Little Sewickley Creek Nature Trail
Field Manual

INTRODUCTION

The Nature Trail Guides was formed in 1976 as a volunteer group with the goal of introducing children to the outdoors and encouraging their interest in and respect for the world of nature. The group works closely with the elementary schools, taking over 1,000 children out for field walks in spring and fall. The area used by the guides focuses on the lower run of Little Sewickley Creek, a protected watershed with some remaining wild areas of field and woods in the Borough of Edgeworth in Western Pennsylvania.

This manual is designed primarily as a teaching aid for use in the lower valley of the Little Sewickley Creek watershed. As such, the field guide section is limited to those plants and animals normally seen or referred to by the guides in the course of field walks Thus, it contains both identification and lore, and a curriculum follows the field guide. The manual should be supplemented by standard field guides. Herbarium plants collected in the Little Sewickley Creek Watershed study but not included in the field guide are listed in an appendix.

Expectations for this publication go beyond teaching; it should also be useful to others interested in the area and should foster a better enjoyment and appreciation of the natural resources in this community.

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Wildflowers

SKUNK CABBAGE (*Symplocarpus foetidus*) F. Arum *
Swamps and marshes; 1'-3'; Feb. to May.
A mottled, hood-like spathe, varying from yellow-green to purple-brown, nearly encloses a knob-like spadix on which the tiny flowers bloom. Broad cabbage-like leaves appear in late spring. Fruits resembling hand grenades can be found in the fall. Buds, formed in fall, melt their way through snow in spring by generating their own heat. A skunk-like odor is given off by the leaves. Indians inhaled the scent for relief of headache.

JACK-IN-THE-PULPIT (*Arisaema atrorubens*) F. Arum *
Moist woods; 1'-3'; April to June.
One or two long-stalked, three-parted leaves accompany a green or purplish brown hood with a flap-like top covering a slender spadix. Tiny flowers are hidden at the base of the spadix. Fruit is a cluster of shiny scarlet berries ripening in the fall. Also called Indian turnip; will burn the mouth if eaten fresh. Indians dried and ground the root into flour.

MAY APPLE (*Podophyllum peltatum*) F. Barberry
Woods, clearings; 12"-18"; April to June.
One or two large, deeply notched, umbrella-like leaves; flower, with twin leaves bearing a single, nodding, waxy-white bloom in the crotch of the leaf stem (single leaved plants do not blossom). Fruit is a pale yellow berry. Plant emerges in spring like a folded umbrella; the colonies look like a crowd holding open umbrellas. Poisonous, excepting the fully ripe fruit which is eaten by wildlife.

Note: F. = family
* Specimen is in Watershed Collection; see p. 125

Jack-in-the-Pulpit

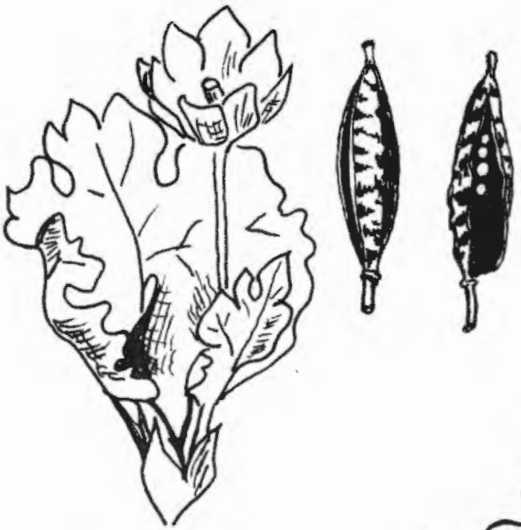
Skunk Cabbage

May Apple

BLOODROOT (*Sanguinaria canadensis*) F. Poppy *
Rich woods; 6"-12"; March to May.
One pale green, lobed leaf embraces the stalk bearing a single white flower with eight to ten petals and a golden center. On cold or cloudy days the leaf wraps around the flower tightly, opening fully only in the sun. After the flower fades (one to three days), the leaf enlarges greatly but disappears by late spring. Grows in colonies. Broken stem or root "bleeds" a strong orange-red juice, used by Indians as ceremonial paint and as a dye.

RUE ANEMONE (*Anemonella thalictroides*) F. Buttercup
Woods; 4"-8"; March to May.
This delicate plant has two to three white (sometimes pink) flowers on dark, wiry stems above a whorl of small slightly lobed bracts which resemble leaves. Stamens are numerous and conspicuous. Commonly called windflower, as the blossoms tremble in a light breeze.

STAR OF BETHLEHEM (*Ornithogallum umbellatum*) F. Lily
Fields, edge of woods; 4"-12"; April to June.
Small, flat-topped blossoms have six waxy white petals with a green stripe on the back. Grass-like leaves may have a white midrib, often appear with no blossoms; grows in large colonies. Poisonous leaves and bulbs.



Blood Root

Rue Anemone

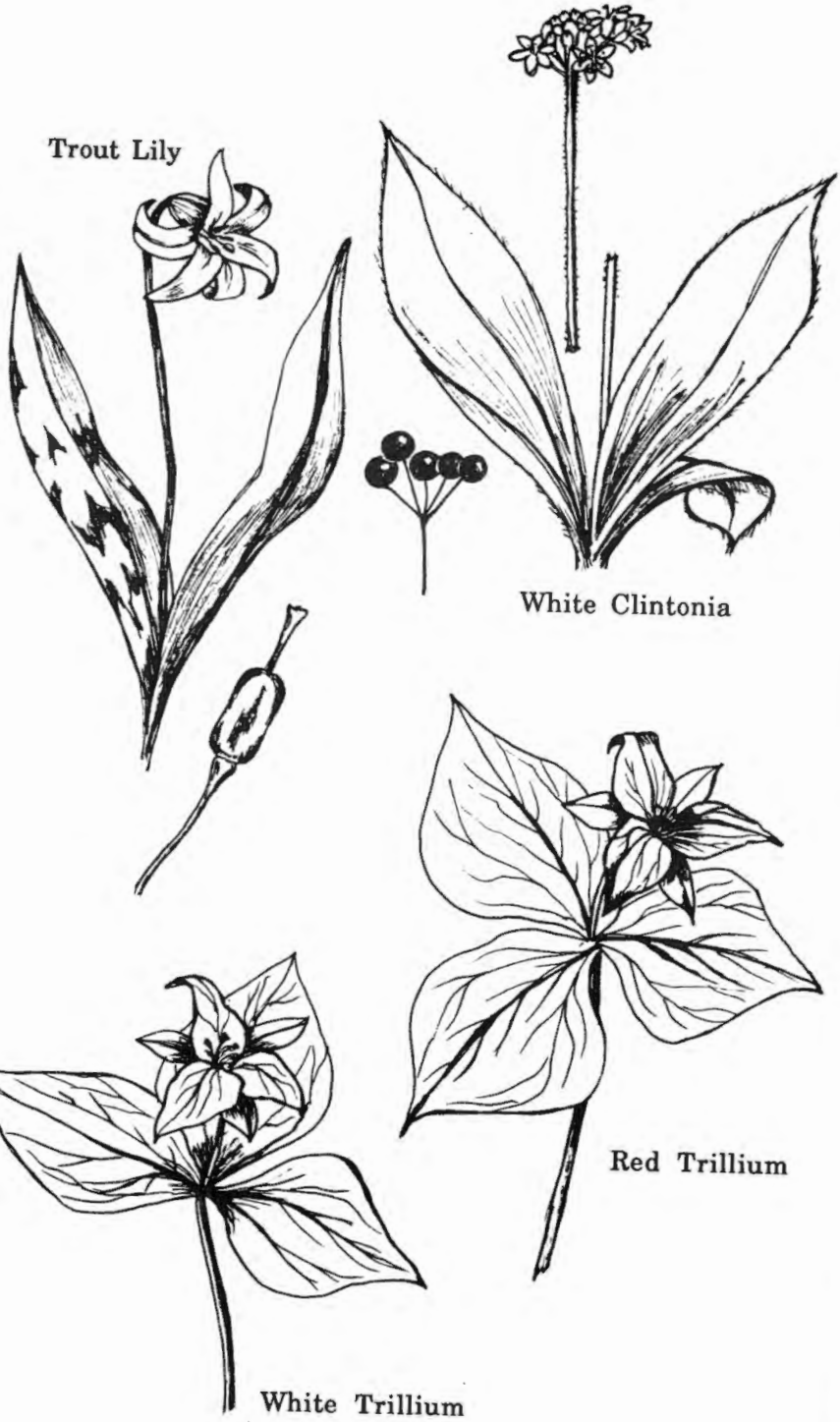
Star of Bethleham

TROUT LILY (*Erythronium americanum*) F. Lily *
Woods; 4"-10"; March to May.
Single flower has reflexed yellow petals. The two broad, basal leaves are mottled like a trout. Plants with single leaves do not bloom; seedling takes seven years to grow to maturity and flower. Other names: adder's-tongue from appearance of fruit after petals fall; dog-toothed violet from appearance of bulb.

WHITE CLINTONIA (*Clintonia umbellulata*) F. Lily
Woods; 8"-20"; May to July.
A downy flower stalk with a tight umbel of fragrant flowers which may be dotted with green or purple, growing from two to five large basal leaves. Fruits are showy blue berries, turning black when mature; also called bead lily.

WHITE TRILLIUM (*Trillium grandiflorum*) F. Lily *
Rich woods; 12"-18"; April to June.
Three broad, ovate leaves and three showy petals supported by three large bracts distinguish the trillium; with age, the white flower turns pink. If the single-stemmed flower is picked, the plant will probably die as the leaves are essential to the formation of food necessary to carry it through the winter. Has never been successfully propagated commercially and should not be purchased on the market. A favorite food for deer. Indians used the root for medicine.

RED TRILLIUM (*Trillium erectum*) F. Lily *
Rich woods; 7"-16"; April to June.
Structure is similar to white trillium, but the flower is on a shorter stalk and smells bad. Color may vary from deep reddish to white, yellow, rose, green. The white form is distinguished from the true white trillium by its reddish ovary. Also called wake robin and stinking Benjamin.


Trout Lily
White Clintonia
Red Trillium
White Trillium

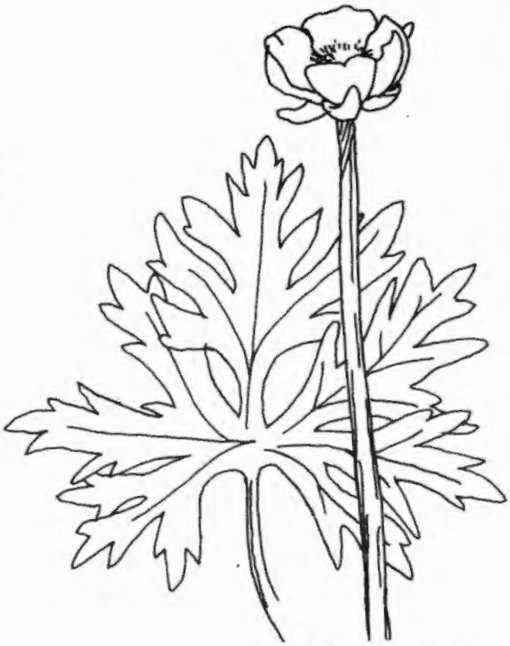
COLUMBINE (*Aquilegia canadensis*) F. Buttercup
Rocky woods and slopes; 1'-2'; April to July.
Delicate plant has drooping tubed flowers (red with yellow) with five distinctive long curved spurs. Roundish compound leaves are divided and subdivided into threes.

TALL BUTTERCUP (*Ranunculus acris*) F. Buttercup
Fields; 2'-3'; May to Sept.
Yellow, glossy flower petals overlap around a center of numerous bushy stamens and pistils. Has sturdy, erect, hairy branching stems. Basal leaves are deeply cut into five to seven unstalked segments; upper leaves finely divided also. Plant is poisonous to many animals when fresh, though harmless when dried. Pollinated by flies.

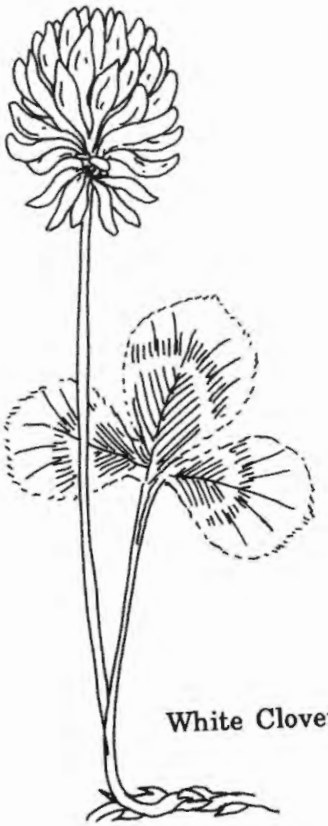
WHITE CLOVER (*Trifolium repens*) F. Pea *
Fields, roadsides, lawns; 4"-10"; May to Oct.
Flowers and three-part leaves with pale triangular marks grow on separate stalks from creeping runners. Flowers are tightly clustered heads of tubular florets which may be tinged with pink. Bees love the nectar. Clover was an important source of food during famines in Ireland as leaves, roots and flowers are edible.

RED CLOVER (*Trifolium pratense*) F. Pea *
Fields, roadsides, lawns; 6"-16"; May to Sept.
Leaves and flowers are borne on the same stem. The plant is larger and more erect in form than white clover and leaves are more pointed. Flower reddish-purple. The plant is a favorite of bumblebees, the only insects with tongues long enough to penetrate the corolla tube.

Columbine



Tall Buttercup

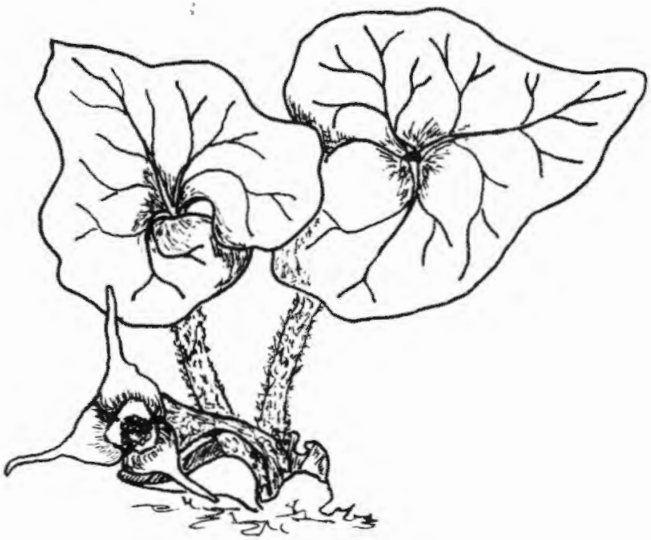


White Clover

Red Clover

WILD GINGER (*Asarum canadense*) F. Birthwort *
Rich woods, 6"-12"; April and May.
Low growing broad-leaved plant with fuzzy stems. The single flower is very low to the ground in the crotch between two leaf stalks and is often concealed by forest litter. It is small, cup-shaped and purplish-brown and is pollinated by carrion flies. Not related to commercial ginger but used by early settlers as a substitute.

ROUND-LOBED HEPATICA (*Hepatica americana*)
F. Buttercup
Leafy woods; 4"-6"; March to May.
Low-growing plant, may be half-buried by forest litter, with glossy leaves having three rounded lobes and hairy stalks. Flowers may be white, pink, lavender or blue, borne singly. The "petals" are actually sepals. Because the leaves were thought to resemble the liver, the plant was formerly used to treat liver diseases.



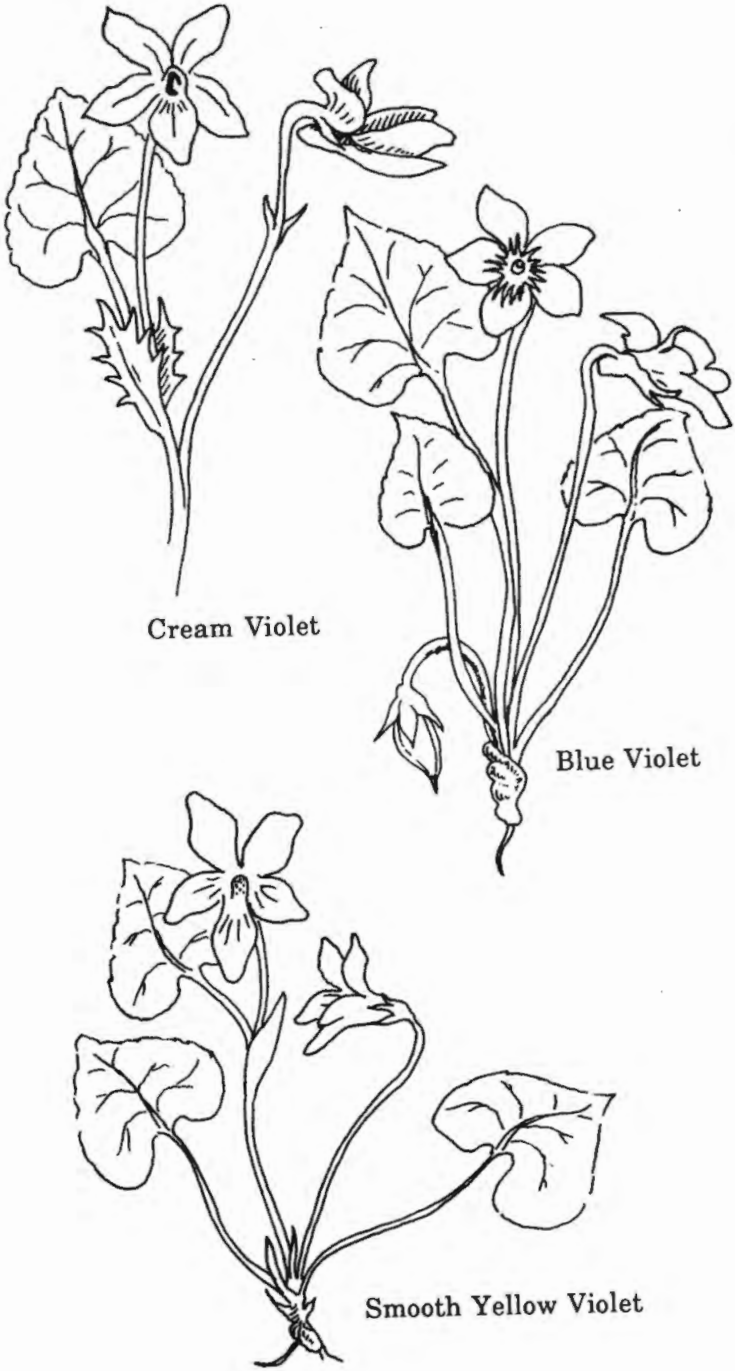
Wild Ginger

Round-lobed Hepatica

CREAM VIOLET (*Viola striata*) F.Violet *
Low woods, streams; 6"-12"; April to June.
Flowers carried on main stem rather than arising from center of plant. Plant has heart-shaped leaves, large, deeply-cut stipules and long flower stalk. Blossom uniformly cream. Stems are smooth and green.

BLUE VIOLET (*Viola papilionaceae*) F. Violet
Damp woods, meadows; 3"-8"; March to June.
Low growing plant with broadly heart-shaped leaves, usually carried above the flowers. Flowers irregular, with the fifth lobe the lowest, heavily veined, extending back into a spur; they seldom produce seeds. Rich violet in color with white center, strongly veined. Flower stalks arise directly from center of plant, as do leaves. Major source of seeds is a green pod developed in late summer and carried low on plant.

SMOOTH YELLOW VIOLET (*Viola pensylvanica*) F. Violet
Meadows and low woods; 4"-12"; April to June.
Flowers arise from main stem of plant. Stems smooth, may have one to five basal leaves, smooth also. Stipules untoothed.



Cream Violet

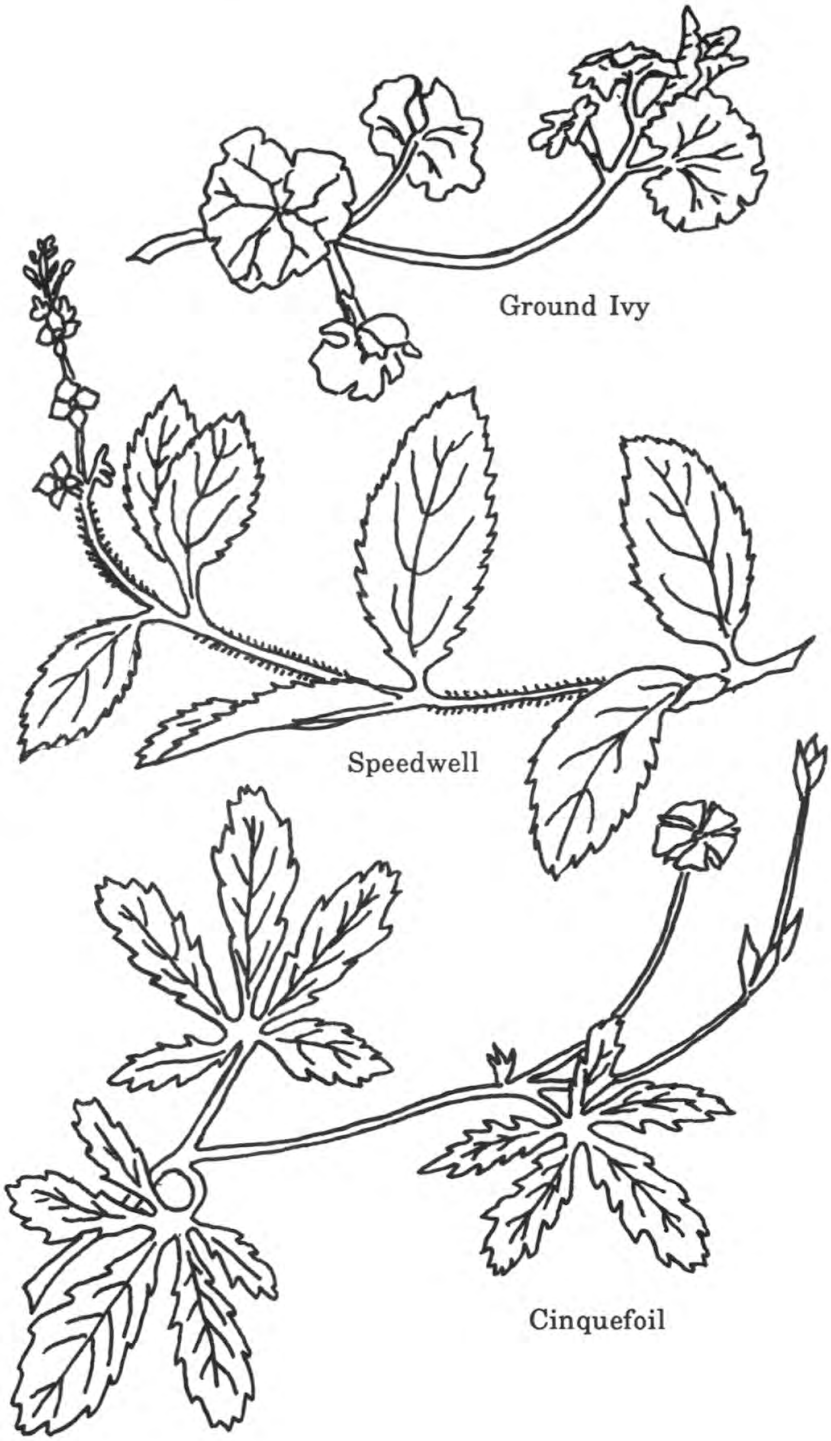
Blue Violet

Smooth Yellow Violet

GROUND IVY (*Glechoma hederacea*) F. Mint *
Lawns, roadsides, shady spots; prostrate; April to July.
Ivy-like, with trailing stems close to the ground and scalloped, roundish leaves rising erect. Flowers small, violet, in whorls in leaf axils. Flower has upper lobe in two parts, lower in three. Stem square, as in most mints; leaves paired. Also called Gill-over-the-ground, creeping Charlie.

SPEEDWELL (*Veronica officinalis*) F. Snapdragon *
Dry soil, fields, lawns; prostrate; May to Sept.
Low, creeping plant with oval, sharply toothed leaves on short stalks. Stems are hairy. Small blue flowers grow from leaf axils.

CINQUEFOIL (*Potentilla simplex*) F. Rose
Fields, dry woods; prostrate; April to June.
Often mistaken for wild strawberry, but name means "five leaved" (strawberry has three). Yellow flowers arise from main stem on separate stalk from the five-parted palmate leaves. Creeping stems root at the nodes.


Ground Ivy
Speedwell
Cinquefoil

CHICKWEED (*Stellaria media*) F. Pink *
Waste places, roadsides, gardens; 4"-16"; in bloom most of year. Delicate plant has short, ovate leaves on long stalks. Petals of small, white flowers are so deeply cut that the five petals appear to be ten.

FALSE MERMAID (*Floerkia proserpinacoides*)
F.False mermaid
Low-lying woods; 3"-5"; April to June.
Small, delicate, inconspicuous annual with stemless leaves, somewhat fern-like. The minute, greenish flowers are barely visible in leaf axils.

ROUGH BEDSTRAW (*Galium Asprellum*) F. Bedstraw *
Woods, thickets; reclines on bushes; July to Sept.
Low growing, weak plant climbs weakly over low shrubs. The square, long stems have rough, rasping prickles. Leaves small, slender, in whorls, usually six but may be four or five. Small white flowers have four petals. Plant was used to stuff mattresses.

Chickweed

False Mermaid

Rough Bedstraw

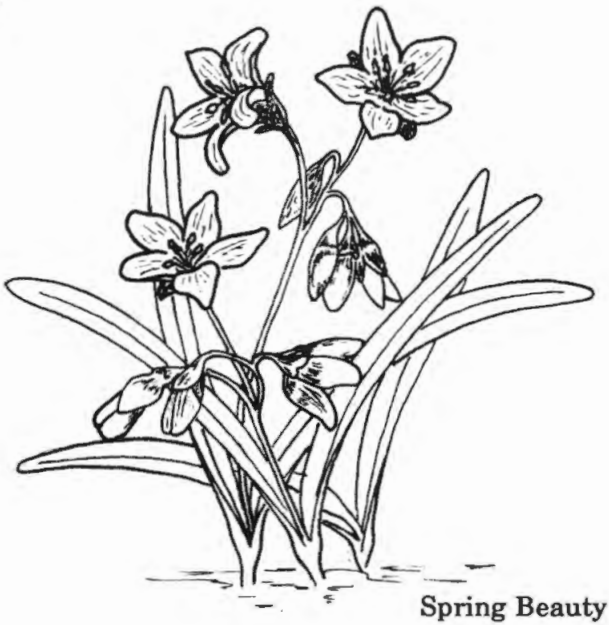
KIDNEY-LEAVED BUTTERCUP (*Ranunculus abortivus*) F.Buttercup *
Woods, damp thickets; 6"-24"; April to Aug.
Basal leaves are kidney-shaped; stem leaves variable and may be simple or divided. The tiny flowers have greenish centers with very small yellow petals.

FORGET-ME-NOT (*Myosotis scorpioides*) F. Borage
Brooksides, wet places, hedges; 6"-24"; May to Oct.
Small five-petalled flowers are sky blue with yellow eye, grow on two diverging branches which uncoil as flowers bloom. Stems slightly hairy and angled; leaves alternate, stemless, hairy. Annual.

SPRING BEAUTY (*Claytonia virginica*) F.Purslane *
Moist woods; 6"-12"; March to May.
Small, delicate plant has a pair of smooth, linear leaves set midway on the single stem. Small flowers are white or pinkish with darker pink veins on the five petals.

Kidney-leaved Buttercup

Forget-me-not

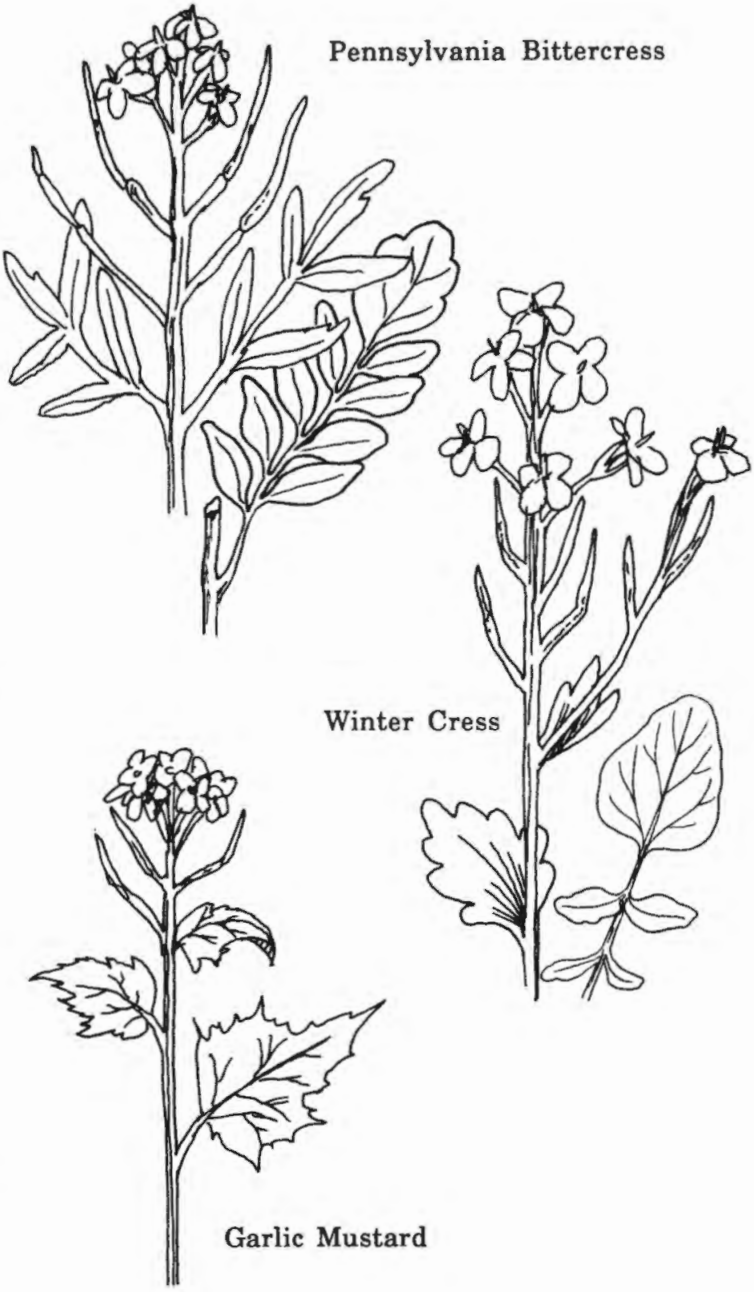


Spring Beauty

PENNSYLVANIA BITTERCRESS (*Cardamine pensylvanica*) F.Mustard *
Wet ground, springs; 8"-24"; April to June.
Small, erect plant has tiny white flowers in ascending terminal cluster. The slender maturing seed pods develop as the flower continues blooming. Seed pods are typical of mustards. Basal leaves have pairs of rounded leaflets while the stems bear slender leaflets.

WINTER CRESS (*Barbarea vulgaris*) F. Mustard *
Wet meadows, fields; 1'-2'; April to Aug.
Lower leaves have large rounded end lobes. Upper leaves are toothed and clasping. Yellow flowers are in terminal clusters, followed by typical mustard seedpods hugging the stem.

GARLIC MUSTARD (*Alliaria officinalis*) F. Mustard *
Waste places, roadsides, wood edges; 1'-3'; April to June.
Heart-shaped or roughly triangular basal leaves appear in fall, persist through winter. Among the earliest to begin growth in spring, the plant has a terminal cluster of small, white, four-petalled flowers. Distinctive garlic odor.


Pennsylvania Bittercress
Winter Cress
Garlic Mustard

BLUE COHOSH (*Caulophyllum thalictroides*) F. Barberry *
Rich woods; 1'-3'; April to June.
Plant emerges early as a bluish spear point. Clusters of small, six-pointed flowers, yellow-green to brown in color, open before the leaves have completely unfolded. Leaves are compound, and both they and flowers suggest meadow rue. Plant may have a whitish cast called "bloom." Fruits are distinctive deep blue berries. Root is very poisonous.

PURPLE DEAD-NETTLE (*Lamium purpureum*) F. Mint
Roadsides; waste places; 4"-12"; April to Oct.
Crowded, heart-shaped leaves tend to overlap and group at the top; the square stem may be leafless below. Rose or purplish flowers cluster at top in leaf axils. "Dead" because this "nettle" does not sting.

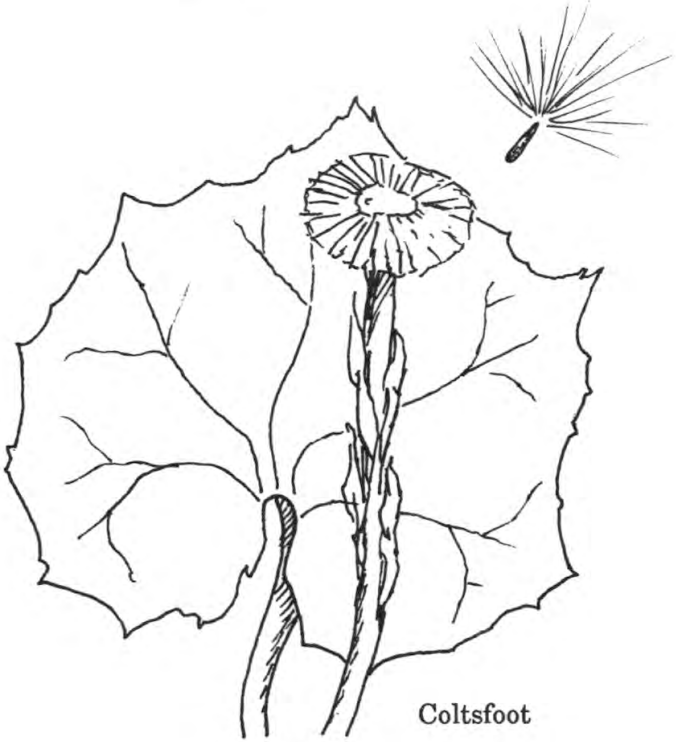
SWEET CICELY (*Osmorhiza claytoni*) F. Parsley *
Moist woods; 1-1/2' - 3'; May to June.
Soft, fuzzy plant has wide fern-like leaves, thrice compounded and bluntly toothed; lower leaves may be up to a foot long. Tiny white flowers appear in sparse clusters; roots and bruised leaves have a sweet, licorice smell.


Blue Cohosh
Sweet Cicely
Purple Dead-nettle

DANDELION (*Taraxacum officinale*) F. Daisy *
Lawns, fields, roadsides; 2"-18"; March to Sept.
Jagged lobed leaves grow in a rosette and are said to resemble a lion's tooth. The name is a corruption of French "dent de lion," lion's tooth. Flower stems are smooth, hollow and milky. The yellow flower has only ray flowers which turn into the fluffy white seed balls.

COLTSFOOT (*Tussilago farfara*) F. Daisy *
Waste places, roadsides; 6"-18"; March to June.
Flowers appear first and superficially resemble dandelions but have reddish scales on the stalk (like asparagus). The yellow blooms have both ray flowers (in layers and fertile) and disk flowers (sterile); the latter are absent from dandelions. Fluffy seed ball also resembles dandelion. The large, hoofprint-shaped leaves appear after flowers are almost gone.

Dandelion



Coltsfoot

FLEABANE (*Erigeron philadelphicus*) F. Daisy *
Thickets, fields, open woods; 6"-30"; April to July.
Pinkish daisy-like flower, less than one inch across, has very numerous rays (up to 150). Stems are erect, may be hairy. Toothed, lanceolate leaves clasp stems. Used by early settlers to keep away fleas and other insects.

OX-EYE DAISY (*Chrysanthemum leucanthemum*) F. Daisy *
Fields, roadsides; 1'-3'; June to Aug.
The familiar flower, borne on a long stem well above foliage, has white ray florets surrounding the yellow disk florets held on long stems. Leaves are dark green, narrow and much lobed. Petals are uneven in number, insuring that "he loves me" will always prevail.

Fleabane

Ox-eye Daisy

TWO-LEAVED TOOTHWORT (*Dentaria diphylla*)
F. Mustard *
Moist woods; 8"-14"; April to June.
Erect stem bears a pair of toothed leaves, each divided in three parts; long-stalked basal leaves are similar. Small terminal cluster of four-petalled white flowers fades to pinkish.

CUT-LEAVED TOOTHWORT (*Dentaria laciniata*)
F.Mustard *
Rich, moist woods; 8"-15"; April to June.
Whorl of three leaves borne on stem are each divided into narrow, sharply toothed segments. White to pink-lavender flowers are in a terminal cluster, followed by the slender ascending seedpods typical of mustards.

VIRGINIA WATERLEAF (*Hydrophyllum virginianum*)
F.Waterleaf*
Woods; 1'-3'; May to Aug.
Leaves are irregularly cut, with five to seven lobes, and are often whitish as if water-marked. White or pale violet flowers have long protruding stamens and are held in radiating clusters.

Two-leaved Toothwort

Cut-leaved Toothwort

Virginia Waterleaf

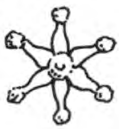
VIRGINIA BLUEBELL (*Mertensia virginica*) F. Borage *
Bottomlands, moist woods; 1'-2'; March to May.
Light green leaves, oval, smooth and strongly veined, are alternate on the unbranched stem. Terminal clusters of flowers are nodding, trumpet-like, pink in bud but changing to blue as they mature.

FALSE SOLOMON'S SEAL (*Smilacina racemosa*)
F. Lily
Woods; 1'-3'; May to July.
Graceful, arching stem carries oval, pointed, alternating leaves, and is tipped with a plume-like cluster of small, creamy-white flowers. Berries are first whitish, speckled with red-brown, maturing to ruby-red. (Note: the true Solomon's seal carries flowers in the leaf axils and has blue-black berries; plants otherwise similar.)

DAME'S ROCKET (*Hesperis matronalis*) F. Mustard
Roadsides, wood edges; 1'-3'; May to July.
Pink flowers (also purplish and white) are in terminal cluster. Resembles phlox closely but has only four petals (phlox has five) and has the long seed pods typical of mustard. Leaves alternate, lanceolate. Spicy fragrance becomes stronger towards evening.

Virginia Bluebell

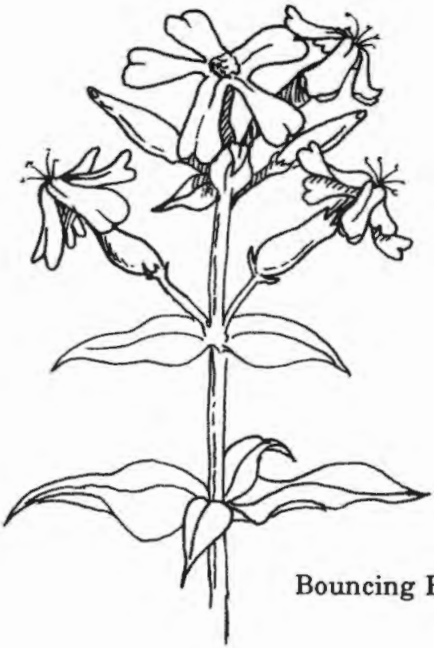
False Solomon's Seal



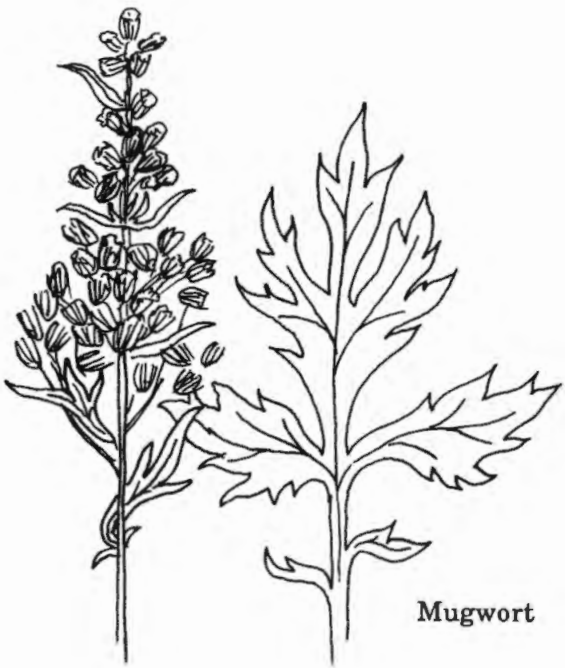
Dame's Rocket

BOUNCING BET (*Saponaria officinalis*) F. Pink *
Roadsides, waste places; 1'-2'; July to Sept.
Pink or whitish flowers have five reflexed petals with scalloped tips and grow from the leaf axils. Thick-jointed stems are smooth and the paired leaves are sessile. Plant forms great colonies at beach edges, railroad banks, etc. Also called soapwort, as plant contains a substance which can be used for cleaning cloth.

MUGWORT (*Artemisia vulgaris*) F. Daisy
Waste places, roadsides; 2'-4'; July to Aug.
This rather weedy plant has deeply cut leaves, silvery-downy beneath. Aromatic flowers are greenish, tiny, and without rays, held in terminal clusters.



Bouncing Bet



Mugwort

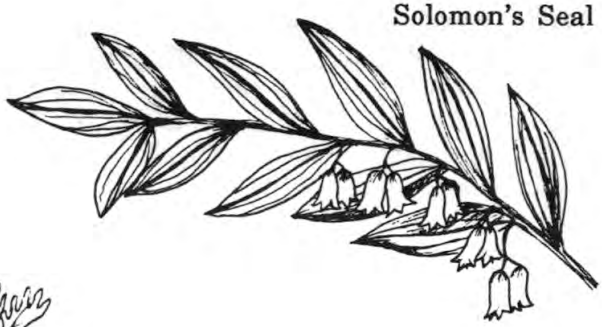
SOLOMON'S SEAL (*Polygonatum biflorum*) F. Lily
Woods, thickets; 1'-3'; April to June.
Delicate, arching stem carries alternate, strongly veined leaves. Nodding, bell-like pairs of small greenish-yellow flowers are borne beneath the leaves. Distinctive blue-black berries follow the flowers. Roots are many-jointed, each joint showing scar of previous year's growth which resembles a seal.

DUTCHMAN'S BREECHES (*Dicentra cucullaria*) F. Poppy *
Rich woods; 5"-9"; April to May.
A delicate spray of waxy, yellow-tipped flowers droops in a loose cluster from an arched stem. Each flower has two inflated spurs which suggest pantaloons, ankles up. Leaves delicate and much dissected. Plant is poisonous, can cause the "staggers" in humans and has killed cattle.

BELLWORT (*Uvularia perfoliata*) F. Lily *
Moist woods; 6"-18"; May to June.
A single, pale yellow, bell-like flower droops at the tip of a forked stem. Lanceolate, veined leaves are perfoliate, appearing to be pierced by the stem.

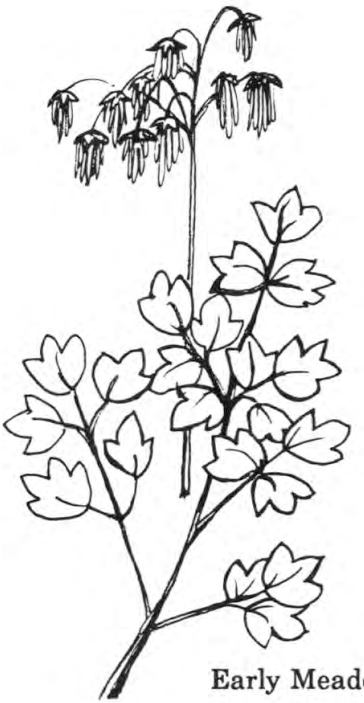
EARLY MEADOW RUE (*Thalictrum dioicum*) F. Buttercup *
Woods; 1'-2'; April to May.
Thin-stemmed leaves are divided into many roundish, three-lobed leaflets. Flowers white to greenish, seem to have four to five petals which are really sepals. Flowers and foliage droop in this species of meadow rue.

Solomon's Seal



Dutchman's Breeches

Bellwort



Early Meadow Rue

STINGING NETTLE (*Urtica dioica*) F. Nettle *
Roadsides, waste ground; 2'-4'; June to Sept.
Opposite leaves and stems are densely covered with coarse, stinging hairs; plant often grows in colonies. Leaves are heart-shaped, toothed and long-stalked. Stems are four-angled and hollow. Tiny greenish flowers in clusters grow from leaf axils, may be both staminate and pistillate on the same plant. The plant hairs are miniature hypodermic needles which release their poison, formic acid, on contact with skin. Jewelweed and dock are antidotes for nettle stings.

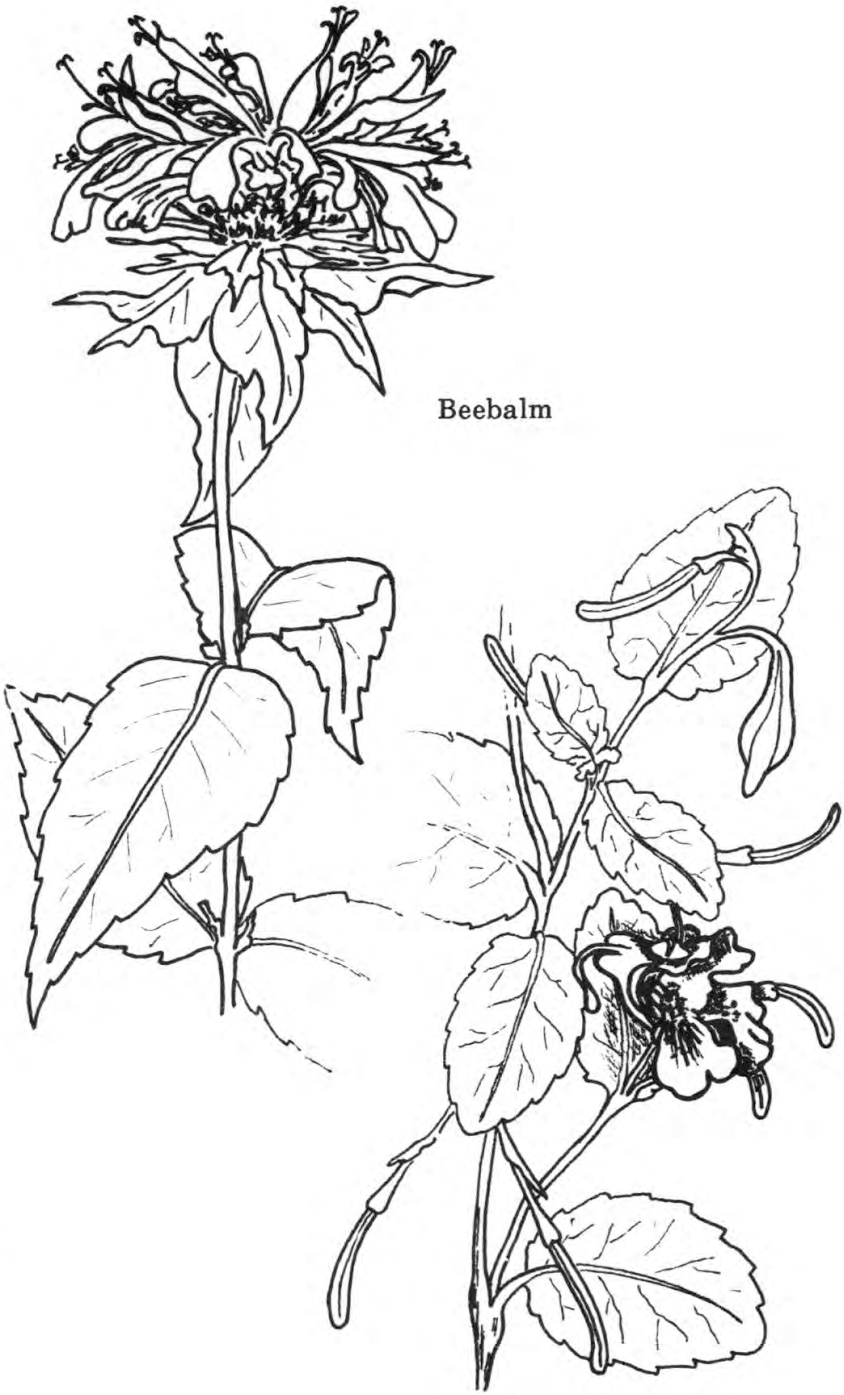
BULL THISTLE (*Cirsium vulgare*) F. Daisy *
Roadsides, fields; 2' -6'; June to Sept.
Stout stem has prickly wings and flower bracts are armed with yellow-tipped spines. Large reddish-purple flower heads (disk flowers only) are usually solitary and will turn into the familiar thistle-down loved by goldfinches for nesting.

BURDOCK (*Arctium minus*) F.Daisy *
Waste ground, roadsides; 3'-5'; July to Oct.
First-year plants show only the broad leaves, often a foot or more in length, with hollow, unfurrowed stalks. Next year the thistle-like, reddish to lavender flower heads appear on tall stems. The familiar burs are formed from hooked, bristly bracts and are on very short stalks in this species. Burs are nature's pattern for velcro and are "hitch-hikers."


Stinging Nettle
Thistle
Burdock

BEEBALM (*Monarda didyma*) F. Mint *
Wet places, stream banks; 2'-3'; July to Sept.
Fragrant plant has toothed, ovate to lanceolate leaves, paired on square stems. Blossom is a rather shaggy scarlet compound of tubular flowers with red bracts. Butterflies flock to it. It was once thought to give relief from bee stings.

