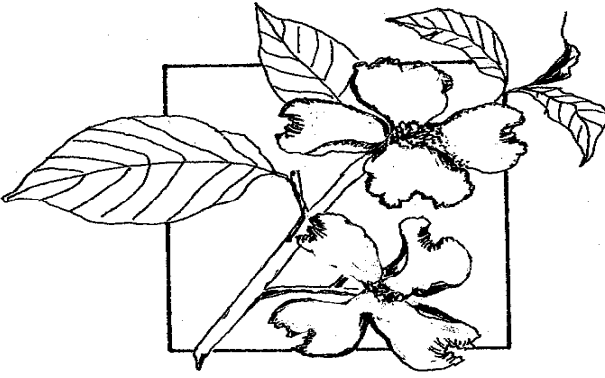
Leaves: only this pine has 5 needles per cluster; 2-4"; soft flexible, blue green needles

Bark: dark; furrowed; not scaly, as in most other pines

Tree Shape: tall trunk; spreading horizontal limbs; delicate spraylike foliage

Other: slender, tapering, thornless cones, 3-10" long; relatively few large branches in whorls around trunk; tree topped by new whorl each year; seeds (less twigs and needles) used by wildlife; one of most important and tallest timber trees in NE; plagued by white pine blister rust, a fungus attacking the inner bark, and white pine weevil, an insect that kills the topmost shoot

Uses: wood used for structural lumber; planted as an ornamental, Christmas trees



STRIPEDMAPLE

Leaves: 3-lobed, sometimes with 2 extra smaller lobes near base; 2-10"; maples are only trees with opposite, lobed leaves

Bark: green bark vertically marked with thin white stripes

Habitat: dry soils

Other: double winged fruits; fruit, twigs, inner bark as wildlife food

Uses: little economic value; bark eaten by deer, moose, beaver, rabbits

WITCHHAZEL

Leaves: alternate; wavy-toothed, uneven-based leaves; 3-6"

Bark: smooth or rough in patches, often with some cross-stripes

Tree Shape: shrub or small tree with broad, open crown of spreading branches

Habitat: moist soils near streams

Other: after leaves drop, old fruit pods pop seeds up to 20' away – then straggly blossoms appear; extract of bark used for medicinal purposes; seeds, buds, twigs used by wildlife

SASSAFRAS

Leaves: lobed or oval; in 3 patterns (3 fingers; thumb-and-mitten outline; smooth egg shape); usually all present; 4-9"

Bark: mature bark red-brown and furrowed

Tree Shape: oblong or flat-topped head; side branches at tight angles, contorted, ending in bushy spray

Habitat:

Other: crushed leaves, twigs, bark spicy-fragrant; flowers greenish-yellow (April-June); fruits blue, fleshy, one-seeded (Aug-Oct); tea from outer bark of roots; fruits and twigs used by wildlife; leaves yellow to red in fall

Uses: oil used in soaps and lotion; dried leaves used to thicken soup; chewing leaves promotes salivation if no water available

FLOWERINGDOGWOOD

Leaves: opposite, elliptical, slightly wavy edges; 6-7" long, curved veins; 2-5"

Bark: dark reddish brown; rough, resembles arrangement of small square plates

Tree Shape: short trunk, crown of spreading or nearly horizontal branches

Other: hidden side buds, stalked flower buds

Uses: bark of roots yields scarlet dye; wood used for shuttles, bobbins, tool handles, mallets and golf club heads; fruits eaten by birds, skunks, deer, rabbits, squirrels; used in landscaping

SERVICEBERRY, DOWNY JUNE BERRY, SHADBUSH

Leaves: fine-toothed, heart-shaped at base, somewhat long-pointed; white-hairy beneath along veins and leafstalk; 3-5"

Bark: light gray; vertical twisting ridges

Tree Shape: 10-40' tall; tree with rounded crown, or irregularly branched shrub

Other: name "shadbush" refers to the fact that plant flowers at the same time that shad (a fish) swim upstream in spring to reproduce

Uses: planted as an ornamental; wood used for tool handles

Getting to Know a Tree

*Activity
Page*

To want to protect something you have to love it; to love it you have to understand it; to understand it you have to learn about it...