JEWELWEED or TOUCH-ME-NOT (*Impatiens pallida*)
F.Touch-me-not *
Damp, shady places; 3'-5'; July to Oct.
Yellow irregular flowers hang like pendant jewels and are a favorite with hummingbirds. Pale green oval leaves contain watery juices and may be crushed and rubbed on skin after contact with nettle or poison ivy as antidote. Ripe seedpods burst at a touch, expelling green seeds which may be scraped to reveal the robin's egg blue color beneath. Another jewelweed variety is taller, has orange, spotted flowers.



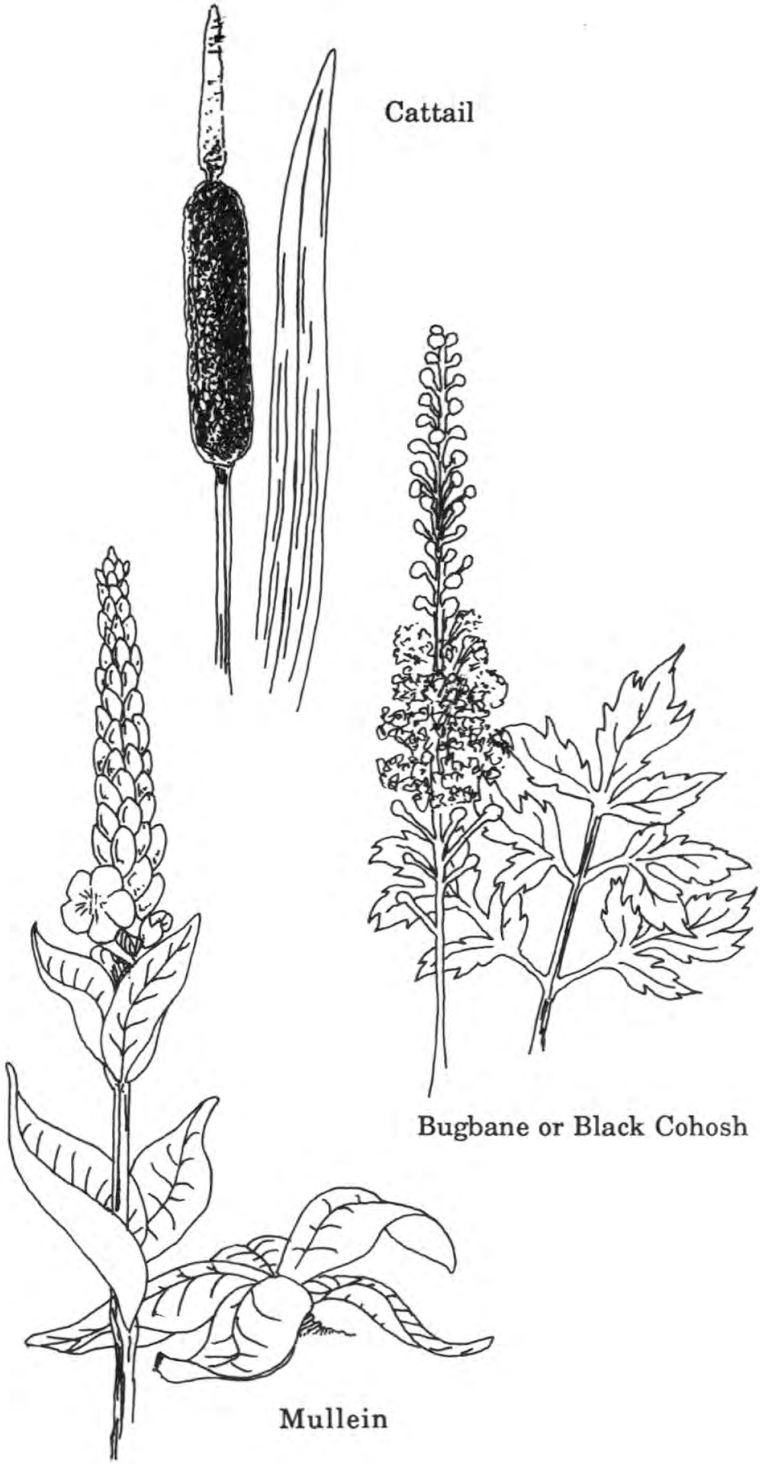
Beebalm

Jewelweed

CATTAIL (*Typha latifolia*) F. Cattail
Marshes, wet places; 3'-9'; May to July.
Tall plants with sword-like leaves grow in dense stands. Stems are stiff cylinders ending in round, brown flower heads. Male flowers, dense with yellow pollen in season, appear in a narrow "tail" above the fatter cylinder of female flowers. They disappear as the female flowers ripen and turn into a plume of yellow-brown fuzz. All parts of the plant are useful, for food, basket weaving and padding.

BUGBANE or BLACK COHOSH (*Cimicifuga racemosa*)
F.Buttercup
Woods; 3'-8'; June to Sept.
The large stalked leaf is divided and subdivided into threes. White flowers are held aloft in slender, dense spikes; the petals fall early, leaving bushy tufts of stamens. "Bane" is from an early Anglo-Saxon word meaning "destroyer," and the plant is a natural insecticide.

MULLEIN (*Verbascum thapsus*) F. Snapdragon *
Roadsides, waste places, poor soil; 2'-6'; June to Sept.
Large, soft fuzzy leaves flow into the stem of this coarse plant. A tall, showy candle-like spike of flowers rises from the basal rosette. Small yellow florets open in sequence over a period of weeks. Also called flannel-leaf, it was used to line shoes in cold weather by colonists.


Cattail
Bugbane or Black Cohosh
Mullein

SMARTWEED or LADY'S THUMB (*Polygonum persicaria*)
F.Buckwheat *
Cultivated ground, waste places; 6"-24"; Aug. to Sept.
Plant has swollen sheaths or joints where leaf attaches to the reddish stem. The pointed narrow leaves often have a dark blotch or "thumbprint." Tiny pink or white flowers are held in a tight cluster. Plant juices may sting an open cut, hence "smartweed."

PLANTAIN (*Plantago major*) F. Plantain
Roadsides, waste places; 6"-18"; June to Oct.
The broad, spade-shaped leaves growing in a flat basal rosette are a common sight in dooryards and lawns. Flower heads are greenish white, long slender spikes with densely packed tiny flowers. Called "white man's foot" by Indians, as it sprang up in the wake of colonists.


Smartweed
Plantain

RAGWEED (*Ambrosia artemisiifolia*) F.Daisy
Roadsides, fields; 1'-5'; Aug. to Oct.
Leaves are finely dissected. Tiny nodding green flowers are in interrupted racemes. Masses of very light yellow pollen grains are windblown and a major cause of hay fever.

TALL GOLDENROD (*Solidago altissima*) F. Daisy
Dry soil, roadsides, open woods; 3'-6'; Aug. to Nov.
The tall plant with a golden plume-like flower head has rough textured leaves with parallel veins and a downy grayish stem. Identification of a particular species is often difficult. The flower head is apt to harbor many insects. An old superstition says that he who carries the plant will find treasure.

SILVERROD (*Solidago bicolor*) F. Daisy *
Dry open woods, fields; 1'-3'; July to Aug.
This wand-like plant is the white goldenrod, with small,whitish to cream flowers. Basal leaves are broad and spoon-shaped. Stem leaves become smaller as they ascend the stalk.

Ragweed

Tall Goldenrod

Silverrod

CHICORY (*Cichorium intybus*) F. Daisy
Roadsides, waste places; to 4'; June to Oct.
Clear blue flowers hug the rigid, nearly naked stem, opening only on sunny days and closing at noon. Ray flowers are square-tipped and fringed. Basal leaves resemble those of the dandelion. This plant is wild endive and is edible; the roasted roots make a coffee additive. Petals are a natural litmus paper.

WOOD ASTER (*Aster divaricatus*) F. Daisy
Fields, thickets; 1'-5'; Aug. to Oct.
White flowers are held in loose flat-topped clusters with relatively few rays. The stalked leaves are heart-shaped. Asters were sacred to all gods and goddesses.

CALICO ASTER (*Aster lateriflorus*) F. Daisy *
Fields, thickets; 1'-5'; Aug. to Oct.
Wide branches, springing from the same axils as the narrow, coarsely toothed leaves, hold the small white flowers on this aster. Central disk florets are yellow, turn purple with age. The small-flowered asters can be difficult to identify as they may interbreed.

CROOKED-STEMMED ASTER (*Aster prenanthoides*)
F. Daisy *
Wood edges, banks, thickets; 1'-3'; Aug. to Oct.
The smooth, zig-zagged stem has clasping leaves, toothed at the tip but narrow and toothless nearer the stem. Ray flowers are pale violet.

Chicory

Wood Aster

Calico Aster

Crooked-stemmed Aster

GREEN-HEADED CONEFLOWER (*Rudbeckia laciniata*)
F. Daisy *
Moist, rich ground, thickets; 3'-12'; July to Sept.
The greenish, button-like disk of the yellow flower protrudes above the reflexed rays. Stems are tall, smooth and branched, with leaves deeply cut into three or five parts.

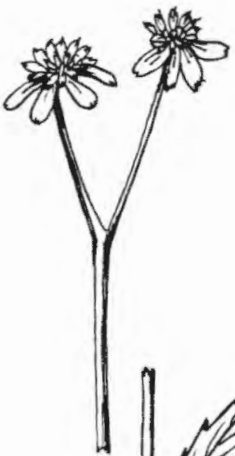
SNEEZEWEED (*Helenium autumnale*) F. Daisy
Thickets, swamps, wet meadows; 2'-5'; Aug. to Oct.
The globular, yellow button of the flower is surrounded by reflexed yellow rays, lobed at the tip. The toothed, lanceolate leaves are alternate on angled stems. The odor is said to cause sneezing.

WINGSTEM (*Actinomeris alternifolia*) F. Daisy *
Wood edges, thickets; 3'-8'; Aug. to Sept.
The yellow rays are few, perhaps two to eight, and are reflexed back from a mop-like center. Alternate leaves are lanceolate, pointed at both ends, and appear to flow out from the "wings" or flanges on the somewhat hairy stem.

BLACK-EYED SUSAN (*Rudbeckia hirta*) F. Daisy
Dry fields, roadsides; 1'-3'; June to Oct.
Leaves and stems are very bristly and hairy; the flower is large, single, slender-stemmed with 10-20 yellow rays and a chocolate-colored center disk. Stem hairs are actually tiny barbs which prevent unwelcome ants from climbing to the flower heads.

Green-headed Coneflower

Sneezeweed



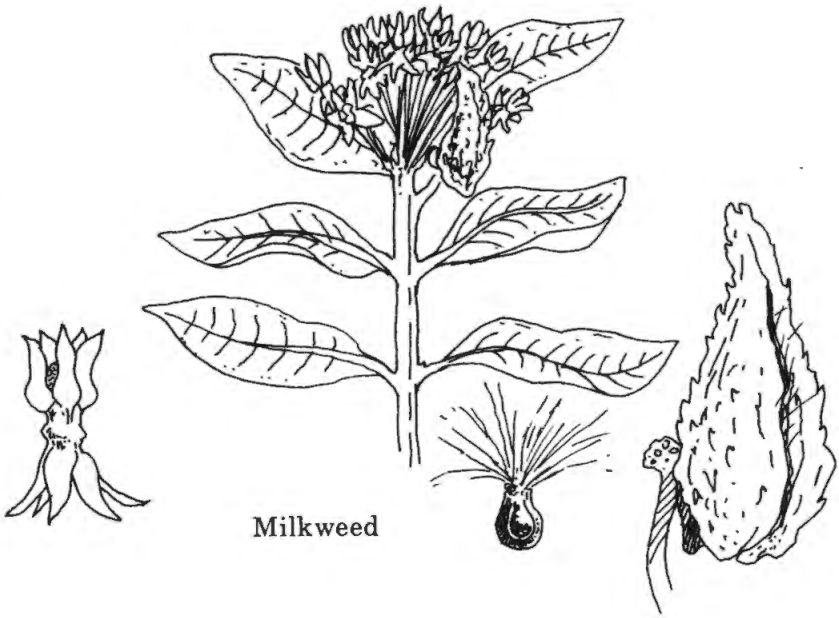
Black-eyed Susan

Wingstem

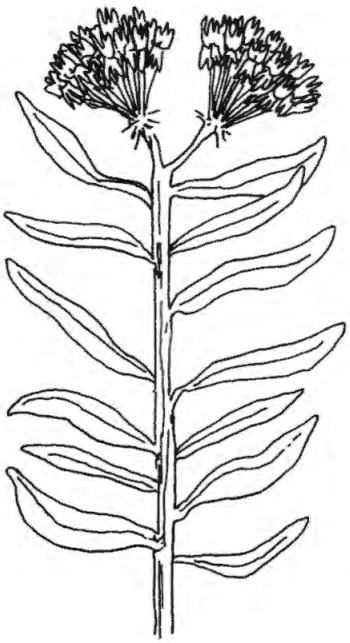
MILKWEED (*Asclepias syriaca*) F. Milkweed *
Roadsides, dry soil, fields; 3'-5'; June to Aug.
The coarse plant is stout and downy with rather large ovate, paired leaves; all parts have a thick, sticky, milky juice, very bitter. The pink flowers, domed and a bit droopy, have the unusual structure typical of all milkweeds and are carried in umbrella-like clusters springing from leaf axils. The fat warty seedpods open as they ripen to release closely packed rows of brown seeds attached to tufts of fluff. Monarch butterfly larvae feed on the bitter plant juices, making them distasteful to predators.

BUTTERFLY WEED (*Asclepias tuberosa*) F. Milkweed
Fields, dry soil; 1'-2'; June to Sept.
Stems are hairy and not milky when broken. Narrow leaves are variable, may be alternate. Orange flowers are in umbels; seed pods are spindle-shaped and held erect, with the typical seed attached to fluff. A popular food with butterflies.

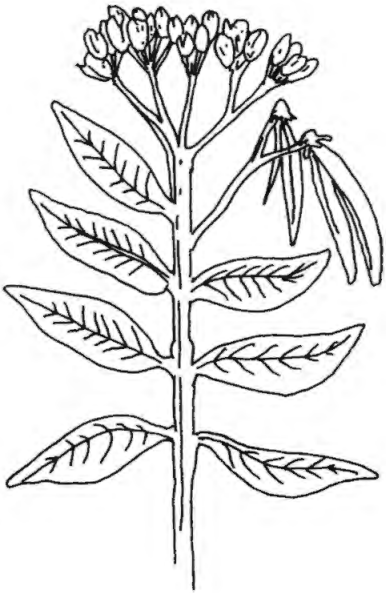
INDIAN HEMP (*Apocynum cannabinum*) F. Dogbane *
Open thickets, shores; 1'-4'; June to Aug.
Plant resembles a milkweed; leaves are tapered, opposite, on smooth stems which are milky when broken. Umbel of small greenish-white flowers gives way to slender seedpods hanging in pairs, with brown seeds attached to fluff as in the milkweed. The stems have very tough, fibrous bark twisted by the Indians into rope.



Milkweed



Butterfly Weed



Indian Hemp

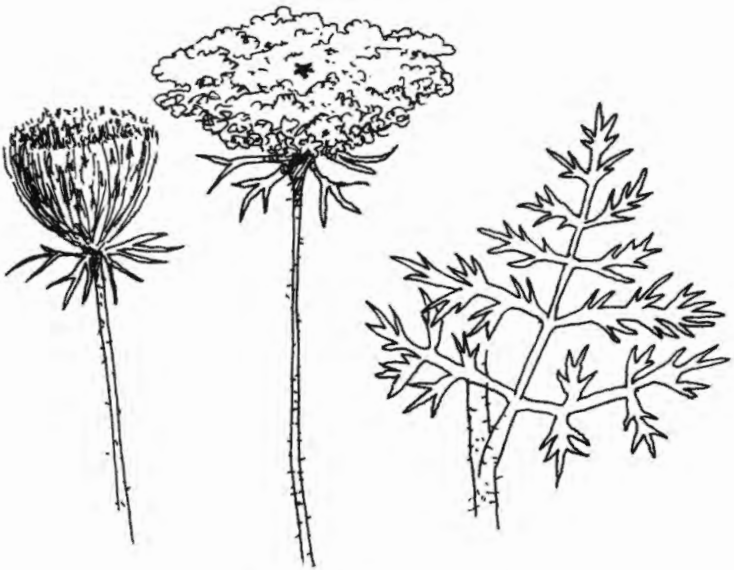
YARROW (*Achillea millefolium*) F. Daisy *
Roadsides, fields; 1'-3'; June to Aug.
The much-dissected fern-like leaves are soft and aromatic. Small white flowers are in flat tight clusters. The five rays give each floret the look of a five-petalled flower.

BONESET (*Eupatorium perfoliatum*) F. Daisy *
Low ground, swamps, thickets; 2'-5'; July to Oct.
The veiny, wrinkled leaves are perfoliate, uniting basally around the stem. Plant is hairy. Small, whitish flowers crowd together to form a fuzzy, rather flat-topped cluster. Plant is thought to speed healing of bone fractures and was once used against "break-bone" fever.

QUEEN ANNE'S LACE (*Daucus carota*) F. Parsley
Roadsides, fields; 2'-3'; May to Oct.
Flat clusters of tiny white flowers, sometimes with a red dot in the center, form a lacy pattern and are carried on long, thin fuzzy stems. Leaves are finely divided and subdivided and resemble both parsley and carrot foliage. Old flowers curl to form a "bird's nest." Also called wild carrot, this plant has relatives which are very poisonous.

Boneset

Yarrow

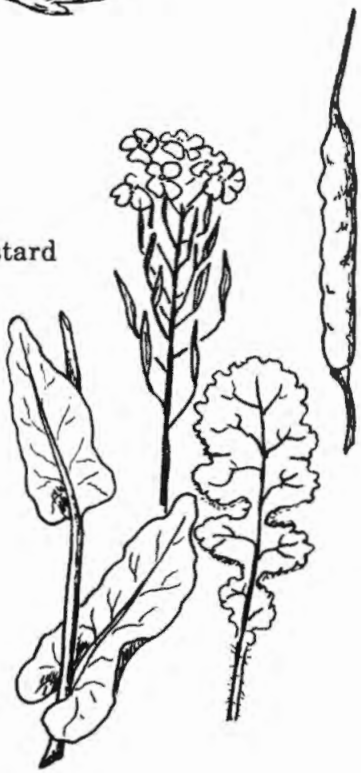


Queen Anne's Lace

YELLOW HAWKWEED (*Hieracium pratense*) F. Daisy
Fields, roadsides; 1'-3'; May to Aug.
Lanceolate, very hairy leaves form a basal rosette. Stems and bracts are bristly with blackish hairs. Flowers are yellow and resemble dandelions. Also called King Devil. In old times it was thought that hawks used this plant to strengthen their eyesight.

FIELD MUSTARD (*Brassica rapa*) F. Mustard
Cultivated fields; 2'-2 1/2'; June to Oct.
Yellow flowers are carried in a flat terminal cluster, appearing in great drifts in meadows, and are succeeded by erect seedpods which gradually narrow into slender beaks. Leaves are broad and deeply lobed and have clasping, ear-like lobes on the stem leaves.

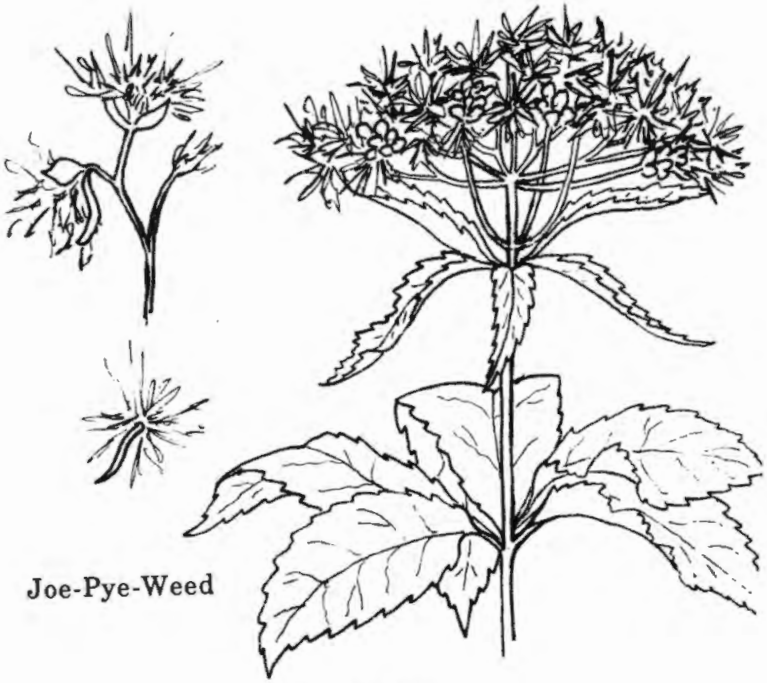
Yellow Hawkweed



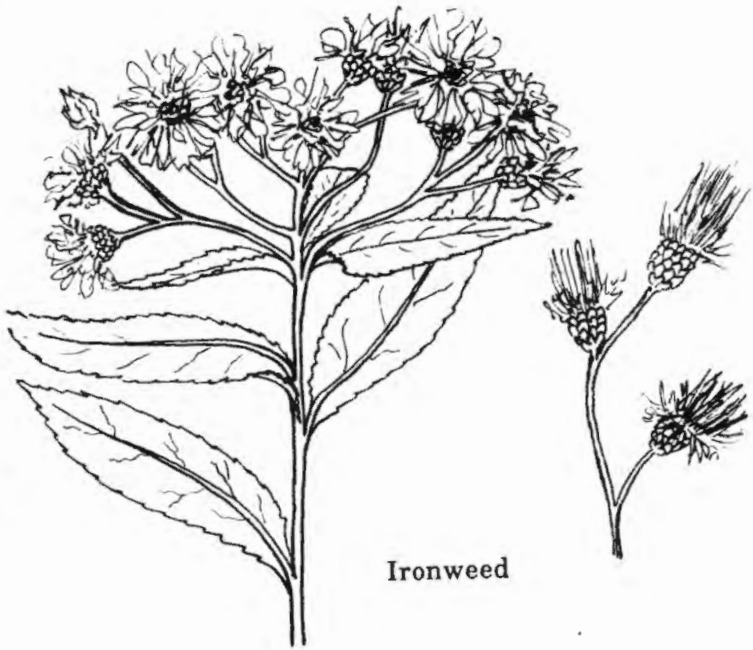
Field Mustard

JOE-PYE-WEED (*Eupatorium maculatum*) F. Daisy *
Wet thickets, meadows; 2'-7'; July to Sept.
Tall, handsome plant with lanceolate, toothed leaves in whorls of four or five on the strong purplish stem. Pale, fuzzy pinkish flowers are held in a slightly domed cluster. The only plant known to be named for an Indian, a New England herb doctor who credited it with medicinal qualities.

IRONWEED (*Vernonia noveboracensis*) F. Daisy
Meadow edges, thickets, stream banks; 3'-7'; Aug. to Oct.
Tall plant has brilliant purple flowers held in a flat-topped cluster on long, very strong stems. Long dark green leaves are slender, toothed, stemless and alternate. Flower bracts have hairlike tips. Name refers to the very strong stems.



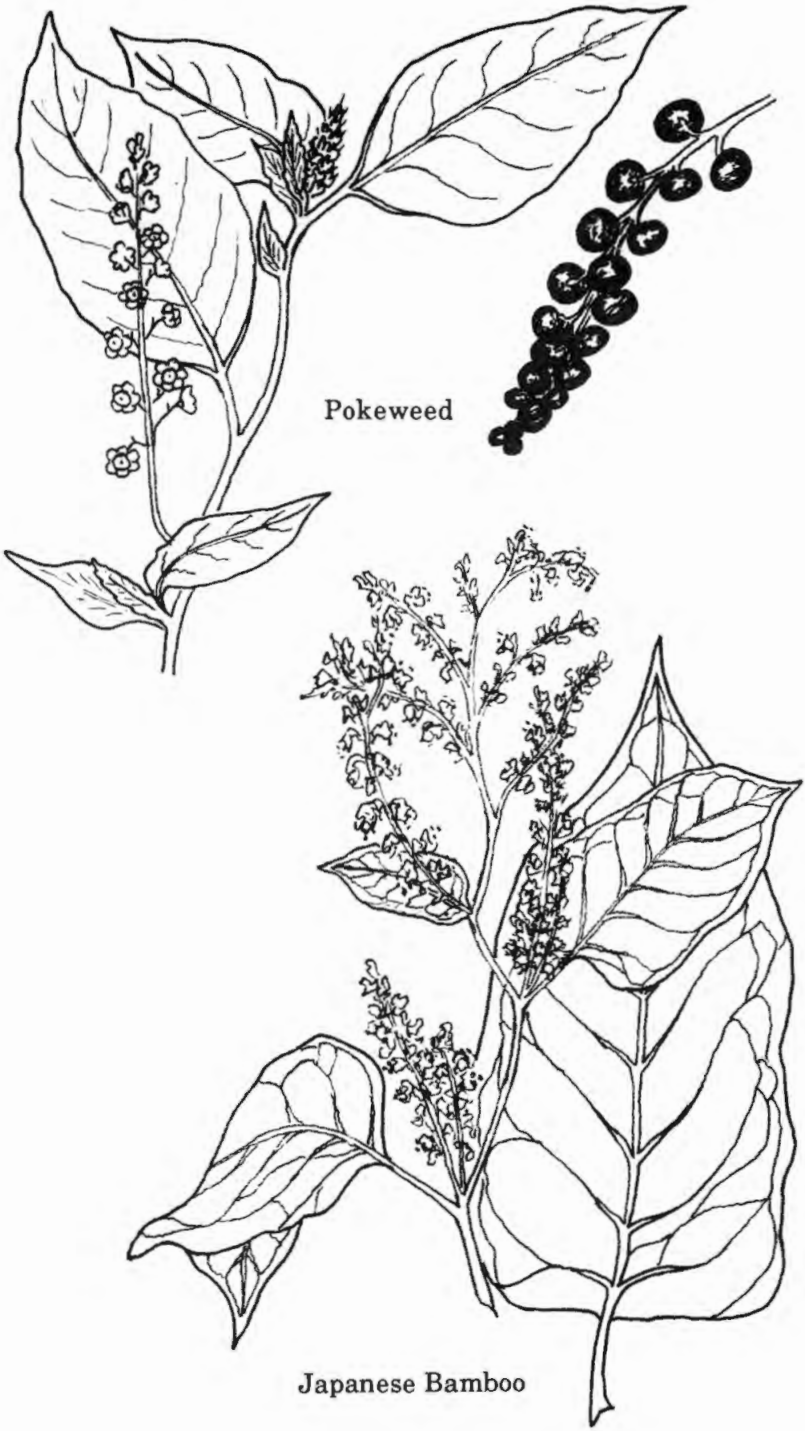
Joe-Pye-Weed



Ironweed

POKEWEED (*Phytolacca americana*) F. Pokeweed *
Damp thickets, clearings; 4'-10'; July to Sept.
Stout plant, branching, with large, toothless leaves carried on stems. Stems are coarse and reddish. White flower clusters are often paired with leaves. The fruiting clusters which follow have flattish, purple-black berries which yield a rich deep reddish purple stain. Berries are eaten by birds but all parts are poisonous to man, except for the very young shoots emerging in spring. Berries used as a natural dye.

JAPANESE BAMBOO (*Polygonum cuspidatum*)
F. Buckwheat *
Waste places, stream edges; 4'-10'; Aug. to Sept.
Large, coarse plant with arching canes, hollow and jointed like true bamboo, which arise from roots near the surface of the soil. The paired leaves are broad and short-pointed. The small, greenish-white flowers grow in branching panicles, mainly from leaf axils but also in a terminal cluster. Once grown as an ornamental but is invasive. Roots spread into thickets. Also called Japanese cane and Japanese knotweed.



Pokeweed

Japanese Bamboo

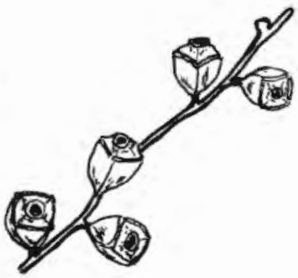
BEECHDROPS (*Epifagus virginiana*) F. Broomrape *
Under beech trees; 6"-24"; Aug. to Oct.
Branching plant is parasitic on the roots of beeches, has no green pigment and scales instead of leaves. Entire plant varies in color from yellow to purplish red. Small flowers are tubular and two-lipped; plant may be seen dried through the winter and is a true flower, not a fungus.

TURTLEHEAD (*Chelone glabra*) F. Snapdragon
Wet ground, stream banks; 1'-3'; July to Sept.
The distinctive, white to pinkish flowers are carried in a tight cluster at the tip of the stem. They are two-lipped and swollen, with the upper lip arching over the lower, presumably looking like a turtle's head. Toothed narrow leaves are in pairs.

SEEDBOX (*Ludwigia alternifolia*) F. Evening primrose
Swamps, damp meadows; 2'-3'; June to Aug.
The small yellow flowers have four petals, somewhat resembling an evening primrose, and are carried on short stems in the leaf axils. Stemmed leaves are alternate and lanceolate. Flowers develop into the squarish, small brown seedpods, containing many small black seeds, which give the plant its name. Seedpods stay on the branched plant long after leaves are gone.

Beechdrops

Turtlehead



Seedbox

BUR CUCUMBER (*Sicyos angulatus*) F. Cucumber
Stream banks, thickets; July to Sept.
A weakly climbing green vine which dies to the ground each fall, it has lobed, maple-like leaves, twining tendrils and a cluster of five-petalled flowers in the leaf axils. The fruit is a cluster of several burs.

Bur Cucumber

Grasses

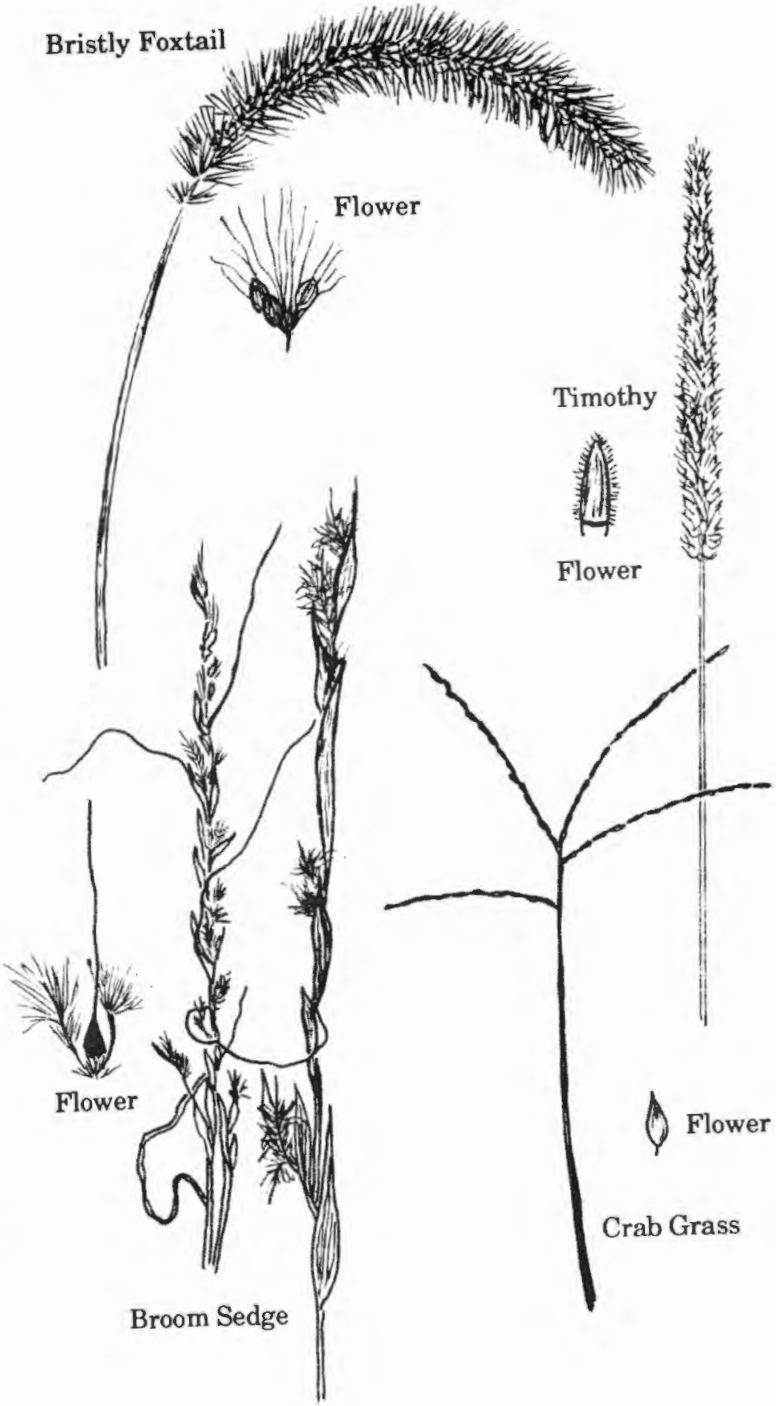
Most grasses are annual or perennial herbs (non-woody plants). The leaves are usually narrow and long and the base forms a sheath around the stem. Stems are often hollow between the nodes. This is the most important of the plant families, as the major portion of the world's food (wheat, rice, corn, etc.) comes from the seeds, carried in the inflorescences or flower/seed heads of this group.

BRISTLY FOXTAIL (*Setaria verticillata*)
Throughout. May grow to 4'.
Flexible, cylindrical inflorescence with many short fine hairs which point down. If you squeeze the inflorescence through your hand, it will wiggle like a woolly bear. Weedy annuals, related to the cultivated grain millet. Green and yellow foxtails are also common.

TIMOTHY or HERD'S GRASS (*Phleum pratense*)
Common in fields, roadsides. 1' - 3 1/2'.
A perennial grass, valuable for hay. Narrow cylindrical inflorescence, rough textured. The single flower is pale green, then turns tan as it ripens in early summer. As hay, it dries well and makes good winter fodder.

BROOM SEDGE or POVERTY GRASS
(*Andropogon virginicus*)
Dry fields, railroad tracks, overgrazed land. 2'-5'.
Not a true sedge, this grass is sometimes called poverty grass (as are several other grasses) because of its prevalence on overgrazed land. Leaves hug the stems and flowers are tucked inside the leaves. Silvery white hairs surround the flowers. Tan yellow in color, it grows in clumps.

CRAB GRASS (*Digitaria sanguinalis*)
Open, waste places. Prostrate; seed head to 1'.
Annual grass, common and unwelcome in lawns and gardens. Its sprawling growth habit, flat on the ground with stems rooting at the nodes, make it resemble a crab. The erect stem forks, with smooth oval seeds hugging the branches.

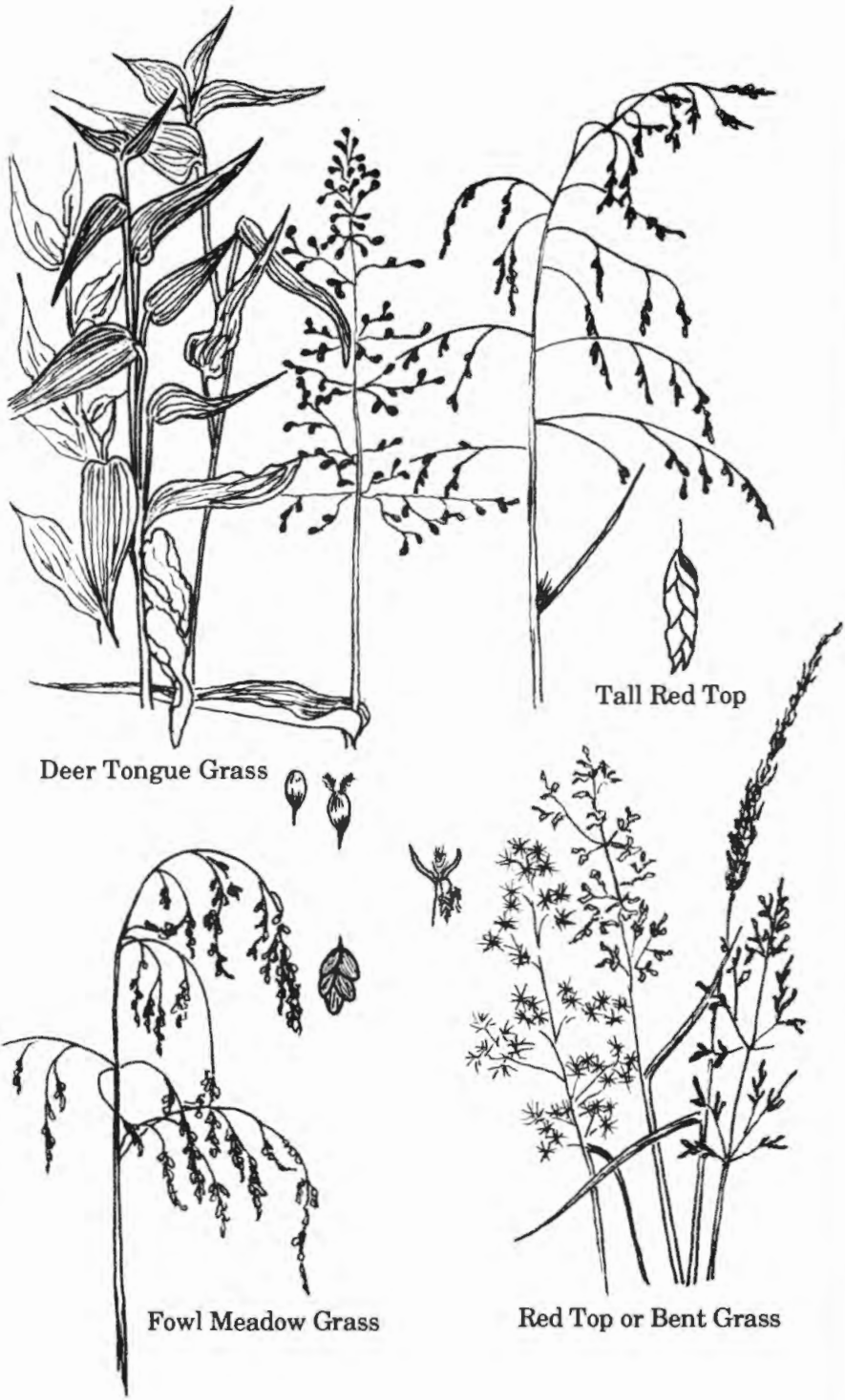

Bristly Foxtail
Flower
Timothy
Flower
Flower
Flower
Crab Grass
Broom Sedge

DEER TONGUE or PANIC GRASS (*Panicum clandestinum*)
Thickets, waste places, wood edges. 3'-5'.
A perennial grass which may form thick clumps, with stiff, rather wide leaves sticking out at right angles to the main stems, usually rough and hairy. The leaf sheath pulls conspicuously away from the stem. Flowers are small, oval, at the end of branches on the main inflorescence, and fade rapidly. Leaf masses persist through the winter.

TALL RED TOP or PURPLE TOP (*Triodia flava*)
Dry places. 2'-7'.
Has little tufts of hairs in leaf axil, stem sticky toward top, drooping branches, widely spaced.

FOWL MEADOW GRASS or PURPLE TOP
(Glyceria striata)
Wet sites. 1'-5'.
Similar to tall red top but not sticky, blooms in spring and usually disintegrates by late summer. More common in wet places.

RED TOP or BENT GRASS (*Agrostis alba*)
Lawns, fields, roadsides. 10"-4'.
An open, delicate inflorescence, with branches in bunches forming a triangular head. Variable in habit; may grow in distinctive circular clumps or sprawl along the ground, rooting at nodes. A fine lawn grass. Reddish only for a short time, then tan, remaining standing through most of the summer.


Deer Tongue Grass
Tall Red Top
Fowl Meadow Grass
Red Top or Bent Grass

Non-Flowering Plants

FUNGI

Fungi are plants lacking chlorophyll, unable to make food by photosynthesis. All live on organic matter. One type, saprophytes, break down or decompose dead plants and animals. Another, parasites, use live plants or animals as hosts, taking food from them and sometimes killing them. The fungus plant consists of branching threads called mycelium which usually live underground. The spore-bearing fruiting bodies appear above ground and are known as mushrooms. "Toadstool" is a popular name for stemmed mushrooms. Fungi are important agents of decay in the natural cycle.

CUP FUNGI and allies (*Pezizales*): **Yellow Morel** (*Morchella esculenta*) appears April-June, on the ground in old apple orchards and burned areas. It is also associated with tulip trees, elm, ash, oak, beech, maple. Cap is yellow-brown with a honeycomb look, about 2" wide and 3" high.

FLASK FUNGI (*Sphaeriales*): **Dead Man's Fingers** (*Xylaria polymorpha*) appears June-Oct. on rotting deciduous wood, at base of stumps, especially maple and beech. Short-stalked, thick, distorted clubs are white to buff, later becoming black. Usually in clusters.

CORAL FUNGI (*Clavarias*): **White Worm Coral** (*Clavaria vermicularis*) appears July-Sept., densely clustered in grass, woods and fields. Consists of white, curved, worm-like clubs which yellow with age. Brittle, almost translucent when wet.

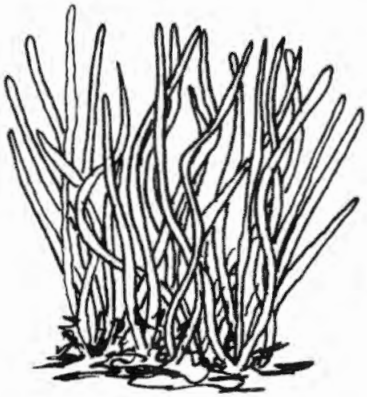
PORE FUNGI (*Polypores*): **Two-colored Bolete** (*Boletus bicolor*) appears June-Oct., on ground under oak, aspen and pine. The 2"-6" wide convex cap is rose-red in center, yellowish toward margin, with minute yellow pores and a yellowish stalk. All parts slowly bruise blue.

Artist's Conk (*Ganoderma applanatum*) is year-round, on dead wood usually but also seen on wounds of living trees. A woody, horny, flat to hoof-shaped cap, stalkless and gray to brownish. White pores bruise readily. Drawings made on it will remain permanently.

Cinnabar-red Polypore (*Pycnoporus cinnabarinus*) is year round on dead deciduous wood, especially cherry and oak. Cap is 1"-5" wide, tough, orange-red and stalkless with orange-red pores. Keeps color when dried.

Yellow Morel

Dead Man's Fingers



White Worm Coral

Two-colored Bolete

Artist's Conk

Cinnabar-red Polypore

GILL FUNGI (*Basidiomycetes*): **Fly Agaric** (*Amanita muscaria*) appears July-Oct. on ground under pine, spruce and birch. Poisonous. Cap 2"-10" wide, convex to flat or sunken. Color ranges from yellow to orange and red, with white patches. Stalk has a ring and bulbous base with rows of cottony patches. Once used to stupefy house flies.

Honey Mushroom (*Armillariella mellea*) appears Aug.-Nov., clustered at bases of trees and near stumps. Yellow-brown, sticky cap is sometimes scaly. Gills are attached to 2"-6" long stalks, usually ringed. Both stalk and gills whitish, staining to yellowish to rust-brown.

Fairy Ring Mushroom (*Marasmias oreades*) May-Sept. in lawns. Cap small, dry, buff to tan and knobbed. Gills are white, felted. Stalk is rubbery. Hundreds may sprout in a loose circle, or fairy ring, which increases in diameter each year. Some other species also form rings.

Walnut Mycena (*Mycena luteopallens*) Sept. to Nov., growing on walnut and hickory shells. Very small yellowish cap is egg-shaped.

Alcohol Inky (*Coprinus atramentarius*) May-Sept., clustered in grass and wood debris and near buried wood. Cap 2"-3" wide, fleshy, gray-brown, egg-shaped and radially lined. White gills darken and liquefy to a black inky fluid, typical of the coprinus family. Alcohol taken up to two days after eating this mushroom will cause headache and nausea.

PUFFBALLS (*Lycoperdales*): **Gem-Studded Puffball** (*Lycoperdon perlatum*) July-Oct. In open woods, along roads, on ground in urban areas. A small white mushroom, 1"-2", turban-shaped with small, detachable conical spines. In maturity, a pore develops at the top from which spores erupt under pressure. White interior becomes green-brown with age.

LICHENS

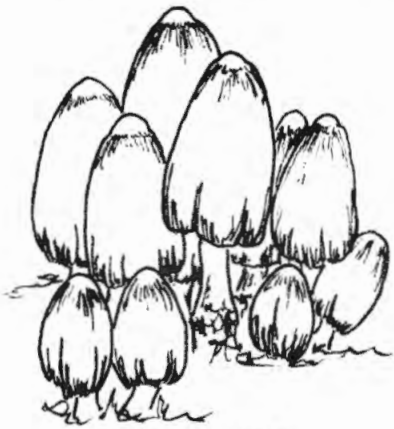
A lichen is composed of a fungus and an alga, the major portion being the fungus. Although both components may reproduce separately, lichens are found in habitats where neither component could survive alone. Lichens produce acids which eat away at rocks, speeding disintegration and the formation of soil. They are the most widely distributed form of terrestrial plant life. One of the few plants able to live at high altitudes, lichens are a major source of food for musk ox, caribou. Colorful when moist.

Fly Agaric

Honey Mushroom

Fairy Ring Mushroom

Walnut Mycena



Alcohol Inky

Gem-studded Puffball

There are three classes of lichens:

Crustose (crustlike). Form hard, granular crusts on rocks and bark. **Pitted lichen** (*Verrucaria calciseda*) is thin, white to gray and partially sunk into limestone. Small fruiting bodies show as black dots.

Foliose (leaflike). Flattened, leaf-like, with edges raised off the surface. **Pale shield lichen** (*Cetraria glauca*) is leaf-like, up to 6" across the lobed margins, found on trees and logs.

Fruticose (shrublike). Branched structures, erect or hanging, bearing fruiting bodies on the branch tips (reindeer moss in this group). **British Soldiers** (*Cladonia cristatella*) has greenish-gray flattened scales, branched stalks to 1" with globular red fruiting tips resembling soldiers' coats. Found on soil, decaying wood. **Pyxie Cup** (*Cladonia pyxidata*) has stalked cups to 1" high. Branches sometimes grow from cup lip, with brown fruiting disks. Found on rocks, soil, rotten wood.

SLIME MOLDS

Slime molds, or myxomycetes, are neither animal nor plant but have characteristics of both. Beginning as a slimy mass, called plasmodium, they creep like an amoeba but reproduce by spores. Molds grow in moist places on rotting logs, etc. There are no cell walls in slime molds.

Chocolate tube (*Stemonitis splendens*) May-Oct. Has hair-like stalks which stand up stiffly through the brown sporangium and grows in dense clumps. **Pink toothpaste** (*Lycogala epidendrum*) June-Nov. Small, white to coral, puffball-like, gray in maturity, ooze a thick pink liquid when broken. **Scrambled egg** (*Fuliga septica*) May-Oct. Large fluffy, soft, yellow sporangia form an irregular mass.

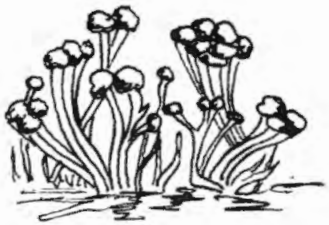
LIVERWORTS, FERNS, CLUB MOSSES, HORSETAILS

Among the oldest living land plants, they were among the dominant plants which formed coal beds some 265 million years ago. They have similar life cycles, all reproducing by means of spores and having two distinct phases: sporophyte, the dominant and easily recognized phase which bears the spores, and gametophyte, a small, bi-sexual phase resulting from germination of a spore. Some liverworts and ferns also reproduce vegetatively.

Common liverwort (*Marchantia polymorpha*) soil and wet rocks. A dark green, flat, thin and ribbon-like plant, much branched.