Introduction: Choose a tree near your school that you would like to get to know better. This tree will be your study tree. Get a medium sized (5x7") notebook that can be used as your "tree notebook." Activities and observations about your tree will be entered into your tree notebook. Date all entries that you make in your notebook.

Observations from a Distance: Sit a distance away from your tree for your first observations, so that you can view all of it at once.

Make a detailed description of your tree in your own words. On the opposite page in your notebook, make a sketch of your tree. Include as much detail as you can.



Watch for wildlife that might be making use of your tree. For example, look for birds landing on its branches, the nests of birds that have been built on its limbs, and the coming and going of squirrels. Record what you observe.

Collect a leaf from your tree. Make a leaf rubbing in your notebook. (Put the leaf under one of the pages in your notebook. Using the side of an unwrapped crayon, rub gently but firmly over the paper as you hold it in place. An image of the leaf will appear.)

Describe the shape, texture and color of the leaf that you collected. Press the leaf for several days in a plant press or between pages of newspaper inside a large book. Attach your leaf to another page in your notebook.

Observations up Close: Move close to your tree. Look carefully at the bark of your tree; feel its texture. Make a written description of the bark in your notebook, and include a rubbing of the bark on the opposite page.

Getting to Know a Tree

continued ...

Sit quietly under your tree for a time and listen. Do you hear the wind in the leaves? Do you hear other sounds? Describe the sounds you hear. Does your tree have a smell? If so, try to describe the smell.

Are there mosses or lichens growing anywhere on your tree? Describe what they look like and where they're found. Does your tree have any vines growing on it? If so, describe them.

Look carefully for signs of insects living on or in your tree. Look not only for the insects themselves, but also for insect homes: galls, holes, webs, etc. Use books about insects to try to identify and explain what you find. Record your findings in your notebook; supplement your observations with sketches.

Library Research: Use the information you recorded to determine what species your tree is. Research your tree species in the school library and record all the information you can find out about it. Include information such as: Is your tree native to the area? What is its normal range? In what type of habitat is it most often found? How large does it normally get? How long does it usually live? If you have not yet seen its flowers or fruits, research what they will look like. What wildlife species use this species of tree, and in what ways (as food, shelter, other)? Is it used by people (for lumber, food, other)? How old do you think it is?

Share what you have learned with your classmates in a report or in poster form.

Predictions: Based on what you have recently learned about trees, and the information you have collected on your particular tree, predict whether you will see any of the same species during your field trip to Hawk Mountain. During the field trip, keep your eyes open for your particular species and point it out to us if you see one. If you would like, you can share with the group some of what you have learned about your species. Also, look for more of the trees around your neighborhood.

Getting to Know a Tree

continued ...

*Activity
Page*

Literary Pursuits: Write a poem or song about your tree. Enter the final version of the poem or song into your tree notebook. Share your writing with your classmates as you sit together under your tree. Here is a guideline for your poem.

Tree Poem

Write one word that indicates the approximate age of your tree.

Write three words that describe what your tree looks like.

Write two words that describe where your tree lives.

Write two words that describe how your tree is important to the Earth.

Write the species name of your tree.

Note:

The above activities are most effective if repeated once each season. Observations change accordingly. Twigs, buds, flowers, fruits, and seeds can replace or be added to the leaf observations, as appropriate.

For older students, various plant studies in biology class can be extended to include their tree. This will help to make the experiments more interesting and personal.

Forests once covered most of eastern North America. In the 1800s, deforestation occurred quite rapidly. It has been estimated that more than half of the original forest was deforested during that century.

Forests have been cleared for timber, agriculture, and to make room for cities, suburbs, shopping centers, and highways. As we lose our forests, we also lose many of the species that depend on the forest for their livelihood.

Pennsylvania Forest Facts

- 60% of Pennsylvania is forested (17 million acres)
- 90 species of trees are common. The most dominant are red maple, red oak, and black cherry
- 70% of forested lands are privately owned
- 15,000 acres of known old-growth forests exist at some 50 locations.

Forest Fragmentation

Forest fragmentation occurs when a large forest is cut into smaller forested patches, with non-forested lands in-between. In order to breed successfully, some wildlife species need large, undisturbed tracts of forest habitat. Fragmentation can cause increased predation, competition, or nest loss for these species. Some birds of prey fall into this category, including the red-shouldered hawk and the barred owl.

Red-shouldered hawks and barred owls are known as “ecological equivalents.” This means that the two species use the same habitat (mature forests) and hunt the same prey, but at different times of the day. The

hawk is diurnal (active during the daylight hours), while the owl is nocturnal (active at night). Recent studies have shown that a minimum of 250 acres of mature forest is needed in order for one pair of each of these two species to breed successfully. In younger, fragmented, and more open forests, the red-shouldered hawk is likely to be out-competed by the more aggressive red-tailed hawk, and the barred owl out-competed by the great horned owl.

Over 200 acres of contiguous forest are needed to sustain a healthy population of some forest songbirds. Some mammals, including bears and bobcats, also depend on large forested areas.

Forests at Hawk Mountain occupy some 2,400 acres, and are surrounded by 15,000 acres of State Game Lands and State Forests, making them part of the largest stand of contiguous forest in this area. It is important that we protect Hawk Mountain and its surrounding forests.

Cutting of Old Growth Forests

“**Old growth**” or virgin forests are those that have never been logged. Such forests contain large, old trees, a fairly closed canopy, and a structurally complex environment. Several wildlife species depend on old growth forests for their survival. The spotted owl of the Pacific Northwest is one example that has received much attention.

Spotted owls are closely related to barred owls. Although barred owls can breed in 250 acres of mature forest, studies indicate that a pair of spotted owls need a minimum of 1,000 acres of old growth forest.

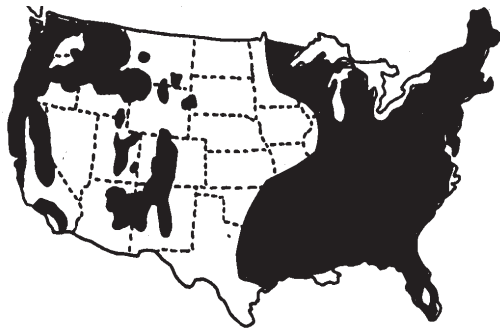
Forest Conservation

Topic
Page

continued ...

Less than 5% of our nation's virgin forests remain. Although some of original forest has been reforested, young forests are different from old forests, and cannot support the same species.

It is important to save old growth forests for the species that depend on them, and for future generations to enjoy.



Virgin Forests 1620



Virgin Forests 1850



Virgin Forests 1989

Acid Precipitation

Due to air pollution (mostly in the form of sulfur and nitrogen oxides), precipitation in eastern North America can be 10 to 100 times more acidic than natural precipitation. Sulfur and nitrogen oxides are produced primarily from coal-burning electrical power plants and from motor vehicles. Pennsylvania and Ohio are major producers of sulfur and nitrogen oxides.

Acid precipitation has numerous negative consequences, not the least of which is damage to our Appalachian forests. Scientists have determined that acid precipitation produces lesions or wounds on the leaves of trees, and breaks down their protective waxy coating. These lesions negatively affect the tree's ability to photosynthesize. Acid rain also leaches nutrients from trees and surrounding soils.

As a result, trees become weakened and are more likely to succumb to natural stresses such as disease and insect attack. They also show decreased growth rates, foliage damage and dieback. Damage is generally worse in the higher elevations of Appalachian mountains where forests are also "bathed" in acid fog on a regular basis.

Forest Conservation

Activity
Page

continued ...