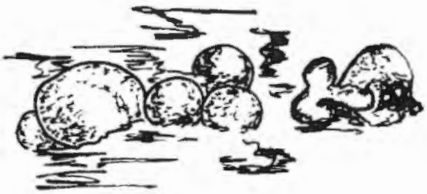
Pitted Lichen

Pale Shield Lichen

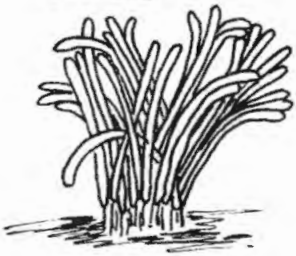


British Soldiers

Pyxie Cup



Pink Toothpaste



Chocolate Tube

Scrambled Egg

Common Liverwort

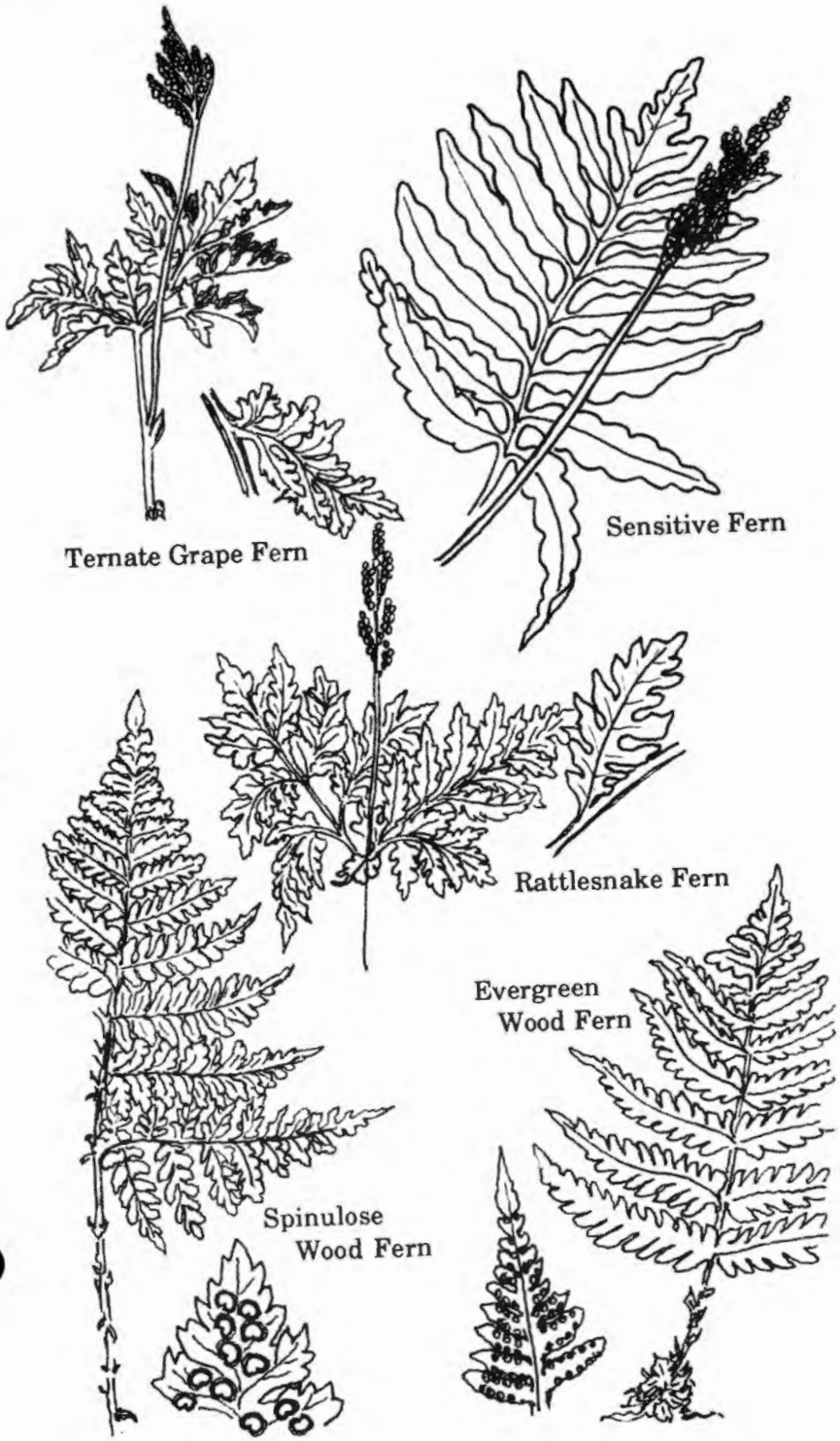
Ternate Grape Fern (*Botrychium obliquum*) fields and open woods. A thick-textured fern with sterile and fertile portions dividing almost at the ground. Blade of sterile part is three-parted, with each part triangular. Fertile portion has round spore cases arranged in two rows, resembling grapes. The sterile blade turns purplish-brown in the winter.

Sensitive Fern (*Onoclea sensibilis*) wet places. Sterile fronds are variable: from 3"-3', coarse-looking but thin-textured, shallowly lobed to deeply cut edges. Fertile frond has bead-like spore cases in two rows. Sensitive to frost. The dried fertile frond remains through winter.

Rattlesnake Fern (*Botrychium virginianum*) moist woods. A thin-textured fern, three-parted with each part triangular. The fertile stalk branches from the base of the blade. Fruits in early summer. Spikes are said to resemble rattlesnake rattles.

Evergreen Wood Fern (*Dryopteris marginalis*) or Marginal Shield fern. Rocky woods. Fronds are ovate, smooth, thick and somewhat leathery, once or twice divided. Spore cases are large, round and close to the margin.

Spinulose Wood Fern (*Dryopteris spinulosa*) rich, moist woods. Lance-like fronds are twice-divided with sharp-toothed pinnules, elongated next to the stalk. Light brown scales scattered on stalks, heavier at base.


Ternate Grape Fern
Sensitive Fern
Rattlesnake Fern
Evergreen
Wood Fern
Spinulose
Wood Fern

Christmas Fern (*Polystichum acrostichoides*) rocky woods. Dark green fronds are lance shaped, once divided and with "eared" leaflets which are said to resemble a Christmas stocking. Fertile frond longer than infertile and is closely covered with spore cases towards the tip.

Maidenhair Fern (*Adiantum pedatum*) moist woods. Thin-textured, with fronds 1'-2' long; stem is shiny, purplish-brown and wiry. Only palmately-branched fern here. Spore cases are in the rolled edges of the pinnae.

Field Horsetail (*Equisetum arvense*) woods and meadows. Stems are ridged and segmented; light brown or pink fertile stems with spores in a cone-like fruiting body appear in spring, dying to the ground after spores are shed. Green, hollow, infertile stems with whorls of branches appear later which

Club Mosses (*Lycopodium*) mostly shady, acid soils. Are generally creeping evergreen plants with small leaves. Not true mosses. They reproduce mostly vegetatively; the spores (in sacs or clubs) rarely germinate.

Christmas Fern

Maidenhair Fern

Field Horsetail

Club Mosses

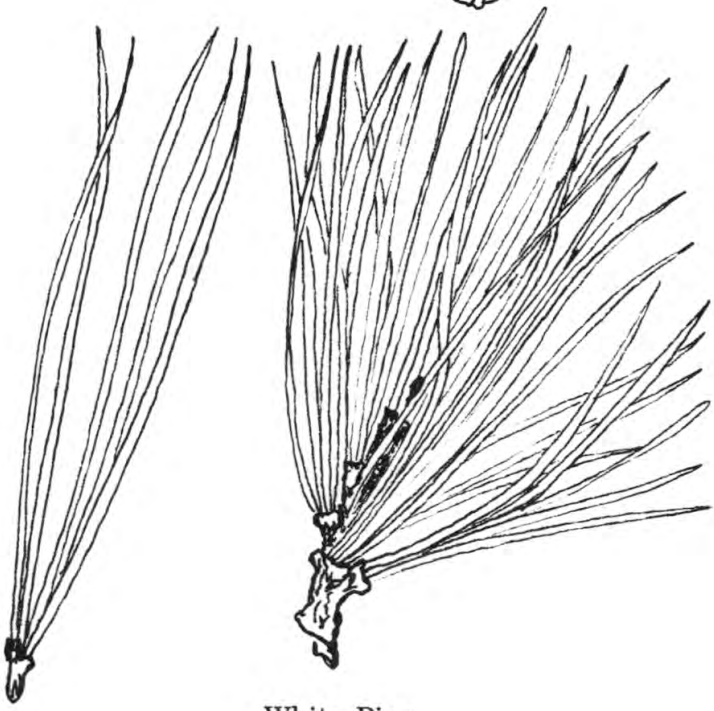
Trees

NEEDLED

EASTERN HEMLOCK (*Tsuga canadensis*) F. Pine
Moist locations, north slopes of rocky ridges, stream banks. 70'. Pyramidal in form with long, sweeping branches, the hemlock has flat, linear evergreen leaves or needles. Flowers appear in April or May. Male flower small, globose and yellow, female oblong and pale green. Small 1" cones mature at end of first season, persist through winter. Grayish-brown bark matures into long ridges covered with close scales. Wood used for construction, paper pulp, laths. May live to 600 years, mature at 250-300 yrs. Considered a climax tree, as competitive seedlings cannot grow in its dense shade. The Pennsylvania state tree.

WHITE PINE (*Pinus strobus*) F. Pine
Fertile, moist, well-drained soil. 80'-100'.
A tall, graceful pine with soft, flexible needles in bunches of five, 3"-5" long. Separate male and female flowers appear in May; stalked, slender, curved cones are 4"-8" and mature in two seasons. Gray bark is broken into small rectangular blocks. Wood is soft, easily worked and has many uses. Once the most valuable tree in the forest (used extensively for ship masts) it grows rapidly and is planted for reforestation as well as landscaping.

Eastern Hemlock

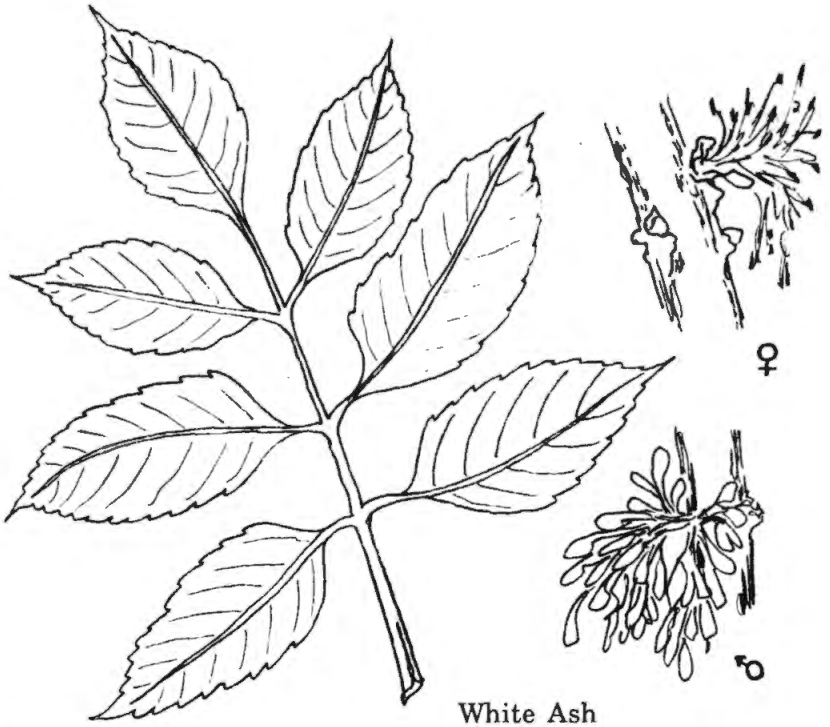


White Pine

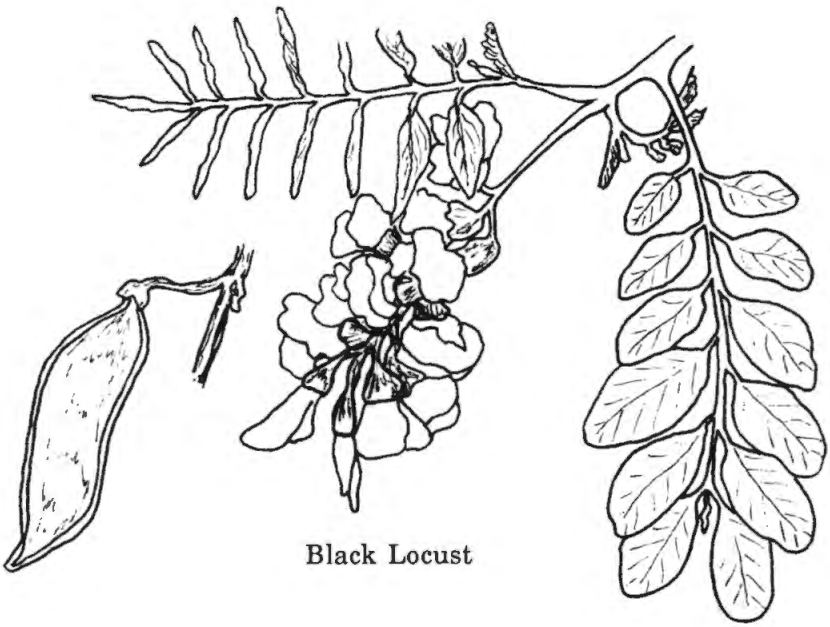
COMPOUND LEAF

WHITE ASH (*Fraxinus americana*) F. Olive
Rich, moist woods, uplands, along streams. 80'.
A tall, straight-trunked tree, the ash has leaf buds and branches opposite. Leaves are pinnately compound, turn purplish in fall. Flowers appear as leaves unfold; fruits are paddle-shaped and hang in clusters well into the winter. Gray bark will mature into fine furrows. Very valuable timber tree, used particularly in hand tools, oars, baseball bats, etc. because of its elasticity. A "white ash breeze," to a sailor, is a flat calm in which oars must be used.

BLACK LOCUST (*Robinia pseudo-acacia*) F. Legume
Rich bottom lands and rocky, sterile slopes. 80'.
A medium-sized tree with spines and pinnately-compound leaves and often a divided trunk. White pea-like blossoms, loved by bees, yield good honey. The flat, long, thin pod is typical of legumes; the roots have the nitrogen-fixing nodules also typical of this family. Wood is very durable, slow to rot, and used for fence posts, railroad ties, etc.



White Ash



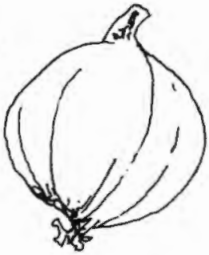
Black Locust

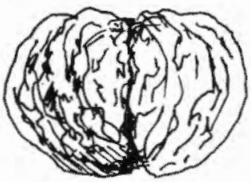
BITTERNUT HICKORY (*Carya cordiformis*) F. Walnut
Fertile woodlots, near streams, often with oaks. 60'.
A round-headed tree with alternate compound leaves bearing six to nine leaflets. Leaf buds are slender and strikingly yellow. Small round nuts are four-chambered, mature in October, and are bitter. Bark is light gray and thin, with narrow ridges at maturity. Hickory wood in general, is strong, resilient, heavy, used for bats, tool handles, chair backs, gunstocks; wood of bitternut is not as strong as that of other hickories. Bark contains tannin, used for tanning leather.

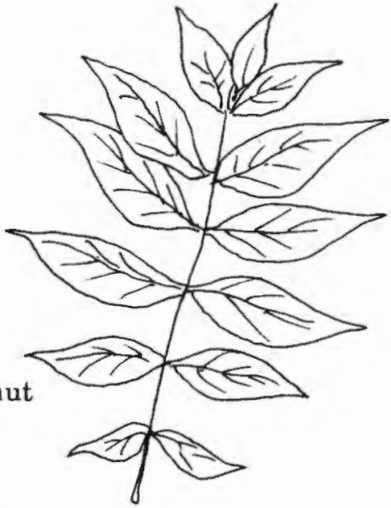
BLACK WALNUT (*Juglans nigra*) F. Walnut
Rich, moist soil, plenty of light. 100'.
A tall tree with heavy, furrowed bark and alternate, compound leaves, 12"-24" long, with 15-23 toothed leaflets on each. Male and female flowers are in separate catkins. Nuts are nearly round, 1 1/2", with a thick fleshy husk which is tough to remove and will stain hands brown. The wood is in great demand for veneers; nuts are delicious. Tree may inhibit growth of other vegetation nearby.

AILANTHUS or TREE OF HEAVEN (*Ailanthus altissima*)
F. Quassia
Introduced; will grow almost anywhere; common in city sidewalk cracks. 100'.
This tough but short-lived tree is very adaptable. The alternate, compound leaves resemble those of sumac, but are toothed at the base. They are 1'-3' long and have a disagreeable odor. The fruit is a winged samara or key, similar to ash but with the seed in the center. Poor quality of wood, readiness to seed anywhere and rapid growth cause it to be considered a weed tree.

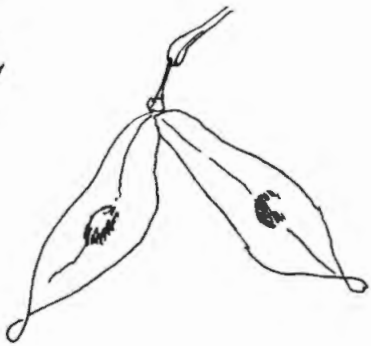
Bitternut Hickory







Black Walnut



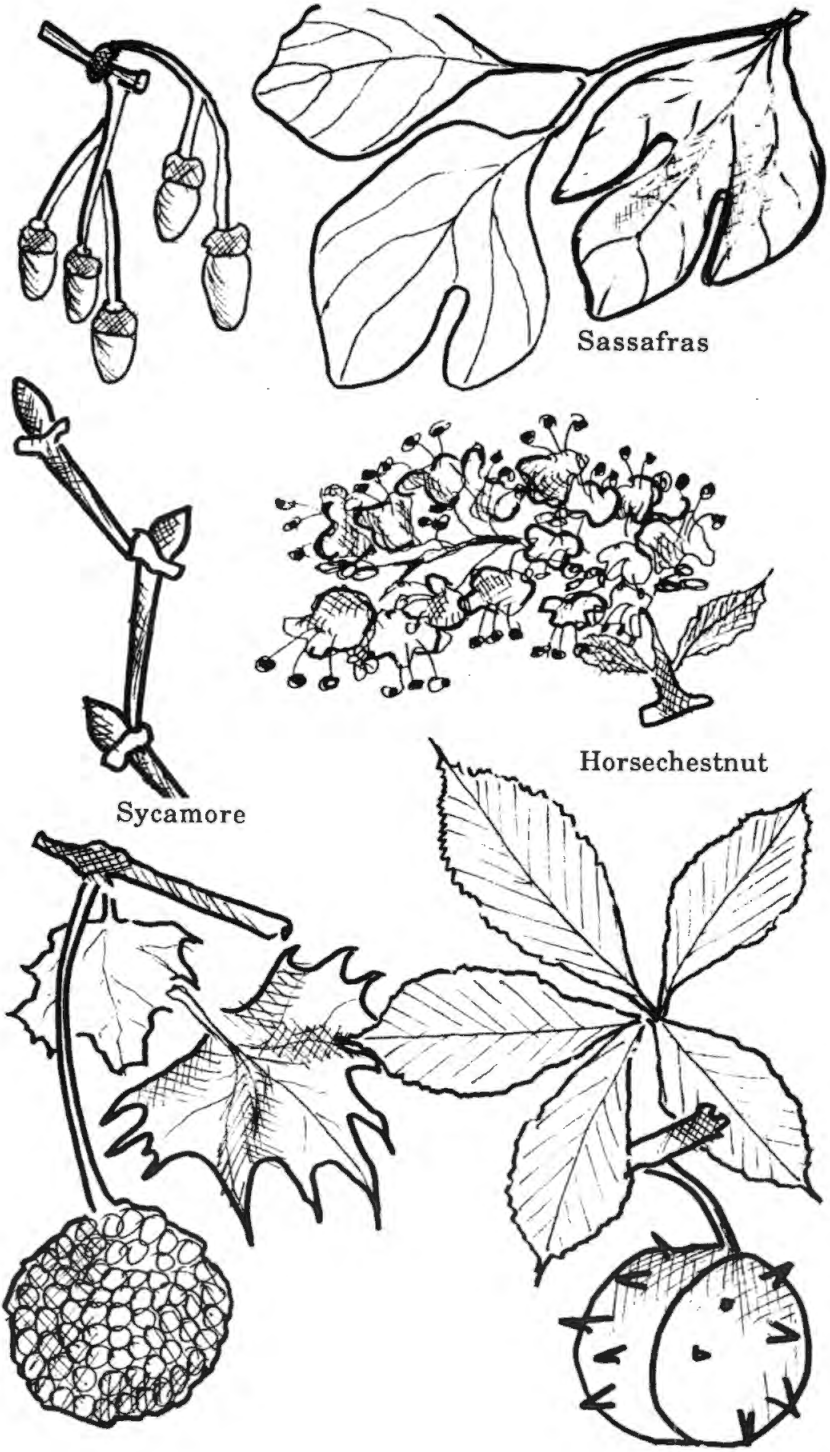
Ailanthus

HORSECHESTNUT (*Aesculus hippocastanum*)
F. Horsechestnut
Introduced; planted as a street tree and for shade. 75'.
The large, round-headed tree has palmately compound leaves and terminal buds which are large and sticky. The attractive showy white blossoms in spring are followed by large, spiny fruit capsules containing one or two smooth, brown, shiny, inedible seeds. The dark brown bark is smooth or in irregular plates.

SIMPLE LEAF

SASSAFRAS (*Sassafras albidum*) F. Laurel
Along fence rows, abandoned fields. 50'.
The "mitten-leaved" tree, sassafras may have three shapes of leaves: egg-shaped, mitten with thumb, mitten with thumb and finger. Twigs are green and brittle. In the fall the ripe fruits are dark blue, shiny drupes on club-like stems, enjoyed by wildlife; the bright red fruit stem clings into winter. Mature bark is reddish-brown, deeply fissured and flat-ridged. All parts are aromatic, smelling of root beer, and roots are used to flavor medicines.

SYCAMORE (*Platanus occidentalis*) F. Sycamore
Along streams, moist soil. 130'.
A very large lowland tree with distinctive mottled bark, brown and whitish, which gives it the name of "ghost tree." Leaves are similar to maple in shape, much larger and with a hollow base to the leaf stalk. Fruits are brown balls with tiny, very fuzzy seeds appearing in October and hanging on through the winter. Prone to rotting from the inside out, sycamores often have such extensive hollows that settlers used them for shelter. Their white bark was used as a guide to water.


Sassafras
Horsechestnut
Sycamore

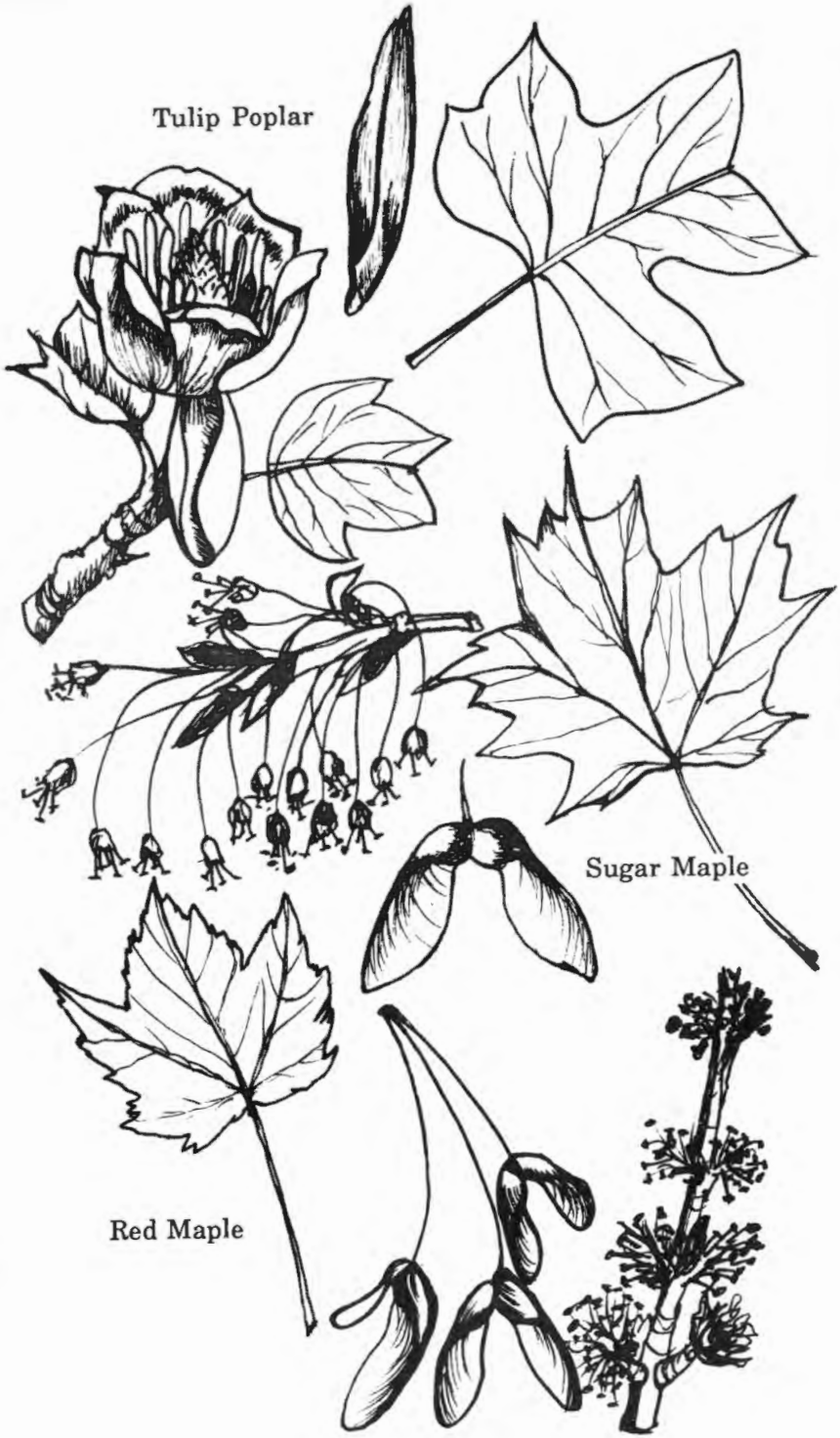
BLACK CHERRY (*Prunus serotina*) F. Rose
Slopes, bottomlands, field edges. 40'-80'.
Leaves are alternate, lanceolate, shiny. Blossoms and fruits are in long clusters; small white flowers in May are followed by bitter, purple-black cherries, popular with birds. Bark is reddish brown on young trees, marked with horizontal lines; on older trees the rough dark outer bark flakes into "potato chip" shapes, exposing red-brown underneath. When injured, a gum substance oozes from the wound. Wood is prized for furniture. Leaves and twigs contain hydrocyanic acid which sometimes (but not always) harms livestock browsing on cherry.

WILLOW (*Salix spp.*) F. Willow
Banks of streams, lakes. 40'-60'.
Leaves are narrow with short stems. Male and female flowers are on separate trees in drooping catkins 1"-3" long. Buds hug the stems and have a single, hood-like scale. Fruit is a small capsule; the tiny, hairy seeds are carried by the wind. Branches will sprout readily if thrust into damp soil. Bark was used in making aspirin, twigs are used in basketry and wood is valuable for artificial limbs because of its ability to withstand shock.

Black willow (*S. nigra*) has very dark bark.

Crack willow (*S. fragilis*), introduced, has brittle twigs.

Weeping willow (*S. babylonica*), introduced, has branches drooping to the ground.

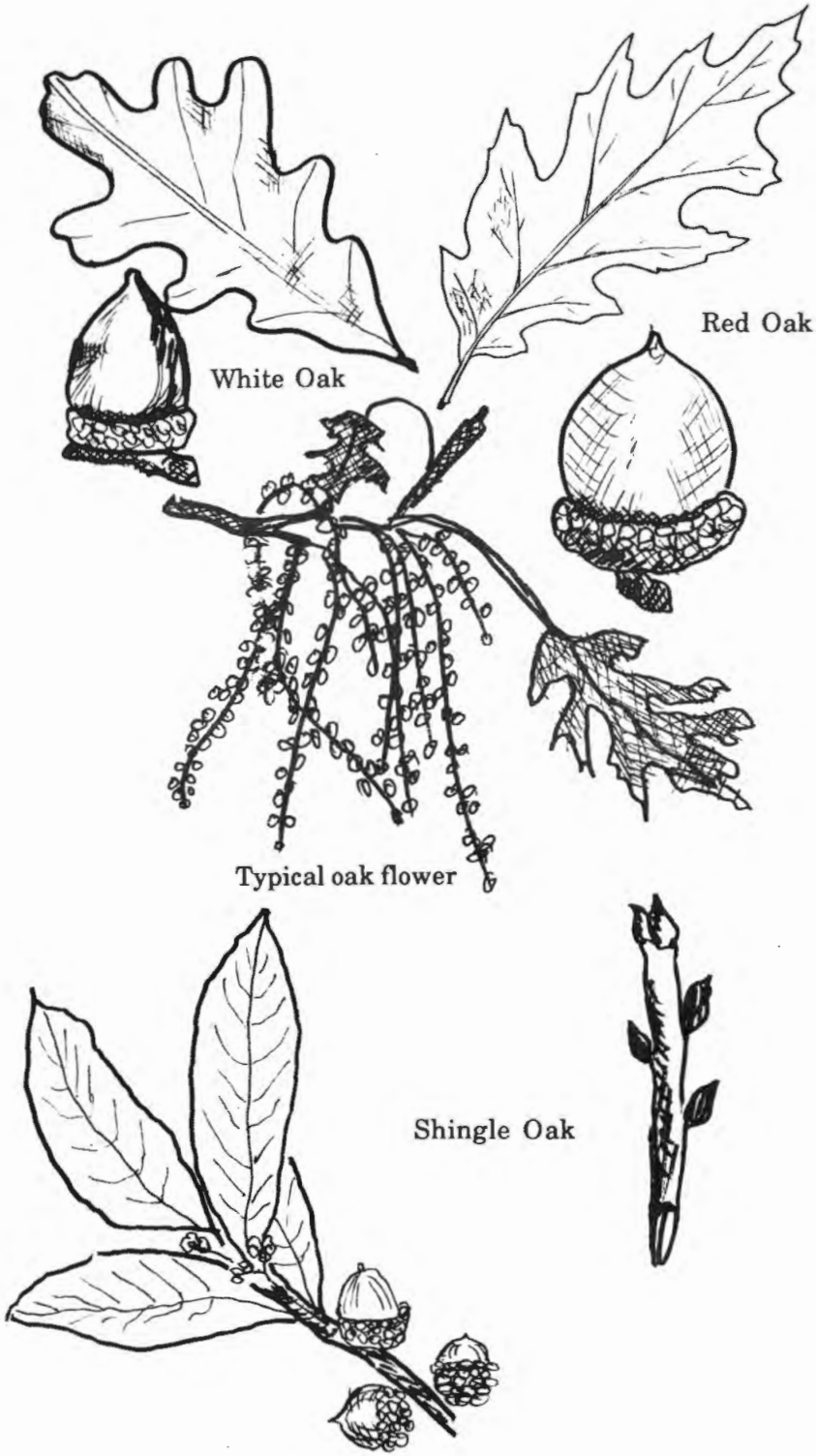

Tulip Poplar
Sugar Maple
Red Maple

OAK (*quercus spp.*) F. Beech
The red/black oak group has bristle tips on the leaf lobes and bitter acorns requiring two years to mature. The white oak group has rounded leaf lobes; its acorns, sometimes edible, mature in one year. Buds are clustered at tips of twigs. Most oaks are slow-growing, long-lived, large, strong trees with sturdy, tough wood of high commercial value. Acorns are an important source of food for wildlife.

White oak (*q. alba*) likes rich uplands, gravelly ridges, has lobed leaves 5"-9" and oblong edible acorns with bowl-like cups, often eaten by deer and other wildlife. 80'.

Red oak (*q. rubra*) has lobed leaves with sharp points and ovoid bitter acorns with flat, saucer-like cups, velvety inside. Bark dark, furrowed. 80'.

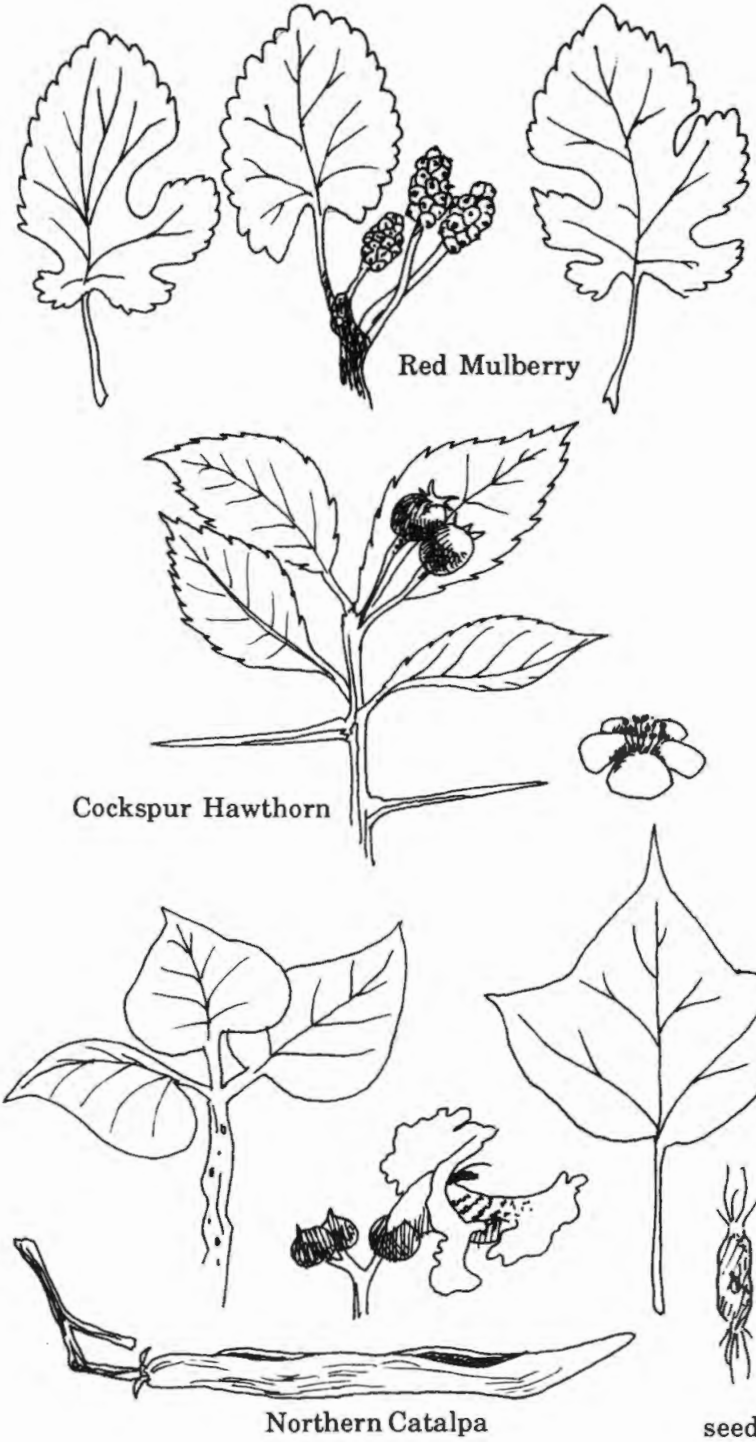
Shingle oak (*q. imbricaria*) laurel-like leaf (oblong to lanceolate) is thin and not leathery, lacks the lobes but has a single bristle tip and is densely hairy beneath. Small oval acorns have a thin, bowl-shaped, scaly cup. Bark is dark and irregularly grooved. 60'.


White Oak
Red Oak
Typical oak flower
Shingle Oak

RED MULBERRY (*Morus rubra*) F. Mulberry
Moist soil, valleys and foothills. 60'.
Leaves are often but not always lobed, finely toothed, sandpapery above. Flowers appear in May or June on dense spikes and are followed by compound fruit, blackberry-like and dark purple when ripe, tasty to people and wildlife alike. (Close cousin white mulberry has hairless leaves, white fruit, is the "silkworm tree".)

COCKSPUR HAWTHORN (*Crataegus crus-galli*) F. Rose
Rocky woods, old pastures. 30'.
Hawthorns are distinctive, with their long thorns, apple-like blossoms and small red to yellow fruits, but the species are very difficult to distinguish. Cockspur is a small tree with simple leaves about 1" long. Hawthorns are popular as a nesting site for birds and the fruits are good food. Once used as a hedging plant ("haw" means hedge). One of the first plants to colonize an abandoned meadow.

NORTHERN CATALPA (*Catalpa bignonioides or speciosa*)
F. Trumpet-creeper
Streams, banks, shaded areas. 60'.
The large 6"-10" leaves are paired or in whorls, heart-shaped with toothless margins. The large, showy flowers, white with yellow and purple spots, appear in June and July in terminal clusters. Long, narrow bean-like pods are packed with seeds. Light brown bark is closely furrowed on older trees. Wood has odor of kerosene, is durable and useful for posts.

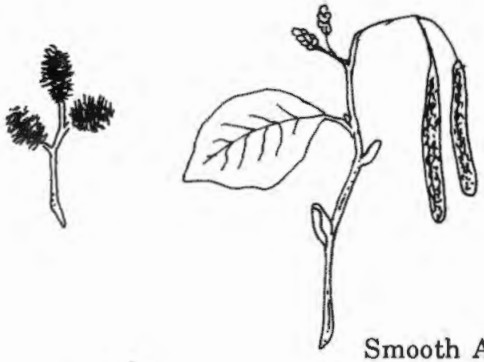

Red Mulberry
Cockspur Hawthorn
Northern Catalpa
seed

Shrubs and Vines

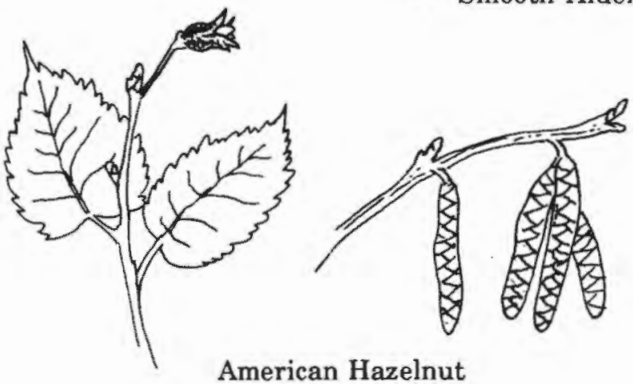
SMOOTH ALDER (*Alnus serrulata*) F. Hazelnut
Wet areas: swamps, stream banks; 6'-15'. March to April.
Tall, shrubby, spreads readily into dense thickets. Male and female flowers are separate on the same plant. Drooping male catkins are 1" and red-brown. The female flower resembles a small pine cone, usually held erect. Both are present in winter. Leaves are alternate, simple, oval to almost roundish, about 2"-4". Veins are almost straight, very prominent. Gall deformations of the fruit are common. In the fall, woolly aphids may be present which may host our only carnivorous caterpillar, the Wanderer butterfly larva.

AMERICAN HAZELNUT (*Corylus americana*) F. Hazelnut
Edge of woods, clearings, fencerows; 3'-6'. March.
The shrub grows slowly in small clusters. The leaves are somewhat heartshaped, toothed, with broad, noticeable veins. Branchlets and leaf petioles are densely downy. The bright red, small pistillate flowers appear in late winter; the staminate catkins are long, drooping, light brown, remain through the winter. The nuts are very popular with wildlife as food and are held in husks which are thin, flattened, hairy, and ragged-edged . Also called wild filbert.

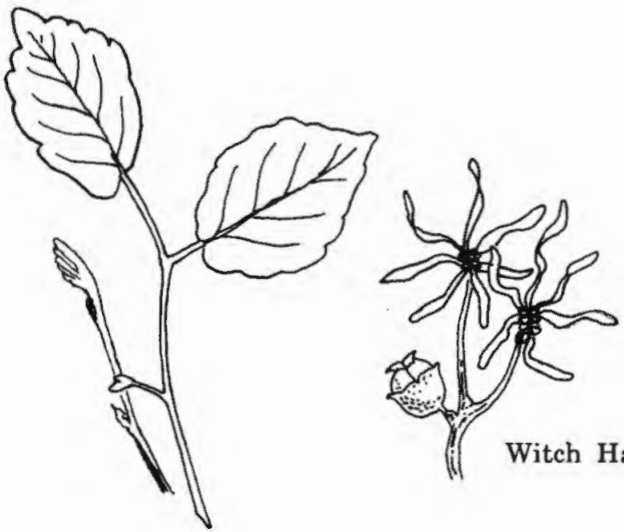
WITCH HAZEL (*Hamamelis virginiana*) F. Witch Hazel
Woods understory; 10'-25'. Oct. to Nov.
Branches are ascending and widely spreading. Leaves have an uneven base (like an elm) and are oval, with coarsely wavy-toothed margins. The distinctive, spidery, yellow flowers have four narrow, wavy petals and appear in late fall. The downy, urn-shaped fruit is a four-parted capsule, grayish, which dries and splits with an audible snap, shooting the shiny black seeds up to ten yards. The shrub was valued by Indians and colonists for medicinal value, as it is astringent. The branches are used by those who "dowse" for water.



Smooth Alder



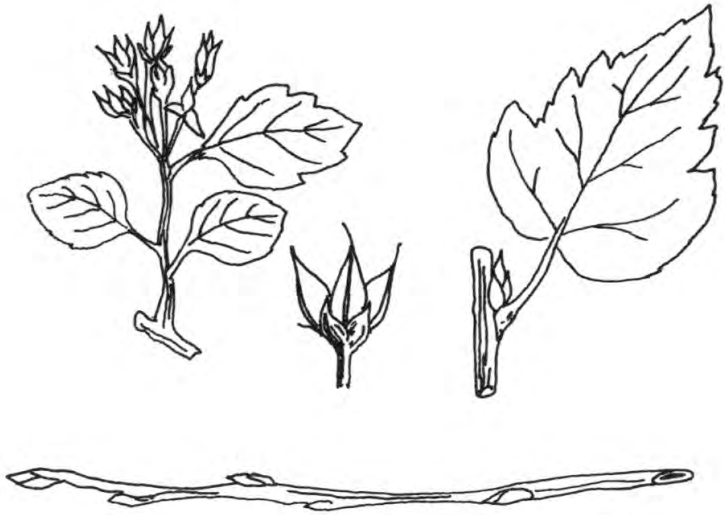
American Hazelnut



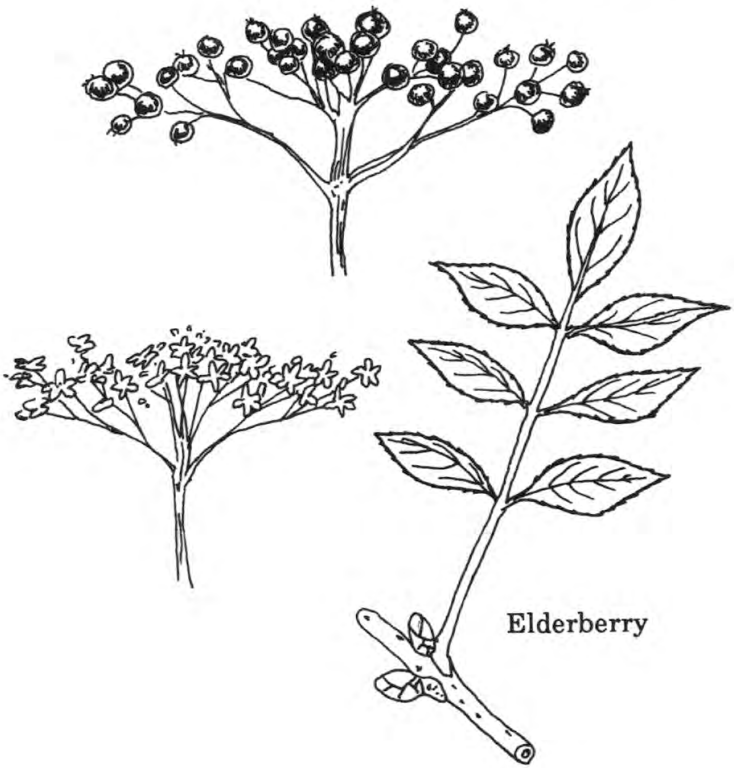
Witch Hazel

NINEBARK (*Physocarpus opulifolius*) F. Rose *
Stream banks, moist rocky slopes; 3'-10'. June.
A much-branched, spreading, upright shrub with distinctive bark which exfoliates in many thin papery layers, hence the name "Ninebark." The dark green leaves are alternate, simple, heart-shaped to wedge-shaped at the base and more or less three-lobed. The umbel-like cluster of flowers has five white to pink petals and many stamens protruding well out beyond the petals. After fertilization, the three carpels in each bloom eventually mature into a smooth-podded fruit which looks like a bellows, purplish to brownish in color.

ELDERBERRY (*Sambucus canadensis*) F. Honeysuckle
Widespread: fencerows, wayside, low ground; 4'-10'.
Late June to July.
The shrub is erect and rather ragged in habit, with soft woody, pithy stems which are very brittle, smooth and a pale grayish brown. Leaves are long and pinnately compound, with seven leaflets normally; individual leaflets are elliptical to lanceolate, 3"-6" long. The flat-topped clusters of small white flowers are followed by purple-black berries, rather seedy, which can be used in pies, for jelly or for wine, and are popular with birds. The stems were used for spiles in gathering maple sap.



Ninebark



Elderberry

TATARIAN HONEYSUCKLE (*Lonicera tatarica*)
F. Honeysuckle *
Open ground, old fields; 4'-10'. May to June.
A bushy, upright shrub which has a distinctive branching pattern, with everything in pairs: leaves, branches, flowers, berries, and new twigs which grow from the axils of old twigs. Leaves are rather small, ovate, and light green in color. The grayish bark on older stems sheds in narrow strips. The white to pinkish, profuse flowers have five rather narrow petals united into a trumpet-shaped tube at the base of the flower and are very fragrant. Fruits are red berries; both flowers and fruit are popular with insects and birds. Escaped from cultivation, it is widely naturalized throughout the Northeast.

SPICEBUSH (*Lindera benzoin*) F. Laurel *
Rich, damp woods, near streams; 3'-10'. March to April.
The "scratch and sniff" plant - all parts very aromatic. Much branched, with branches generally horizontal to the ground in tiers. Leaves are alternate, elliptical, from 2"-6" long, pointed at both base and tip. Twigs are dotted with pale lenticels. The profuse tiny yellow flowers have six showy sepals but no petals and appear in clusters in early spring, opening from globular buds held directly on the branches. The oval, bright red, spicy berry ripens in the fall and is enjoyed by wildlife. Host to the spicebush swallowtail, whose spectacular caterpillar hides in a folded leaf and is a bright leaf-green with two large black and yellow spots resembling eyes on its back.

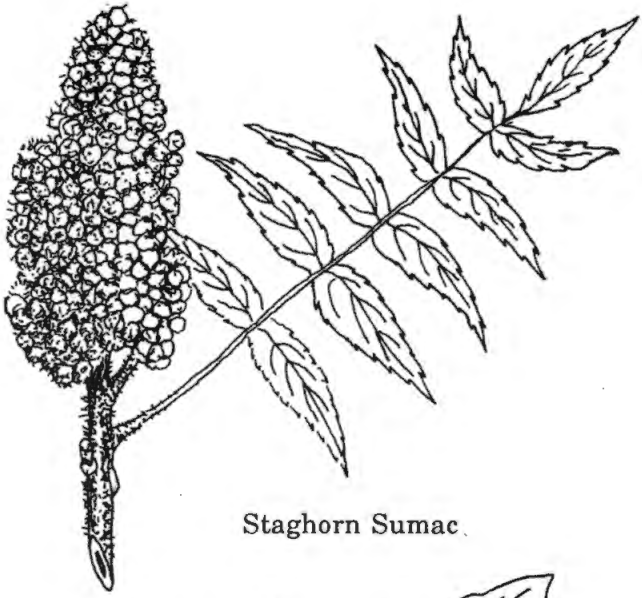
Tatarian Honeysuckle

Spicebush

STAGHORN SUMAC (*Rhus typhina*) F. Cashew
Abandoned fields, disturbed land; 5'-20'. Late June to July.
A tall, woody shrub with stout twigs and buds and distinctive cones of red fruit at the tips of branches. All parts are densely, velvety hairy. The pinnately compound leaves are alternate, from 1' to 2' long, and turn a brilliant scarlet in the fall. Twigs have a very large, yellowish-brown pith, conspicuous large leaf scars and corky lenticels. The greenish-yellow flowers are fragrant; the pistillate clusters soon turn bright red. The leafless branches resemble a deer's antlers in the "velvet" stage of development, hence "staghorn." An early pioneer in abandoned fields. (Note: poison sumac has dangling clusters of white fruit, not red cones, and grows in bogs and swamps.)

POISON IVY (*Rhus radicans*) F.Cashew
Ubiquitous, of variable form.
This common plant may appear in three forms: 1) trailing, with short upright stems, 1'-2', with small vestigial tendrils; 2) more or less erect, loosely branching and scrambling over fences; 3) vining, attached to tree trunks by hairy aerial rootlets. Three-parted leaves are generally ovate but quite variable and may be toothed or not. The central leaflet is on a long petiole, with the two side leaflets nearly stemless. Leaves turn a brilliant scarlet in the fall. Flowers insignificant; the white-berried fruits are an excellent wildlife food.

All parts of the plant contain the oily resin which causes severe itching and blistering of the skin in most people. Antidotes include thorough washing with soap and rubbing with jewelweed juices. Firewood should always be checked for poison ivy vines, as the smoke carries the toxic substance. "Mr. Hairy Man," from the appearance of the vines on a tree trunk, and "leaflets three, let it be," should be learned by children and adults alike.



Staghorn Sumac

aerial root

Poison Ivy

MAPLE-LEAF VIBURNUM (*Viburnum acerifolium*)
F. Honeysuckle
Moist to dry woods, often rocky; 2'-6'. May to July.
Shrub with opposite, simple leaves, usually three-part like its namesake but sometimes almost unlobed, coarsely toothed on margins, dull green and smooth. Flowers are white to pinkish, numerous in a flat-topped end cluster, followed by roundish blue-black fruits which ripen in Sept.

WILD HYDRANGEA (*Hydrangea arborescens*) F. Saxifrage
Shaded banks, along streams; 3'-6'. May to July.
Loosely branched shrub has dark green, opposite, long stalked, simple leaves, egg-shaped, sharply pointed at tip and sharply toothed on the margins. The flat-topped clusters of flowers are creamy white and are of two types, as is typical of hydrangeas: small, fertile flowers and much larger, showy, sterile ones with four large petals. The branchlets are pale brown. Fruits are small, urn-shaped capsules with a large number of very small seeds.