What You Can Do to Help Save Our Forests

“Nobody makes a greater mistake than he who did nothing because he could only do a little.”
Edmund Burke, British statesman and orator

- 1. Forest Fragmentation--Cutting of Old Growth Forests:** One thing you and your family can do to help slow the cutting of our forests is to reduce, reuse and recycle your paper products. It takes a forest of 500,000 trees to produce each week’s edition of the Sunday newspaper in America. Making paper from recycled paper uses 60% less energy than making paper from trees. Only 30% of the newspapers in the United States are recycled.
- 2.** Contact the recycling company within your community and organize a paper-recycling drive with your class. Use this as an opportunity to share what you have learned about forests with others. You can create signs, distribute flyers, and designate bins for collections.
- 3.** Make a conscious effort to not accept a bag when you buy something at a store, unless you really need one. Or consider bringing your own reuseable bag to the store for your purchases.
- 4. Acid Rain:** Most sulfur and nitrogen oxides that cause acid precipitation come from two sources: coal-burning electrical power plants and car emissions. If we use less electricity, less coal will be needed to produce electricity, and less emission will be produced. If we carpool, use public transport, or walk rather than drive we will help lessen car emissions.
- 5. Tropical Rainforests:** It is difficult to try to convince other countries not to cut their tropical rainforests, when Americans are still cutting old-growth forests.
- 6.** Encourage your family to use “environmently-friendly” products. “Shade-grown” coffee and cacao beans are grown under the canopy of mature trees and do not require the cutting of forests as other products do.
- 7.** Learn more about tropical rainforests and the need to conserve them and our own forests. There are numerous places where you can get information on tropical rainforests. You can begin by contacting the following organizations and learning more about their missions.

Rainforest Action Network

221 Pine Street, 5th Floor
San Francisco, CA 94104
Phone: (415) 398-4404
Website: www.ran.org
Email: rainforest@ran.org

Rainforest Alliance

665 Broadway, Suite 500
New York, NY 10012
Phone: (212) 677-1900
Website: www.rainforest-alliance.org
Email: info@ra.org

Forest Conservation

*Activity
Page*

continued ...

7. Plant Trees: Consider planting and caring for tree seedlings near your home and school. For more information on planting trees contact your Local Conservation District Office. You can find a complete list of counties in PA at: www.pacd.org

In Berks County:

Berks County Conservation District
Agricultural Center
1238 County Welfare Road
Suite 200
Leesport, PA 19533-0520
Phone: (610) 372-4657
Email: c-jravert@state.pa.us

In Lehigh County:

Lehigh County Conservation District
Ag. Center, Suite 102
4184 Dorney Park Road
Allentown, PA 18104
Phone: (610) 391-9583
Email: info@lehighconservation.org

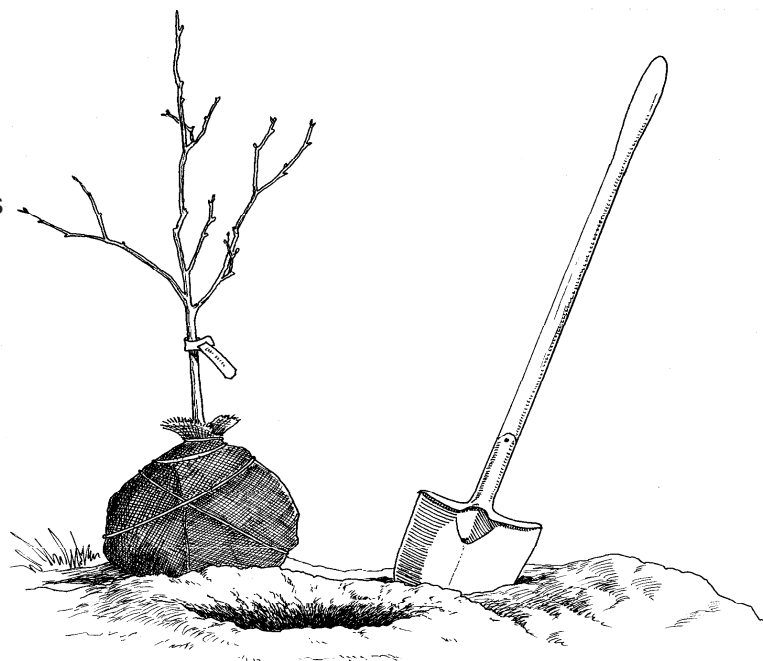
In Schuylkill County:

Schuylkill County Conservation
District
1206 Ag. Center Drive
Pottsville, PA 17901
Phone: (570) 622-3742
Email: schuylcd@co.schuylkill.pa.us

Join Conservation Organizations: Hawk Mountain is one of many conservation organizations working towards forest conservation; consider becoming a member. Membership in a conservation organization is an excellent way to learn more. For more information about Hawk Mountain membership, contact:

Hawk Mountain Sanctuary
1700 Hawk Mountain Road
Kempton, PA 19529
Tel: (610) 756-6961
Fax: (610) 756-4468
Website: www.hawkmountain.org

The Nature Conservancy
4245 North Fairfax Drive, Suite 100
Arlington, VA 22203-1606
Telephone: 703-841-5300
Website: www.nature.org



Litter and Decomposition Rates

When a plant or animal dies in the forest, bacteria and fungi digest and absorb the remaining nutrients from the organism, break it down or decompose it. Bacteria, fungi and other decomposers, are important organisms. Without them, the forest would be piled with dead plants and animals.

When litter is left behind in the forest, the same bacteria and fungi work to decompose the litter. However, many litter items are not organic; they do not have a lot of nutrient value for bacteria or fungi, and are much more difficult for the bacteria and fungi to break down.

Complete decomposition of litter can take a long time.

Decomposition Rates

Banana peel	2 to 5 weeks
Cigarette butt	1 to 5 years
Plastic-coated paper	about 5 years
Plastic bag	10 to 20 years
Aluminum can	80 to 100 years

In addition to being unsightly, litter also can be a danger to wildlife. Wildlife may mistake litter for food, try to eat it and become poisoned or choke on it. Wildlife also may become caught or entangled in litter.

While you are at Hawk Mountain Sanctuary (or anywhere)—please don't litter.



Forest Word Search

*Activity
Page*

How many words about trees can you find? They go from top to bottom, left to right, and diagonally. When you're finished, the leftover letters will spell out a hidden message.

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

Words to look for:

acid rain	environment	oldgrowth	shrubs
acorns	evergreen	oxide	sunlight
bark	flowers	pinecone	trees
chestnut	forest	photosynthesis	twigs
conserve	hemlock	poplar	white oak
deciduous	leaf	rain	wood
deforestation	nuts	seeds	

Message:

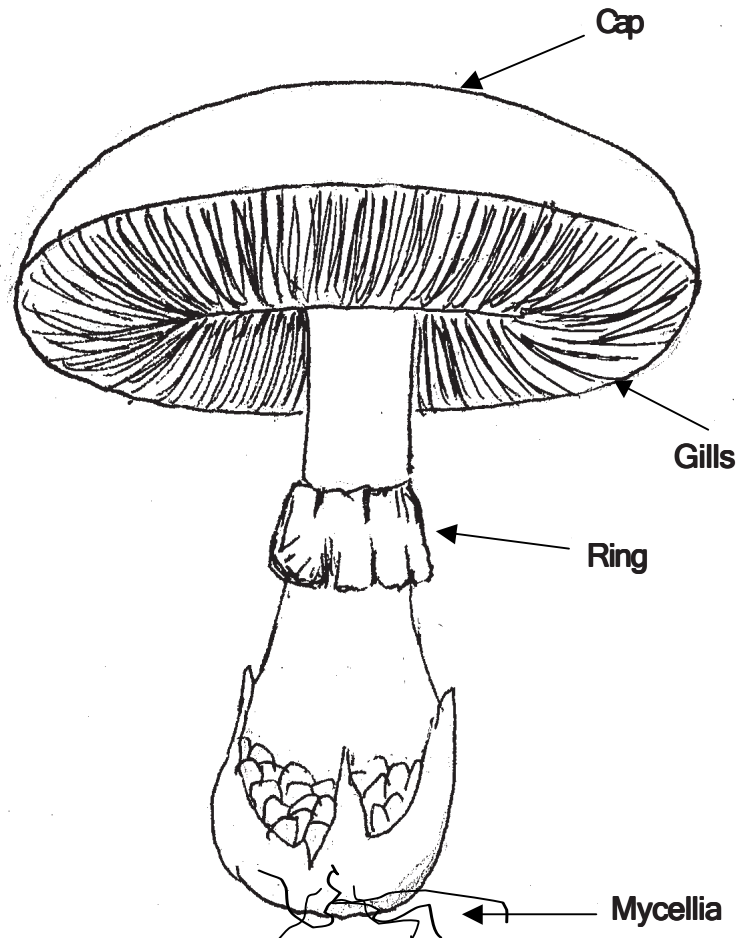
Make a list of tree species in your neighborhood. How many of them are native? Imported?

Topic
Page

Mushrooms

The “umbrella” that comes to mind when you mention the word mushroom is actually the fruiting body of a larger organism that grows mainly underground as a complex, ever-expanding, system of root-like structures called **mycelium** (singular: **mycelia**). Mushrooms are **fungi**—members of a kingdom of plant-like organisms that lack **chlorophyll**. Chlorophyll is the special pigment that enables most plants to produce food through photosynthesis. Mushrooms obtain their food by breaking down and absorbing nutrients from their surroundings. By breaking down organic matter, fungi return nutrients to the soil.

Fungi that break down and decompose dead plants and animals are called **saprophytic fungi**. Fungi that attack and feed on other living organisms, such as tree roots and leaves, are called **parasitic fungi**. Still other fungi form a unique symbiotic or mutually beneficial association with roots of other plants called mycorrhiza. **Mycorrhizal fungi** penetrate the roots of plants, and exchange nutrients with the root cells. The root cells provide moisture, organic compounds, and protection, while absorbing phosphorous, inorganic nitrogen and other minerals with the help of the fungi. **Mycologists** have discovered that mycorrhizal fungi are not able to survive without their host plant. Hosts deprived of their mycorrhizal associate exhibit slower growth and are not able to compete with trees that have their normal complement of fungi.



Fungi reproduce by means of microscopic spores. Most mushrooms produce spores on the exterior of microscopic club-shaped cells called basidia (singular: basidium). A few fungi produce their spores inside microscopic sac-like mother cells called asci (singular: ascus). When a spore lands in a suitable environment, **mycelium** form. The mycelium, or vegetative portion of the organism, produces the familiar, fruiting reproductive body we call the mushroom. These expand and produce more spores, and the cycle begins again.

Mushrooms

Topic
Page

Identifying Mushrooms

There are more than three thousand species of mushrooms in North America, and no single field guide identifies each one. However, with a little practice, one can learn to identify many of the common species. (A list of helpful field guides can be found at the end of this section.)

Features that help you identify mushrooms include size, color, habitat, fruiting season, smell, presence of gills or pores, the shape of the cap, stalk, presence of an annulus or veil, color of spores and whether or not the mushroom bruises when pressed gently with a finger.

Studying Mushrooms

Never eat or taste a mushroom in order to identify it. While many wild mushrooms can be eaten, many species are poisonous. Some mushrooms cannot be identified easily in the field, but require microscopes and other laboratory equipment. Often the identifying characteristics can only be noted after picking the mushroom and examining its underside or underground parts. (Please remember that you should not pick anything on the Sanctuary.) If you pick mushrooms elsewhere and bring them back to class for identification, store them in waxed paper or paper bags. Never store mushrooms in plastic, and try not to mix species in the same bag, especially if you are planning to eat edible finds. Make sure you keep the stalk with the cap, as it can often be instrumental in accurately identifying your mushroom.

Do not be discouraged if you have problems identifying mushrooms. With practice and experience, you can develop your identification skills.