Maple-leaf Viburnum

Wild Hydrangea

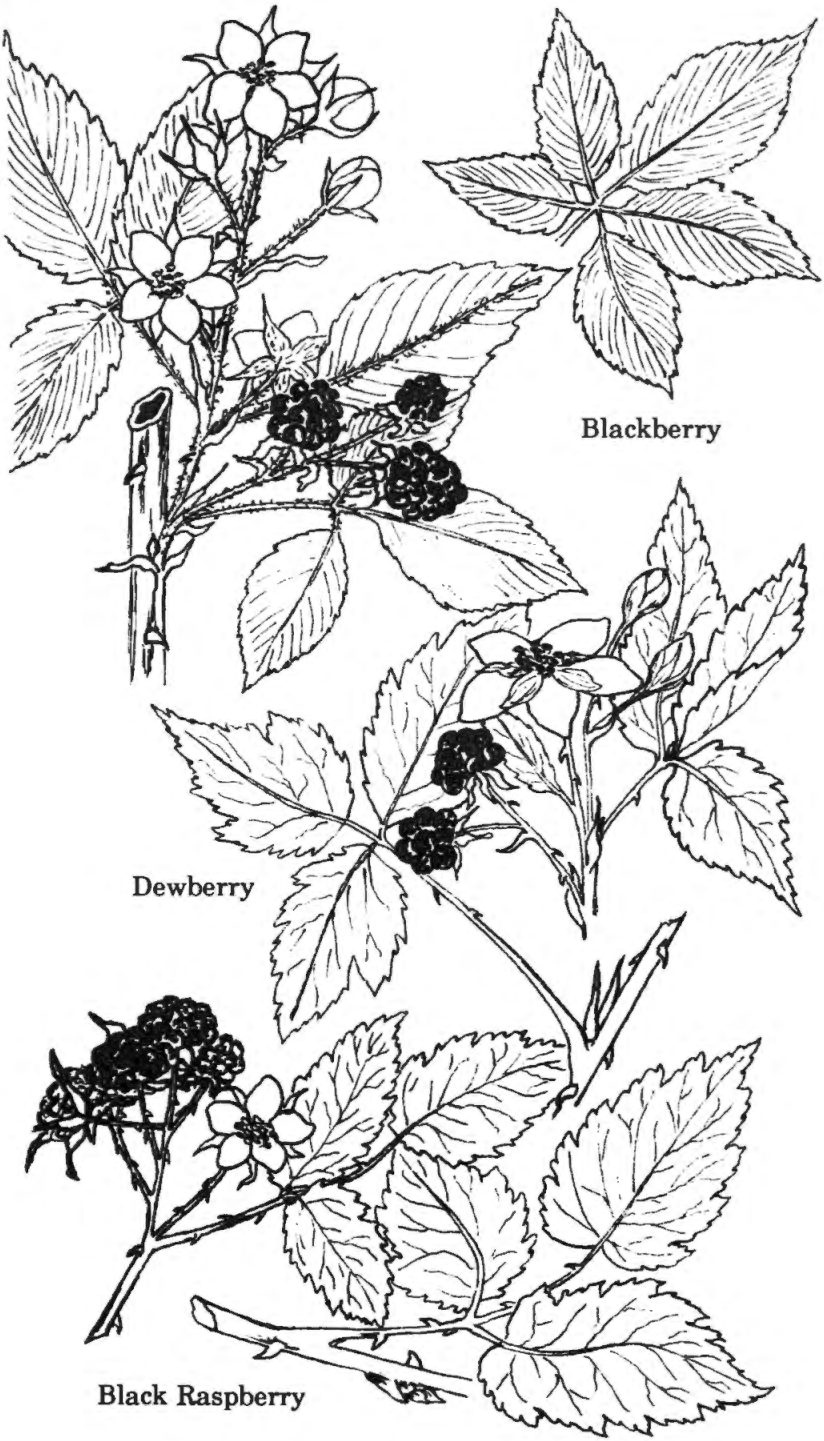
BRAMBLES

All brambles hybridize easily; the following notes describe the general characteristics of each group, and the Latin name is that of the most common species in this area.

BLACKBERRY (*Rubus allegheniensis*) F. Rose
Dry thickets, clearings, roadsides; 3'-6'. May to June.
Arching canes are five-sided and ridged, with sparse stout thorns, distinguishing them from the raspberry group, and may root at the tips to form new plants. The three-parted leaves (sometimes five) are coarsely toothed with downy undersides. The showy white blossoms, each as much as an inch across, are carried in racemes. The black fruits, more seedy than raspberries, do not separate readily from the receptacle.

DEWBERRY (*Rubus flagellaris*) F. Rose
Dry, abandoned fields, acid and barren soils; prostrate.
May to June.
Long, trailing stems are round, greenish to reddish and prickly, and may form mats which can easily trip the walker. The typically bramble leaves are usually three-parted but sometimes five, pointed and toothed, on short, upright branches. The 1/2" fruits do not separate easily from the receptacle.

BLACK RASPBERRY (*Rubus occidentalis*) F. Rose
Roadsides, fence rows, old fields; 6'. May to June.
The slender, round, elongated canes, arching back to the ground, may be ten feet long. They are covered with a distinctive whitish coating and have stout, scattered prickles. The small white flowers are five-petalled. Fruits are green to bright red at first, ripening to a very dark red to black. May tip-root.

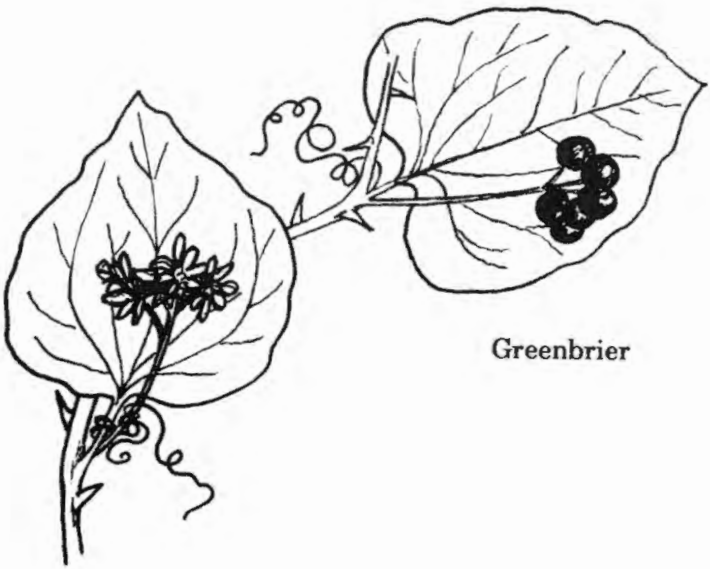

Blackberry
Dewberry
Black Raspberry

PERENNIAL VINES

FOX GRAPE (*Vitis labrusca*) F. Vine
Forest edges, fence rows, second growth woods. May to July. Species tend to interbreed and can be difficult to distinguish. Tendrils in each leaf axil and a heart-shaped, somewhat lobed leaf mark the fox grape. The small, greenish flowers, borne in clusters, are very fragrant and the fruit, ripening in the fall, is dark blue to black. Ancestor of many cultivated grapes, including the Concord. Unusual twining mechanism of the tendrils results in both a left-hand and right-hand spiral on each tendril. Grapevines deep in the woods indicate that the land was once cleared for farming, since they must begin growth in sunlight. Mature vines develop the distinctive bark which may shed in long strips and is used by birds in their nests, especially catbirds and cardinals. Grapes are a very important source of food for wildlife.

GREENBRIER (*Smilax rotundifolia*) F. Lily
Moist thickets, woods. April to Aug.
The only woody vine with green stems and both thorns and tendrils, greenbrier can form dense thickets and ascend into trees. The glossy, ovate to roundish leaves have prominent veins parallel to the leaf midrib. Leaves drop in the fall by breaking off halfway down the petiole. The small, inconspicuous flowers are in spherical clusters in leaf axils on short stalks. Dark blue berries have a powdery bloom, and are valuable as wildlife food. The tangle of vines is an ideal nesting site for birds. Also called horsebrier.

Fox Grape

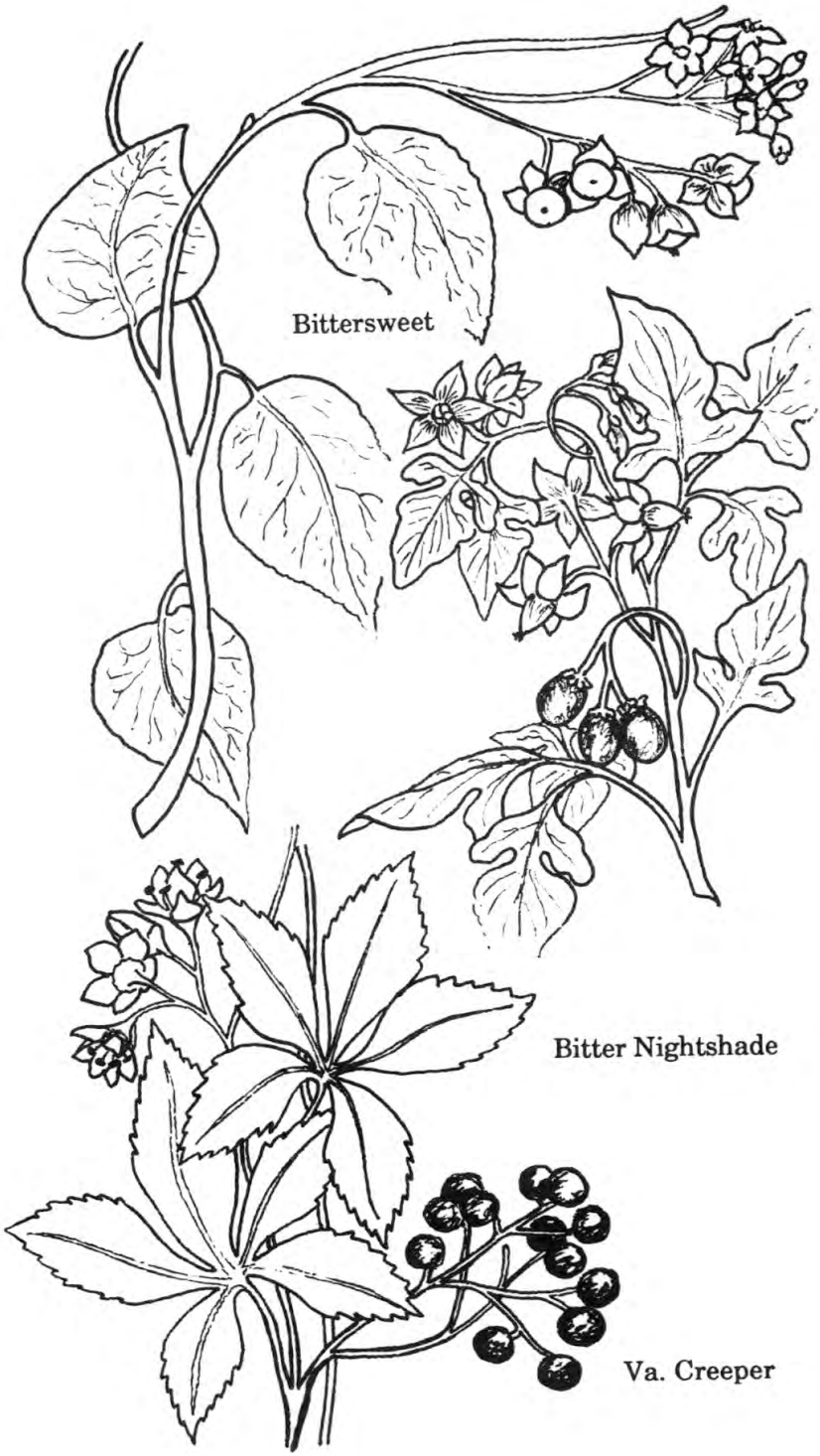


Greenbrier

BITTERSWEET (*Celastrus scandens*) F. Staff-tree
Stream edges, thickets, fence rows. Flowers May to June, fruits Sept. to Dec.
A twining, woody vine with distinctive orange-podded fruits which split open to reveal scarlet seeds. The vine scrambles but may also climb trees; early growth is apt to twine about itself. The egg-shaped leaves have finely toothed, wavy margins. Clusters of small green flowers appear only at branch tips in American bittersweet but are present along the twigs in the Oriental variety. Vines are dioecious, with berries only on female plants.

BITTER NIGHTSHADE (*Solanum dulcamara*) F. Nightshade
Thickets, dooryards, waste places. May to Sept.
Scrambles rather than twines, with semi-woody, ridged or angled stems. The triangular leaves are usually lobed, with the terminal segment largest, and in fall turn a dark purple. The small flowers have five recurved violet petals (occasionally white) surrounding a yellow, conical column of stamens, held in open, lateral clusters. Green berries ripen to red. Flowers, unripe and ripe fruit may be found at the same time on a given plant. Fruits are very bitter and possibly poisonous. Sometimes known (incorrectly) as deadly nightshade, a European plant which yields the drug belladonna. When crushed, the vines have a characteristic odor.

VIRGINIA CREEPER or WOODBINE
(*Parthenocissus quinquefolia*) F. Vine
Woods, thickets, fence rows. June to July.
Compound, five-parted leaves on long petioles; each stalked leaflet is pointed, ovate and jaggedly toothed, turning brilliant scarlet in the fall. Flowers are greenish and insignificant. The dark blue berries are much eaten by wildlife. Woodbine climbs by means of tendrils which branch, developing an adhesive disc on meeting support. If no support is available, tendrils twine around each other. The common food plant of most of the Sphinx moths (see Field Guide).


Bittersweet
Bitter Nightshade
Va. Creeper

Addendum

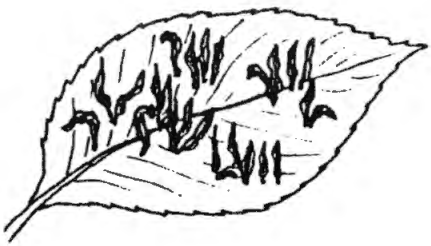
Addendum: Flora of Little Sewickley Creek Watershed

The collection was compiled for the Little Sewickley Creek Watershed Association during 1983-1985 by Myrta Macdonald, students and faculty of Sewickley Academy. Plants listed in the Field Guide have been marked with an asterisk; this list includes specimens not included in the Field Guide. The collection of specimans is available for inspection and study; please contact Mrs. Macdonald at Sewickley Academy.

List is given in botanical order of plant families.

Common horsetail
Nodding wild onion
Scilla
Clearweed
Carolina spring beauty
Hispid buttercup
Celadine
Yellow rocket
Wild stonecrop
Wild strawberry
Crown vetch
Wild geranium
Flowering spurge
Spotted jewelweed
March blue violet
Pale violet
Evening primrose
Indian hemp
Hedge bindweed
Viper's bugloss
Blue vervain
Wild bergamot
Pale plantain
Guelder rose
Indian tobacco
Heart-leaved aster
Panicled aster
Beggar tick
Jerusalem artichoke
Blue-stemmed goldenrod
Lance-leaved goldenrod
Ground pine
Day lily
Nodding lady's tresses
Lady's thumb
Night-flowering catchfly
Tall meadow rue
Pepper grass
Tumble mustard
Mock orange
Steeplebush
Yellow sweet clover
Field milkwort
Sweet buckeye
Common St. Johnswort
Woody blue violet
White violet
Wild parsnip
Myrtle
Wild blue phlox
Smaller forget-me-not
White vervain
Catnip
Bluet
Teasel
Great ragweed
Crooked-stemmed aster
English daisy
White snakeroot
Orange hawkweed
Canada goldenrod
Rough-stemmed goldenrod

Galls



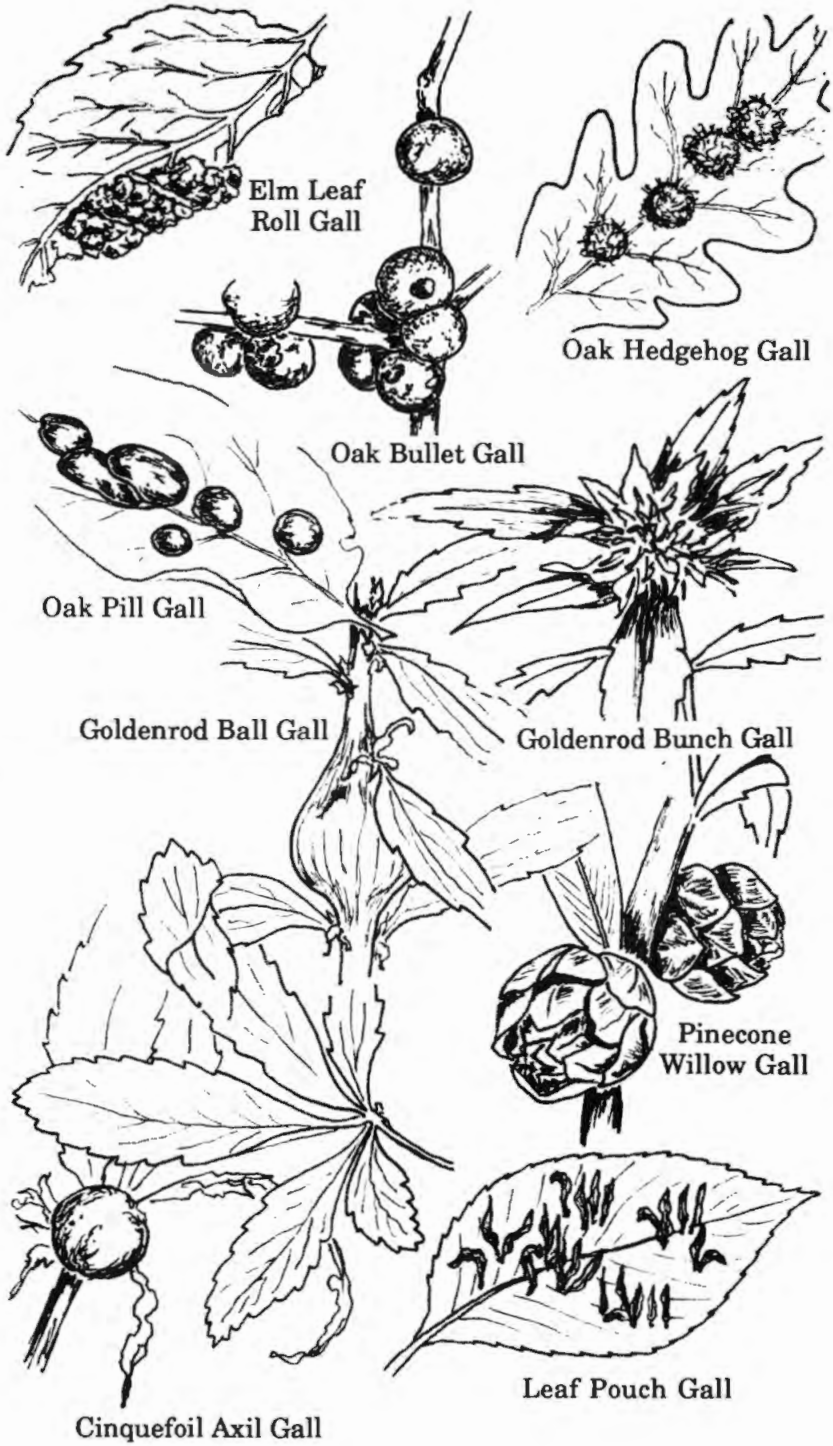
Galls are abnormal growths of plant tissue which may be found on roots, stems, leaves, flowers and seeds. They are caused by a stimulus supplied mostly by insects but also by fungi, viruses and bacteria.

Galls may be classified by the plant on which they grow and have group names such as rosette, oak apple, bud, bullet, roly-poly and pouch.

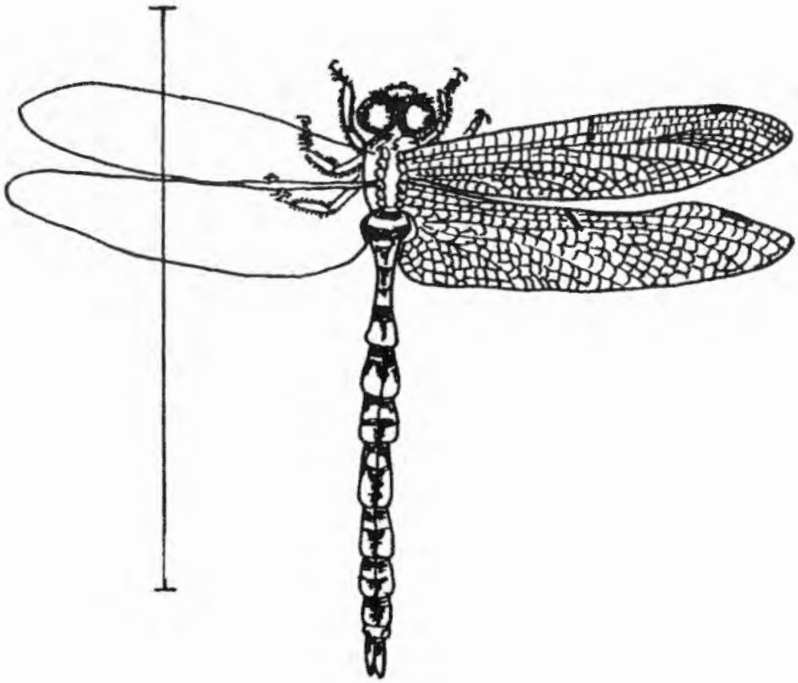
Each gall insect, mostly numerous species of tiny wasps, or other gall agent produces its own distinctive style of gall and affects only one plant species. Oaks host the greatest variety of galls. The galls have little or no detrimental effect on the host.

Insect galls serve as protection for the egg and food for the larva developing within. If no exit hole is present, galls may be opened and the larva within located. A perfectly round hole indicates that the mature insect has left; a ragged hole indicates that a bird has pecked its way through and eaten the larva.

GALL	HOST	AGENT
Goldenrod Ball Gall	Tall Goldenrod	Gall Fly
Goldenrod Elliptical G.	"	Gall Moth
Goldenrod Bunch G.	"	Gall Midge
Cinquefoil Axil G.	Cinquefoil	Gall Wasp
Blackberry Knot G.	Blackberry	Gall Wasp
Pinecone Willow G.	Willow spp.	Gall Midge
Elm Leaf Roller G.	Slippery Elm	Aphids
Oak Apple Gall	Red Oak	Gall Wasp
Oak Hedgehog Gall	White Oak	Gall Wasp
Oak Bullet Gall	"	Gall Wasp
Oak Pill Gall	Shingle Oak	Gall Midge
Gouty Oak Gall	"	Gall Wasp
Leaf Pouch Gall	Black Cherry	Gall Mite


Elm Leaf
Roll Gall
Oak Hedgehog Gall
Oak Bullet Gall
Oak Pill Gall
Goldenrod Ball Gall
Goldenrod Bunch Gall
Pinecone
Willow Gall
Leaf Pouch Gall
Cinquefoil Axil Gall

Insects



INSECT RELATIVES

Phylum Arthropoda; Classes Diplopoda, Chilopoda, Crustacea, Arachnida.

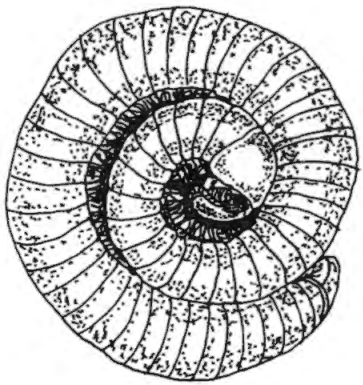
DIPLOPODA: GIANT MILLIPEDE (*Narceus americanus*)
A tubular animal with a hard casing, it has double segments, most of which have two pairs of legs. The largest millipedes have merely 200 legs, not 1000, and they move with a gliding motion created by successive waves of movement along the rows of legs. Some have stink glands which secrete a noxious substance capable of repelling insects. Mainly vegetarian, they are found in rotting wood or under logs or leaves and are mostly scavengers with an important role in turning organic matter into compost. They curl up when disturbed.

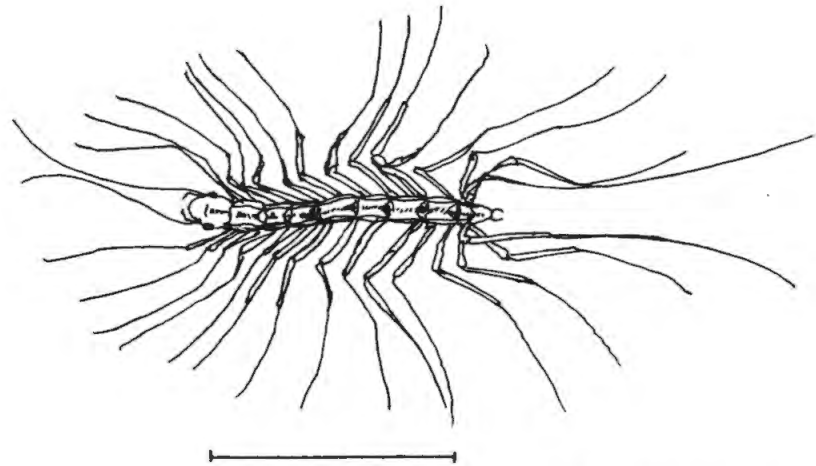
CHILOPODA: HOUSE CENTIPEDE (*Scutigera coleoptrata*)
The centipede's legs give it a fringed appearance. It has one pair of legs per segment, for a total of 15-20 pairs. The first pair of legs is modified into fangs for attacking, as centipedes are active and predaceous with a poisonous bite. Usual prey consists of insects, slugs, earthworms and even other centipedes. They are nocturnal and prefer damp, dark areas. They walk by using opposite legs alternately.

CRUSTACEA: WOODLOUSE or PILLBUG
(*Armadillidium vulgare*)
Woodlice are small oval creatures, found everywhere under bark and on old logs where they feed on humus and fungi. The pillbug, which can roll into a ball if disturbed, and the sowbug, which cannot, are both woodlice. They have two pairs of antennae and seven pairs of legs. They may secrete a sticky, repugnant fluid from glands on their bodies. Females have a special pouch for carrying eggs and newborn woodlice.

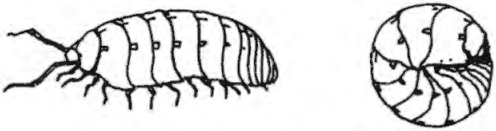
|——————| Indicates Actual Size

Giant Millipede





House Centipede



Pillbug

CLASS: ARACHNIDA

Arachnids differ from insects in that they have eight legs rather than six, two distinct body parts rather than three, and no wings or antennae. They have a pair of jaw-like, fang-bearing appendages in front of the mouth and a pair of leg-like appenages (pedipalps) in front of the first pair of walking legs.

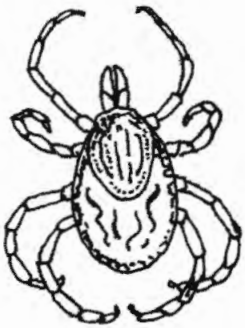
DADDY LONG LEGS or **HARVESTMAN** (*Leiobunum spp.*)
This insect relative has a small brown body with eight long legs and is found everywhere. It differs from true spiders in having the cephalothorax and abdomen fused into one structure. The long legs may break off if the creature is caught, apparently without causing serious harm. They feed mainly on insects. Eggs are laid in the ground each fall.

RED VELVET MITE (*Trombidium spp.*)
Mites surpass all other spider-like creatures in numbers, with over 20,000 species named. Mites are very small and live in widely varying and very restricted habitats, such as a bird's nostril. Many are parasitic and transmit disease. Red velvet mites are described perfectly by their name and are found on damp wood and plants. The larvae are parasitic to insects and the adults eat insect eggs.

EASTERN WOOD TICK (*Dermacentor spp.*)
Ticks are small round flattish creatures which attach themselves to mammals, birds or reptiles, gorging on blood. When sated and distended by their meal, they drop off and complete their life cycle. The deer tick is a hard-bodied tick which does not engorge. It is the size of a pinhead, much smaller than the American dog tick or the wood tick, which are one-eighth to one-quarter inch before engorgement. Ticks transmit diseases; the deer tick is a vector for Lyme's disease. Ticks can be removed by applying alcohol or heat to them to make them let go; attempts to pull them off may result in the head remaining in the wound and subsequent infection.

Daddy-long-legs

Red Velvet Mite

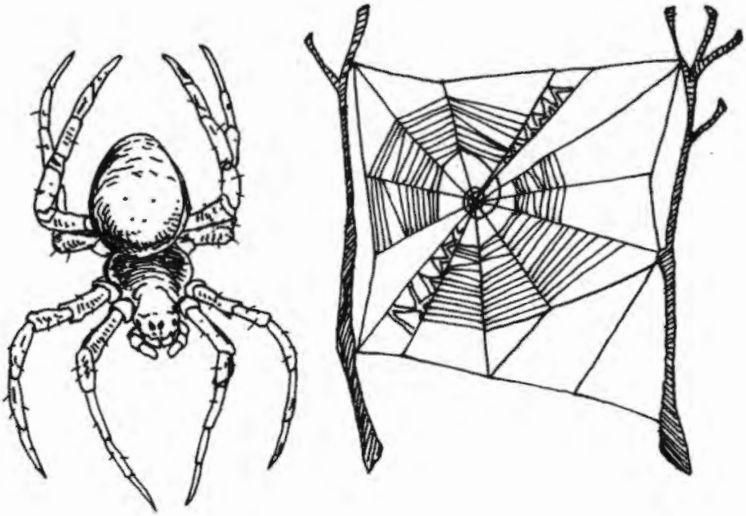


Eastern Wood Tick

Spiders differ from other arachnids in having a "waist" separating the cephalothorax (head and thorax) and the abdomen and in having fangs with venom. There are usually six spinneret glands at the tip of the abdomen. Not all spiders spin webs, but most of them spin silk egg cases.

BLACK AND YELLOW ARGIOPE or SIGNATURE SPIDER (*Argiope aurantia*)
This spider makes the classic web which is most familiar to us and belongs to the group known as orb weavers. Each species has its own web design, carried out through intricate instinctive behavior. The signature spider puts a zig-zag in the center of its web. Some web lines are runners, others are sticky for catching prey. The female sits either in the center of the web or nearby. The struggling of a trapped insect alerts her, and if the prey is to her liking it is wrapped with threads. It may be eaten then or paralyzed by her sting for future consumption. When seeking to mate, males approach the female cautiously with an escape thread ready and are seldom eaten. Females generally lay a large egg mass and then die.

GRASS SPIDER (*Agelenopsis spp.*)
Grass spiders belong to the funnel web weaver group. The female weaves a flat sheet on grass stems with a funnel retreat into a group of rocks or tuft of grass where she hides waiting for prey. The male taps on the web to see if she is interested in mating. If she is, she will often allow him to live with her and share her food.



Signature Spider

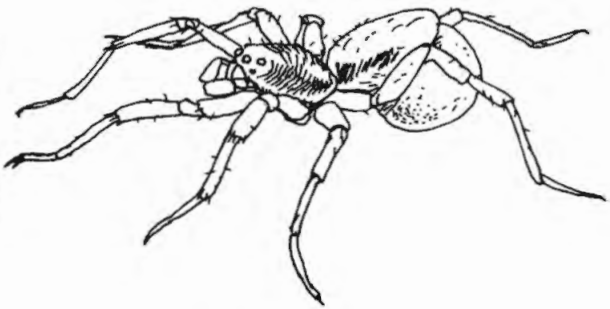
Grass Spider

CRAB SPIDER (*F. Thomsidae*)
Crab spiders are small, sedentary and well camouflaged, hunting prey from ambush on a flower. The flat body and arrangement of legs and the motion sideways suggest a crab. The long front legs grasp the victim. After paralyzing its prey, the crab spider drinks the body juices and discards the husk. When mating, the male may loosely bind the female with silk. She makes a flat silken egg nest which she defends ferociously from predators, never eating again until she dies.

WOLF SPIDER (*F. Lycosidae*)
Wolf spiders have keen eyesight and are ground hunters, chasing and pouncing on their victims. Many live in small burrows. The female carries an egg sac on her spinnerets and aids the young to hatch by opening the sac. The spiderlings climb on their mother's back, not eating until their first molt. The mother then chases them away. Many wolf spiderlings will "balloon" (use a silk thread to float on the winds) to find a new home.

JUMPING SPIDER (*F. Salticidae*)
This group of spiders is stout and hairy. They like the sun and hunt during the day, using their excellent eyesight. When hunting, they may leap long distances but always with a silk safety thread. During cold weather they hide in a crack or spin a small silken cocoon. The male courts the female by waving his pedipalps in rhythmic gestures.

Crab Spider



Wolf Spider with Egg Case

Jumping Spider

CLASS INSECTA

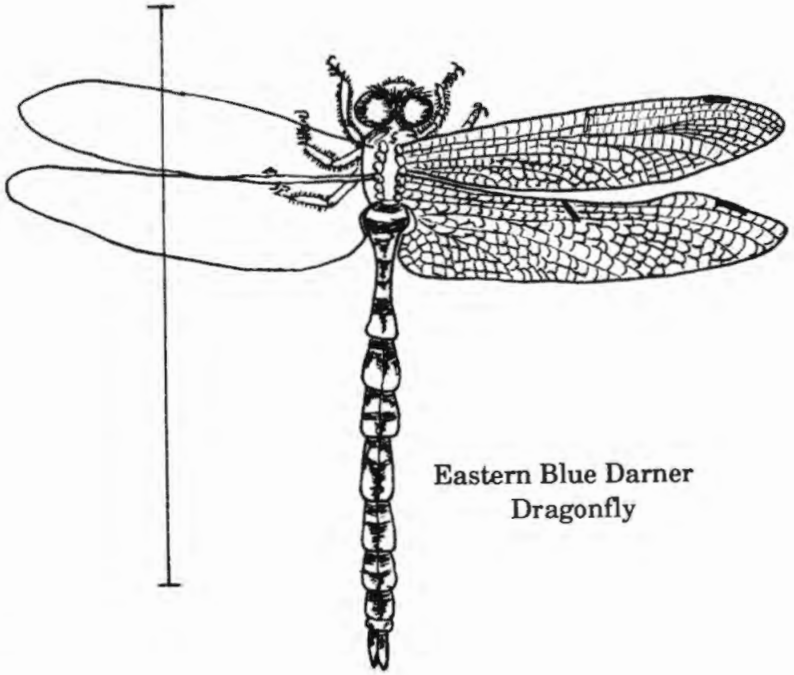
Orders Odonata, Orthoptera, Dermaptera, Homoptera, Coleoptera, Lepidoptera, Diptera, Hymenoptera.

ODONATA

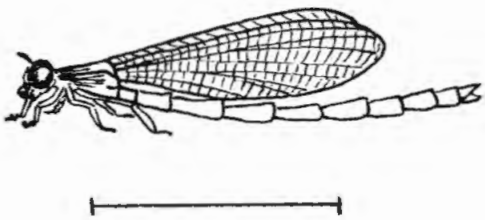
Dragonflies and damselflies are often called the hawks of the insect world. The adults catch their prey on the wing, aided by the large compound eyes and the wing pairs which operate independently and give them great skill in flight. Mating is also on the wing. Most adults have beautiful jewel-like coloration. The aquatic nymphs are predators; this order is carnivorous in all stages and of great benefit, especially in mosquito control. Incomplete metamorphosis.

EASTERN BLUE DARNER DRAGONFLY
(*Aeshna verticalis*)
Nymphs have specialized shapes adapted to the water they live in, streamlined for creeks and rounded for ponds. The nymph breathes by pulling water into the anus and expelling it through the gills on its sides, propelling it forward. At rest, the adult holds its wings outstretched. Females lay eggs directly into the water while in flight, sometimes with the male still attached to her body.

COMMON FORKTAIL DAMSELFLY (*Ischnura verticalis*)
Nymphs live in shallow streams and small ponds. They have three external feather-shaped gills at the apex of their abdomen. The adult's two pairs of wings are identically shaped and are folded together vertically and held parallel to the body when the insect is at rest. Males claim a territory and patrol it. After the mating flight, the female deposits her eggs on vegetation in or close to the water. Damselflies are generally more delicate then dragonflies.



Eastern Blue Darner
Dragonfly



Forktail Damselfly

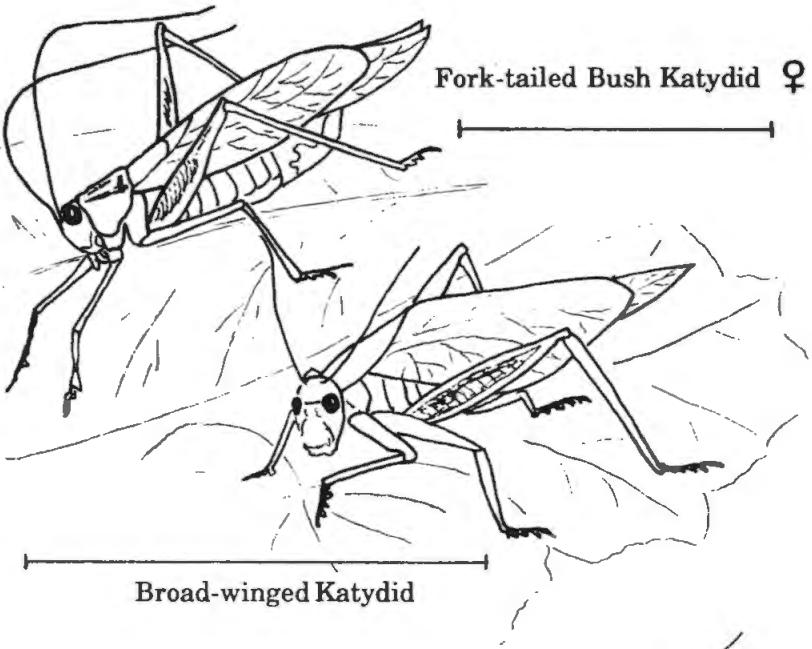
ORTHOPTERA

Grasshoppers, crickets and kin. Most adults have long, strong hind legs for jumping. The males attract mates by rasping wings or legs together, each species having its own distinctive call. They are food for many other animals, but migratory hordes can be quite destructive of crops. Incomplete metamorphosis.

FORK-TAILED BUSH KATYDID (*Scudderia furcata*)
BROAD-WINGED KATYDID (*Microcentrum rhombifolium*)
Both species belong to the long-horned grasshopper group, with antennae that often are as long as the body. They are nocturnal and are plant eaters. The "katydid" call is used by males to attract mates, and some females can answer. Most of this group are leaf-green in color and hold their wings elevated above the body. The resulting leaf silhouette is excellent camouflage. Eggs are laid on leaves and twigs in early fall.

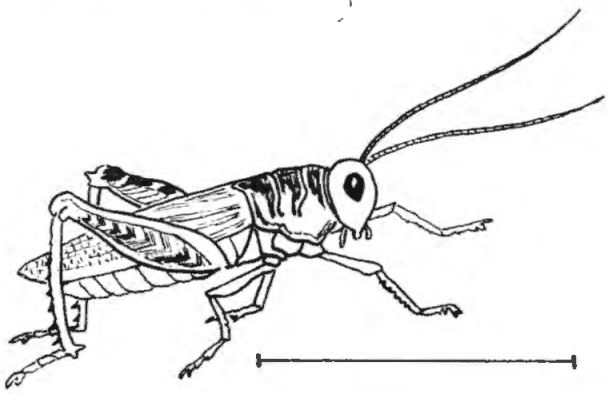
DIFFERENTIAL GRASSHOPPER
(*Melanoplus differentialis*)
Short-horned grasshoppers are sometimes called locusts when swarming. Of the 5000 kinds, only nine are migratory and descend on crops in clouds. Most grasshoppers are active during the day. Color and pattern may vary in different locations. Eggs are laid in the ground and can be destroyed by deep plowing.

FIELD CRICKET (*Gryllus assimilis*)
The black male cricket is territorial, chirping to identify his home and to warn off other males. When calling to a female, he trills. Crickets are most active at night, feeding on vegetation and sometimes dead insects. The temperature in F degrees may be determined by adding 37 to the number of chirps in 15 seconds.

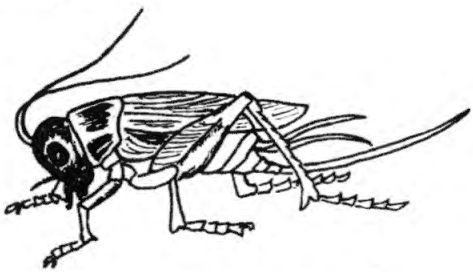


Fork-tailed Bush Katydid ♀

Broad-winged Katydid



Differential Grasshopper



Field Cricket ♀

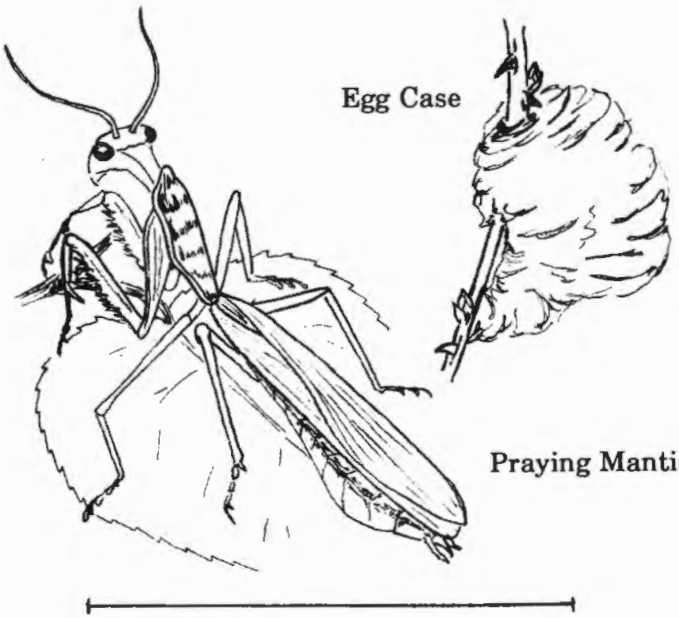
PRAYING MANTIS (*Mantis religiosa*)
This large, slender insect ranges in color from green to brown. The triangular head rotates farther than that of any other insect, and its eyesight is excellent. It has a voracious appetite and hunts by seizing prey with its long front legs. The female lays her eggs in a foamy mass that hardens to resemble papier-mache. In the spring, when the weather warms, the tiny young emerge as nymphs. Most of our mantids are European.

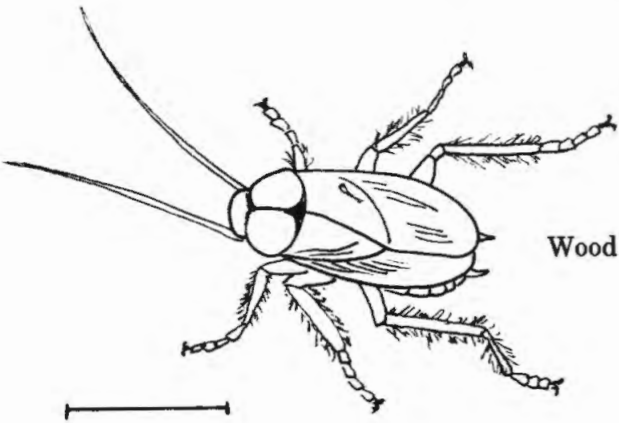
WOOD COCKROACH (*F. Blattidae*)
Cockroaches are among the oldest winged insects. The wood roach has a dark brown oval flattened body, wings which it rarely uses, and long antennae which are acutely sensitive. Roaches prefer damp, dark, warm places. They will eat anything and are notable pests. Glands on their sides emit a foul smelling liquid. The female lays eggs in a hard foam mass which she sometimes carries around with her, opening the egg case when the nymphs are ready to hatch. Wood roaches live under logs and stones but will visit houses also.

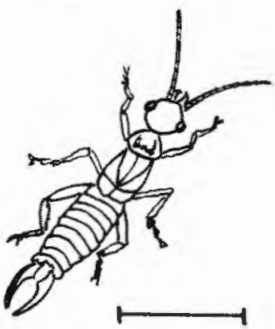
DERMAPTERA

Small insects with a pincer-like tail and usually two pairs of wings. Incomplete metamorphosis.

EUROPEAN EARWIG (*Forficula auricularia*)
Introduced from Europe, it is nocturnal and a scavenger. It will eat garden plants, particularly blossoms. The adult hibernates over the winter. In spring the female lays her eggs, guarding them even after they hatch. The hind pincer is used in mating. Earwigs do not creep into our ears, despite the legend.


Egg Case
Praying Mantis


Wood Cockroach


European Earwig

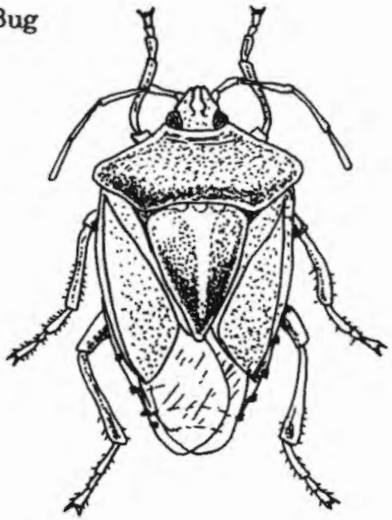
HEMIPTERA

True bugs, with two pairs of wings with forewing partly thickened. Jointed beak for sucking. Incomplete metamorphosis.

GREEN STINK BUG (*Acrosternum hilare*)
Stink bugs are very common and can be found anywhere plants live. When disturbed, they secrete a bad-smelling fluid from slits under the thorax, but this does not deter birds from preying on them. Most stink bugs feed on plants, but a few eat caterpillars and beetle eggs. Eggs are laid in fall on leaves; the clusters resemble shiny barrels with spines. Adults overwinter.

SMALL EASTERN MILKWEED BUG (*Lygaeus kalmii*)
A member of the family known as seed bugs which eat flowers and developing seeds. Milkweed bugs are black and white. The markings warn predators that the bugs' diet of milkweed renders them poisonous due to a chemical found in milkweed. In mating, the male attaches himself to the posterior of the female's abdomen facing the other way. The cooler it is, the longer he remains, and he may be dragged around by the female for several days.

Green Stink Bug



Small Eastern Milkweed Bug

HOMOPTERA

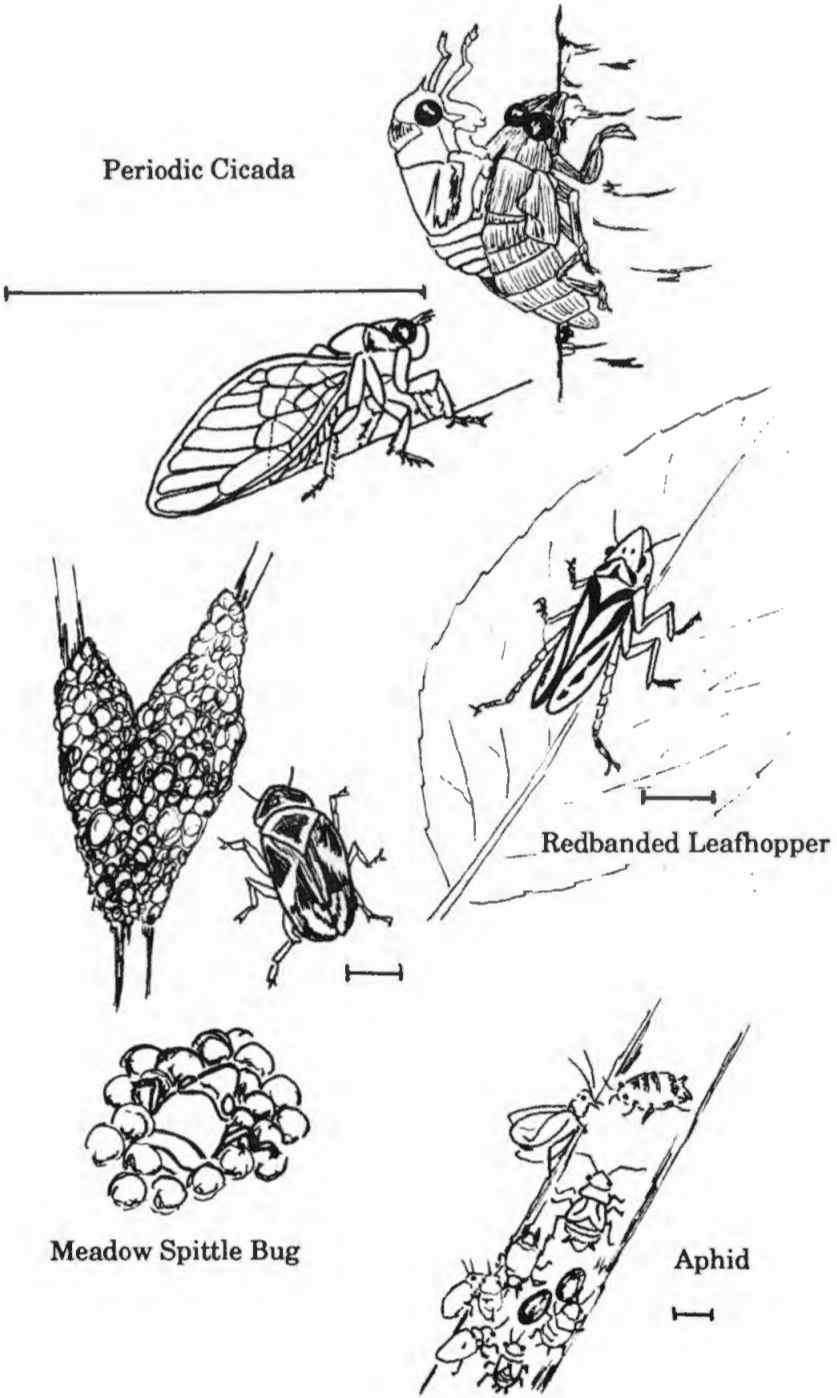
Leafhoppers, aphids, cicadas, scale insects. Small to medium insects, most with two pairs of similar wings held sloping at side of body. Jointed beak for sucking. Incomplete metamorphosis.