Mushrooms at Hawk Mountain

Nearly 300 species of mushrooms have been identified at the Sanctuary, and mycologists believe that there may be as many as 900 species. The highest abundance is observed during summer months of July and August, but even in winter many mushrooms can be seen at the Sanctuary. The eight most commonly observed families are:

Family Name	Size	Color	Cap Shape	Common Species
1. Sponge Mushrooms (Morels)	Medium to large	Gray, brown, white, yellow	Sponge-like or bell-shaped	Common morel; black morel
2. Fleshy Pore Mushrooms (Boletes)	Small to large	Brown, yellow, gray	Convex, nearly flat	Spotted bolete; Old man of the woods
3. Coral Mushrooms	Small	Purple, yellow, white	No caps—clublike or branched fungi	Spindle-shaped yellow coral; crested coral; violet-branched
4. Shelf Mushrooms	Medium to large	Grayish brown	Brackets attached to wood	Artist's fungus; curry-comb bracket; turkeytail
5. Stinkhorns	Large	Reddish-orange	No cap	Elegant stinkhorn
6. Puffballs	Small to large	White, gray	Large round ball	Earthball; Gem-studded Puffball
7. Gill Mushrooms	Medium to large	Yellow, red, brown	Fan-shaped, convex, rounded	Blusher; fly agaric; honey mushroom
8. Chanterelles	Small to large	Yellow; red	Flat or depressed	Smooth; cinnabar-red; small chanterelle

Native Wildflowers

Topic
Page



Flowers are often thought to exist for our pleasure—as pure decorations. In fact, while they are indeed pleasant to look at and pleasant to smell, flowers are important tools for the survival of plant species. A flower holds a plant’s reproductive system.

A flower can be either male or female. Some can have both male and female organs. The female part of a flower, or pistil, consists of a stigma, style, and ovary. The male part, or stamen, is a stalk topped by an anther, which holds the pollen. A flower’s petals are the usually large, brightly colored, leaf-like structures surrounding the reproductive organs. Petals are the plant’s way of advertising itself to insects and other animals on which it depends for pollination.

Pollination occurs when pollen from the male anther is deposited on the female stigma. This can happen when the wind carries pollen, or when birds and insects brush pollen onto the stigma. Pollen grains travel down the style until reaching the ovules within the ovary. The process by which pollen and ovule combine is known as **fertilization**. In most flowers, fertilization is required before the plant can produce fruit. Fruits contain seeds, which create the next generation of plants if conditions of water, light, acidity and oxygen are right. So, without flowers, there would be no fruit or seeds, and therefore no new plants.

Why are Wildflowers Important?

Taking a walk through a forest or meadow is a great way to see wildflowers. A closer look at flowers not only will give you a good smell, but also several clues as to why they are an important part of the landscape. A bright red cardinal flower might have a Ruby-throated Hummingbird hovering “helicopter-like” over it. The jack-in-the-pulpit berry clusters may be pulled to the ground by a hungry chipmunk. Honey bees or bumble bees will probably be buzzing busily over sneezeweed and asters, collecting pollen and nectar to bring back to the hive. A monarch butterfly might be slowly munching away at the leaves of a milkweed plant, while bright red-and-black milkweed bugs feed on the seed pods of the same plant. Wildflowers provide food for countless animals in the Appalachian environment.

Many of our common wildflowers are not **native**. For example, crown vetch is a common plant in Pennsylvania found at Hawk Mountain Sanctuary. However, crown vetch is an **exotic** species, a plant that was not originally found in the area, but was introduced by humans.

*Topic
Page*

Native Wildflowers

continued ...

Exotic plants cause several problems. Successful exotic plants tend to be hardy plants that grow well in a variety of different conditions. Because they take advantage of many environments, exotics can quickly overtake and crowd out the native plants that require more specialized conditions for growth. For this reason, you may discover fewer kinds of plants on your journeys through the countryside. Exotic plants are not as useful to wildlife as native plants are.