PERIODIC CICADA (*Magicicada spp.*)
This group, with some 75 species (including the seventeen-year "locust"), has periodic cycles with variable intervals depending on the species. The nymph spends years in the soil sucking on tree roots. When it is ready to mature, the nymph tunnels up out of the ground, leaving a clearly visible round hole, crawls up a tree or fence post and splits up the back to molt, crawling out as an adult and leaving the case behind. Males produce a loud rasping chorus from two stiff membranes under the abdomen. Eggs are laid in a slit twig. When the young hatch they drop to the ground and burrow down.

RED-BANDED LEAFHOPPER (*Grapocephala coccinea*)
These small insects are found on grassy plants and can leap several feet. Most are green, but many have other bright colors as well. They suck sap from plants and may spread disease in the process. The honeydew secreted attracts other insects.

MEADOW SPITTLEBUG (*Philenus spumarius*)
Also called froghoppers in the adult stage, spittlebugs are mostly pale green or brown. The froth produced by the nymph is commonly seen on meadow grasses. Spit is produced by the nymph to hide it and protect it during molt. Juices are sucked from the plant and emitted from the anus, foaming up as they run down the insect's body and creating the froth.

APHID (*F. Aphididae*)
A large group of plant-sucking insects, also called plant lice. The species are difficult to tell apart. The life cycle is complex and varied. In spring and summer, females asexually reproduce both winged and wingless females which are born alive in some species. In the fall, males as well as females are produced. Mating then occurs, and the eggs laid will winter over. Aphids secrete honeydew which is very attractive to ants. Some species of ants tend the aphids like cows, protecting and milking them and even storing the aphid eggs over the winter.


Periodic Cicada
Redbanded Leafhopper
Meadow Spittle Bug
Aphid

COLEOPTERA

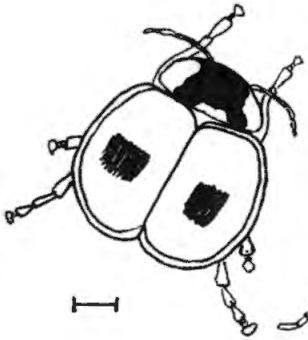
Beetles have the forewing modified into thickened covers. Hind wings fold under the cover except in flight, when covers are held aloft so that wings can work. They have chewing mouth parts and short antennae. By far the greatest number of families in the insect world. Complete metamorphosis.

TWO-SPOTTED LADYBIRD BEETLE (*Adalia bipunctata*)
Also called ladybugs. Members of this group are very beneficial except for the Mexican bean beetle and squash beetle. The ladybird larva has a segmented black and tan body and is predaceous, as is the adult, both eating aphids and other harmful insects. Some ladybird beetles congregate and migrate in the fall, while others overwinter under logs. Many species are named for the number of spots on their backs. These comments apply to all ladybird beetles; here the two-spotted is illustrated.

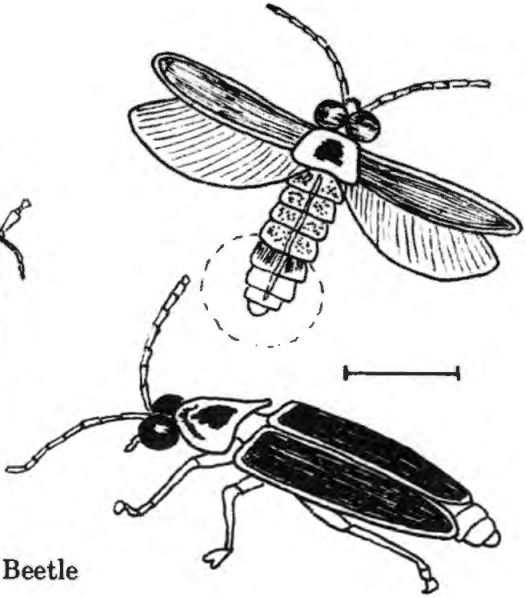
FIREFLY (*F. Lampyridae*)
Larvae live on the ground in damp places, feeding on various invertebrates including slugs. Both larvae and adults emit a flashing greenish light, the source of which is of great interest to scientists. The light is flashed in code which differs according to species, with the male in flight and the female on the ground signalling to each other. The female of a few species is carnivorous and imitates the light pattern of other species, luring males in and eating them.

SHORT-WINGED BLISTER BEETLE (*Meloe angusticollis*)
These plant eaters as adults can be serious pests to food crops. The larvae are parasitic and generally beneficial, but this blister beetle is an exception. It lays its eggs near a plant which is climbed by the larvae after hatching. They then hitch a ride on bees to the hive where they live on bee eggs and larvae. The adults eat potato foliage. If disturbed, the beetle will play dead and exude a liquid from between the leg joints which can cause a painful blister.

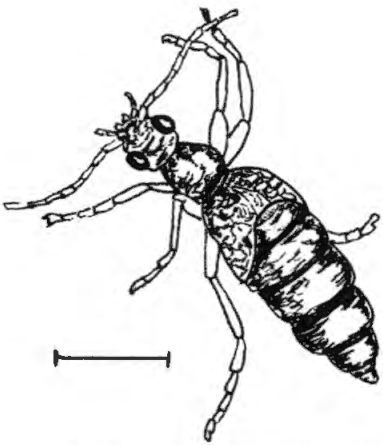
GROUND BEETLE (*F. Carabidae*)
There are more than 3000 species of ground beetles in North America. Most are shiny black, but some are brightly colored. They hide under objects on the ground, running if disturbed, and hunt at night for caterpillars, including gypsy moth larvae. Larvae are predaceous also. Very beneficial as a group.



Two-spotted Ladybird Beetle



Firefly



Short-winged Blister Beetle

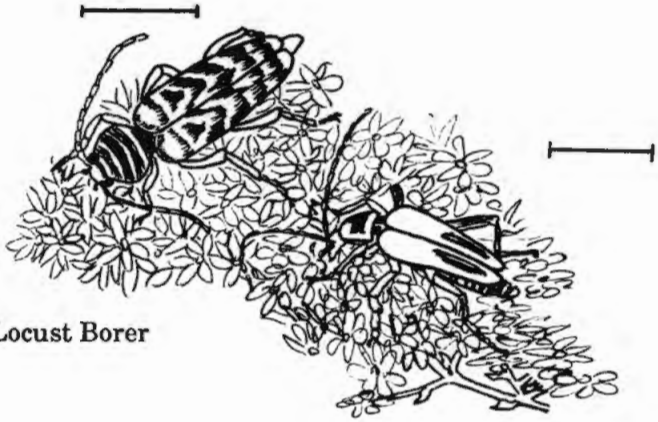
Ground Beetle

LOCUST BORER (*Megacyllene robiniae*)
Belongs to the long-horned beetle family, members of which have antennae at least half the body length. Many are brightly colored. Larvae eat the heartwood of trees and shrubs and can be very destructive. Adults feed on flowers. Larvae of locust borers eat sapwood of locust trees; the adults eat goldenrod pollen and are a vivid yellow and black.

GOLDENROD SOLDIER BEETLE
(*Chauliognathus pennsylvanicus*)
Also known as the Pennsylvania leatherwing, it is related to and resembles a firefly. Adults are brownish-yellow on the back with two broad, black lengthwise marks and long antennae. They feed on pollen and nectar and also eat aphids and other insects. Larvae are predaceous.

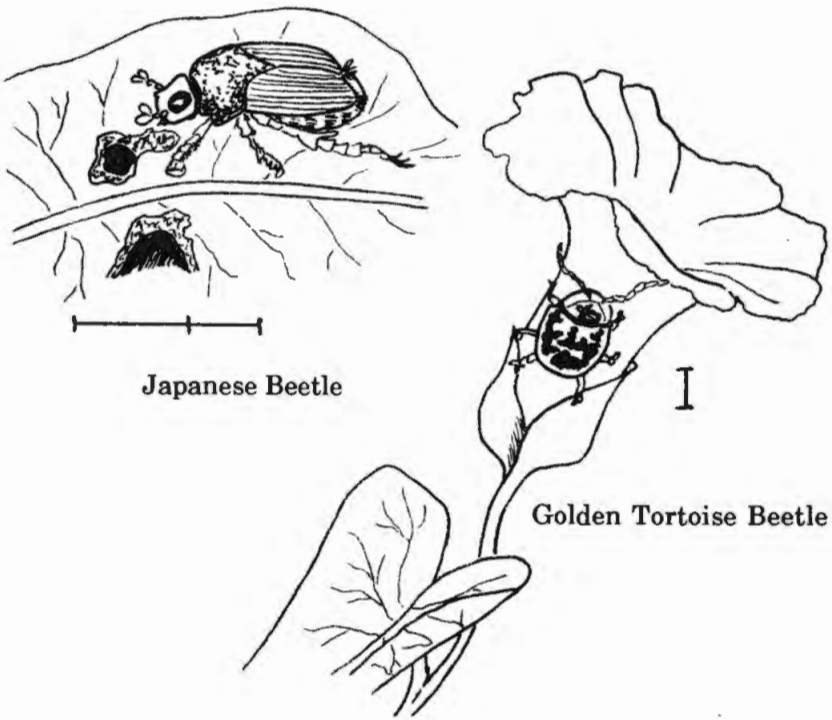
JAPANESE BEETLE (*Popilla japonica*)
Introduced in 1916, they are now a serious pest. Larvae feed on the roots of plants and adults attack more than 200 kinds of plants. Adults are a bright metallic green and bronze. Milky spore disease and parasitic wasps have been used for control with some success. It is a member of the scarab subfamily, most of which are crop pests.

GOLDEN TORTOISE BEETLE (*Metriona bicolor*)
Also called the gold bug, a name it shares with other species, it feeds on wild morning-glory leaves. A bright gold in color, it will fade quickly to dull brown if disturbed. Adults have an extended, flattened turtle-like shell and translucent upper body and wings. Molted skin and frass get caught on the larva and are held aloft as a shield against predators.



Locust Borer

Goldenrod Soldier Beetle



Japanese Beetle

Golden Tortoise Beetle

LEPIDOPTERA

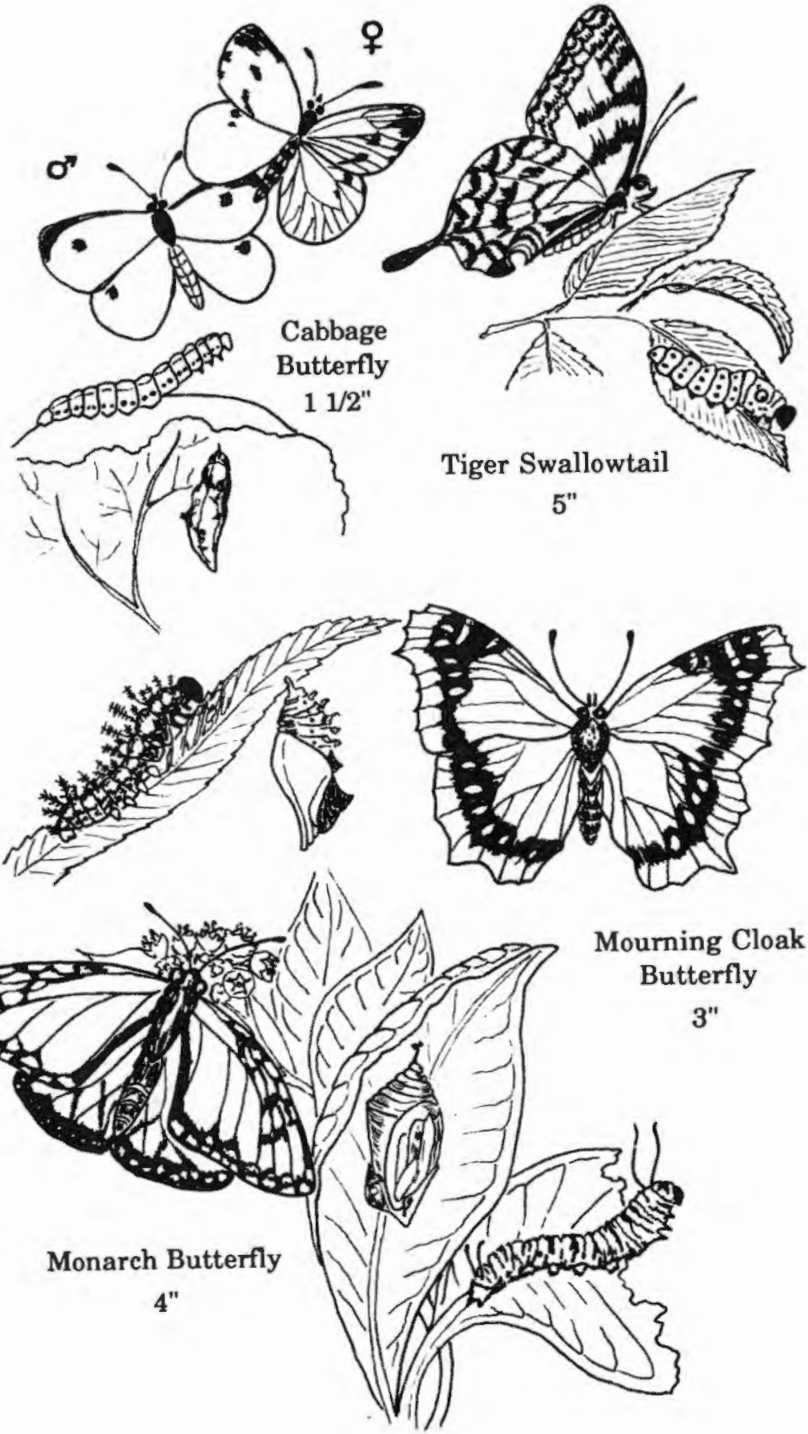
Butterflies and moths have two pairs of wings covered with delicate scales. The mouthpart is generally a long coiled tube for drinking liquids. Butterflies fly during the day, tend to be brightly colored, have knobbed antennae, and hold their wings upright when at rest. Most moths fly at night, have feathery antennae and hold their wings flat or next to the body at rest. A few moths fly by day and are colorful, but most are drab. Moth larvae may spin a cocoon or pupate underground. During transformation, the butterfly larva excretes a shiny covering which hardens into the chrysalis. Metamorphosis is complete.

CABBAGE BUTTERFLY (*Pieris rapae*)
A widely spread introduction from Europe, the larvae are garden pests. Caterpillars are small and green, usually found feeding on the cabbage family. A pair of the small white adults often spiral up in the air together to great heights, a behavior also typical of Whites and Sulphurs.

TIGER SWALLOWTAIL (*Papilio glaucus*)
The green caterpillar has yellow "eye" spots and eats leaves of a variety of shrubs and trees, especially wild cherry and tulip. Male adults are yellow with black stripes; females may be yellow or dark brown with yellow and blue spots. Larvae are protected by a foul-smelling scent gland in the head.

MOURNING CLOAK BUTTERFLY (*Nymphalis antiopa*)
The purplish brown wings with yellow edging and blue spots suggest a cloak over a ball gown. The front legs are greatly reduced in adults, in the typical manner of brush-footed butterflies. Adults overwinter and are seen in early April, when they emerge and feed on sap. Larvae are dark with red spots and branching spines and feed on willow, elm and poplar in large numbers.

MONARCH BUTTERFLY (*Danaus plexippus*)
The orange and black butterfly is migratory, flying south to Mexico. En route they congregate in regular stopping places. In spring the adults return part way north, laying eggs and dying. The larva feeds on milkweed, which contains a poison making both larvae and adults distasteful. The Viceroy butterfly, a member of the brush-footed group, mimics the Monarch in coloration and shares the protection, though it is edible. Monarch caterpillar is black with white and yellow bands.


♀
♂
Cabbage
Butterfly
1 1/2"
Tiger Swallowtail
5"
Mourning Cloak
Butterfly
3"
Monarch Butterfly
4"

WOOLLY BEAR, ISABELLA or BANDED WOOLLY BEAR MOTH (*Isia isabella*)
The woolly bear caterpillar has stiff bristles and is black at each end and red-brown in the middle. It will roll up when disturbed. The larvae winter over. Superstition says that the width of the brown band forecasts the severity of the coming winter. Actually it indicates the stage of growth as determined by current, rather than future, weather. Adults are pale brown with tiny spots.

HUMMINGBIRD MOTH (*Hemoris thysbe*) (*Sphingidae*) One of the sphinx moths.
Larvae of most species have a large horn-like projection, rear up when disturbed, and have a specific food preference, as in the tomato hornworm. They are often parasitized by wasps. Pupation is in the ground. Adults are strong fliers and often hover at a flower while sipping nectar. The hummingbird moth often has clear areas on its wings; the banded body is spindle-shaped. One of the dayflying moths. It lays its eggs on honeysuckle leaves.

GIANT SILKWORM MOTHS (*Saturniidae*): **CECROPIA** (*Hyalophora cecropia*)
Giant silkworm moths are large and colorful. The male has feathery antennae used to detect the female's scent. The nocturnal adults are short-lived and do not feed. Leaf-eating larvae hatch from eggs laid on a host tree. All species spin a cocoon of tough, resilient silk. The Cecropia cocoon is large, gray-brown and connected along one entire side to a branch. The larva is greenish with numerous colorful tubercles. The adult moth has speckled gray-brown coloration with rusty orange and white markings.

Isabella Moth 2"

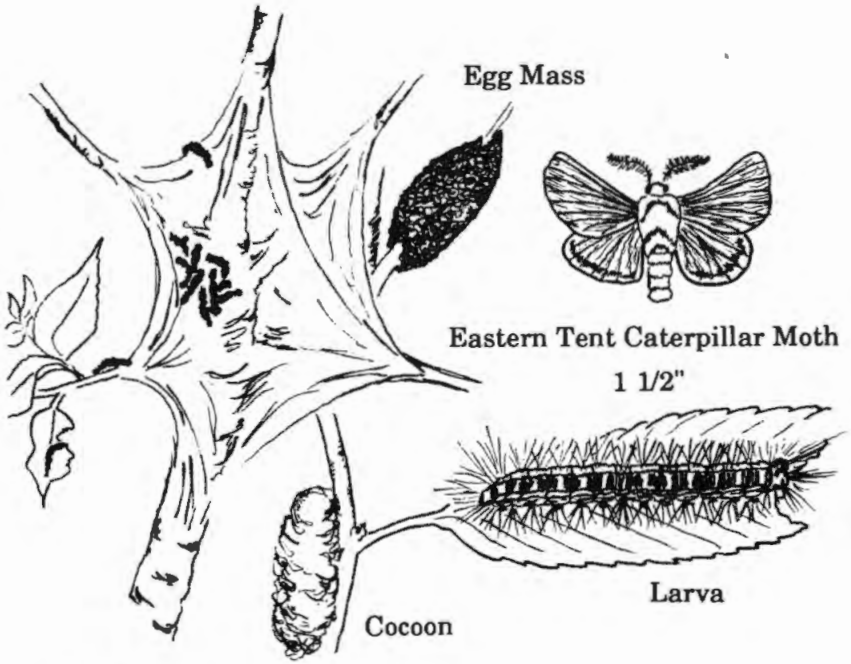
Hummingbird Moth 2"

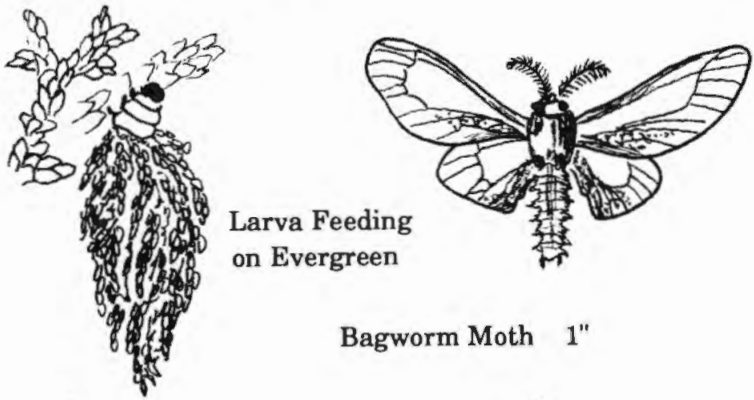
Cecropia Moth

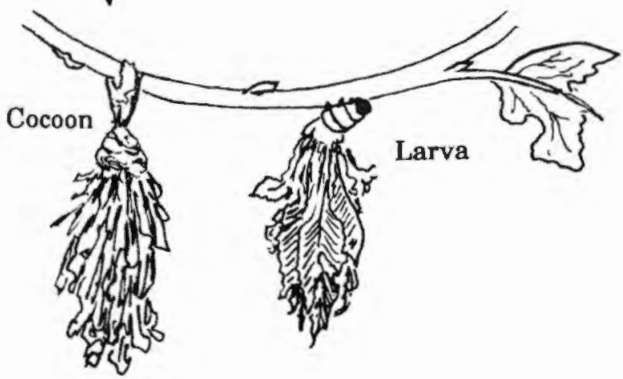
5"

TENT CATERPILLAR (*Malacosoma americanum*)
The egg container is a shiny dark cuff-like case on twigs of cherry, etc. The larvae construct a large silken communal nest at the junction of several branches. The nest is steadily enlarged as the tree's leaves are eaten and serves as protection for the larvae from predators and bad weather. The host tree is usually stripped of leaves and may die. Larvae molt five times. Adults are brown and drab.

BAGWORM MOTH (*Thyridopteryx ephemeraeformis*)
A small, short-lived moth. The female lacks wings, legs and mouthparts, existing only to breed. Caterpillars construct and carry about with them empty cocoons made of twigs and leaves. These cocoons protect the caterpillar, are then used for pupating, and eventually are the receptacle for eggs. Bagworms can be a serious pest.


Egg Mass
Eastern Tent Caterpillar Moth
1 1/2"
Larva
Cocoon

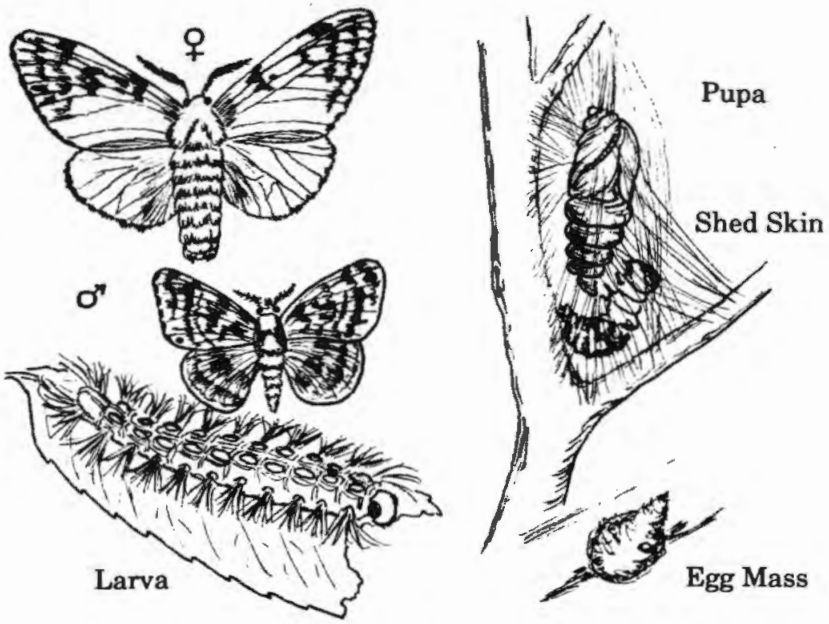

Larva Feeding
on Evergreen
Bagworm Moth 1"


Cocoon
Larva

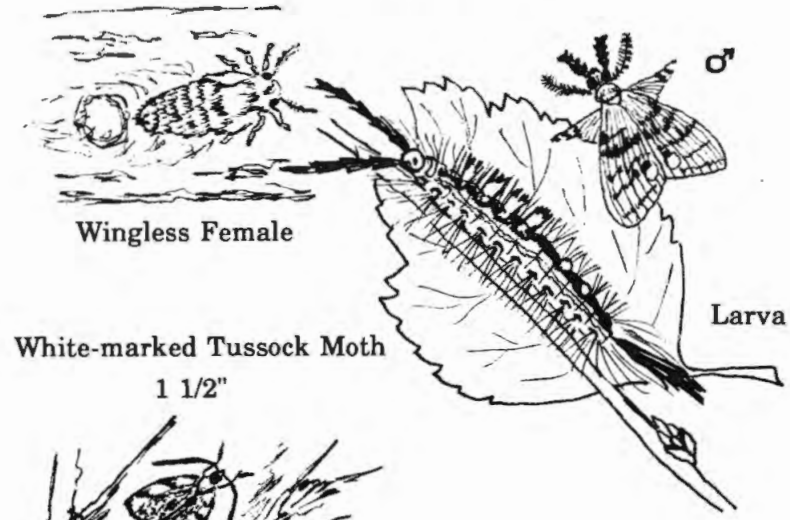
GYPSY MOTH (*Lymantria dispar* or *Porthetria dispar*) (*F. Lymantria*)
This tussock moth was accidentally introduced to America in 1868 and is a serious pest of forest trees. The male is smaller and brown; the female is white with black markings and rarely flies. The yellowish foam egg masses are laid on tree trunks and rocks and contain several hundred eggs. The larvae hatch and crawl up the tree, eating all its leaves and stressing it so badly that some trees die. The caterpillar is gray with red and blue tubercles on its back and hair tufts. There are several controls for this pest.

WHITE-MARKED TUSSOCK MOTH (*Orgyia leucostigma*)
The caterpillars have distinctive hairlike tufts at each end which contain an irritant in some species of tussock moth. Newly hatched larvae release a silk thread which carries them to a new location. Adult moths are stout, rather hairy and gray-brown; they do not feed. Males have large feathery antennae for detection of females. Females are wingless.

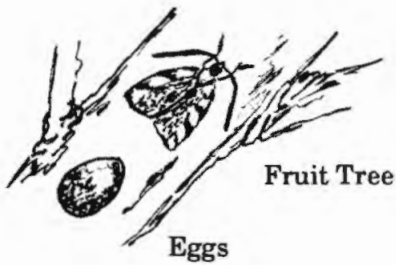
FRUIT TREE LEAF ROLLER (*F. Tortricidae*)
This family has a large number of species, all small inconspicuous moths. Some are serious pests. The larva rolls a leaf or several leaves together, binding the structure with silken threads. Inside the structure it lives and eats.



Gypsy Moth 2"



White-marked Tussock Moth
1 1/2"



Fruit Tree Leaf Roller 1"

DIPTERA

Flies are a large order and are prevalent in all habitats. They have one pair of normal wings. Most larvae are called maggots, are legless and may lack heads. Some are parasitic. Flies often carry diseases. Complete metamorphosis.

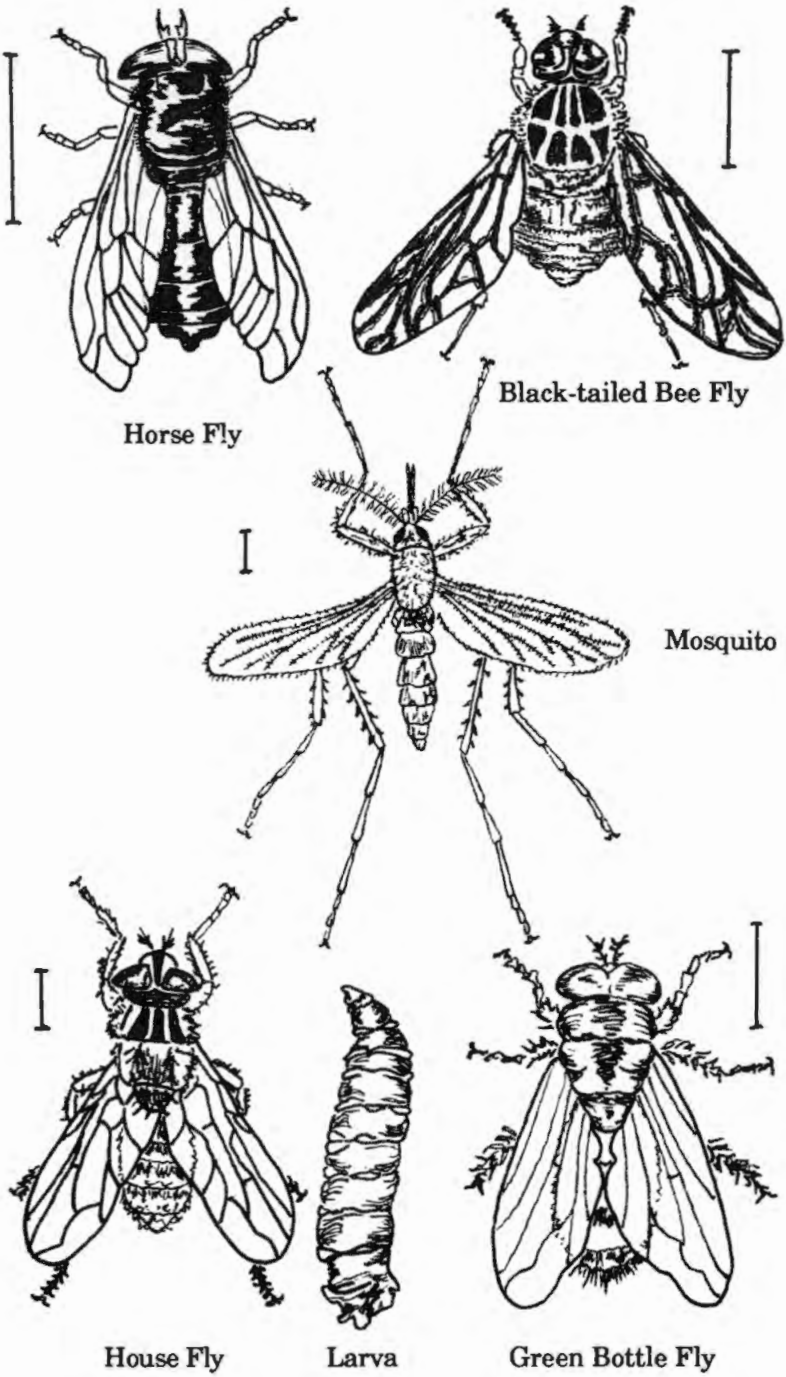
MOSQUITO (*F. Culicidae*)
There are many species of mosquitoes. All larvae are aquatic but may need only a puddle to breed. They breathe at the water's surface through a tube on the abdomen and feed mainly on organic debris. The male adult sips plant juices, but the female is attracted to body heat and sucks blood through her proboscis. Among the diseases which are sometimes transmitted are yellow fever and malaria., Mosquitoes are considered a serious pest, but the larvae are important in the aquatic food chain.

AMERICAN HORSE FLY (*Tabanus americanus*)
This is a large, broad fly with large green eyes. The larvae are mostly aquatic and predaceous. The adult female feeds on human and animal blood and can transmit diseases in the process. Her saliva contains an anti-coagulant and the bite is painful. If many flies attack an animal, it may stampede and lose much blood. Males are harmless and feed on flowers. Adults can travel long distances in search of food.

BLACK-TAILED BEE FLY (*Bombylius major*)
Bee fly adults have stout bodies covered with hair and resemble bees closely; they can be distinguished only by close observation. They suck nectar with a long proboscis. Most larvae of bee flies are parasitic to insects.

HOUSE FLY (*Musca domestica*)
House flies are vectors for typhoid fever and other diseases through contamination of food and water. They have a short fleshy proboscis, used to suck liquids from sweet or decaying substances, and do not bite. Eggs are laid in any kind of filth; the maggots help to decrease the quantity of decaying matter.

GREEN BOTTLE FLY (*Phaenicia sericata*)
The blow fly family, to which this species belongs, resembles house flies but has larger bodies and metallic color. Green bottle flies lay eggs in dead animals or open wounds; all stages feed on decaying animal matter.


Horse Fly
Black-tailed Bee Fly
Mosquito
House Fly
Larva
Green Bottle Fly

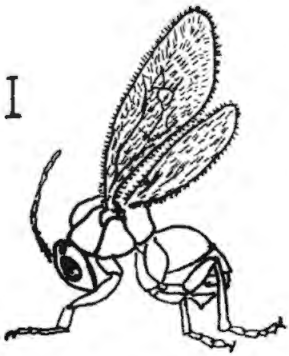
HYMENOPTERA

Ants, bees and wasps belong to this large order. Adults are active insects, often with a complex social order. Adults of many species can sting, either in hunting prey or in defense of their nests. Wasps and hornets can sting repeatedly, but the honey bee leaves her sting in the wound and dies. This order is economically important, with various species serving as pollinators and as parasitic controls on other insects. Complete metamorphosis.

OAK APPLE GALL WASP (*Loxaulus maculipennis*)
Cynipid family. Gall wasps are minute and difficult to identify, but the galls are distinctive. (See Galls, Field Guide). The laying of an egg, a secretion injected during egg laying, or a larval secretion may cause gall formation. Oak apple gall wasps have wingless females which lay an egg on branchlets. These develop into soft, rapidly growing cells resembling an apple. Winged males and wingless females breakout through the gall.

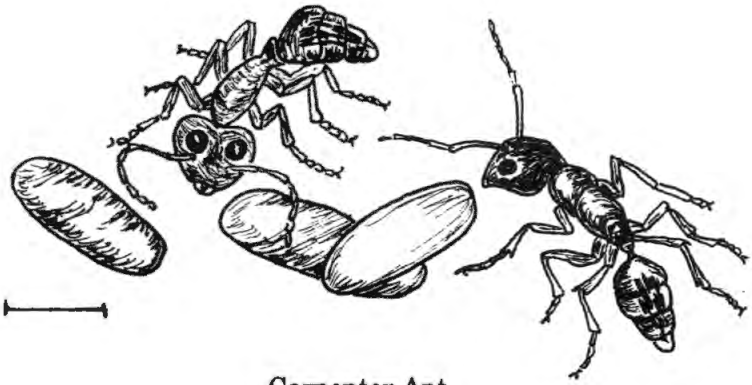
ANT (*F. Formicidae*)
Ants have the most complex and diverse social behavior of all insects; some are farmers, some slave holders, some builders. Queens live ten to fifteen years. Nests are founded by a young queen after her mating flight. They are randomly designed, with chambers built for different purposes or seasons. Workers share the varying duties of the colony: building, nursing, cleaning, foraging. The large, black carpenter ants (*Camponotus pennsylvanicus*) live in wood which must have moisture in it. The workers have powerful jaws for excavating tunnels and can riddle a house beam. They do not eat wood but are scavengers.

YELLOW JACKET (*Vespula maculifrons*)
Smallest of the vespid wasps, yellow jackets are also among the fiercest. In spring, the queen starts the nest, building a few clustered hexagonal cells. The nest is made of chewed wood pulp, rendered into paper, and is usually built underground in an abandoned animal hole, although it may be in a tree or house. The first workers born expand the nest and care for new larvae. Larval food is usually made from fly, bee and lepidopteran larvae which are captured and chewed up by the workers. The colony expands to several hundred workers which eat pollen, nectar and fruit pulp. In late summer, viable males and females are produced which then mate. The fertilized queen will hibernate until spring in forest litter, but males and workers die from cold.

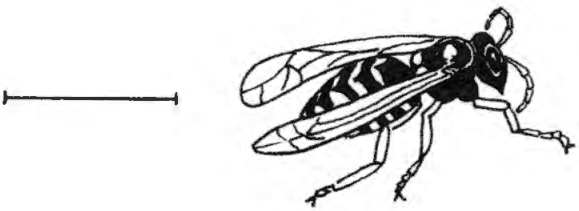


Oak Gall Wasp

Apple Gall



Carpenter Ant

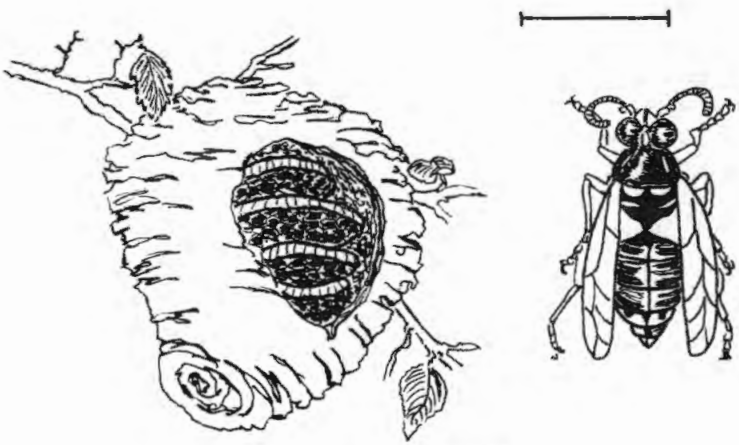


Yellow Jacket

BALD-FACED HORNET (*Vespula maculata*)
Black and white patterns distinguish this vespid. The paper nest is always hung in the open from a tree or house eave. Social life is the same as yellowjackets.

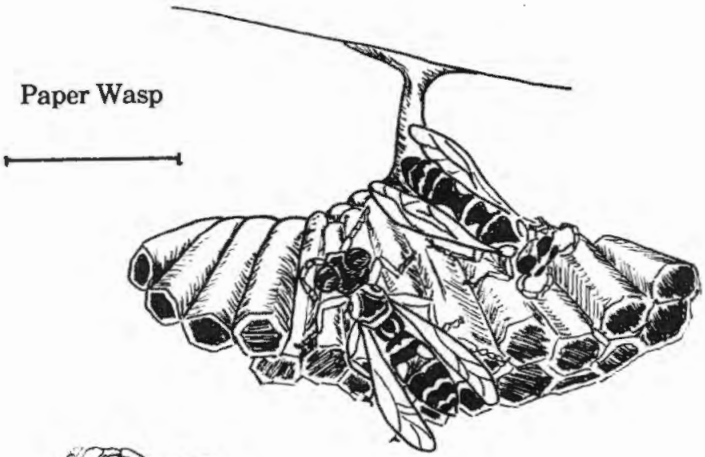
PAPER WASP (*Polistes exclamans*)
The "wasp waist" is a helpful clue in distinguishing wasps. Colonies of paper wasps outnumber all other wasps. They are much more tolerant of people and disturbances than are the hornets and yellow jackets. In spring, a fertilized female finds an abandoned nest or makes a new one. The nest, a flat single comb without an outer shell, is made from masticated wood pulp. In some species, several fertilized females cooperate in nest-starting. One female becomes dominant through aggression; other females are only allowed to care for larvae. Newly hatched females assume lesser roles in the colony. In late August, fertile males and newly hatched fertile females disrupt the nest, with the males hanging around to be fed. Workers become exhausted driving off the males while larvae may starve. Only mated young queens winter over.

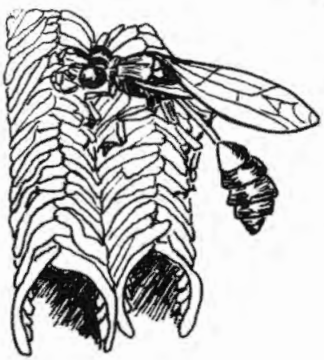
MUD DAUBER (*Sceliphron caementarium*)
Sphecid wasp group. A female carries mud pellets in her mouth to the side of a building where she shapes them into a long tube. A spider is located, paralyzed by her sting and put into the tube along with the wasp's egg. The tube is sealed. The egg hatches and the larva eats the living spider, chews its way out when mature and flies away. Adults eat nectar. The fertilized female winters over.



Bald-faced Hornet

Paper Wasp





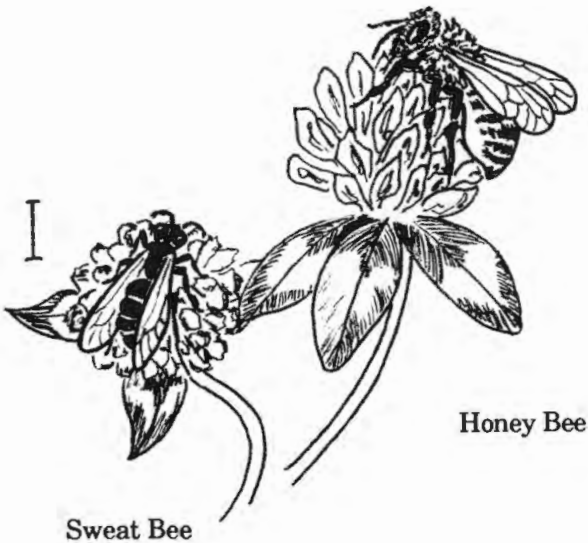
Mud Dauber

BUMBLEBEE (*Bombas pennsylvanicus*)
This large furry bee has a golden fuzzy abdomen with a broad black band. The queen overwinters and in spring emerges and flies close to the ground looking for a nesting hole. In the nest, the egg cells are small cups of wax placed on a wax plate. In each cell a pollen ball is placed, an egg laid and the cell sealed. The queen dominates and regulates all activities. Males hatch in late summer, wait on an observation post and alight on anything resembling a female; one will fertilize the queen. Bumblebees are attracted to red clover and can reach the nectar with their long tongues. An aerodynamic engineer once "proved" that the bumblebee should not be able to fly; its body mass, he said, is too great for the wing area.

HONEY BEE (*Apis mellifera*)
Smaller and more golden than the bumblebee, with narrow bands of black on the abdomen. The queen is much larger than the workers. The queen mates once, for life. Her only role is to lay eggs. Sperm is stored in a sac in her body; she can control the sex of the eggs by opening or closing the sperm sac. Drones do nothing but mate and eat; a single mating provides a fifteen year sperm supply to the queen. Workers gather nectar, collect pollen in leg sacs, defend the nest by stinging (loss of stinger causes death), construct larval cells, feed larvae, care for the queen and make honey and wax. They run the hive, regulate egg laying and insure the survival of the whole colony in winter. Bees communicate through scent messages and through bee dances. When a colony becomes overcrowded, the swarming instinct is stimulated. The old queen will leave with a portion of the workers. The bees mass on some object such as a tree branch and send out scouts to find a new hive location. In a matter of hours the swarm will move to its new site and begin work. Honey bees are very important as pollinators of our food crops and for the honey and wax they produce. Humans and animals have benefitted from harvesting the honey and wax for thousands of years.

SWEAT BEE (*Agapostemon texanus*)
Halictid bee family. Twelve of the many species seek out human and animal sweat; all are pollen and nectar gatherers. Fertilized females winter over in tunneled burrows, which may be used as spring homes. Queens and workers look very similar. The colony is rudimentary, without a complex social structure. Cells are constructed of soil in lateral tunnels branching off from the main tunnel. A pollen ball is placed in each cell as provision and an egg laid there by any bee.

Bumblebee



Honey Bee

Sweat Bee

Birds

A bird is a warm-blooded vertebrate, distinguished from its close relatives the mammals and reptiles by being completely clothed in feathers. Phylum Chordata, Class Aves. Birds here are sorted according to color, size or habitat, along with a few special families.

COLORFUL BIRDS

Some of our most brilliant and often seen birds are included in this group. The females may be quite different in appearance, or they may be a duller version of the male.

BLUE JAY (*Cyanocitta cristata*) 12".
Robin-sized, this noisy backyard resident has flashing blue and white plumage with a conspicuous crest and a strong, stout bill. The harsh call "jay, jay" seems to be scolding other birds or warning of a predator. Jays may dominate a feeder. They often bury acorns and other seeds, thus planting trees. They are related to crows, with whom they share an omnivorous appetite.

NORTHERN or BALTIMORE ORIOLE (*Icterus galbula*) 8".
The male is a brilliant orange with black head, back, wings and tail, while the female is a drab olive yellow. Orioles are champion nest builders, weaving a hanging basket at the very tip of a branch. They will accept 4" pieces of yarn or string left out for them but can get entangled in longer pieces, and are sometimes seen yanking strands of bark from milkweed or grapevine for their nests. Orioles only nest once a season, and occasionally high winds will bring a nest down. One of the few birds which will eat woolly caterpillars. The clear, flute-like single or double notes seem to say "oriole."

CARDINAL (*Cardinalis cardinalis*) 8"-9".
Our only almost all-red bird, the cardinal has a black face and a stout bill, showing its kinship with the finches and grosbeaks. Females have the same reddish beak but are drab buffy brown. Cardinals are friendly and are often seen at feeders, where they love sunflower seed. The loud call of "cheer, cheer" alternates with "purty, purty," and the birds sing at any time of year. The nest is a rather untidy affair of twigs. The male is an exemplary father and tends the first brood after it leaves the nest, while the female begins a second nesting.

ROSE-BREASTED GROSBEAK
(*Pheucticus ludovicianus*) 8".
The jet-black head and back, rose throat and white breast of this bird are elegant. The female resembles a very large sparrow, heavily streaked with brown, with a stout beak. A rather slow-moving resident of trees, it has a lovely warbled song very similar to a robin's and has been known to sing while sitting on the nest.

SCARLET TANAGER (*Piranga olivacea*) 7".
Smaller and more sedate than the cardinal, this equally brilliant red bird has black wings and tail. Its habit of moving slowly through the treetops make it surprisingly hard to spot. The female is even harder to see and to identify, as she blends into the foliage with her olive-green coloration. The tanager's song is said to suggest a robin with a sore throat.

BLUEBIRD (*Sialia sialis*) 7".
The most colorful of the thrush family, the bluebird has a bright blue back, reddish breast and white belly; the female is only slightly duller than the male. Bluebirds prefer fairly open fields with a few trees as a habitat. Many communities have worked with considerable success to re-establish the bluebird, by providing nesting boxes and controlling competition from starlings and house sparrows for those sites. The song is soft and melodic. Young bluebirds, like their robin cousins, have speckled breasts when first fledged.

INDIGO BUNTING (*Passerina cyanea*) 5".
The male bunting must be seen in sunlight to appreciate his rich blue coloration, as the sun's refractive rays are responsible for the hue. In shade he appears black, while the female is mainly brown with a touch of blue in the wings. A lively warble, with each phrase repeated, is the characteristic song, often delivered from a roadside telephone wire.

FAMILIAR DOORYARD BIRDS

Birds most commonly seen around our houses are included here, subdivided by size.

ROBIN-SIZED 9"-13".

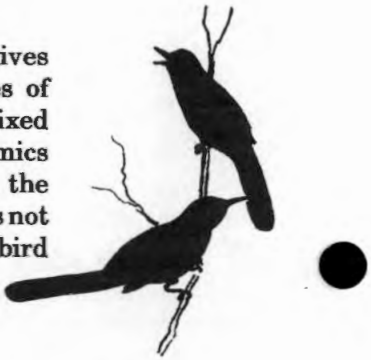
ROCK DOVE (*Columba livia*) 13".
The common "city pigeon" is usually gray with iridescence on its neck, but there are many color variations. The birds are strong fliers and can easily handle the gusty winds of downtown cities; they are tame and can be a nuisance. In spring the males puff out their chests, holding their heads proudly aloft, strutting and displaying before the coy females to win a mate. Introduced from Europe, they are a cousin to the famed homing pigeons.

MOURNING DOVE (*Zenaida macroura*) 12". The common wild dove, it is pale brown-gray with blue-gray wings and has the typical small head of pigeons. The pointed, wedge-shaped tail with large white spots along the edges is very distinctive in flight. The call, a series of mournful coos with a dying fall, gives the bird its name. Males display in the spring in the same fashion as rock doves.

ROBIN (*Turdus migratorius*) 9"-11". Probably the most familiar bird to children, it is a very tame resident of yards and gardens. The gray back and brick red breast make it easy to identify, though the spotted breast of newly fledged young can be confusing to novice birders. The song is a series of rich caroling notes, and the bird will perch in a low tree to give its serenade. Robins hunt for worms on lawns, taking a short run and then standing up straight with head cocked to listen, then probing to bring out the worm. They also eat berries.

MOCKINGBIRD (*Mimus polyglottos*) 9"-11".
This gray, slim bird shows dramatic white patches in wings and tail when it flies. It is a noted singer and may perform for hours, imitating many bird songs and other noises. Strongly territorial and aggressive, mockers will defend their nesting area vigorously, even attacking their reflection in auto hub caps or window panes.

CATBIRD (*Dumetella carolinensis*) 9".
A cousin of the mockingbird, the catbird gives voice to an amazing but unmusical series of squeaks, chatters and mechanical notes, mixed with a cat-like mewing, and sometimes mimics other birds. Dark gray with a black cap, the catbird is a welcome visitor in gardens and is not shy around people. Both it and the mockingbird often sing after dark.



SPARROW-SIZED 5"-7"

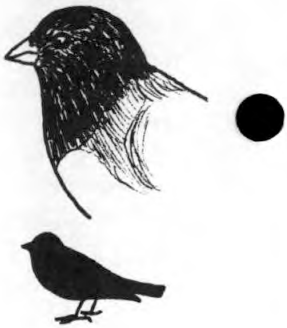
SONG SPARROW
(*Melospiza melodia*) 6"-7".
A long-tailed, heavily streaked sparrow with a central blotch on its breast, it pumps its tail in flight. The song has much variation but commonly begins with three notes, succeeded by a varied trill. The young birds can be heard practicing the song in late summer. Song sparrows are our most common dooryard sparrow (excluding the English or house sparrow, not a true sparrow.)

CHIPPING SPARROW (*Spizella passerina*) 5".
A small sparrow, commonly seen foraging on the ground. It keeps a low profile, rummaging among grass and stones for seeds and insects. The clear gray breast and chestnut crown with a white eyebrow identify it. The thin musical trill, usually given from a high perch, resembles an old-fashioned sewing machine.

WHITE-THROATED SPARROW
(*Zonotrichia albicollis*) 6"-7".
Larger than the song or chipping sparrows, the white-throated looks rather portly, with its clear gray breast, sharp white throat patch and striped crown. It does not breed here but is common in the winter and spring. The clear, plaintive whistle is often rendered as "old Sam Peabody, Peabody, Peabody."

HOUSE SPARROW
(*Passer domesticus*) 6".
Not a sparrow and not a native, this weaver finch was introduced from Europe. It is the common sparrow of city streets and lives in close association with man. Its noisy chirping and aggressiveness make it unwelcome at backdoor feeders, but it is now having some competition from the house finch in many areas. The male has a black throat patch and chestnut nape, while the female is much less streaked than native sparrows. The nest may be roofed over with woven grasses.

DARK-EYED or NORTHERN JUNCO (*Junco hyemalis*) 6".
The gray back, head and throat, along with the pink bill and flashing white outer tail feathers, make this winter resident easy to identify. Juncos are often called snowbirds because they arrive from their northern nesting grounds around the time the first snow flurries appear. They scratch around on the ground for seeds, talking to each other with soft twitters.



CHICKADEE-SIZED 4"-6".

TUFTED TITMOUSE (*Parus bicolor*) 6".
A cheerful, gray, crested, long-tailed bird, it visits feeders often in company with the smaller chickadees. The soft whistle "peter, peter" and its squeaky call notes help to identify it. It feeds on insects and eggs hidden under tree bark.

BLACK-CAPPED CHICKADEE
(*Parus atricapillus*) 5".
Among the best-known birds is the tame chickadee, with its black cap and buzzy "chicka-dee-dee-dee" call. It is a friendly and curious bird and has a habit of feeding upside down, clinging with one foot while it searches for insect eggs under tree bark.

WHITE-BREASTED NUTHATCH
(*Sitta carolinensis*) 5"-6".
Usually seen creeping headfirst down a tree trunk, the nuthatch's black cap and gray back distinguish it. Its flight pattern is a characteristic bounding, and the nasal call "ank, ank" is often heard. Nuthatches tend to remain in their territories year-round and often are seen in company with titmice and chickadees.

HOUSE WREN (*Troglodytes aedon*) 5".
This small, energetic, brown-gray bird usually carries its tail cocked as it bustles around gathering insects for its family. Male wrens make several nests for the female's inspection; she may reject all of them and build her own bulky nest of twigs in a box or cavity, while the male drives all other wrens away. Nests occur in odd places, such as mailboxes or pockets of old coats hung in a garage. House wrens are combative towards other birds and will peck holes in the eggs of other hole-dwelling species, especially bluebirds. The cheerful, bubbling song is heard all day long.

CAROLINA WREN
(*Thryothorus ludovicianus*) 5 3/4".
Larger than the house wren, with a warm, reddish-brown back and a conspicuous white eye stripe, the Carolina has a loud, melodic song "tweedle, tweedle." It cocks its tail like the house wren and will come to bird feeders for suet. Carolina wrens are year-round residents which do not migrate.

LARGE BIRDS

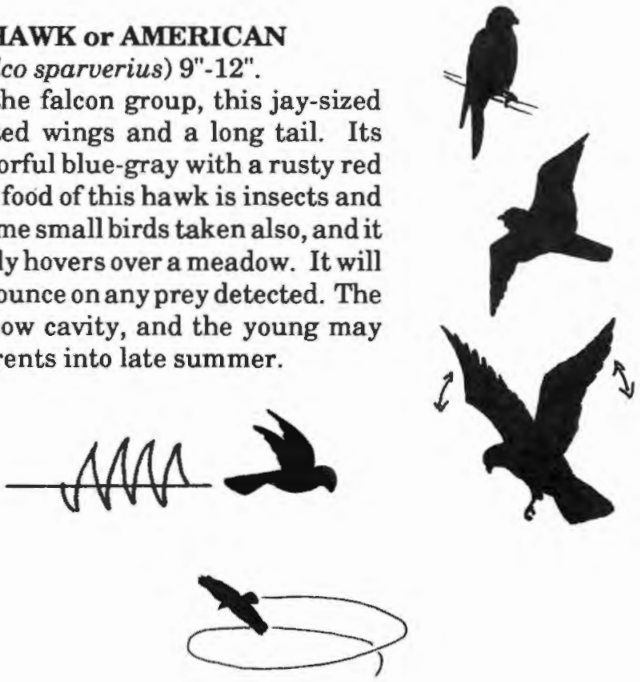
This group is larger in general than the average dooryard bird, although the sparrow hawk, included here with its cousin the red-tailed, is nearly jay-sized.

CROW (*Corvus brachyrhynchos*) 17"-21".
A large, very common bird, completely black with a black bill and purplish sheen to its feathers. One of the most intelligent and wary birds, crows have been found by hunters to be able to count up to twelve. Crows roost and nest in colonies, posting sentries to warn of approaching danger with the familiar "caw." Nests are large masses of twigs placed high in trees, and the crows may bring shiny objects to the nest. Crows will eat almost anything and can be a pest to newly planted fields or ripened corn, although they also eat quantities of insects.

TURKEY VULTURE
(*Cathartes aura*) 26"-32".
Nearly eagle-sized, the vulture when seen overhead has two-toned wings which may reach a spread of six feet. The small naked head (red only in the mature male) is barely visible from below, making the bird appear headless. When soaring, the wings are held in a shallow V or dihedral, unlike most hawks and eagles which soar with wings held flat. Vultures use columns of rising warm air to soar, and they can be seen riding these "thermals" in slow, lazy circles, rocking a bit. Their excellent eyesight and sense of smell enable them to locate dead animals. They are nature's garbage men and are esteemed and protected as such in some parts of the world.

RED-TAILED HAWK
(*Buteo jamaicensis*) 18"-25".
A large, stocky hawk with a wing span of 4 feet, it has a rufous tail which is usually visible as it wheels in circles overhead. Red-tails eat mainly rodents, especially meadow mice (not chickens), and capture these by watching for tiny movements in the grass as they circle overhead or perch on a conspicuous limb. They make huge nests in trees and return to them yearly, breeding in the early spring. This species belongs to the buteo group of hawks, which typically have broad wings and tail and soar overhead.

SPARROW HAWK or AMERICAN KESTREL (*Falco sparverius*) 9"-12".
Like others in the falcon group, this jay-sized hawk has pointed wings and a long tail. Its plumage is a colorful blue-gray with a rusty red back. The main food of this hawk is insects and rodents, with some small birds taken also, and it characteristically hovers over a meadow. It will swoop low and pounce on any prey detected. The nest is in a hollow cavity, and the young may remain with parents into late summer.



BIRDS OF THE OPEN AIR

While almost all birds fly, this group spends most of its waking hours aloft; swifts, in particular, mate, gather food and nesting materials, and drink on the wing. Swallows will perch on nesting boxes or wires, swifts only in their nesting holes. The following species are particularly good neighbors to man because of the large number of insects they consume.

CHIMNEY SWIFT (*Chaetura pelagica*) 5". Commonly seen over cities, this "cigar with wings" is entirely dark and flies like a bat, darting erratically. A loud, rapid twittering is heard as they fly overhead. Chimney swifts nest in colonies and attach their nests to the vertical walls of the chimney by using their saliva as glue. The twigs used are secured in flight by snatching them from treetops. Swifts may be seen swooping down on ponds to bathe and drink on the wing. They are among the fastest flyers; an Indian species was clocked at 180 mph.

TREE SWALLOW (*Iridoprocne bicolor*) 6". One of the loveliest swallows, the tree swallow has a steely blue-green back with a snow-white breast. The flock calls back and forth sociably with liquid twitters as it swoops over a meadow. Tree swallows will often nest in bluebird boxes and are tolerated as close neighbors where another bluebird would be driven off. While eating mainly insects, this swallow will also feed on bayberries and consequently may winter farther north than other swallows. It is often seen playing games with a feather, carrying one aloft and chasing it in the air currents, and it seeks out white feathers for nest linings.

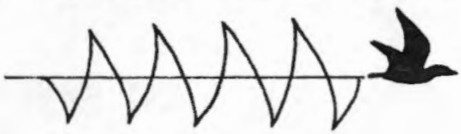
BARN SWALLOW (*Hirundo rustica*) 7".
The only swallow with a true, deeply forked "swallowtail," this handsome bird has a deep blue-black back and cinnamon underparts. It likes to nest around people and often will put its nest inside a shed or barn if access is available, making an open mud nest attached to a wall or beam. The parent swallows vigorously defend their eggs and young, dive-bombing any who approach too closely, and can make life miserable for the family cat. They may fly up to 600 miles daily in search of insects for their young. Swallows are considered good luck by farmers.

NIGHTHAWK (*Chordeiles minor*) 10".
Not a hawk at all, the nighthawk is closely related to the whip-poor-will. It earns its name through its habit of "hawking" for insects. Its long, narrow wings have a broad, white bar across them near the wingtips. Nighthawks are commonly seen over cities diving, and when the bird turns sharply upward it creates a booming sound. The nasal cry of "peent" is easy to hear. The bird has the unusual habit of perching lengthwise on a branch, although it is seldom seen resting. Eggs are often laid on flat roofs, with little attempt at a nest.

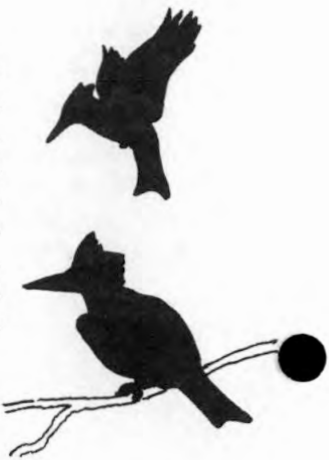
WATER BIRDS

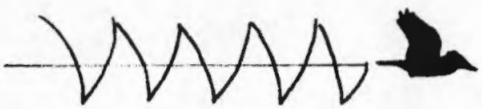
This group of birds is at home on or near the water, although the killdeer and ring-billed gull may be found inland as well.

MALLARD (*Anas platyrhynchos*) 20"-28".
The familiar duck of park lakes. The male has a glossy dark green head and chestnut breast; the female is mottled brown, with an orange-patched bill. Mallards belong to the marsh duck group, also known as "puddle-jumpers" because of the way they spring into flight from a small body of water. When feeding on aquatic plants, they dabble and tip up, sticking their tails straight up. Nests are placed on the ground near the water's edge. Up to a dozen eggs may be laid.



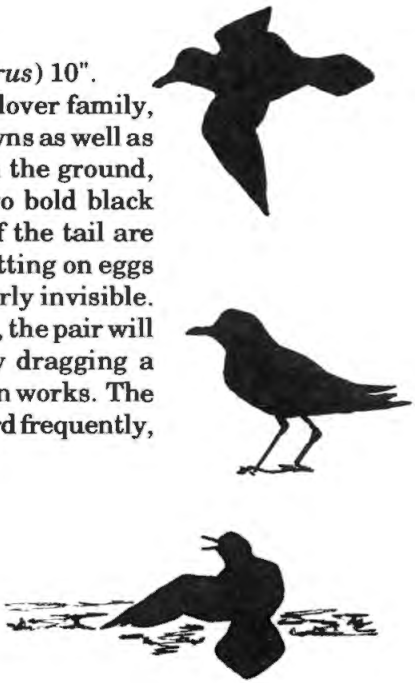
BELTED KINGFISHER
(*Megaceryle alcyon*) 13".
A gray-blue bird with a strong, dagger-like beak and a large, crested head, the kingfisher often advertises its presence with a loud rattling call. It patrols streams or perches on a limb with a good view of the water. On spotting a fish, it hovers and then dives to spear its prey with its stout beak. Nesting tunnels are dug into banks, with a length of up to eight feet. The nests can often be detected by the odor of rotten fish scraps.



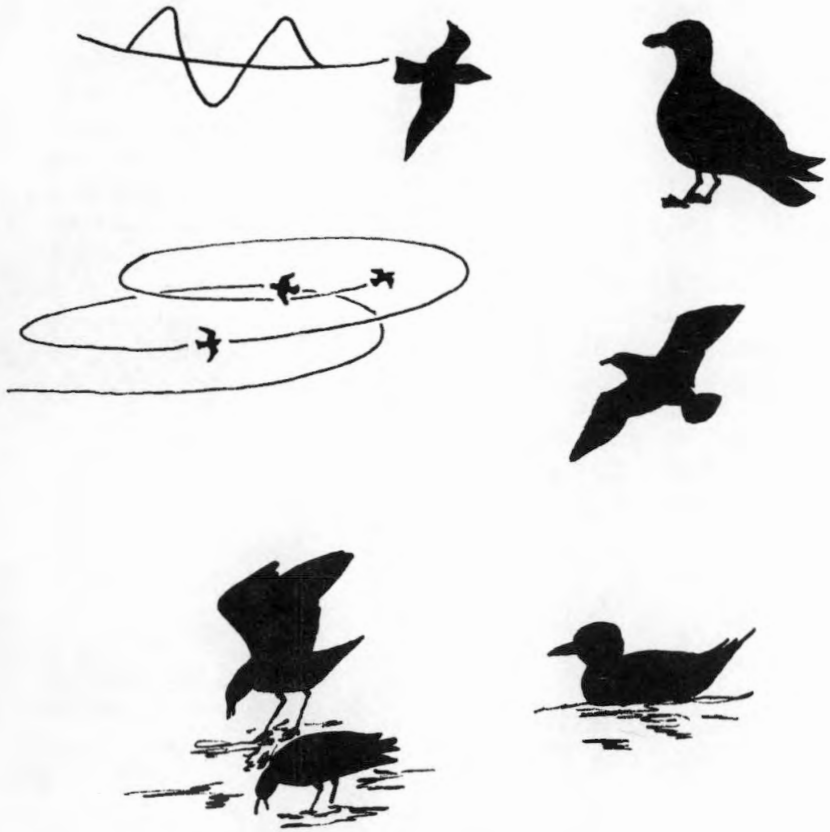


SPOTTED SANDPIPER
(*Actitis macularia*) 7".
The most familiar of the sandpipers, this shorebird nests along small streams and ponds as well as lakes and oceans. The clear black spots on its breast in breeding plumage are distinctive, but even more so is its habit of continually bobbing and teetering. In flight, it appears to fly on the tips of its wings with a shivering motion. The clear peet-weet call also identifies it.

KILLDEER (*Charadrius vociferus*) 10".
This shorebird, a member of the plover family, can be found on golf courses and lawns as well as seashores. When the bird runs on the ground, the white breast, crossed with two bold black stripes, and the bright chestnut of the tail are distinctive. However, when it is sitting on eggs the dusty brown back makes it nearly invisible. If the nest is approached too closely, the pair will try to draw the intruder away by dragging a wing as if wounded, a ruse that often works. The loud call of "killdeer, killdeer" is heard frequently, hence the Latin name "vociferus."



RING-BILLED GULL (*Larus delawarensis*) 18"-20".
This bird shares the common appellation "seagull" with the herring gull but may be told from its relative by the ring on the bill. Adults are silvery gray on back and have black-tipped wings, white head and breast; the young of the first two seasons are mottled and dark. The silhouette in flight shows crooked wings bent at the elbow. It often nests in very large colonies and is common inland.



FAMILY GROUPINGS

The five bird families described here have several representatives which are commonly seen on any bird walk. Each group shares characteristics which help in identification and in understanding their life styles. Birds are listed by size, from small to large, within each family.

BLACKBIRDS

A large, generally noisy group whose members often flock together, particularly in the fall. The black feathers are generally iridescent. The walk is a cross between a waddle and a strut and is distinctive. They may damage crops but are also beneficial, as insects form a major part of their diet.

COWBIRD (*Molothrus ater*) 7".
A small blackbird with a brown head and dark body, it has a sparrow-like bill. The female is gray. Their habit of lifting their tails high when feeding is distinctive. The female never makes a nest but lays her egg in the nest of a smaller bird. Usually the baby is raised, but occasionally the host mother will outwit the cowbird and build a false floor over the strange egg.

STARLING (*Sturnus vulgaris*) 8".
Actually more closely akin to the meadowlark, the starling is included here because it flocks with blackbirds. A garrulous bird, talking with squeaks and whistles, it has a yellow bill in spring. The dark feathers are iridescent in the spring but heavily speckled in fall and winter. The short tail gives the bird a triangular look in flight. The starling gives unwelcome competition to native hole-nesting birds, but it is a major predator of beetle larvae and gathers in large flocks on lawns to harvest these insects.

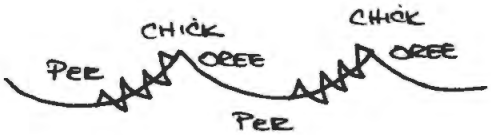
RED-WINGED BLACKBIRD
(*Agelaius phoeniceus*) 8"-9".
The male is all black except for red and yellow wing epaulets which are very conspicuous in breeding season, while the female is a mottled brown. They have sharp pointed bills. Redwings generally nest near marshes but may also choose brush near any water or even a ditch. They are strongly territorial and will attack anyone who comes near the nest, but they are also gregarious, flocking together sometimes in the hundreds of thousands after the breeding season. The song is a rich "quong-ka-ree."

GRACKLE (*Quiscalus quiscula*) 11"-13".
A large blackbird with a distinctively wedge-shaped tail, often held not flat but sideways like a rudder as the bird flies. The yellow eye in an otherwise all black bird is noticeable, as is the iridescence in breeding season. They may nest in colonies, often in evergreens, and will eat almost anything, raiding trash cans at picnic sites. The screeching call sounds like a rusty hinge.

FINCHES

A large family, most of these birds have large seed-cracking beaks. Sparrows, grosbeaks, cardinals and buntings are included in this family, though only finches are covered here. Many are brightly colored.

GOLDFINCH (*Carduelis tristis*) 5".
This happy little bird, often called "wild canary," has a bright yellow body with black wings and tail. Males in winter and females show much duller and grayer plumage. They flock all winter, usually with other finches. Mainly seed eaters, they delay nesting until midsummer when seeds become plentiful and thistledown is available for lining their nests. They undulate in flight, giving their call "per-chick-or-ree" or "potato chip" in perfect time with each undulation.

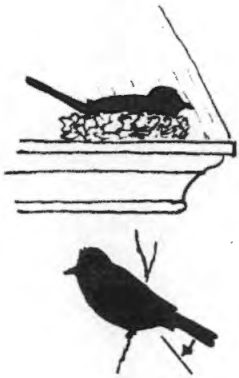


HOUSE FINCH (*Carpodacus mexicanus*) 6".
Introduced from the American west, where it is native, the house finch is now common in the east and is often seen at feeders. The female resembles a sparrow with a slight tinge of red, but the male has a reddish-orange breast, forehead and rump. Its clear warble is musical and frequently heard. House finches make rather large nests in evergreens or on a building but do not compete for hole sites like their cousins the house sparrows.

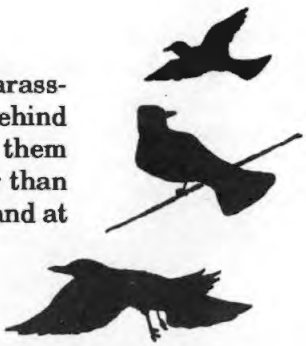
FLYCATCHERS

A family of birds, mostly 6"-8", with a distinctive habit of catching food. Flycatchers perch on an exposed twig or telephone wire, darting out with acrobatic flight to snatch an insect in midair, and then returning to the same perch. Sexes are alike, and most are a soft gray in color with white breasts.

PEWEE (*Contopus virens*) 6".
The plaintive whistle "peewee" announces the presence of this rather shy, brown bird which inhabits the dense upper levels of the forest canopy. It has two whitish wing bars and can be distinguished from the phoebe by this mark and the very different call.



PHOEBE (*Sayornis phoebe*) 7".
A tail-bobber which says its own name, "fee-bee," in a quick, two-syllabled call note, this flycatcher nests readily around homes. It is particularly fond of bridges or sites with water near by, putting its nest on a ledge and lining it with mosses. Usually the pair returns to the same nesting site year after year. The lack of wing-bars or eye ring, the call, and the tail-wagging distinguish it from other flycatchers.



KINGBIRD (*Tyrannus tyrannus*) 8".
This feisty bird earns its Latin name by harassing hawks and crows, flying above and behind them and pecking at their backs to drive them from its nesting site. Larger and darker than most flycatchers, it has a narrow white band at the end of its tail.

WARBLERS

This group is composed of small, active, brightly colored insect eaters, with the sexes dissimilar. Their songs, however, are scarcely worthy of the name and are mostly buzzy trills or lisps. They are so lively in pursuit of insects (one blink and they are three branches away) that they present a special challenge to the birder.

REDSTART (*Setophaga ruticilla*) 5".
One of the liveliest warblers and a common breeder in the United States, the redstart is black with bright orange patches on wings and tail, while the female is brown with yellow patches. Redstarts have a characteristic habit of dropping down suddenly in midair to snatch an insect and then fanning its brightly marked tail.

YELLOW WARBLER (*Dendroica petechia*) 5".
Bright yellow with an olive tinge on the wings, this is one of the most common warblers in this country. When victimized by the cowbird, it is resourceful and may build a false bottom over the unwanted egg, raising its own young on the upper story. The lovely whistled song "sweet, sweet, sweeter than sweet" is one of the few melodious warbler songs. The nest is a beautifully made cup of grasses and plant fibers and is often placed in gardens and near houses.

YELLOW-RUMPED or MYRTLE WARBLER (*Dendroica coronata*) 5".
The bright yellow rump on a blue-gray back and the loud call note "check" help to distinguish this warbler. It is the only warbler to winter regularly in the United States and nests mainly in Canada, like many other warblers.

RED-EYED VIREO (*Vireo olivaceus*) 6". Included with the warblers because of similarity in size and feeding habits, the vireos are a separate family from warblers and are more sluggish and drabber. The red-eyed is seldom seen because it feeds on insects in the tree tops, moving slowly about. However, it is a persistent and tireless singer, continuing on through the heat of midday and midsummer when most other birds are silent. The song is a series of short, abrupt notes, sometimes given as : "see me now?", "betcha don't", "here I am". The nest is a cup suspended from the fork of a horizontal branch.

WOODPECKERS

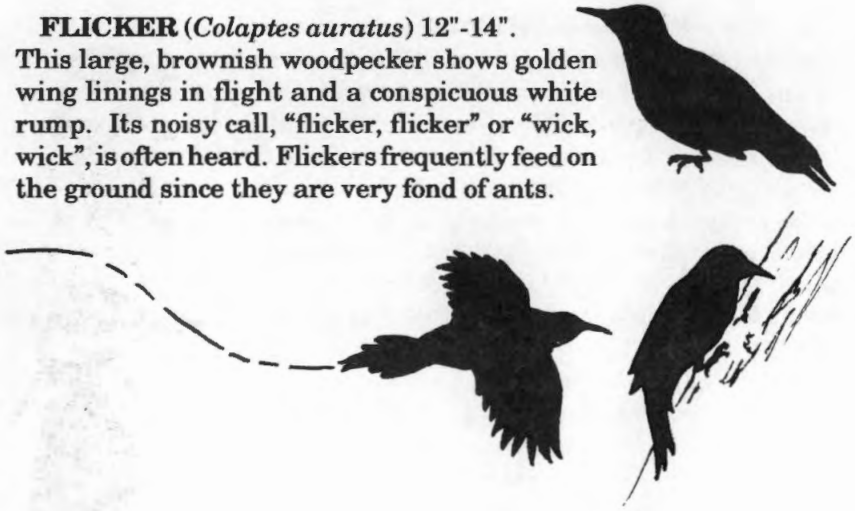
Chisel-billed and wood-boring, with stiff tail feathers which act as props on a tree trunk, woodpeckers also are equipped with feet having two toes before and two behind, remarkably long tongues with a barb at the end, and special cushioning in the bone of the head. They find food by drilling into tree trunks with dead wood containing insects, spearing the insect with their tongues and extracting it. Drumming on a special limb is used in place of song to defend territory and find mates. Their nest holes, excavated by the parents, are used subsequently by many other birds for their young. The typical flight is bounding or undulating. Most are white and black, with the males having some red at the head.

DOWNY WOODPECKER
(*Picoides pubescens*) 6".
A common visitor at feeders offering suet, the downy is quite tame. It has a relatively small bill, surrounded with downy feathers (hence the name), and a white stripe down the back. It often gives its call note, a sharp "pick." A close relative, the **Hairy Woodpecker** (*P. villosus*), is three inches longer, with a longer and stouter beak, but is marked almost identically to the downy.

YELLOW-BELLIED SAPSUCKER
(*Sphyrapicus varius*) 8".
Smaller than the downy, with a yellowish belly and a long white wing stripe, the sapsucker has a red forehead and black and white head pattern. When feeding, it drills a neat line of holes in a tree trunk, drinking the sap and also eating the insects attracted to the sap. It is shy and retiring.

RED-BELLIED WOODPECKER
(*Melanerpes carolinus*) 9"-10".
A zebra-backed woodpecker with a rolling, melodious call. The belly is only very faintly reddish, but the bright red on both male and female heads is conspicuous. The bird will visit feeders for both seed and suet and is known to store up food.

FLICKER (*Colaptes auratus*) 12"-14".
This large, brownish woodpecker shows golden wing linings in flight and a conspicuous white rump. Its noisy call, "flicker, flicker" or "wick, wick", is often heard. Flickers frequently feed on the ground since they are very fond of ants.



PILEATED WOODPECKER
(*Dryocopus pileatus*) 16"-19".
A spectacular, crow-sized bird with flashing white underwings in flight, the male and female both have flaming red crests. The holes dug in search of insects or for nests are typically rectangular or oblong and may be several inches across. The loud, ringing call resembles that of a flicker.

Animals

MAMMALS

Mammals are warm-blooded animals with fur or hair; the young are fed with milk by the mother from her mammary glands. Most mammals, with two exceptions (duck-billed platypus and spiny anteater), give birth to live young rather than laying eggs.

ORDER: MARSUPIALIA

OPOSSUM
(*Didelphis marsupialis*) 20"-40", 4-12 lb.
The only marsupial in North America, the opossum is the size of a house cat with gray fur and a long, naked, prehensile tail which it uses for gripping and balancing when climbing. Babies grown too big for the pouch may ride on the mother's back, clinging to her tail. 'Possums were formerly seen mainly in the south but have been extending their range north. An unusual trick is the ability to "play dead." It is not known if this is a deliberate act or an involuntary nervous paralysis caused by fear. A nocturnal animal, the opossum is omnivorous and has 50 teeth, the most of any mammal on the continent.

ORDER: CHIROPTERA

BAT, LITTLE BROWN MYOTIS
(*Myotis lucifugus*) length 3.5", wingspan 10".
Bats are the only true flying mammals. The hand is formed into a wing with a membrane of skin covering. Insects are their food, taken in flight by scooping them in with the femoral membrane. Because of the number of insects eaten, bats should be considered beneficial. Of the nine species in our area, the Little Brown was selected as fairly typical. Bats are largely nocturnal, emerging from the roost near dusk. They navigate by using sonar, a series of very high-pitched squeaks. They roost in such areas as caves, hollow trees, chimneys and vacant buildings.

ORDER: CARNIVORA

FOX

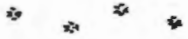
The fox is a member of the Carnivore family but in fact is omnivorous, rounding out its meat diet of rabbit and mouse with available berries and fruits. It resembles a small dog with a long, brushy tail. There are two fox species in the area.

RED FOX

(*Vulpes fulva*), 22"-42", 15" high, 8-15 lb.
This species is usually found in areas combining open country and forests. It is reddish yellow with a dark back and a brushy tail perhaps 15" long which is tipped with white, a good field mark. There are many color variations. It has a reputation for cleverness in eluding the hunter.

GRAY FOX (*Urocyon cinereoargenteus*)

21"-44", 14" high, 7-13 lb.
The gray fox is associated with wooded, brushy areas and has been known to climb trees. Its coat is pepper and salt with buffy underfur. The tail, about 12"-16", has a black stripe and is tipped with black. It will not tolerate the red fox as a neighbor but drives it away. This fox very rarely raids hen houses, preferring mice, and is beneficial.



STRIPED SKUNK

(*Mephitis mephitis*) 13"-18", tail 7"-10", 6-14 lb.
Also a member of the Carnivore family but omnivorous as well, the skunk eats mice, birds, eggs, insects and some vegetable matter. It will often dig beetle grubs out of a lawn, leaving small holes behind, and also will dig out yellow jacket nests to eat the larvae. The white stripes contrasting with the black coat make it easy to identify. The skunk is a dignified creature, relying for defense on its ability to discharge its odorous spray up to 12' at any enemy. However, the great horned owl apparently does not mind the spray and will often prey on skunks.

RACCOON (*Procyon lotor*) 18"-28", tail 8"-12", 15-40 lb.
The black mask, pepper and salt coat and black rings on the tail identify this common resident of the suburbs. Raccoons originally lived along rivers and in woods but have readily adapted to urbanization, where they live in hollow trees, sewers or chimneys. Intelligent and curious, they raid garbage cans and are very clever at opening latches and the like to get at food. Raccoons still prefer to wash their food before eating if water is handy. Although they are carnivores, they will eat almost anything.

ORDER: INSECTIVORA

STAR-NOSED MOLE
(*Condylura cristata*) 5"-8", 1.5 oz.

Often people speak of moles when they mean voles, but the true mole is an underground creature with specialized front feet made for digging tunnels. Eyes are tiny and there are no external ears. Moles are in the Insectivore family, not the Rodent, and eat mainly earthworms and insects. They do not eat plants, though their tunnels may cause damage by letting air into the roots and the tunnels maybe used by plant-eating species such as voles.

SHORT-TAILED SHREW
(*Blarina brevicauda*) 3"-4", 1 oz.

The shrew has a very high rate of metabolism and is constantly on the go, seeking insects, worms, snails and other prey. Shrews are aggressive hunters and may eat up to three times their weight each day. Nests are made in old stumps or under brush piles.

ORDER: RODENTIA

DEER MOUSE (*Peromyscus maniculatus*)
3"-4", tail 2"-5", 1 oz.
There are many very similar species of mice which inhabit woods and meadows. The deer mouse is one of the most attractive, with a buffy to reddish-brown coat, white feet and underparts and a bicolored tail. It may live in forest or grassland and eats both seeds and insects, sometimes storing food. Mice are a most important element of the food chain and are the basic diet of many predators. Mice are prolific breeders. The deer mouse has four litters a year, but house mice will breed all year round, with a litter every six weeks.

MEADOW VOLE (*Microtus pennsylvanicus*)
3"-5", tail 2", 1-2 oz.
Voles closely resemble mice but have much smaller ears and shorter tails. Voles will cut small runways through the matted grass of meadows and dig burrows on the surface; it is a good swimmer. It feeds on grasses, seeds and some insects. It is as important in the food chain as mice and may have several litters per year.

COTTONTAIL RABBIT
(*Sylvilagus floridanus*) 15"-18", 2-3 lb.
Possibly the most familiar wild mammal to many people, the cottontail has been memorialized in many bedtime stories. The long ears and cotton puff of a tail identify it. It prefers overgrown fence rows and thickets but may also be seen on lawns. Feeding mainly from dusk to dawn, it eats green vegetation and will raid the garden for young shoots. In the winter it eats bark and twigs. Rabbits are a major source of food for other wildlife. Rabbits hide in the day in small depressions in the ground, called "forms," in thickets or under brush. (The rabbit holes of children's stories are dug only by European rabbits).

EASTERN CHIPMUNK
(*Tamias striatus*) 5"-6", tail 3"-4", 3-4 oz.
The chipmunk is a ground squirrel, easily identified by the stripes running along its back and on its face. A lively rodent, comfortable around houses, it carries food in cheek pouches into its long burrows for storage. Its sharp call "chuck chuck" is often heard as it chases another chipmunk away from its territory. It will occasionally climb trees for fruit and nuts and is omnivorous, also eating insects, meat, and eggs.

SQUIRREL
There are four tree squirrels in our area, including the seldom seen, nocturnal flying squirrel and the gray squirrel. The gray is omitted here because it is so rarely seen in the Sewickley area.

RED SQUIRREL (*Tamiasciurus hudsonicus*)
7"-8", tail 4"-6"; 5-9 oz.
A lively, noisy dweller in conifers and deciduous trees, the red squirrel has a ratchet-like chatter which is often heard. It may sit on a favorite stump and eat pine cones, shedding the scales about it. It will take baby birds and eggs when it can get them. The nest may be in a hole or on a tree crotch.

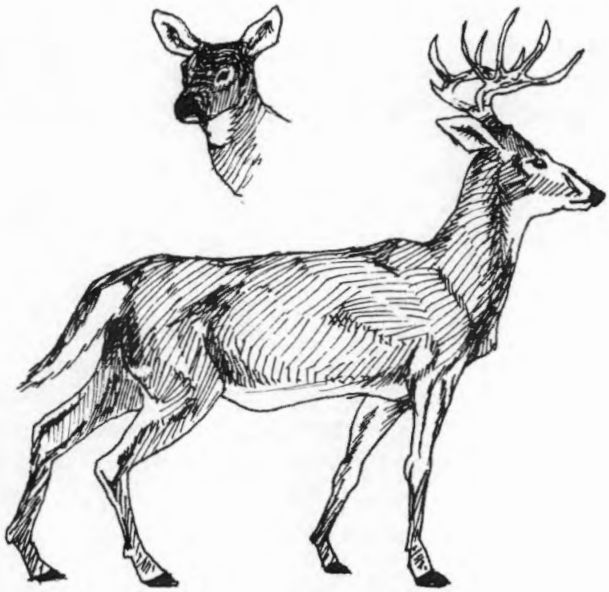
FOX SQUIRREL (*Sciurus niger*) 10"-15", tail 7"-13", 18-38 oz.
This is the largest Pennsylvania squirrel and is a handsome rusty yellow with a tawny belly. There are color variations found in other areas. It is more comfortable on the ground than some tree squirrels and may be found some distance from trees. It feeds on a great variety of nuts, seeds etc. and will eat eggs and fungi as well. The nest is a twig and leaf mass high in a tree or in a cavity.

WOODCHUCK (Groundhog, Marmot) (*Marmota monax*) 16"-20", tail 4"-7", 5-15 lb.
A common mammal with many names and also a member of the squirrel family, the woodchuck is a ground-dweller. Its tail is much shorter proportionately than that of a squirrel, and its heavy body with grizzled brown fur is less well adapted for climbing, though it can climb to some extent. The woodchuck is a vegetarian and is most often seen in meadows or at roadsides where it will frequently sit up erect to look for danger. Extensive burrows are dug, perhaps 25'-30' long, which have several entrances, all but one well concealed. The burrows are used by many other creatures for homes and refuges. A woodchuck can cause considerable damage to gardens or farm crops. Farmers say that woodchucks eat to give them strength to dig holes, and dig holes to give them an appetite!

ORDER: ARTIODACTYLA

WHITE-TAILED DEER (*Odocoileus virginianus*) 3'-3.5', male 75-400 lb., female 50-250 lb.

The white-tailed deer is a creature of brushy areas, mixed woodlands and forest edges. It has readily adapted to the encroachment of man and now is common in suburban developments. It can be the despair of gardeners through its fondness for shrubbery and flowers. It is a browser, eating twigs, shrubs, fungi, acorns, and grass and herbs in season. In summer, the white-tail is a reddish brown but in autumn turns grayer. The flashing white underside of the tail is used as a signal of alarm. The young fawns, born in spring, are spotted and have no scent to help them elude predators. Antlers are grown each year by the buck, sprouting in spring, enlarging over the summer in "velvet," and hardening in fall in time for the mating season. Afterwards the antlers drop off but are seldom found in the woods, as many small animals nibble at them for the mineral content.



REPTILES AND AMPHIBIANS

Reptiles are cold-blooded, usually four-legged, except for snakes, and have skin with scales or bony plates. They have lungs and breathe air, even in the aquatic species. Most lay eggs with hard or leathery skin, but some snakes bear live young (viviparous). They hibernate in cold weather. Turtles, lizards, snakes and alligators are all reptile groups.

Amphibians were the animals which first crept out of the water to spend some time on land. Most species still need water at some stage of their development. They differ from reptiles in never having clawed feet or true scaly skins. They lay jelly-covered eggs, either in water or on moist leaf mold, which hatch into larvae or tadpoles. They also hibernate in cold weather. Amphibians include frogs, toads and salamanders.

REPTILES

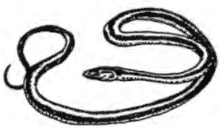
ORDER: CHELONIA

EASTERN BOX TURTLE

(*Terrapene c. carolina*) 4.5"-6".
This dry-land turtle, found mainly in the woods, has a high domed shell which is brownish with yellow markings. It can close its shell very tightly if threatened; the hinged plastron or undershell aids in this. Males usually have red eyes and concave plastron, while females are brown-eyed with a convex plastron. They are omnivorous and long-lived, perhaps reaching a century.

ORDER: SERPENTES

EASTERN GARTER SNAKE



(*Thamnophis s. sirtalis*) 18"-26".
A common, rather small snake, it has lateral stripes of yellow, rows of spots between stripes and a yellowish to greenish belly. It is found in a wide variety of habitats, from meadow and wood to streamside or anywhere the ground is damp. Garter snakes give birth to live young, usually about 20. They are relatively easy to handle but can bite.

NORTHERN WATER SNAKE
(*Natrix s. sipedon*) 24"-48".

A rather thick-bodied snake, it is common in streams, ponds, swamps, etc. The color is highly variable, but adults are generally quite dark. The half moons on the belly and dark crossbands on the neck help identify it. The female gives birth to around 30 young in late summer. Water snakes will bite viciously if cornered but are not venomous.

BLACK RAT SNAKE
(*Elaphe o. obsoleta*) 42"-72".

This large, rather thick snake is usually a plain shiny black, sometimes showing traces of a spotted pattern. The chin and throat are white. It is a good climber and may be seen quite high in trees. An important control on small mammals, it kills by constriction. In the fall, young hatch from eggs which are often laid in manure piles.

AMPHIBIANS

ORDER: SALIENTIA

AMERICAN TOAD
(*Bufo a. americanus*) 2"-3.5".

A plump animal with a short, wide head and a dry, warty skin, the toad is found in many places as long as there is some moisture present and at least temporary standing water for breeding. In spring, the male heads for water and calls for a mate with a long musical trill, swelling out his throat to produce the sound. He clings tightly to the female's back as she extrudes long strings of jelly-like eggs. The eggs hatch into tadpoles in about three days and the tadpoles mature into adults in about eight weeks. Toads move in a succession of short hops. When disturbed, they may exude an irritating liquid which will cause dogs to foam at the mouth. In the fall, toads burrow into loose soil and spend the winter hibernating.

WOOD FROG (*Rana sylvatica*) 1.5"-2.7".

The small buffy frog with the robber's mask, the wood frog breeds very early in the spring and then disappears into the woods, where it can be found some distance from water. Eggs are laid in masses attached to underwater twigs and stems and hatch in two weeks. The spring call is a clacking noise, resembling ducks quacking in the distance. Frogs do not hop but leap strongly.

NORTHERN LEOPARD FROG
(*Rana p. pipiens*) 2"-3.7".

This green to brown frog has dark, irregular blotches with light borders on its smooth skin. Its close relative, the pickerel frog, has square spots arranged in parallel rows. The spring call is a harsh, low-pitched note followed by short grunts. Eggs are laid in rounded masses which are attached to underwater objects or placed on the bottom of the pond. They hatch in 6 days and tadpoles mature in eight to eleven weeks. After the breeding season, the frogs may be found in meadows well away from water.

ORDER: CORDATA

RED-BACKED SALAMANDER
(*Plethodon c. cinereus*) 2.2"-3.5".

Salamanders have long slender bodies and long tails, with very short legs. The woodland salamanders hide during the day under logs or stones where the soil is moist. The red-backed has a wide pink, red or yellow stripe running from the head down the center of the back out onto the tail. There is a lead-backed form with a uniformly dark back. The belly is mottled, producing a salt-and-pepper effect. Eggs are laid in little cavities under rocks and logs and look like miniature bunches of white grapes. The female stays with the eggs until they develop into larvae. There is no aquatic stage.

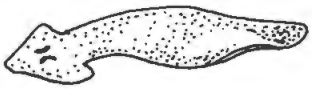
Water Creatures

TURBELLARIA: FLATWORM (*Planaria*)
Flatworms are flattish, small (0.8") leechlike creatures but not parasitic, very simple in body structure. The triangular head and the body are dusky in color. They avoid light, living under rocks.

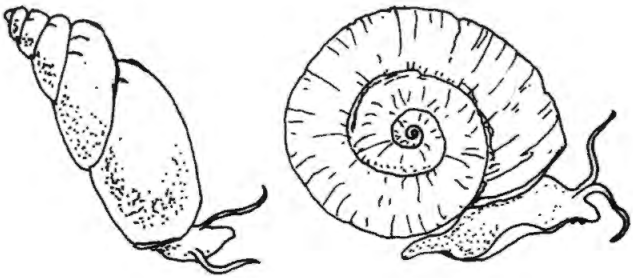
ARTHROPODS

MOLLUSK: SNAIL (*Gastropoda*)
pond snail, wheel snail. Snails have one foot and a rasping tongue, called a radula, with which they scrape off plant material for their food. They eat mainly plants but may also feedon dead animals. They are food for many fish and for some birds and animals. Pond snails will tolerate poor water, but other snails will not.

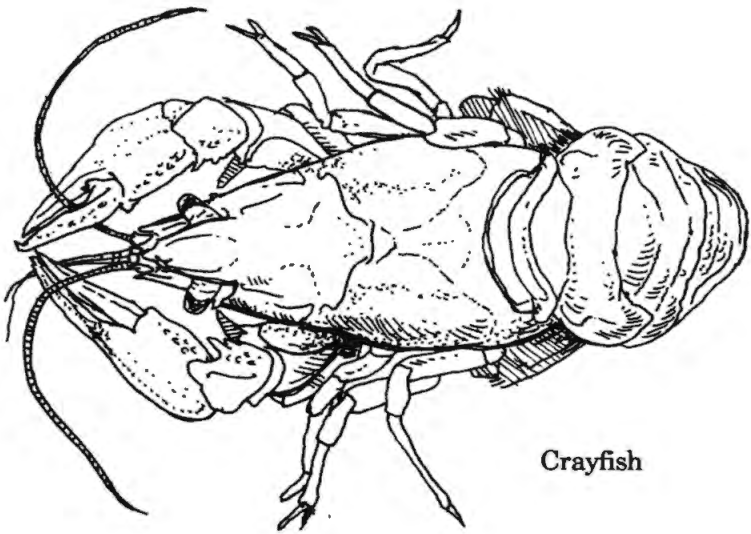
CRUSTACEAN: CRAYFISH (*Decapoda*)
Crayfish look like miniature lobsters. They are active at night, hiding by day in burrows, and are mainly vegetarian. Crayfish can scoot backwards very fast by using the powerful tail.



Planaria



Pond Snails



Crayfish

INSECTS

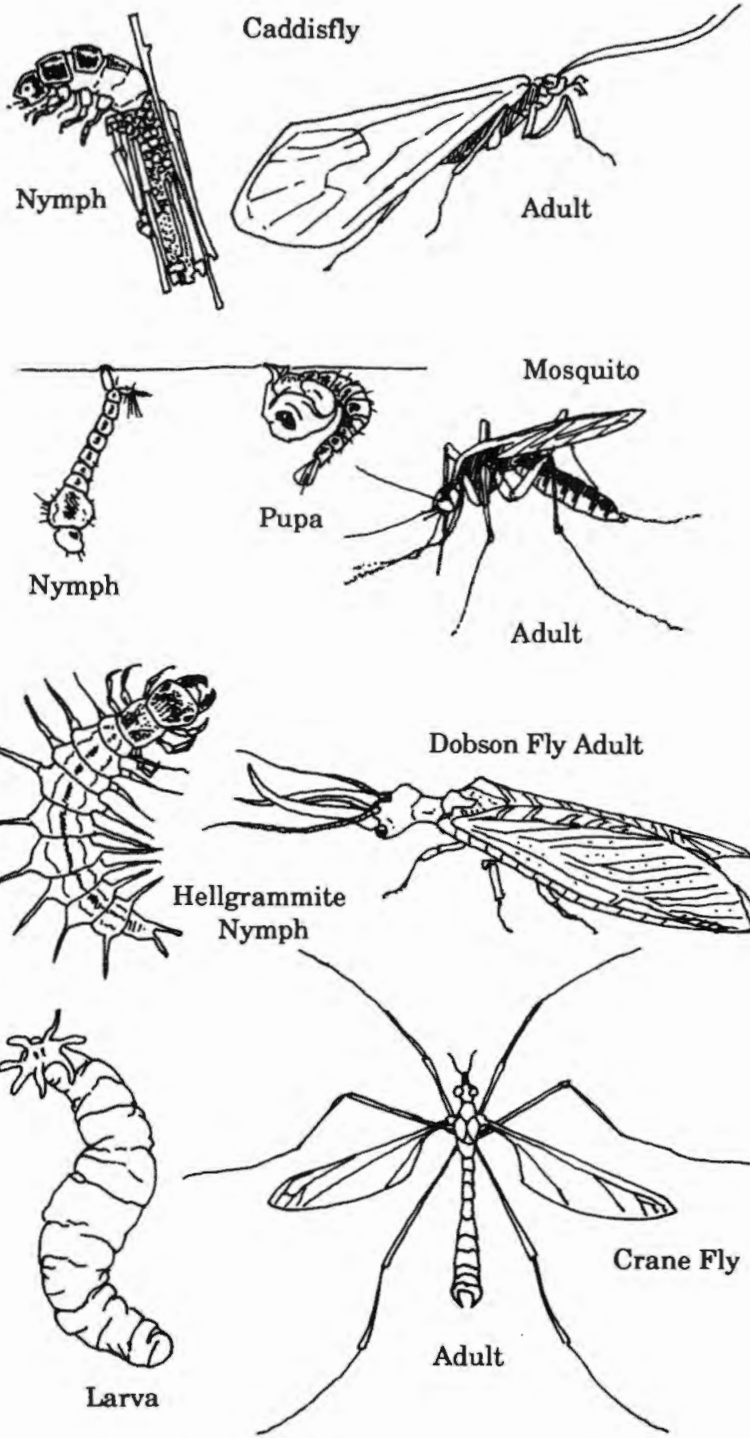
(Order or sub-order rather than species name is given in parentheses)

CADDISFLY (*Trichoptera*)
Caddisfly larvae live in tubes or cases which they construct from pieces of wood, leaves, or sand, binding the material with silk from their bodies. Each species uses its own material. The cases are portable and are dragged around by the insect. The tails of the larvae have small hooks to anchor them to stones in the stream current. They serve as food for many fish. The adult looks like a small brown moth.

MOSQUITO (*Diptera: Aedes*)
Larvae, commonly called wigglers, hang downward from the surface film of the water and breathe by means of an air tube and by gills. They are an important fish food. The adult has one pair of transparent wings. The female's mouth is a piercing and sucking tube for obtaining food. Males are harmless.

HELLGRAMMITE, DOBSON FLY (*Megaloptera*)
The hellgrammite is a large (1"-3") predatory larva showing gill tufts along its body. The adult, called a Dobson fly, is a delicate creature, brownish with white splotched wings. The male has large curved mandibles which clasp the female in mating.

CRANEFLY (*Tipulidae*)
Larvae have a breathing disc at the end of their tails and may appear transparent or leathery. The adult form resembles a giant mosquito in appearance but not in habit, as they do not bite.

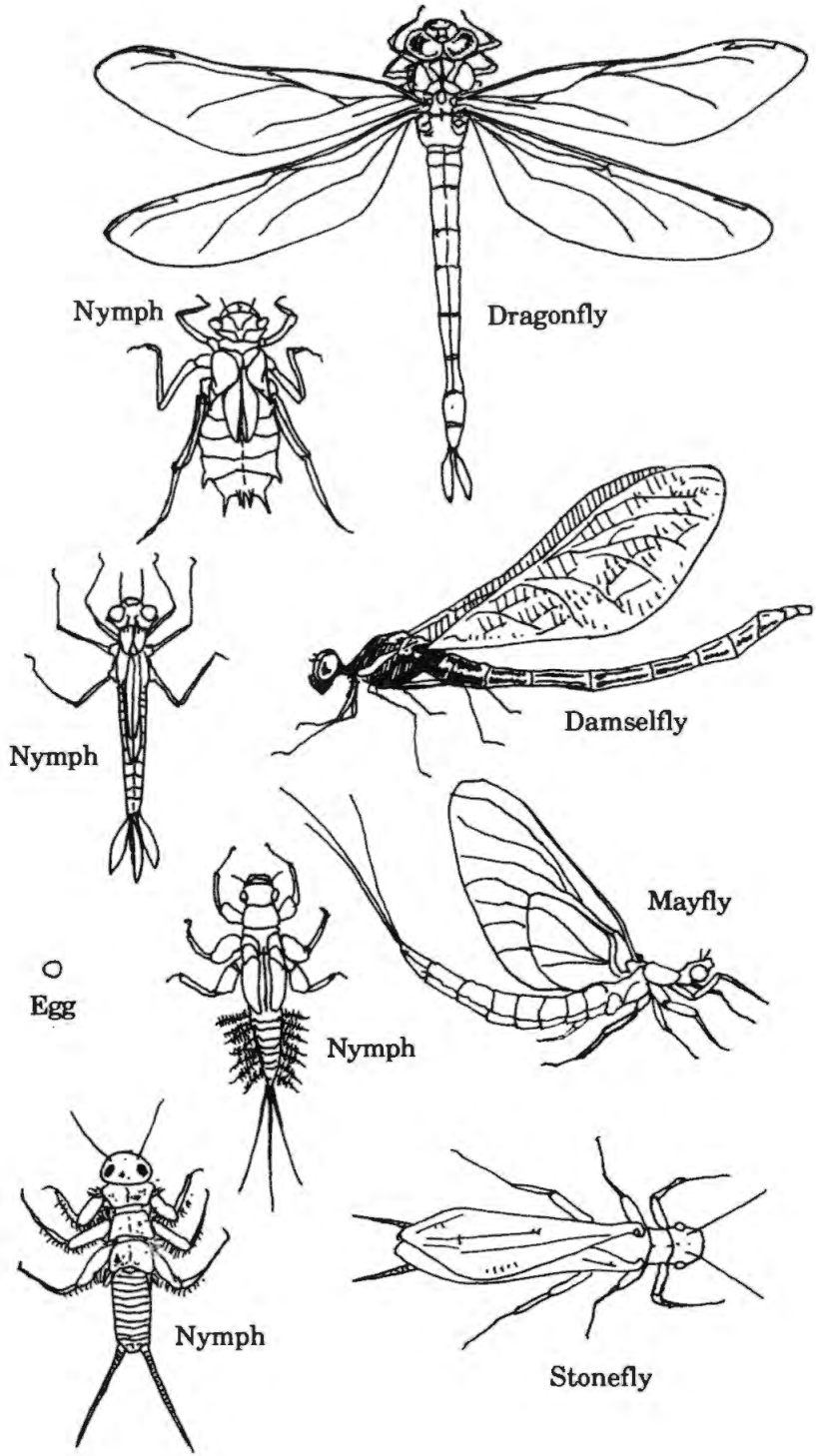

Caddisfly
Nymph
Adult
Mosquito
Pupa
Nymph
Adult
Dobson Fly Adult
Hellgrammite
Nymph
Crane Fly
Adult
Larva

DRAGONFLY (*Odonata*)
The predatory nymph uses jet propulsion to move around. In most species, the adult is beautifully colored, with two pairs of wings held horizontally at rest, and is predatory and territorial. They are the hawks of the insect world.