Plants and animals in a particular environment have developed close relationships over thousands of years of evolution. A plant depends on an insect or bat for pollination and seed dispersal, while the animals depend on the plant for food. An exotic plant does not have the same relationships with animals in its new environment, and uses up valuable resources (like light and water) that might be better used by plants that are native to the area.

Native Wildflowers

continued ...

*Topic
Page*

Common Wildflowers at and around Hawk Mountain Sanctuary

*indicates plant is found only within our native plant garden

(1) Jack-in-the-Pulpit An unusual plant commonly found in lower elevations of the Sanctuary. Its autumn fruits are a cluster of bright red berries, often eaten by deer and chipmunks. Its name comes from the appearance of a spike ("Jack", or the preacher) inside a spathe (the "pulpit", a part of the flower that curls up to hide Jack).



(2) Pink Lady's Slipper The most common lady's slipper, Pink Lady's Slipper grows in dry, acidic soils. If you look closely, the flower looks like a pink ballet shoe. This plant, which belongs to the orchid family, has large oval leaves at the base of its stem, but none **on** the stem. Its fruit is a capsule, which, when dry, splits open and thousands of tiny seeds are dispersed on the wind.

(3) Bloodroot* This plant gets its name from the reddish sap in its underground rhizome, which is actually a stem, not a root. The flower blooms in early spring, and grows on a stalk about 6 inches high. It can be found in moist soils, often at the edge of forests. Native Americans used the sap as a dye.



(4) Cardinal Flower* This flower gets its name from its bright red color. Cardinal flowers grow in rich, moist soil. Their red, tubular flowers are designed to be pollinated by moths and hummingbirds. Ruby-throated Hummingbirds can often be seen feeding at these flowers that bloom in July at the Sanctuary.

(5) Jewelweed* Also called Spotted touch-me-not, this plant has a dainty orange flower with red spots. Jewelweed grows in moist areas throughout the Sanctuary. The plant probably gets its name from the way the tips of leaves collect drops of water on dewy mornings, or from the way its flowers dangle like earrings from the plant stems. The fruit of jewelweed consists of small capsules filled with tiny seeds that spring open with the slightest touch, flinging their contents in all directions.



Native Wildflowers

continued ...



(6) Milkweed* This plant also produces rhizomes-there are often many stalks growing from one rhizome. The name milkweed comes from the white, milky sap that comes out of the stems and leaf veins when cut. This sap contains compounds called glycosides, which are poisonous to many animals. Some insects, like the caterpillars of the monarch butterfly and milkweed bugs, eat parts of the plant without harm. Look for these insects on milkweed throughout the Sanctuary. The fruit of a milkweed is a large pod filled with small seeds that drift away on the wind when the pod opens in the fall.

(7) Indian Pipe This colorless plant is usually found growing beneath pinetrees. Indian pipe is named for its flower, which points down and looks like the bowl of a pipe. It is also called ghost flower and corpse plant because it has white stems and no green leaves. Indian pipe lacks chlorophyll. Instead, this plant has developed a close relationship with fungus in the soil around its roots. The fungus breaks down organic matter on the forest floor and the roots of the plant absorb nutrients released in that process. The stalks of the plant are topped with fruit capsules, which are split open and spread tiny seeds like a fine dust.



(8) Asters* These flowers are very noticeable at the Sanctuary. In part, because they are so abundant, and in part because they bloom in the fall, rather than the spring. Frost asters, which have yellow centers and white rays, continue to bloom even after fall frosts. New England asters are also common, these are dark purple asters. There are hundreds of species of asters; flower color and shape of leaves are clues to distinguish one variety from another.

(9) Solomon's seal This is a rather unusual-looking plant. It grows stems from a rhizome; each stem grows about 3 feet long, usually bending over so it does not look that tall. There are several large leaves along the stem, and hanging from the opposite side of the stem are one or two green-white flowers. Its fruits are dark blue berries.



(10) Violets There are three species of violets at Hawk Mountain: northern blue violet, sweet white violet, and downy yellow violet. Their flowers, which are very fragrant are often visited by bees and butterflies. The leaves and flower petals of violets contain large amounts of vitamins A and C and are edible.