DAMSELFLY (*Odonata*)
The larvae have three leaflike structures extending from the tail and are more delicate appearing than the dragonfly larvae. The adult damselfly is as beautiful as the dragonflies but has a slimmer body and holds its wings close together and pointing backwards when at rest.

MAYFLY (*Ephemeroptera*)
Larvae are free-swimming. They have reddish brown eyes and feed on algae. The abdomen has flaplike gills on the sides, and there are 3 long, featherlike "tails." They may take several months or several years to reach adult size, depending on species, and are a very popular fish food. The adults have no mechanism for eating at all, existing only to mate, lay eggs and die.

STONEFLY (*Plecoptera*)
Also a valuable food for fish, the stonefly larva has only two "tails." It has two claws on each foot. The adult hatches in the fall or winter and may be seen along iced-up streams. It has rather weak wings and does not fly far from the water.

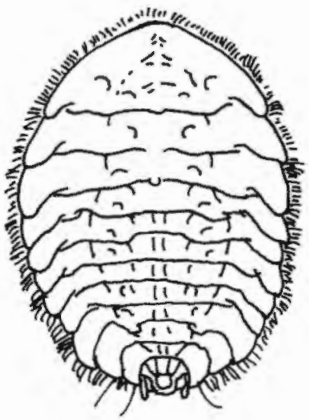

Nymph
Dragonfly
Nymph
Damselfly
Mayfly
Egg
Nymph
Nymph
Stonefly

WATER PENNY (*Coleoptera*)
Water penny larva are pear-shaped with a flat body and are found under rocks. The adult psephenid beetle crawls rather than swims.

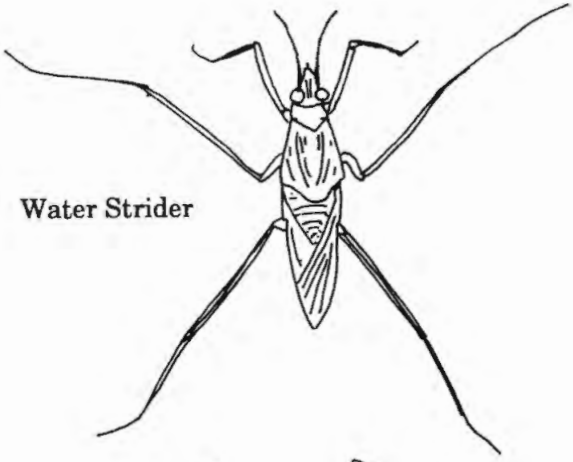
WATER STRIDER (*Hemiptera*)
An insect (.2 -.75") with long, spider-like legs. Their feet have hairlike projections which allow them to run about on the surface tension of the water. The beak is used to spear prey such as mosquito larvae. They often congregate in numbers on the water surface. They overwinter as adults.

WATER SCORPION (*Hemiptera*)
The first pair of legs look slightly like those of a mantis and are used for seizing prey. The long legs resemble those of a walking stick. The two long tail filaments make a breathing tube when pressed together.

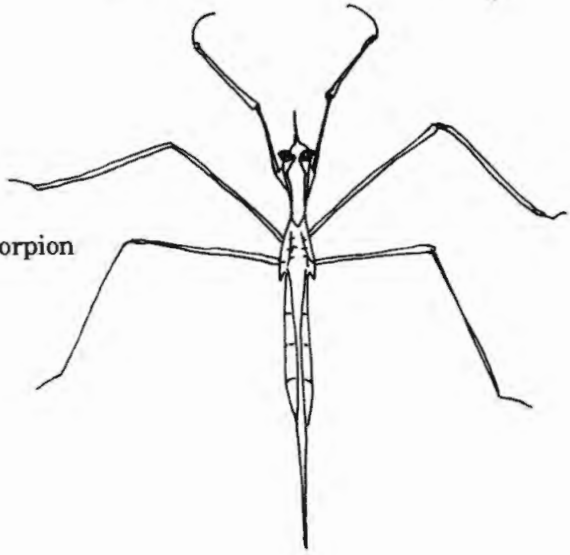
Water Penny



Water Strider



Water Scorpion



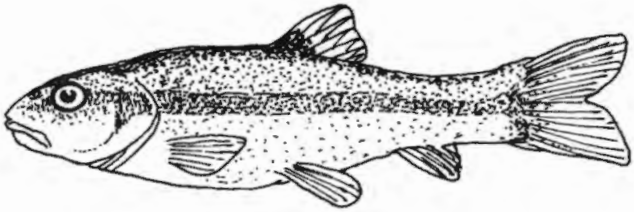
FISH

CREEK CHUB (*Semotilus atromaculatus*) 12".
Chubs are large minnows in appearance, with olive backs, silvery sides and a relatively large head. They like small, clear to turbid streams and lakes with a sand or rock bottom. Chubs are used for bait and are frequently caught by fly fishermen.

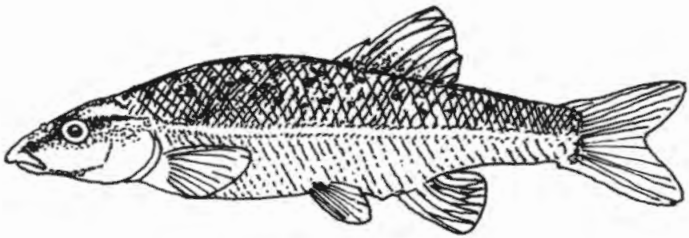
BLACK-NOSED DACE (*Rhinichthys atratulus*) 3.5".
Small and elongated, the dace is yellow-olive to dark brown with black blotches. The fins are small and rounded. It prefers springs and clear, cool creeks. The primary food is aquatic insect larvae.

SHINER (*Notropis cornutus*) 6".
This small minnow has a dusky olive back and rounded fins, with a moderately large, blunt head. It is found in clear, cool creeks and small rivers with a moderate current and riffles over a firm bottom. Shiners are often used as bait in fishing.

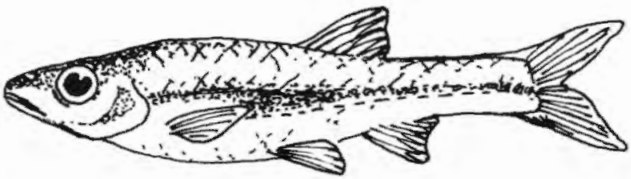
BROWN TROUT (*Salmo trutta*) 1'-4'.
Brown trout were introduced from Europe into this country and are more tolerant of warm water than native trout. The tail is squared rather than forked as in native trout. Back and sides are olive brown with numerous red to orange spots scattered on head, body and fins. The young feed on aquatic insects, while adults feed to a large extent on other fish.



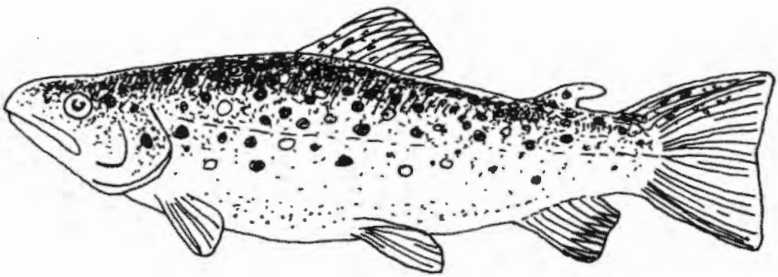
Creek Chub



Black-nosed Dace



Shiner



Brown Trout

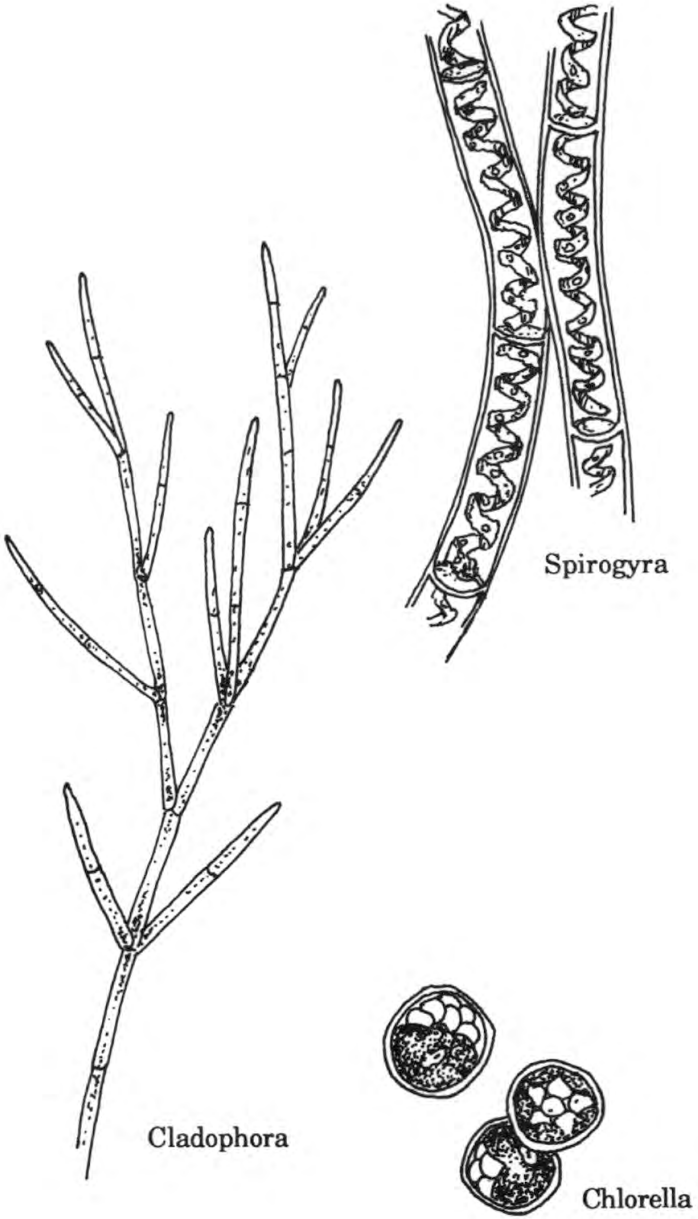
PLANTS: ALGAE

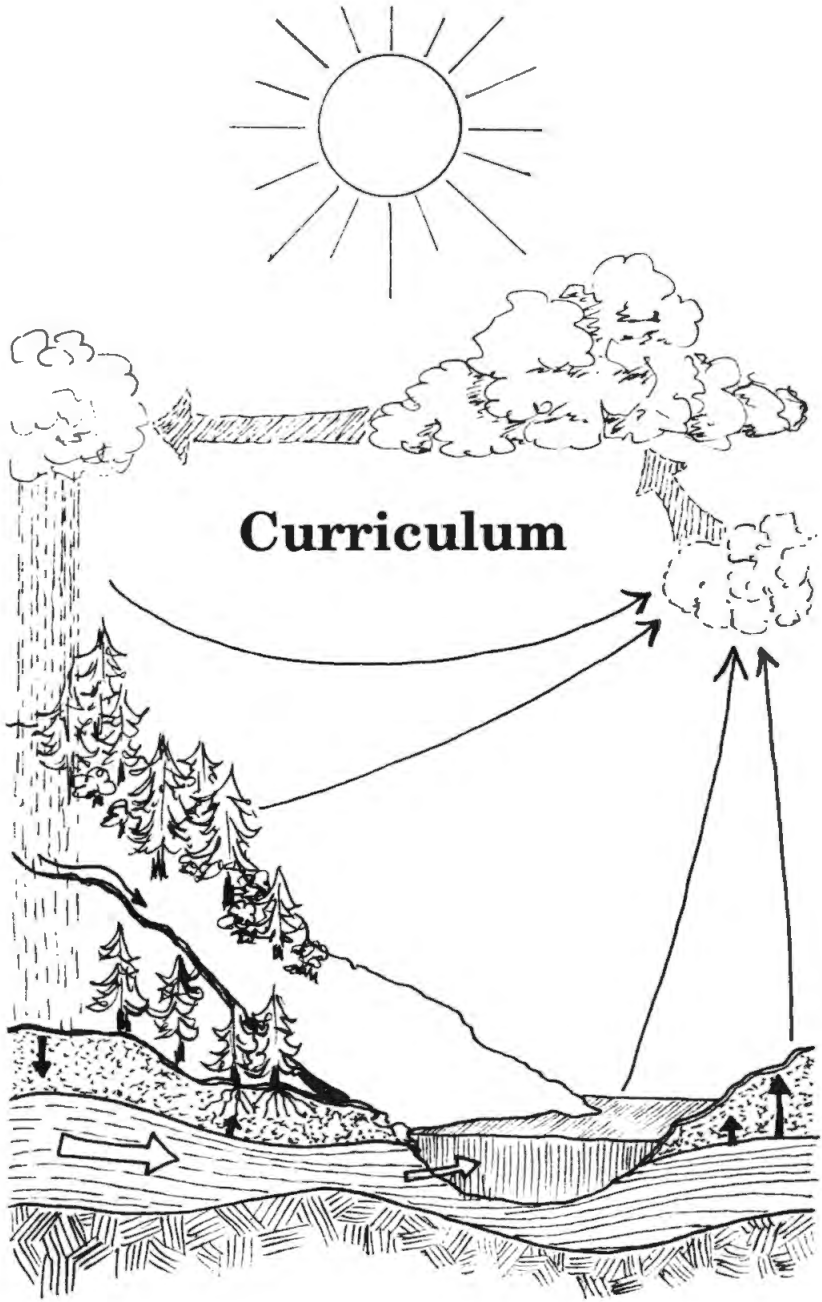
SPIROGYRA
A common filamentous green alga with a spiral chloroplast in each cell. In spring, dense blankets may be seen on the surface of ponds.

CLADOPHORA
Long slim cells form branching filaments. Some species grow attached to rocks, stream bottoms, etc., while others may float and form mats.

CHLORELLA
A single-celled green alga which may occur in clumps or loose aggregates. Widespread, especially in organically rich and polluted waters.

DIATOM (not illustrated)
minute, unicellular brown algae, also filamentous, which appear as brown fur on rocks. An important source of oxygen for streams.


Spirogyra
Cladophora
Chlorella


Curriculum

MAPLE SYRUP

BACKGROUND

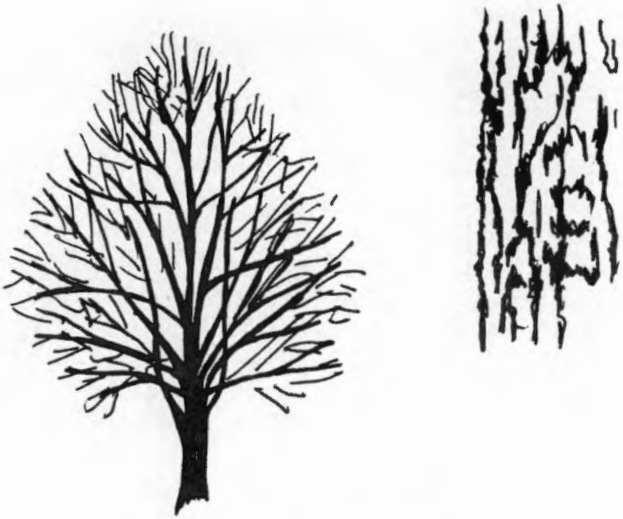
Indians first discovered that sweet syrup could be made from trees. A legend has it that an Indian wife asked her husband to get water for a stew. Angry at being asked to do women's work, he threw his tomahawk at the tree under which he had been resting and stomped off, leaving the tomahawk in the tree trunk and the birchbark water container under the tree. The wife noticed later that the container was full of fluid and used the fluid in her stew. The resulting gravy was thick and sweet because the tree was a sugar maple. Early Indian methods of tapping were crude. The tree was gashed and the bark or hide container was set underneath. The sap was put into a long hollow log and boiled down by adding hot stones to the sap. Sometimes the sap was allowed to freeze and the ice removed, thus concentrating the sap.

Colonists learned to make maple syrup from the Indians and added refinements of technique. A spile or hollow tube was driven into the tree and a wooden tub hung from it, a method resulting in less damage to the tree and cleaner sap. Large shallow metal pans were used to boil down the sap. Groves of sugar maples, called "sugar bushes", were planted. Oxen were used in early days to draw sleds through the sugar bush to collect the sap.

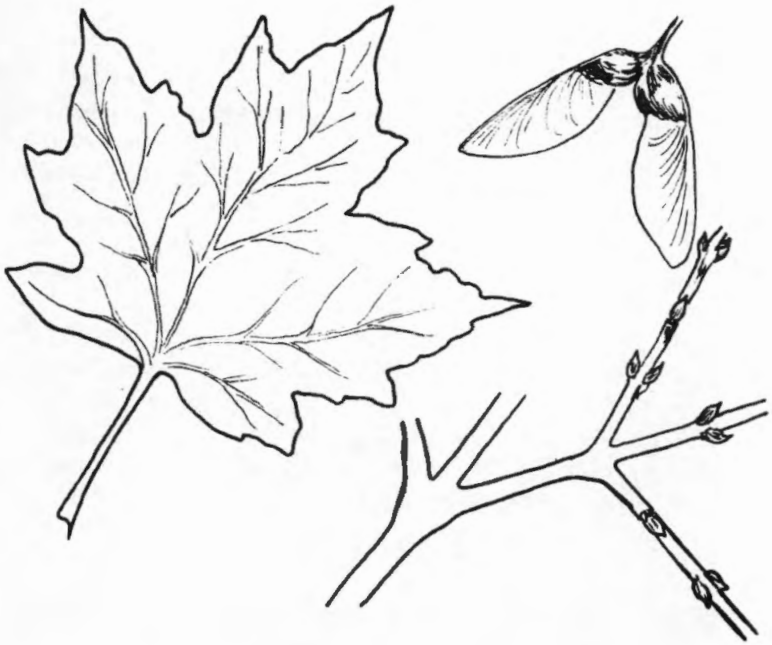
Sap is the lifeblood of the tree, composed of stored food reserves mixed with water and minerals taken by the roots from the soil. Sap contains between 1% and 12% sugar, with a norm of 3%. The yield is about 35:1, or 35 quarts of sap to make one quart of syrup. Sugar maples contain the sweetest sap for making syrup. Red maple and birch are less sweet but can be tapped. The sap is clear, watery and only faintly sweet. Sugar maples thrive only in climates with a fairly cold winter.

CHARACTERISTIC LIFE FORM

The sugar maple species gives sap with the highest concentration of sugar. Look for a tree which has opposite twigs, slim pointed buds, shaggy gray bark in slabs, and five-lobed leaves. On older trees, branches grow at random angles to the trunk, some horizontal and some nearly vertical. For further identification, see accompanying drawing and the field guide.



Sugar maple



CYCLE

Food made by the leaves during the summer is converted from sugar to starch for the nourishment of the tree. As fall approaches, excess nutrients are converted back to sugar and are stored in the tree roots. Spring brings warming weather and triggers the sap flow. Sap brings nutrients to the entire tree. It flows from roots to twig tips via the cambium layer, the inner bark hidden just under the outer corky bark. Sap needs warm days and cold nights to flow properly. Sunshine encourages the flow of sap. Daytime warmth (45-50 degrees) will draw the sap up from the roots and night-time cold (below freezing) will retard the opening of buds. Tapping must stop when the buds open.

WALK PLAN

To tap a maple tree, find one at least twelve inches in diameter. Smaller trees should not be tapped. For each additional six inches, another tap may be added. Avoid previous tap holes, which will have been covered over with bark but contain scar tissue which hinders sap flow. Holes should be drilled on a slight upward slant on the sunny side of the trunk and should just barely pierce the cambium layer, or about one inch depending on bark thickness. When the dark, corky bark turns pale and becomes wet, stop. The hollow spile must be exactly the same diameter as the hole and should be tapped in gently. (Note: during the walk, only one hole should be drilled in a tree. For succeeding groups, pull the spile out and re-enact the drilling.)

Sap should flow at once; if it does not, the hole may be too deep or too shallow and/or the day too cold. Hang a container from the spile, covered to exclude insects, and check regularly; on a good sunny day, gallon containers may need to be emptied several times. Sap will keep for several days if refrigerated. Early season sap is best in quality.

Spiles may be made from metal tubing or from elderberry shoots with the soft pith removed. Farmers use wooden sap buckets or plastic tubing to collect the sap; gallon milk jugs with a hole cut in the side work well at home. To boil down at home, strain the sap through cheesecloth and use a large pan. Great

quantities of water vapor will be produced; run the exhaust fan and ventilate the room from time to time to preserve the wallpaper. It will take several hours, and you will need to watch the sap closely near the end to prevent scorching. Syrup is ready at 219 degrees on a candy thermometer. Pour into clean jars and seal. Further cooking will produce maple sugar.

This walk works best if stations are used. In the station method, the guides stay put and the children move in groups from one to the next. At one station, the physiology of the tree is explained, including the food supply and storage, role of cambium layer, etc. At a second, a maple tree is identified and the tapping demonstrated. At a third, a guide talks about colonists and Indian lore. At a fourth, the method of boiling down is discussed and each child is given a taste of the syrup.

EARLY SPRING and MAY

BACKGROUND

As spring comes, the sun rises higher in the sky and gives us longer days. Snow melts and the meltwater runs into streams. The ground warms and earthworms come to the surface. Early perennial plants poke up their shoots through the ground, and acorns and other seeds sprout. Tree buds begin to swell. Woodchucks emerge from hibernation and chipmunks become active. Toads and frogs begin to call and birds arrive from the south, singing. Insect eggs hatch, and trees flower. Baby rabbits are born. There is an explosion of new life.

Events are neatly timed in the spring. The tree buds begin to open just as the eggs of insects which will prey on them hatch. As the insect eggs hatch, birds arrive in migratory flocks to eat the insects. Spring ephemerals shoot up in the woods from their perennial rootstocks or bulbs, flowering and setting seed hastily before the tree leaves come out and deprive them of sunshine.

CHARACTERISTIC LIFE FORMS

(See Field Guide for more detail.)
Poison ivy is at its worst in early spring as the sap rises. Be sure the children can identify it in all forms, especially the sprouts which cluster over roots in the ground. They are about a foot tall, mostly unbranched, and show vestigial tendrils.
Bloodroot is sensitive to sun and will close on a cloudy day, the leaf wrapping around the closed flower.
Coltsfoot fools people into thinking it is a dandelion. Look closely at both stem and flower to see the difference. Coltsfoot leaves emerge well after the flower and are hoof-shaped.
Dandelions are among the earliest perennials to emerge and bloom; colonists picked the leaves for a green spring tonic.
Fiddlehead ferns look like violin necks curled up when they first emerge.
Garlic mustard is everywhere, with new shoots arising from the perennial roots. Basal leaves wintered over. Pungent smell and taste of garlic.
Ginger's flower is down on the ground, attracting crawling pollinators.

Jack-in-the-Pulpit has a unique bloom which mimics a preacher in a pulpit.
Jewelweed seedlings appear, small, pale, with twin apple-shaped leaves.
Hepatica is called liverwort because its leaf was thought to have the shape of a liver. It will also wrap the flower up in its leaf on cloudy days.
May-apple is called the umbrella plant. Ask children why.
Skunk cabbage generates its own heat and melts its way through snow to emerge.
Spring beauty is also sun-sensitive, staying closed on cloudy days. Fragile stems make this and all other spring ephemerals not suitable for picking. Not only will flowers droop at once, but the root will not live as the leaves are picked with the flower.
White trillium stores energy in its roots over the winter. Leaves and blossoms are a favorite food of deer. Every part of plant is in three's.
Trout lily takes seven years to reach blooming size. Only plants with two leaves will bloom. Leaves are spotted like trout.
Violet flower has a "landing platform" for bees on the lower lip of the blossom.
Bees see shades of blue, purple and yellow best and do not see red.
Bumblebee queen is the only one of the colony to winter over; she may be seen in spring hunting for a spot for her new nest.
Mourning cloak butterfly is one of the few butterflies to winter over as an adult; it hides under bark and emerges early.
Pussy willow is a favorite blossom for children because of its silky gray coat. A favorite nursery school song: "I know a little pussy/ her coat is silver gray/ she lives down in the meadow/ not very far away/ she'll always be a pussy/ she'll never be a cat/ for she's a pussy willow/ now what do you think of that!"
Spicebush has very tiny yellow flowers which are wind-pollinated, as are the pussy willow's and the willow tree's. The aromatic "scratch and sniff" bush.
Sugar maples put forth their greenish blossoms, and, as soon as these open, gathering sap for syrup must stop. Look for tree flowers dropped on the forest floor as well as on the branches.

Squirrels begin to play tag in the trees.
The **redwing blackbird** is among the earliest birds to return from the south and has a very distinctive song "quong-ka-ree."

CYCLES

Earth Cycle: The earth tips on its axis as it rotates and circles the sun. In spring, it is inclined so that the sun's rays fall more directly on the northern hemisphere. More warmth and longer days result.

Plant Cycles: This section deals with herbaceous plants, or those with non-woody tops. Early woodland flowers are called spring ephemerals because they emerge, bloom and complete their life cycle before the leaves overhead expand to block out the sunshine.

Annual: The seed sprouts in spring when conditions become favorable and grows into a mature plant which then flowers. The flowers are pollinated and set seed, which is dispersed when it has ripened. Annuals may stay in bloom over most of the summer. In the fall, the mother plant dies, root and all, and only the seeds are left to carry on the species. Example: jewelweed.

Biennial: In its first year of life, the plant grows leaves but no flowers. In its second year, the root sends up leaves and a bloom stalk which produces flowers and then seed. The mother plant dies at the end of its second year. Example: some burdocks.

Perennial: These plants grow from seed initially but will live for at least several years and often much longer. They may take several years just to reach maturity and bloom. The plant's leaves make food over the summer through photosynthesis. With the onset of cold weather, the food is stored in the root. The root may be in the specialized form of a bulb, corm or tuber. Bulbs make the new flower to come during their growing season; it has only to emerge the next spring. The plant tops die back to the ground, but the roots live on and send up new growth each spring. Perennials flower, generally for a much shorter time than annuals. Some perennials reproduce mainly through vegetative offshoots, as when roots spread and send up suckers. Example: Japanese bamboo.

Trees and shrubs are **woody perennials**. Their buds are formed over the summer and carried through the winter, protected from the drying winds by waxy bud sheaths which tightly enclose the bud. In spring the sap rises to bring stored food to the buds and begin the new cycle of growth. The buds then swell, breaking out from the bud sheaths, and open into flowers and leaves.

Animal Cycles: Birds have several ways of surviving winter. A few species remain in their territory year round, finding food during the winter (crows). Some species migrate a short distance but not all the way south (chickadees). Some species make long journeys to warm weather and never encounter cold (warblers).

Mammals may sleep through the winter in true hibernation, with a greatly slowed heartbeat and breathing (woodchuck), or they may sleep much of the time with periods of wakefulness (chipmunk), or they may remain active during the winter (fox, squirrel) and rely on hunting or on stored food for survival. Generally, babies are born in the spring when food should be plentiful.

Reptiles seek a place where they will not freeze to death and spend the winter in torpor.

Songs or calls are used by many species of animals to attract mates and/or to claim territory. These range from the trill of the spring peeper to the song of the redwing blackbird.

WALK PLAN

Lesson focuses on how all organisms survive winter and on the emerging new life. If the students are young, emphasize use of all senses, especially smell and touch, as plants are examined. Don't omit listening, as you may hear bird songs, spring peepers, squirrel calls and other sounds of spring.

Survey the park briefly before the walk to see what is up, as in the spring the species available for study change daily. Remind young children of the park rules: only the leader picks, nothing to be taken home, try not to stand on the plants, etc. Let their curiosity be your guide.

PLANT REPRODUCTION

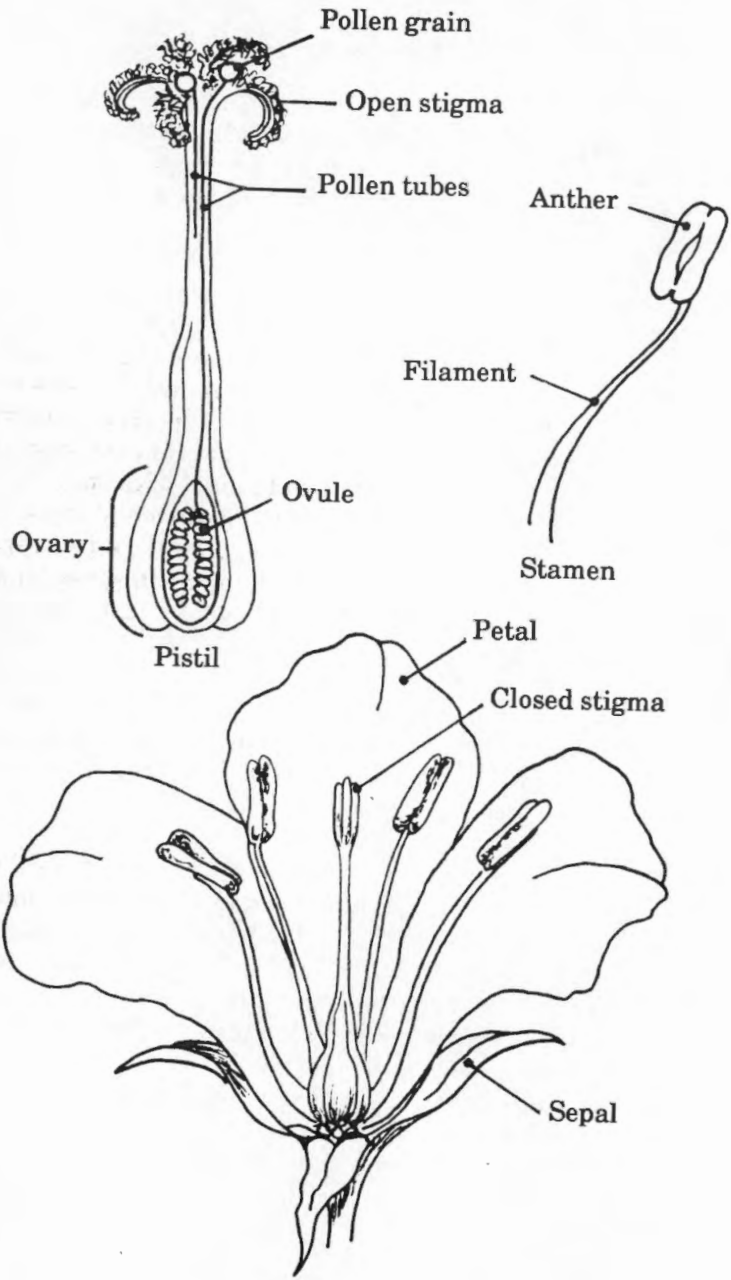
BACKGROUND

Plants are the basis of the food chain for life on earth. They receive the sun's energy; through the working of chlorophyll and raw materials derived from the earth and atmosphere, they can use that energy to create carbohydrates, or basic food substances (photosynthesis).

Plants reproduce by either vegetative or sexual means. In vegetative reproduction, a parent plant produces offspring by means of root suckers, cuttings or grafts. For instance, balsam poplar or any of the bramble bushes send up shoots from their roots which can live independently of the parent plant if the root connection is severed. In many plants, a portion of leaf or stem can grow into a new plant if taken from the parent and planted. Several common house plants, such as the jade tree and African violet, are examples. In layering, a branch bent to the ground and covered with earth will grow new roots at that point, as in rhododendrons. In vegetative reproduction, the offspring will be exact copies of the parent plant.

There is also reproduction by means of spores. Spores produce an intermediate life form, usually very small, called gametophyte which in turn gives rise to the saprophyte, the form which produces spores (as a fern.)

In sexual propagation, there is a union of pollen and ovule which produces viable seed. The flower is the part of the plant that forms pollen or seeds or both. If it depends on insects, animals or birds to transfer the pollen to the ovary, it will be showy in order to attract the pollinator. If the wind serves to spread the pollen, the flower will be small and not showy or colorful. The latter type of flower is found in grasses and many trees. In sexual propagation, the new plant will have characteristics of both parents.


Pollen grain
Open stigma
Pollen tubes
Anther
Filament
Ovule
Ovary
Stamen
Pistil
Petal
Closed stigma
Sepal

CHARACTERISTIC LIFE FORMS

The basic flower contains stamens and pistils, the sex organs. The **stamen** is the male or pollen-bearing organ and is made up of the filament and anther (see illustration.) The female organ is the **pistil**, a stalk-like structure with the stigma at the top which opens to receive the pollen grain, the style, and the ovary or seed-producing organ.

The sex organs are surrounded by other parts of the flower. In a showy flower, the **corolla** consists of petals and is surrounded by the calyx, formed by green sepals. There is great variation in flowers and not all these parts may be present.

Pollinators are attracted to flowers because they eat the nectar and pollen found there. Flowers have developed an infinite variety of shapes, scents and colors to attract insects. Each flower part fits the tongue or body of a specific insect. Many flowers have honey guides, such as the converging lines on a violet's lower petal. The petal also serves as a landing platform. Some flowers have trigger mechanisms which cause the pollen-laden anther to snap down on the bee's back; these mechanisms can be set off by a pencil as well as the bee's body.

Bees are the most important pollinators, especially honey bees. Most flowers are visited by honey bees, with a few exceptions. Some blossoms are too deep, some are the wrong color and some are too tightly closed for her to push in.

Bumblebees pollinate flowers such as clover with nectar too deep for honey bees to reach.

Butterflies drink nectar from flowers with their long tongues. They prefer to perch on the blossom, but moths hover and will favor different flower shapes.

Hummingbirds and **bats** pollinate tropical flowers.

Flies pollinate flowers with a rotten odor.

Beetles pollinate but also eat the flower.

Ants rob the flower of nectar but are too smooth-bodied to carry pollen, and flowers try to exclude them.

In **wind pollination**, flowers have no need to advertise, no need of honey guides, no need of landing platforms. The flowers are generally greenish and have a small, tough calyx. Stamens have long filaments to dangle anthers in the breeze, and pistils have furry or feathery stigmas to catch the floating pollen. There must be tremendous amounts of pollen produced, and it is these clouds of wind-borne pollen that cause our breathing allergies.

CYCLE

There is a carefully arranged series of steps involved in fertilization of a flower. Cross-pollination is preferred to self-pollination, as the latter restricts genetic diversity. Most plants have mechanisms to avoid self-pollination, which is however kept as a last resort if other sources of pollen are unavailable.

In a typical flower (the wild geranium, for example,) the filaments spread out as the flower opens and the anthers open to release their pollen. At this time, the stigma of the pistil remains closed. When the pollen is mostly gone from the anthers, the stamens droop and the stigma splits open into five arms, ready to receive pollen. The grain of pollen is brought to the flower by the pollinator and is transferred to the stigma, which is usually rough or sticky. The pollen grain then begins to grow down the style to the ovary. When the pollen tube reaches an ovule, two sperm are released into the ovule. One sperm unites with the egg cell in the ovule and becomes an unripe seed which can eventually grow into a new plant.

If no pollen is brought from another geranium flower, self-pollination may occur. The stigma arms twist and the petals and filaments crinkle up, allowing the stigma to touch the anther and receive any last grains of pollen present. After pollination, the petals and stamens drop off and the sepals fold up around the ovary. The ovary swells and ripens, eventually splitting open and releasing the mature seeds.

This is only one type of cycle, however. In other cycles the pistil may become receptive before the stamens produce pollen, especially in wind-pollinated plants. Still other flowers use many different devices to insure cross-pollination.

WALK PLAN

Lesson focuses on the fertilization process. Try to find as many flowers in different stages of fertilization: bud, stamens erect, style open, etc. Look also for pollinators at work. It may be helpful to have students list flowers and the pollinators at work on them. Be sure the insects are actually pollinating and not predators waiting for a free lunch to come along. Bring flowers from home and cut them open to show the ovaries with seeds inside and the other sex organs.

Materials: magnifying glasses for everyone. A knife, and flowers, brought from home, in all stages of development for dissection. Daffodils especially good for this purpose. Paper and pencil for recorder.

BIRDS

BACKGROUND

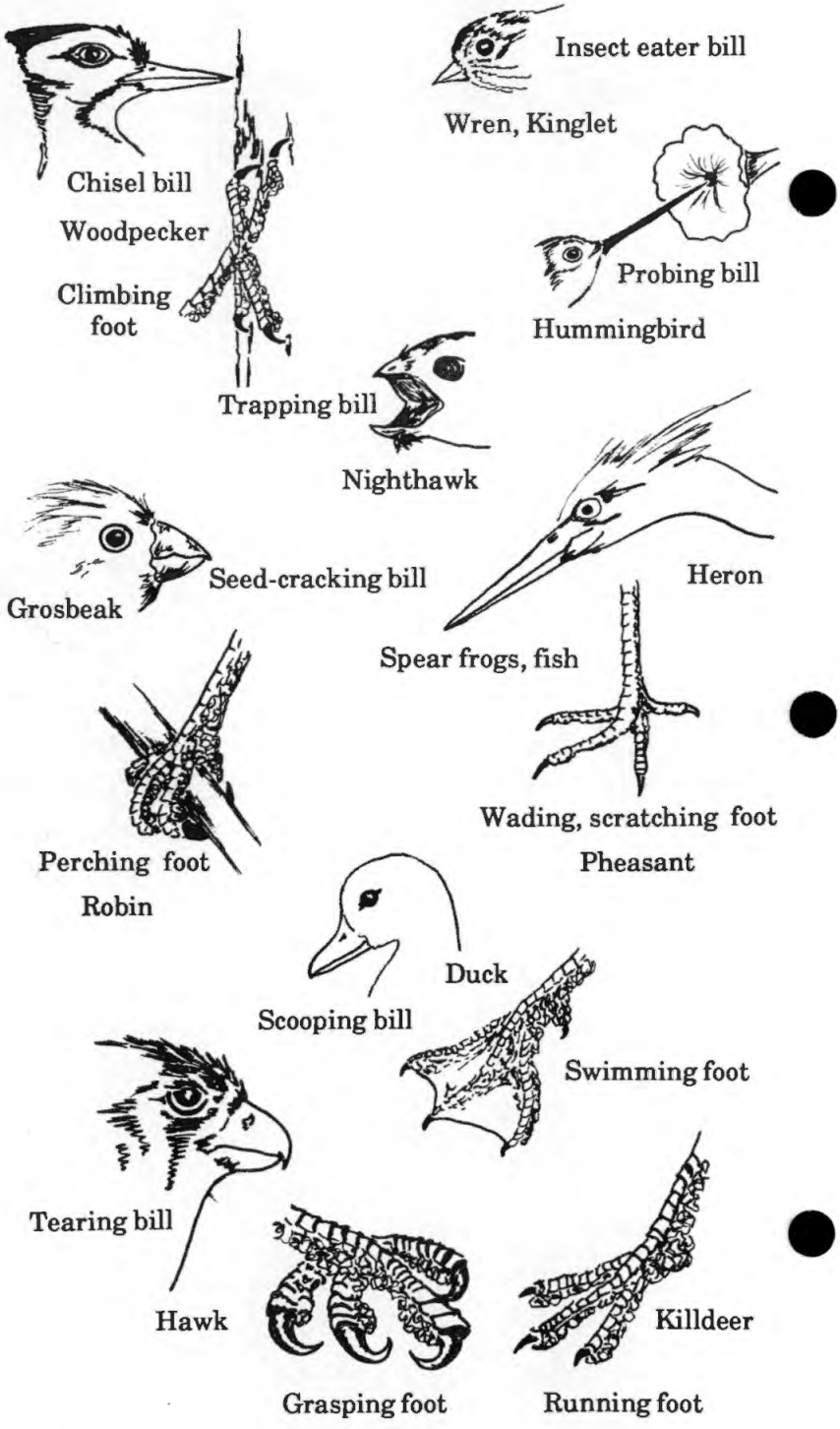
A bird is a warm-blooded vertebrate and the only animal which has feathers. Most birds can fly, with a few exceptions such as the ostrich and the penguin. Young are hatched from eggs and are cared for by the parents. In some species, the young are precocial and can run as soon as they dry off after hatching; in most species they are born blind and naked. Birds are descended from reptiles. Size varies from the three-inch-long hummingbird to the six-foot ostrich or the Andean condor with an eleven-foot wingspan.

Feathers are very light and strong and are unique to birds. They have a complex construction with interlocking barbs, barblets, barbicels etc. Birds have muscular control over individual feathers, enabling them to perform marvelous feats of flying. The downy underfeathers keep the bird warm. Water birds have an oil gland which helps to keep their plumage dry in the water. The birds spread the oil when preening. Feather color in some species results from a quality of refracted light rather than pigmentation. The blue jay is a good example of refracted light coloration.

CHARACTERISTIC LIFE FORMS

Birds have many special adaptations to aid in survival in their ecological niche. The following attributes should be checked for clues to a bird's identity and lifestyle.

For example, the duck group has flat bills to aid in grasping underwater plant life, while the fish-eating duck has saw-tooth edging on the bill to aid in holding fish. Both types of duck have broad, flat webbed feet, enabling them to swim strongly, and strong wings and swift flight to help them cover great distances. Check also a bird's habitat: pine forest, sandy beach, open ocean, brushy thickets, treetops.


Insect eater bill
Wren, Kinglet
Chisel bill
Woodpecker
Climbing foot
Probing bill
Hummingbird
Trapping bill
Nighthawk
Heron
Seed-cracking bill
Grosbeak
Spear frogs, fish
Wading, scratching foot
Pheasant
Perching foot
Robin
Duck
Scooping bill
Swimming foot
Tearing bill
Hawk
Killdeer
Grasping foot
Running foot

Shape and **size**: plump or slender? Size of crow, robin or sparrow?
Wing shape: rounded or sharply pointed? Crooked at elbow? Broad or narrow?
Bill: small and fine (insect eater, warbler)
stout and short (seed eater, sparrow)
dagger-shaped (fish eater, tern)
strong and hooked (meat eater, hawk)
broad and flat (plant eater, duck)
Feet: toes three before and one behind, or two and two for tree climbing? Claws for grasping or flat feet for swimming? Long toes (and long legs) for wading?
Tail: notched, forked, square-shaped, rounded, pointed?
Behavior: flycatching in mid-air, tail cocked like a wren, tail wags when perched, walk, hop or run on the ground?
Flight: straight and swift, fluttering, undulating, wavering, hovering or soaring?
Field marks: look for eye stripe, rump patch, wing bars or patterns, as well as general behavior and habitat.

CYCLES

Migration is a highly developed instinct and skill used by birds in their regular travels north in spring and south in the fall. Migration is probably triggered by changes in sunlight, both angle of rays and length of day. It is known that birds use many clues when finding their way, from magnetic fields to guidance from the stars to landscape recognition. However, the process is still not fully understood. In most species, adults do not lead the way but go on ahead, leaving the first-year birds to follow some days or weeks later. Birds may fly as high as 20,000 feet.

One champion migrator is the golden plover, which nests near the North Pole and flies south to Tierra del Fuego for the other half of the year, making a round trip journey of some 37,000 miles. Furthermore, they fly non-stop from Labrador to the north coast of South America, about 2,500 miles. They return north by way of the Great Plains. Many species make lesser but still impressive migrations; hummingbirds and warblers cross the Gulf of Mexico over its full width in a single night. Others make short migrations. The chickadees seen in your yard over the

winter may move on north a few hundred miles and be replaced by a new group coming up from the south. Most owl species do not migrate at all.

At breeding time, **territory** is established by many male birds, which may fly north before the females to find a space. They look for a site which will yield enough food for the nestlings and provide good cover. The male perches on a special singing post and sings lustily to warn other males of his species away and to attract a female. When she arrives and accepts him, they hunt together for a nest site. The actual building may be a joint enterprise or done only by the female. Some males may be polygamous. Some, notably the cardinal, are very good fathers, taking a major share in raising the babies. Orioles nest only once a season, robins often up to three times.

Nesting habits vary widely from species to species. The killdeer lays camouflaged eggs on an open beach, a plowed field or even on a bare rooftop. Ospreys build large nests in treetops to which they return for many years. Our common backyard birds usually make a new nest for each brood, thus avoiding to some extent the parasitic insects that plague baby birds. The oriole carefully weaves a basket nest, the meadowlark constructs a hidden runway to its nest, and the cowbird builds none at all but simply borrows the nest of a smaller bird in which to lay her eggs, leaving the young to be reared by the unwitting foster parent. Nests are build of twigs, grasses, mud and the like and are often lined with breast feathers.

Eggs usually number three to four, but pheasants and ducks may lay a clutch of twelve, and the larger birds often lay only two and raise only one chick to adulthood. The larger the egg in relation to the mother's size, the more advanced is the development of the hatchling. Shorebirds lay very large eggs for their size because the young must be able to run almost as soon as they emerge from the egg, owing to the exposed location of the nests. This quality, called precocity, is typical of ground nesters.

WALK PLAN

Lesson plan is to concentrate on the marvelous variety of birds and on bird behavior rather than species identification.

Small groups are particularly helpful in birding, as there are times when silence and stillness are needed to observe bird behavior. Rather than working on species identification, ask the children to become good observers of behavior, color pattern, style of flight, etc. Do lots of listening, as many birds advertise their presence only by their call note or song and would not otherwise be noticed. The biology students of Quaker Valley are very helpful on the bird walks. Also helpful are the habitat boxes from the Carnegie Institute showing mounted birds, as some trips can be frustrating in the lack of bird life present. In Morrow-Pontefract Park, look for tree-top birds as well as lawn birds. Binoculars are useful for the guide for spotting birds to show the children, but looking through them is a knack and it may not be productive to share them around the group. Lists should be made of the birds seen, including location (ground, air, tree) and any special characteristics.

Guides should know that collecting dead birds or old nests is against federal law.

WATER

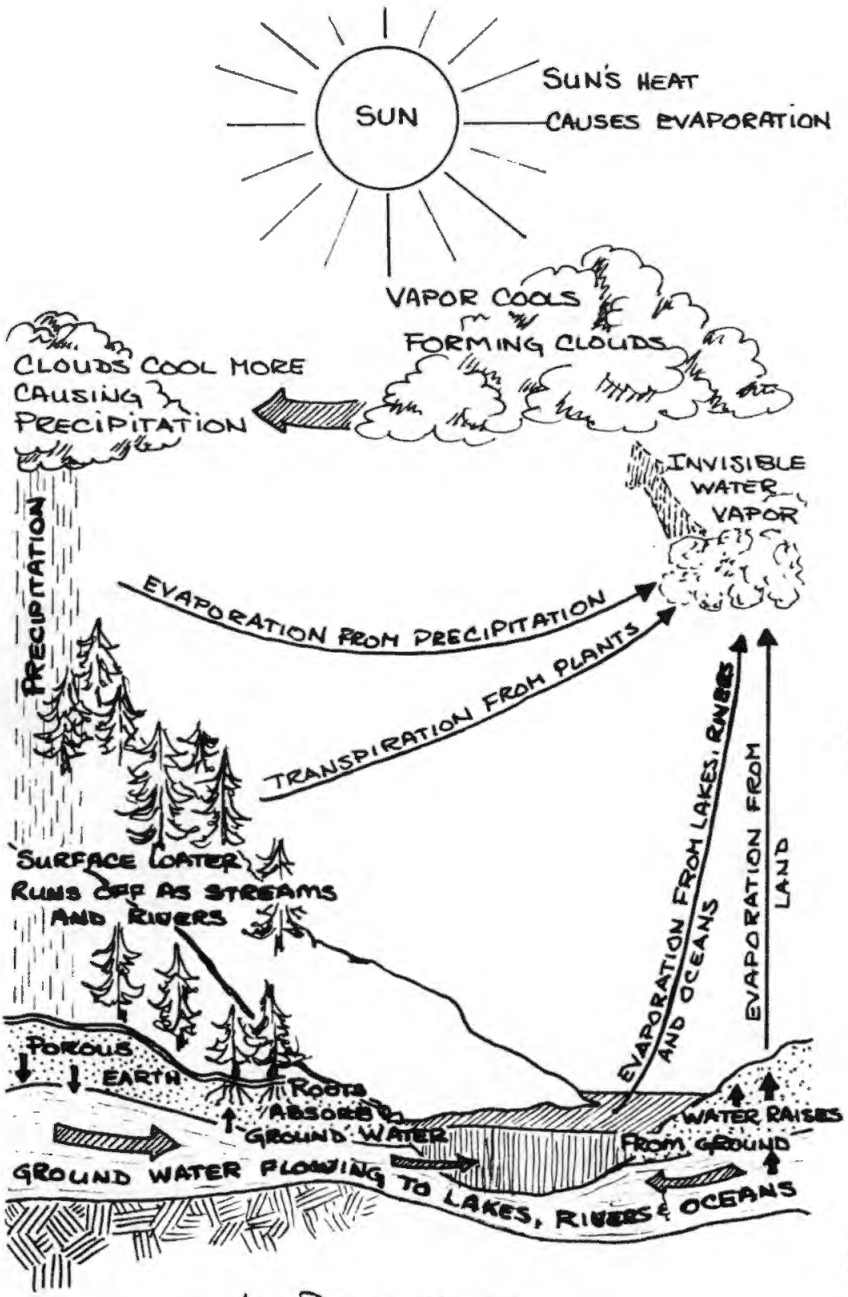
BACKGROUND

Fresh water comprises only 0.0001% of the earth's water. Freshwater systems are characterized as either standing pools or lakes (lentic) or flowing streams or rivers (lotic). Little Sewickley Creek is of course a lotic system. Species diversity can be much greater in fresh water than in salt.

Streams are divided into areas characterized by the velocity of current, the bottom composition and the volume of water flow. The riffle is fairly shallow and has a rapid flow of water with coarse rocks on the bottom and white water or broken water on the surface. It occurs about every five to seven stream widths, measured downstream. A run succeeds a riffle and is midway between run and pool in character. A pool follows the run and has an unbroken surface, relatively deep water and fine particles of silt and sand on the bottom.

Animals living in waters with some current need modifications to survive there. Some means of staying in place, of not being washed downstream, is needed. Body adaptations such as suckers, caudal hooks or permanent attachment are common. Some swiftwater creatures head into the current with streamlined bodies, or they may burrow. Limits to the variety of aquatic life include pollution, impoundment of waters (such as dams) and channelization.

Little Sewickley Creek flows southwest into the Ohio River. The area it drains, or its watershed, is 25.2km (2) and it flows a distance of about 12.8 km. The watershed is spread over seven boroughs. A watershed is defined as an area of land from which all water falling on any part of that land flows into a particular stream. The LSC watershed is considered a clean and unspoiled area and has won state environmental awards as a model of a clean watershed. While the stream itself is spring fed, the present form of the watershed is at least partially due to the last Ice Age. Although this region was not covered by an ice sheet, it did receive large amounts of silt, sand and gravel from glacial meltwater.



NON POROUS EARTH

CHARACTERISTIC LIFE FORMS

The most characteristic and abundant animal forms to be found are the caddisfly larvae, mayfly nymphs, stonefly nymphs, fly larvae, crayfish, snails, clams, sponges and fish. The stream is stocked with **trout** yearly, and they are now a breeding population. The **caddis fly larvae**, **water penny**, **stone fly larvae**, **mayfly larvae**, and **planaria** may all be found clinging to the underside of rocks. **Crayfish** crawl on the bottom, lurking under rocks and in crevises, and **hellgrammites** search for prey as they move about the bottom. **Salamanders** hide in damp earth at the stream's edge. **Algae** cling to rocks or float freely. Other organisms may be free-swimming (**shiners**), attached to vegetation (**snails**), walking on the surface (**water striders**), or tube dwellers (**caddisfly larvae**). See the field guide section for identification. Slow current areas have large plants, but the most common organisms using photosynthesis are the algae, which are often microscopic and filamentous.

Note the importance of clean water to these organisms. Silt clogs delicate gills and reduces the sunshine needed for plant growth; chemicals inhibit, alter or prevent normal growth and development; acid rain if too severe prevents any life from existing. Trout can only live in water with plenty of oxygen.

CYCLES

The water cycle is best shown by the accompanying illustration and should be clearly understood by the students. Surface water evaporates into the air, where it forms clouds and falls as rain. Rain falling on earth enters the ground, where it may have one of the following fates, depending partly on the characteristics of the soil:

1. it may be absorbed by plant roots and subsequently transpired from plant leaves back into the air, or
2. it may remain in topsoil and evaporate, or
3. it may sink into the ground and eventually reach the water table, or
4. it may take the form of surface runoff into a body of water.

Rain falling into rivers may swell the flow of that river as it descends to the sea; as the river flows, water will also constantly evaporate into the air. No matter what form it takes, whether water vapor, liquid or ice, it is the most important factor to life on earth. The importance of keeping it clean should be overwhelming.

WALK PLAN

Materials needed: hand lens or magnifying glass, dip nets or plastic cups, white pans, boots or tennis shoes, paper and pencil to keep records, guide to water creatures.

Program: Plan for small groups and spread out in the park. Sit down with your group on the creek bank first and introduce the topic, asking them questions. Establish rules: the stream is home to many organisms, so don't muddy it up. No running, splashing or pushing, no screaming; stress that this is a classroom. No souvenirs from the creek. All rocks to be put back in their former location, with the under side down.

Once this introduction is complete, then enter the creek and gather specimens, holding them in pans. After a short period of gathering, have the students come out of the stream and identify the organisms, noting adaptations to stream life. After study, creatures should be carefully released into the stream as near to the location of capture as possible.

Record: where were plants growing, current or stream edge? Was the algae slimy, free floating or attached? Description and identification (where possible) of animals. Type of life style: free swimming, attached (to rock or vegetation?) burrowing or crawling, tube dwelling.

Leader should help in identification, ask students to act as recorders and discuss the relationship between the organisms and the environment: food relationships and effects of physical environment on organisms.

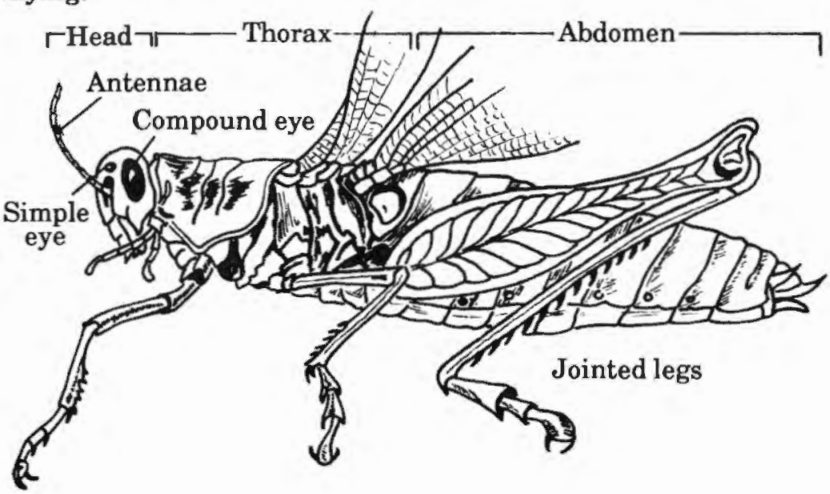
INSECTS

BACKGROUND

An insect is a small creature having an exoskeleton (on the outside of the body) made of chitin. Its body is divided into three parts: head, thorax and abdomen. Three pairs of legs are attached to the thorax, a pair of antennae are on the head, and wings are often found on adults. Insects undergo metamorphosis in their life cycle. They belong to the phylum Arthropoda and the class Insecta and are further subdivided into orders (see Life Forms).

Insects are the most successful life form on earth. There are over 800,000 species identified; this is three times the number of all other known animal species. There may well be four times more species as yet unidentified. They can live under almost any conditions, including extreme heat, cold, salt, petroleum, and even for a short time in pure carbon dioxide, which is poisonous to all other animal life.

Their success may rest on the following traits. Flight helps to evade predators and to find food. The exoskeleton has great strength for its weight and size. Wide food choices include glue, wood, soil, flowers, wool, pepper, tree bark, all "people" foods, etc. Insects can adapt to almost any environment, including extremes of temperature. Their small size means exploitation of varied habitats unused by others. Metamorphosis utilizes different food sources for larvae and for adults. The delayed fertilization of eggs aids survival, as one mating may suffice for a lifetime of egg laying.



CHARACTERISTIC LIFE FORMS

Insect size varies from the 12" Atlas moth and the 15" tropical walking stick to leaf miners to microscopic insects. Their strength is great in proportion to size. For instance, an ant can carry 50 times its own weight; a bee can pull a burden 300 times its weight; a grasshopper can jump 20 times its own length, or the equivalent of 30 yards for man (the broad jump record is eight yards); a fruit fly can hover for nine hours.

Insects create sound in a variety of ways, such as rubbing leg or wing covers together. Many cannot hear but are sensitive to air currents and vibrations. Ants make war and take slaves; they also "milk" aphids for honeydew. Wasps and termites make elaborate homes, and hornets make paper. Beetles are undertakers, burying dead bodies. Fireflies light up to signal each other, and honey bees dance to give information to other workers on the source and amount of nectar.

In their relationship to man, insects can be both harmful and beneficial. Bees make honey and pollinate the flowers of vegetables and of fruit trees. Other insects also pollinate. Some species kill other species which would damage our crops. Insects are food for birds and some animals. Harmful insects damage food crops, houses and clothing, and a few transmit diseases such as typhoid and malaria. A very few are quite poisonous.

Insect orders:
Coleoptera ("sheath wing"): beetles. Beetles hold their hard wing covers up when in flight so that the real wings underneath are free to move. Complete metamorphosis (see CYCLES).

Diptera ("two wings"): flies, mosquitos, gnats. Only one pair of wings. Complete metamorphosis.

Hemiptera ("half wing"): true bugs such as shield bug, squash bug. Wings form a triangle on the back when folded. Incomplete metamorphosis.

Homoptera ("same wing"): leaf hoppers, cicadas, aphids, etc. Wings form a tent over the body when at rest. Many of this group damage crops. Incomplete metamorphosis.

Hymenoptera ("membrane wing"): bees, wasps, ants. Many are social or colonial and many are beneficial. The only insects with stingers. Complete metamorphosis.

Lepidoptera ("scaly wing"): butterflies, moths. Butterflies have club-like antennae, hold their wings upright when at rest, make chrysalises, and are active during the day. Moths have feathery antennae, hold their wings flat at rest, make cocoons, and often feed at night. Both feed on nectar with long tongues. Larvae (caterpillars) have many false legs or prolegs as well as the six true legs. Complete metamorphosis.

Odonata ("tooth"): dragonflies and damselflies. Two pairs of long narrow wings operate independently of each other. Dragonflies rest with wings outstretched, damselflies with wings parallel to the body. The hawks of the insect world, catching prey on the wing. Most are brilliantly colored. Larvae are aquatic. Incomplete metamorphosis.

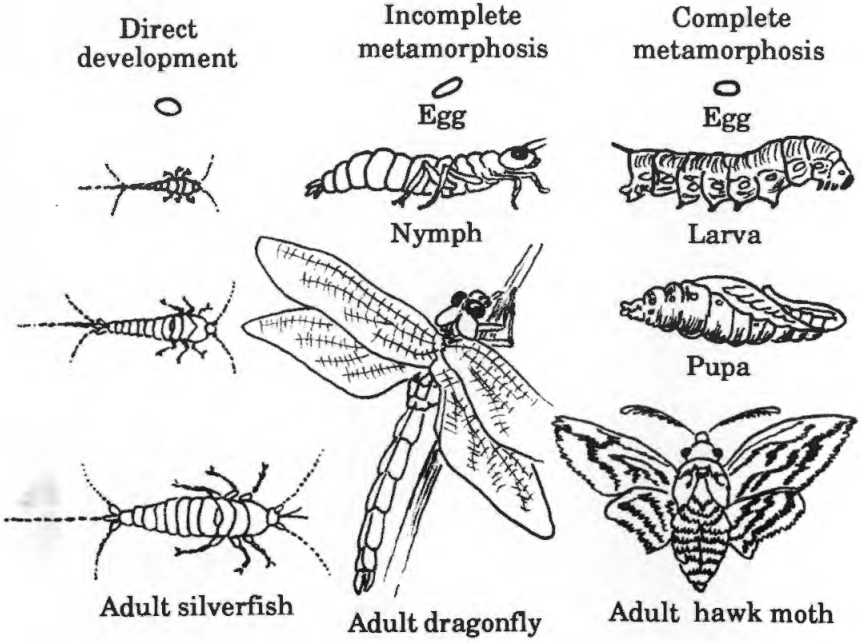
Orthoptera ("straight wing"): grasshoppers, roaches, crickets. Many have long back legs and are jumpers. Some "sing" to call mates by rubbing wing or leg covers together. Incomplete metamorphosis.

Insect-like creatures include spiders, sowbugs, centipedes and millipedes. Spiders belong to the class Arachnida. Spiders are grouped by web type. The classic round web, or orb web, the layer-like web or cup and saucer web, and the funnel-shaped web are three types. Another spider group, the wolf spiders, actively hunt prey and build no web. Daddy-long-legs are related to spiders. See Field Guide for comments on sowbugs, centipedes and millipedes, each of which belongs to a different order.

CYCLES

Insects have three patterns of development. In direct development, the insect hatches from the egg and grows, shedding its exoskeleton regularly, until it reaches full size. No changes of form are involved. In incomplete metamorphosis, the egg hatches into a wingless nymph which may or may not closely resemble the adult. The nymph grows, molting several times, and develops wings on reaching the adult stage. In complete metamorphosis, the egg hatches into a larva or caterpillar which eats and grows. It then forms a pupa (such as a butterfly's chrysalis) and rests, undergoing a transformation. When this stage is complete, it emerges as an adult in a dramatically different form from the larva. Only adults are sexually mature; in some species they exist only to breed, even lacking mouth parts.

Insects winter over in every phase, according to the species. Praying mantids winter over as eggs, the woolly bear as a larva, moths as cocoons, and bumblebees as adult queens. Ants and honey bees, among others, can survive winter, and water beetles burrow into the mud. The monarch butterfly migrates. In spring, pupae mature and eggs hatch. Adults emerge as the weather warms, many of them only to lay eggs and die. The queen bumblebee, however, sets about recreating the colony.



WALK PLAN

One lesson is the beneficial aspect of insects; many children regard them as all harmful and to be killed. Insects are predators of other harmful insects; they are pollinators and as such necessary to our food supply. Stress the necessary role of insects in the world. Capture methods are designed to avoid injuring the insect, and all specimens should be freed after examination. Point out also the beauty of insects, as in the compound eyes of a fly, and the infinite variety of forms.

Materials: an old sheet, paper plates, clear plastic cups, jars with lids, magnifying glasses, paper and pencil. The sheet is placed under a bush. When the bush is shaken, many insects will let go as a defense mechanism and drop onto the sheet. Flying insects will readily land on paper plates, where they can be covered with clear plastic cups. The cups will capture even bees without harm to bee or student. The plate can also be placed under a goldenrod blossom and the flower shaken. A few jars with lids will retain insects long enough to identify and list them. Magnifying glasses so that all students can examine the insects and pencil and paper to record findings are needed.

All catches should be closely examined with the lenses and notes made about them. No insect should be touched with the hand, with very few exceptions (grasshopper), to prevent injury to insect and to student.

FALL IN A MEADOW

BACKGROUND

What is a meadow? A sunny, open area, with grasses and summer flowers growing and a few well-spaced trees and shrubs. Fairly dry ground.

CHARACTERISTIC LIFE FORMS

Some kinds of plants and animals live only or mainly in open, grassy areas. Stories to tell children about such life forms follow.

Beetles have many species in a meadow. Watch for them in flight, holding up the hard wing covers so that the real wings underneath can do the work. Ladybird beetle is common: count the spots on her back.

Bumblebee loves red clover, can reach nectar with its extra-long tongue. Only the queen lives through the winter and may start the next year's nest in a mouse hole. **Honey Bee** tells other workers where honey can be found by dancing a pattern. Both bees carry pollen in sacs on their legs.

Butterflies like meadows, and many kinds will live there: monarch on milkweed, swallowtail, skippers. Butterflies have an oil in their eyes which acts like sunglasses and helps them see red and orange colors best.

Crickets scrape their wings together to chirp and chirp faster when it is warmer. Count the chirps in 15 secs., add 40 to that number to find the temperature in F.

Grasshopper has ears on his knees. Check to see if antennae are short or long.

Praying mantis lies in wait for prey, catching other insects with its long forelegs.

Signature spider signs her name in the web, making a zigzag of thread like the mark of Zorro.

Birds may be catching insects on the wing in the open meadow: swallows, chimney swifts, night hawks, flycatchers. Hawks will soar in circles watching for a mouse to move. Vultures soar with wings in a V, looking for dead animals.
Deer are very common now in the area and can be a pest to our shrubs and gardens. Fawns are born in spring and have no scent for the first several weeks, a protection against predators.
Foxes are very intelligent predators who keep mice and rabbits in check. There are several pairs with dens in the Sewickley area.
Mice live everywhere; look for the pathways through the grass. Sometimes they live in or store food in old bird nests. Mice breed so fast that without predators they would destroy the meadow. Hawks, snakes, foxes eat them.
Rabbit babies are born blind and helpless but mature rapidly; they too breed very fast and are also a major food source for predators. They do not dig holes like European rabbits but rest in a 'form' or sheltered nook.
Woodchuck digs an underground burrow with several exits and is a true hibernator in the winter.

Bindweed may have a "gold bug" on the underside of leaves. Bindweed can strangle a host plant by entwining the stem and cutting off circulation.
Buttercup is pollinated by flies. Hold under the child's chin to see if she loves butter; the shiny yellow will cast a reflection.
Goldenrod is an insect city; count the many types. They are said to point north; is this true? Look for galls.
Mullein's tall center spike was used as a torch when dipped into wax. Many insects hide under the basal leaves, which were used by colonists for their softness.
Queen Anne's lace resembles what garden vegetable? (Carrot) The dark red center is said to be Queen Anne's blood. Also an insect city.

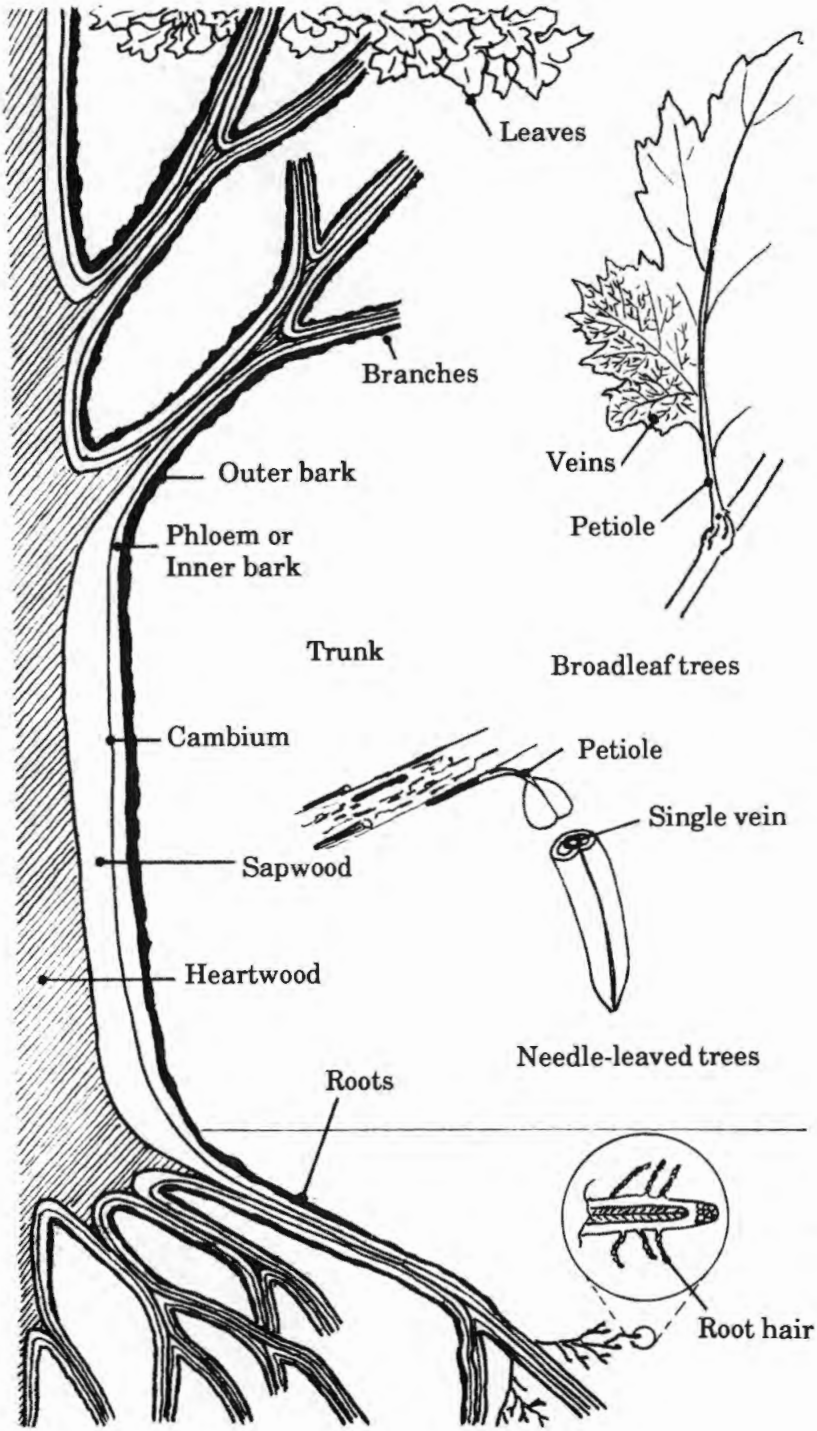
CYCLES

Meadow may revert to forest eventually if it is not mown, if the soil is suitable for trees and if there is enough moisture present. There is a predictable cycle of plants which move in and colonize an unmown meadow, of which sumac is chief. (See Field Guide for life cycles of individual creatures and plants.)

WALK PLAN

As this walk is for a young group, almost anything is grist to your mill and there is no set plan suggested; simply be alert to the possibilities. Stress the value of plants to man and all forms of life as the primary food factory for us all. Ask the children what they ate for breakfast and link the menu to the plant world. Note the value of insects as pollinators and stress their beauty. This is a good walk on which to stress general ecology and how everything in nature interrelates.

As always when dealing with young children, remember their short attention span and keep moving, both bodily and in terms of subject matter.


Leaves
Branches
Outer bark
Phloem or
Inner bark
Trunk
Cambium
Sapwood
Heartwood
Roots
Veins
Petiole
Broadleaf trees
Petiole
Single vein
Needle-leaved trees
Root hair

TREES AND LEAVES

BACKGROUND

Trees are of major importance in our environment. They moderate the climate in many ways, by shading houses from sun, by acting as windbreaks, and by transpiring water to cool the atmosphere. Trees are planted to control soil erosion. They create oxygen and reduce carbon dioxide in the atmosphere through the process of photosynthesis. (See CYCLES for an explanation of photosynthesis.) Tree planting is a good response to concerns about too much carbon dioxide in the atmosphere (the greenhouse effect and the resulting warming of the earth. Further, they beautify the landscape and provide homes for many different creatures. Some of our food comes from trees, such as fruits, nuts and spices. Different tree saps yield turpentine, rubber and maple syrup. Finally, the wood from trees is used in many different ways, such as houses, furniture, paper, firewood, crutches and baseball bats.

CHARACTERISTIC LIFE FORMS

A **tree** is a large, woody plant, usually with a single stem. It is made up of roots, trunk, and a crown containing branches and leaves. See the accompanying drawing.

Roots anchor the tree, bring water and minerals to the tree's system and store sugars over the winter. Only the tips of the fine roots can absorb water. The entire root system usually is larger than the crown of the tree.

The **trunk** is composed of outer bark, the phloem or inner **bark**, the cambium layer which carries nutrients from roots to leaves, the sapwood, and the heartwood. Rings on a tree stump show yearly growth and will give a tree's age and some of its history (fire, drought, etc.) if examined.

Branches allow the tree to extend its leaves out toward sunshine. Note that all trees have alternate branching except for the "MAD HORSE" group: M for maples, A for ashes, D for dogwoods and HORSE for the horsechestnut. These trees have opposite branches, though the opposing branch in many instances may have broken off.

Buds may be leaf or flower buds, and the difference on a specific tree is usually apparent from their shape. A dogwood has flower buds resembling a tiny turban, but the leaf buds are small and slim.

Leaves are the food manufacturing center for the plant. They may be evergreen or deciduous. **Evergreen** leaves remain on the tree through the winter. They may be needled, with a waxy coating and minimum surface area to reduce moisture loss, or broad as in a rhododendron, with a waxy coating and the ability to curl up tightly in very cold weather. Snow slides off evergreen leaves easily. **Deciduous** leaves are shed by the tree each fall when it goes into winter dormancy. (See Forest Life and Fall Changes Curriculum for further explanation of fall changes.) The leaf contains small green bodies called chloroplasts which contain the chlorophyll needed to produce the tree's food. Veins help to support the leaf structure, and the petiole attaches the leaf to the branch.

Leaves come in many different shapes and sizes, from the small needle of a hemlock to the giant leaves of a palm tree. (See the Pictorial Glossary for a variety of leaf shapes and their names.)

CYCLES

Buds containing leaves and flowers are formed, usually in late summer, and held on the tree over the winter. They are protected by bud sheaths which usually have a waxy coating to protect the bud; drying out is a much greater danger than cold. Within the bud, a fully formed leaf or flower is curled up with a supply of sugar. When spring comes, daylight hours increase and the weather warms. The buds expand, shedding their sheaths.

Photosynthesis is the process by which leaves turn raw materials into food for the tree. Sun provides the energy needed for the process. Water is drawn up from the roots and carbon dioxide is absorbed from the air. These substances are transformed in the chloroplasts into carbohydrates, which nourish the tree. In the transformation, water is split into its components, hydrogen and oxygen. The hydrogen is combined with carbon dioxide to create carbohydrates (sugar or starch). Oxygen is a by-product of the chemical reaction, and excess water is also given off by the leaf. The carbohydrates are stored in the leaves and are also circulated through the tree. They can be stored in the roots in the

Fall color is unique to North America and was startling to the early colonists, as no display in Europe comes anywhere near the spectacular colors of this continent. To initiate the change, a decrease in sunlit hours triggers a chemical change in the tree. As the leaf food factory shuts down, food is sent to the roots for winter storage.

Adjoining layers of cells (abscission layers) grow that block off the nutrient supply to the leaf, with one layer at the tip of the leaf stem and the other forming the scar on the twig where the stem was attached. The chloroplasts which gave the leaf its green color die, allowing the underlying color of the leaf to show through. The leaf will drop once the abscission layer is complete. However, some trees such as oaks will form new buds but retain their brown, withered leaves until they are pushed off the following spring by the opening leaf buds.

The color of the leaves is particular to the tree species and the brilliance of fall colors is affected by the amount of summer moisture. Most pigments are already present in the leaves, masked by green chlorophyll, but reds, scarlets and purples are produced at this time. The pigments break down soon, leaving only the brown tannins in the dead leaf.

Color groupings: (note that there is much individuality among trees and that many species may be either red or yellow or a mixture.)

Yellows: basswood (linden), elm, sugar maple, hickory, American elm, aspen and poplar.

Reds: red and swamp maples, sumac, sassafras, red oak, dogwood, black cherry.

Brown: black, white and shingle oaks, American beech.

Purple: some ashes.

WALK PLAN

Goal of this lesson is to understand the life cycle in trees and leaves. Tree bark can be examined closely for the different characteristics, and young children can hug a tree. Leaves should be collected and examined for the veining and different shapes. Ask the children to imagine themselves as a tree, with their shoes planted firmly on the ground and their hands reaching to the sunshine. Look for a tree stump and examine the growth rings. Look also for leaf scars on branches and branch scars on trunks. Check for the "MAD HORSE" trees. The Forest Life andFall Changes curriculum deals with what happens to fallen leaves and branches, but you may want to discuss decomposition and returning materials back to the soil here as well.

Leaves can also be collected and checked to see the fall color change taking place. Look for the leaf scar and abscission layer on the leaf stem.

Sometimes a paraffin dip is used at the park to preserve leaf color, and each child takes home a leaf.

SEEDS

BACKGROUND

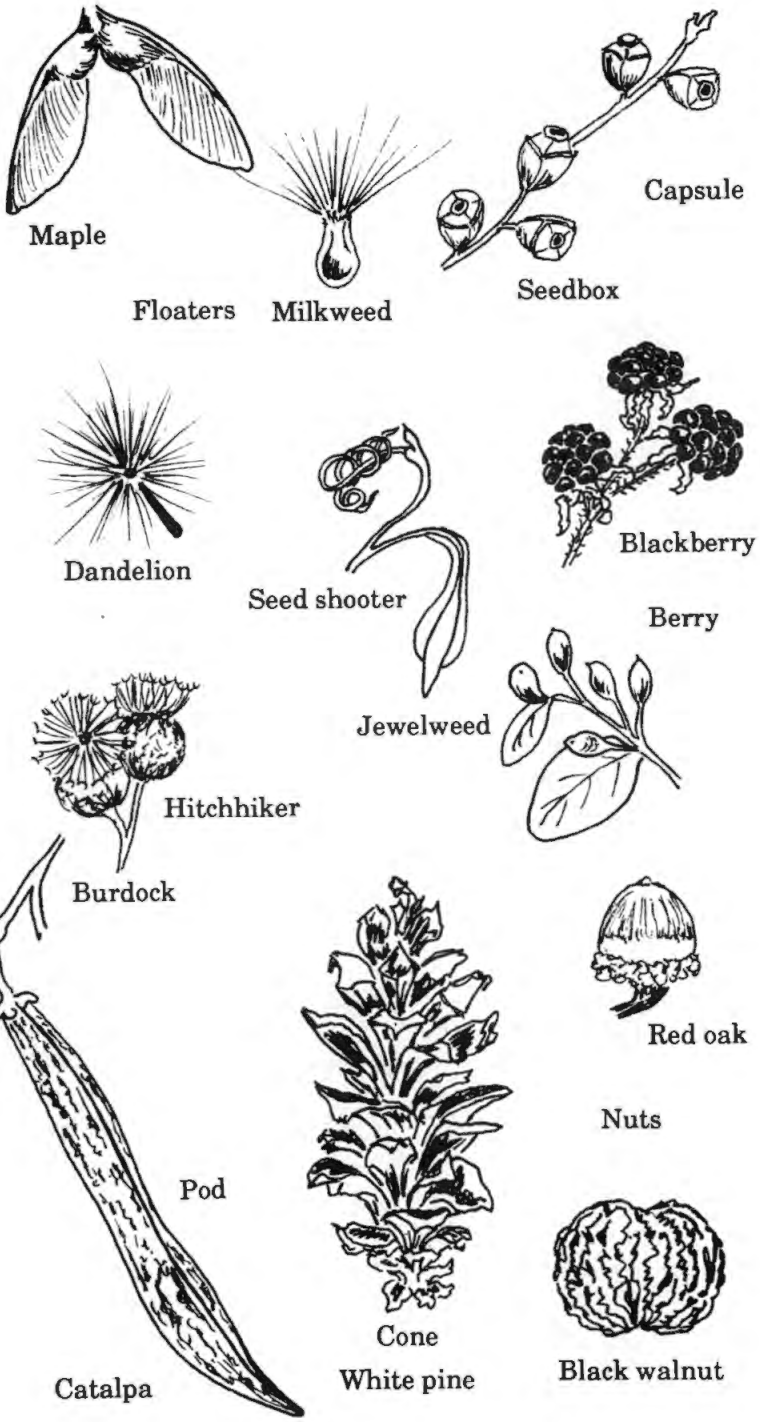
A seed is a small body produced by flowering plants which contains an embryo capable of germinating and developing into a new plant. All flowering plants produce seeds to form new plants. Seeds come in many sizes, from the dust grains of a mustard plant to the coconut which can weigh ten pounds.

The process begins with pollination of a flower and subsequent fertilization of the ovary. (A complete discussion of pollination is found in the Plant Reproduction Curriculum.) Next, the fertilized ovary swells and the seeds mature within the ovary. The seeds must then be released and dispersed.

Spores rather than seeds are used for reproduction by some plants, such as ferns and mosses. A spore is usually a single cell which must go through two different forms to produce a new plant, while a seed has the tiny plant already developed in it.

The seed is made up of three parts: the miniature plant, or embryo; the supply of food, or endosperm, for the tiny plant; and the seed coat. The seed may be surrounded by additional parts of the plant, such as the flesh of apple, melon or squash, or the husk of a walnut.

Seeds form an important part of man's diet, either for the starch contained in peas, beans, rice, wheat and oats, or for the oils in soybeans, peanuts and cottonseed.


Maple
Floaters
Milkweed
Capsule
Seedbox
Dandelion
Seed shooter
Jewelweed
Blackberry
Berry
Hitchhiker
Burdock
Pod
Catalpa
Cone
White pine
Red oak
Nuts
Black walnut

CHARACTERISTIC LIFE FORMS

Some common seeds are listed below; see also the illustration. They may be grouped as floaters, such as dandelion; flyers, such as maple, springers, as in jewelweed; clingers, as in burs.

Acorn: the hard shell with a distinctive cap encloses a nut; only the white oak nuts are edible.

Black walnut: the edible nut is covered by a fibrous covering (which will dye your hands black) and then by a tough husk, hard to remove.

Blackberry: the berry is composed of many small pulpy masses, each with a seed inside.

Bur: the fruit of the burdock plant has hooks which enable it to cling to clothing or animal fur for dispersal. Each individual hook is a seed.

Dandelion: fluffy parachute seed; the naked base after the fluff is gone shows the mark of each seed on it.

Horse chestnut: The spiny outer covering conceals a handsome but inedible nut.

Jewelweed: soft green seeds are flung from the ripe seed capsule when it is touched; if the covering is rubbed off, the seeds show a lovely robin's egg blue.

Maple seed: the winged parachute seed can be shown to "helicopter" if tossed into the air.

Milkweed: parachute silk seeds with a different construction than the dandelion. Look for the difference.

Pine cone: naked seeds hidden under the scales. Red squirrels will eat off the scales to get at the seeds, just as we eat an ear of corn.

Seedbox: the bare dried branches of this perennial hold the square seed capsules into winter.

CYCLES

Seeds germinate on different timetables. Some seed must grow within a matter of days or die; other seeds need a period of rest or cold before they can germinate. Lotus seed has germinated which was found in a bog 2,000 years old. In the desert, plants may bloom only once in ten or fifteen years, depending on rainfall; the seeds must then wait until rain falls again before germinating.

Seeds need proper temperature, air and moisture conditions to grow. Some need light and others need darkness. Soil must be sufficient to sustain the new plant. Many seeds germinate in gutters, sidewalk cracks, etc. but cannot grow to maturity. Many are eaten by man, birds, animals and insects. A great number of seeds must be produced by plants in order for any to survive.

In order to insure the survival of enough seeds to continue the species, nature has arranged methods of dispersal. Seeds hitchhike on animals and birds, clinging to the coats or feathers or feet of animals. Some have hooks, some have stickers, some have a glue-like substance on them, and some are bristly. In one experiment, plants were raised from 30 seeds found in a ball of mud taken from a bird's foot. Birds eat berries and distribute the undigested seeds in their droppings. Squirrels bury nuts and forget them. Many seeds float on the wind. The parachute seeds of milkweed and dandelion have been seen 20,000 feet in the air. The helicopter seeds of ash and maple are wind-blown. Explosion spreads some seeds. Witchhazel capsules contain a spring mechanism which shoots the seeds away, and jewelweed seed pods have a similar system. Water carries some seeds to new locations, including the water lily, the lotus and the coconut. Man also distributes seeds, some byhitchhiking, some through garbage disposal and some through use of plant material for packing goods to be shipped abroad.

WALK PLAN

Materials: "Seed-Go" game; a white sock to check for clingers; a knife to open seeds if you wish; a container to collect seeds; paper and pencil.

Lesson stresses concept of reproduction of species through seeds. Examine a germinating acorn to show the tiny plant beginning. Collect a number of seeds in the park and bring other unusual ones from home. Discuss methods of dispersal, testing with the sock, and play the seed-go game. List the seeds found and possible dispersal; there may be more than one method for some seeds.

FOREST LIFE AND FALL CHANGES

Introductory Note: the following curriculum on forest life and fall changes is presented in two sections. Forest life deals with the structure and life of a forest and of a tree, including the process of decay and renewal. Fall changes covers winter survival of plants and animals and the cycle involved in fall color.

FOREST LIFE: BACKGROUND

A forest is a dense growth of trees and underbrush occupying a large area. A forest has its own ecology and life forms which can vary according to the trees present. For example, a spruce forest has different species from an oak-hickory forest.

The forest is divided into layers, and different creatures inhabit each layer. The highest layer is the canopy. The canopy leaves are eaten by the larvae of many moths, by inchworms and by katydids and cicadas. These insects are preyed upon by tree frogs, vireos, orioles and warblers. Many of these birds, plus squirrels, crows and hawks, nest in the canopy. Tall shrubs and the lower-growing trees, such as dogwood, form the understory. This level is inhabited by such creatures as wood-boring larvae and other caterpillars. These and their eggs are harvested by woodpeckers, chickadees, nuthatches, brown creepers and the black and white warbler, among others. The forest floor is the third layer. Here are found the spring ephemeral plants, ferns, and small shrubs, together with the beetles, snakes and small creatures of the soil, and the oven bird.

CHARACTERISTIC LIFE FORMS

Spring ephemerals are the group of flowering plants, such as trillium, may apple, and spring beauty, which blossom early in the spring before the forest leaves block out the sunlight. These short-lived plants emerge early, blossom, set seed and die back to the ground by mid-May. They store food in roots or bulbs for next spring's brief life.

Trees may be evergreen or deciduous. If evergreen, the needles will be small and slippery, coated with a waxy substance, so that little moisture is lost when the ground is frozen and so that snow will slip off the flexible branches easily. Deciduous

trees shed their leaves each fall, preventing the loss of moisture and reducing greatly the surface area to which snow can cling on their more brittle branches. A forest may consist of both evergreen and deciduous trees, or it may be entirely one or the other. Certain trees are generally found together, such as oak, beech and hickory, or hemlock, white pine and maple.

CYCLES

The annual cycle of a deciduous tree may be considered as starting in late winter. The buds which have been in place since last summer begin to swell, triggered by longer days and warmer weather. The stiff, waxy, protective bud sheaths split and fall off as the new leaves emerge. Tree flower buds also swell and open, sometimes before the leaves and sometimes after. During the summer, the leaves serve as the tree's food factory. (See TREES and LEAVES on food manufacturing.)

The **decay** of all the leaves and other forest litter is a very important cycle which returns nutrients used in creating the leaves, branches, etc. to the soil for reuse. Trees take an enormous amount of minerals from forest soil during their growth, all of which must eventually be returned. An acre of forest may have up to two tons of plant and animal material as forest litter. The first step in reducing the enormous bulk of this material is predigestion by bacteria and fungi. Fungi are present everywhere in great quantity. Earthworms too attack fallen leaves. Then pillbugs, springtails and millipedes further reduce the litter as they feed on it. Finally soil microbes and bacteria release into the soil and atmosphere the minerals and chemicals which were used in the making of the forest litter. One result of the breakdown process is the return of carbon dioxide to the atmosphere, available for reuse by plants in photosynthesis.

The role of **fungi** is a major one. A teaspoon of forest soil may contain nearly two miles of fungus strands, or hyphae, which form the major part of the fungus and which secrete enzymes and acids. The mushroom or fruiting body is a very small part of the fungus. Since fungi live directly on decaying organic matter, they are a vital link in the breakdown process. For example, they are almost the only organism capable of breaking down a newly fallen pine needle.

Fungi have no chlorophyll, leaves or roots. They can be beneficial but can also cause great damage. The famous potato blight of 1845 in Ireland and the chestnut blight which destroyed the American chestnut tree were caused by a fungus. Molds, yeasts and rust diseases on plants are all fungi. Fungi can live under any conditions on earth except in fire.

A forest may be the product of successive stages. An abandoned open field will be first colonized by grasses, wildflowers and perhaps berry seedlings, all of them plants which need sun, like open ground and can endure drying winds. Sumac may follow, and then trees will germinate. White pine and birch are often first. As they grow, the shade created will inhibit the germination of their own seedlings. Oak and maple, which can germinate in shade, will succeed the pines. Hemlock, beech and basswood can all grow in denser shade than oak and maple and will eventually replace them. From now on, only their own seedlings can survive in the hemlock, beech and basswood forest, and it has reached the climax stage. If a large tree falls, a clearing will be opened in which the stages of succession can be repeated. Grapevine in a forest is there because its seeds germinated before there were any trees large enough to block the sunlight it needs; its presence almost always indicates that the land was once cultivated.

The animal and bird life will also change with the successive stages of the forest, beginning with the lovers of open space and ending with the denizens of the deep forest.

FALL CHANGES: BACKGROUND

Signs of fall: The sun is lower in the sky and gives less warmth. It rises later and sets earlier. Leaves begin to change color, and swallows gather on telephone wires as they prepare to migrate south. Squirrels and chipmunks race around gathering acorns for winter food. Berries and nuts ripen, and thistle and milkweed shed their fluffy seeds.

Winter survival in the north presents problems for both plants and animals. Dessication and food storage over the winter are concerns for plants; for animals, warmth and food are necessary to live through the winter. Survival techniques vary. Nature's typical response to a problem is to have many different methods of dealing with the difficulty. When change comes, as it always does, one method may lose its effectiveness but others should maintain theirs, insuring survival for at least some life forms.

CHARACTERISTIC LIFE CYCLES

Winter survival techniques may be summarized for life forms as follows.

As cold weather approaches, **trees** make buds for next year's leaves and flowers and prepare for dormancy by storing a food supply in their root systems. Deciduous trees shed their leaves to cut off the loss of water; the waxy coating on evergreen leaves serves the same function.

Herbaceous plants include annuals, perennials and bulbs (see Plant Reproduction). Annuals shed their seed for spring renewal and die; perennials store food in their root system and die back to the ground, leaving the roots to sprout again; bulbs store both food and a pre-formed blossom and plant, all ready to emerge in spring.

Insects survive in any of the metamorphic stages. Eggs which are laid in fall have some sort of protective coating, such as the praying mantis' rigid foam mass, or the tent caterpillar's varnished egg cases, or the bagworm's cocoon. Woolly bear caterpillars hide under fallen logs, along with many other larvae. Mourning cloak butterflies and bumblebees may winter under bark also. The monarch butterfly is the only insect known to migrate, flying to Mexico at the onset of winter. The colony of bees remains alive, clustering for warmth and feeding on stored honey.

Animals hibernate, sleep, or hunt or store food during the winter. The woodchuck is a true hibernator; his body temperature drops to near freezing, and his heart may beat only two or three times a minute. The chipmunk stores food in his burrow and sleeps much of the winter, rousing and snacking during mild spells. The fox remains active, and so do the rabbits and mice, his food supply. Deer develop the ability to digest bark instead of leaves, as their diet changes radically in winter.

Birds fly south, either on a very long migration to summer in the southern hemisphere, or on a short flight to milder climates. (See BIRDS for more information on migration.) Some, such as owls, remain in their territory year round. Wintering birds eat seeds from weeds and pine cones and seek out insect eggs laid under bark. They benefit greatly from our feeders, especially if provided with suet and seeds high in oil. Generally, feeders should be kept supplied all winter, although apparently a short break is not too harmful to your customers. Birds seek shelter in dense bushes or evergreens and fluff out their feathers in the cold to trap warm body heat. While sleeping, they sit down on their feet to keep them from freezing. Grouse in the far north grow extra feathers on their feet to help them walk on deep snow and dive into a snowbank for warmth at night.

Reptiles and **amphibians** are cold-blooded and go into torpor but must keep from freezing. Snakes coil up together in a den. Turtles burrow into soft earth or pond ooze. Frogs seek the soft mud in the pond botton, and toads burrow into soft soil, often choosing a vegetable garden as a winter site. Breathing slows greatly for all these creatures, and body functions are suspended.

WALK PLAN

The two parts to this walk dovetail better in the field than on paper. The first lesson is on nature's recycling; nothing is wasted and all materials are returned for reuse. Only man does not recycle what he uses; many of our materials are left in a form where they cannot be recycled, and we dig up and use mineral resources which cannot be renewed, such as coal and oil. The complexity of the forest world should be stressed; everything is interdependent, and many specialized life forms make up the forest community. Look at a fallen log, and review the process of decay. Find mushrooms or other fungi and talk about the unseen parts of them.

The second lesson might be how life shuts down for the winter and re-emerges in spring, or how it survives winter. Review the great problems of winter, such as drying out for plants and cold and lack of food for animals. Discuss the many different ways in which the problem is solved. Look for leaf and flower buds on twigs.

INDIAN LIFE

BACKGROUND

The ancestors of the American Indians came from Asia on a land bridge across the Bering Sea into Alaska. They were hunters and wanderers who used flint for weapons, following seasonal animal migrations. Indians living in America before the first white colonists arrived developed and practiced agriculture but did not use metal. Indian life as described here is pre-Columbian, lacking any of the tools and innovations brought to America by European explorers.

The Indians of eastern United States are woodland Indians; the western Pennsylvania Indians were less warlike than many tribes. Most closely associated with Pennsylvania are the Delawares, or Lenni Lenape ("real" or "original people"). Senecas and Shawnees also were in the area. One Indian name still in use in western Pennsylvania is that of Queen Aliquippa, who was a Seneca chieftain. Shawnees named Sewickley ("sweet water"); there were several Indian sites by that name in this area. Fairly extensive trading between Indian communities took place, as both clay pottery and wild rice (from New Mexico and Minnesota) have been found near Pittsburgh.

LIFE STYLE

Indian **homes** were designed in the longhouse style, with twenty or more family groups sharing shelter. The buildings were made from young flexible saplings which were fashioned into a frame and covered with deer hides or with bark slabs, usually from elm, hickory or ash trees. When these were scarce, woven cattail mats were used to cover the poles. Interior partitions marked off family space, with a row of hearths down the open center of the longhouse.

Most of the work was done by the women, with the exception of hunting, canoe-making and house construction. They cleared land and raised food **crops**, especially corn, beans and squash, a trio of vegetables so important that they were called "The Three Sisters". They understood the use of fertilizer and added fish heads and ashes to the soil. The corn was boiled, pounded to make corn meal or soaked with wood ashes to produce hominy. Maple trees were tapped to make syrup. No natural salt was

present in western Pennsylvania, and maple sugar was used to season food instead. Hunting by the men supplemented the diet, along with berries, nuts and roots; weapons of flint and wood served them until white men came.

Food was preserved by drying vegetables in strips and parching corn; it was stored in bark vessels and sometimes put in underground pits. Meat and fish could be dried also; some Indians combined dried meat with suet, corn and berries to make pemmican, a nutritious trail food. Tobacco was widely grown and used, smoked in clay or stone pipes. Maple syrup was fermented into an alcoholic drink, often with spruce needles incorporated.

Cooking utensils were of bark, sewn with fibers or roots and calked with spruce gum so that they were watertight. Gourds and wooden bowls were used as dishes. Indians were excellent carvers and made wooden spoons, ladles and canoe paddles.

Cleanliness was important to Indians; they were horrified at the dirtiness of the European settlers. They washed daily and took a weekly sweat bath for purification. Camps were moved for hygenic reasons. The horsetail plant, which contains much silica, was used to scour items clean.

Clothing was mainly of skins, tanned by the women and chewed to make them soft; most women had their teeth worn down by middle age because of this practice. Durable mats and waterproof containers were woven from grasses, reeds and cattails. Porcupine quills, usually dyed, and beadwork were used to decorate clothing. Hats were sometimes made from burdock leaves on a hot day. Both men and women painted their faces; each color had a special meaning. White stood for peace, black for war, grief, death, or evil. Colors were obtained from colored earths, fireplace ashes, or various berries and plants such as poke and bloodroot. Walnut hulls made brown dye and butternut hulls black dye; goldenrod made yellow, bloodroot red and sumac orange or red dyes.

Indians were great **storytellers** and had many games and dances with music for entertainment. They made toys for the children, such as gourd rattles, dolls from bunches of white pine needles, ducks from cattail leaves, and whistles from twigs or onion stems. However, the children all worked, helping their elders and learning necessary skills. The group travelled at certain times, following the harvest of berries or fish in season, and a tribe often gathered in summer at a favorite spot. Travelling and hunting trails usually were on high ground, skirting

rivers and ravines if possible. Travel by water was the easiest method, and canoes were important. Indians living in the northern birch country made birchbark canoes, and elm bark canoes and tulip tree dugouts were made farther south where birch was unavailable. Bark was sewn together with split spruce roots and seams were calked with spruce gum pitch. Dugouts were made from an entire log by charring and chipping away the interior. There were no horses in North America until the Spaniards brought them in the 16th century.

USES OF PLANTS

Plant lore among Indians was extensive, as most of their needs were supplied by plants. Some of the medicinal plants known to them are still in use today. A partial list of plants and their uses follows.

Balsam poplar bark was boiled and the water used to wash a broken limb before splinting.

Basswood inner bark was shredded and the fiber twisted into thread for weaving belts, headbands and bags.

Birchbark was used by the northern Indians for cooking vessels and for canoes.

Boneset leaves were dried and used to induce sweating.

Black spruce twigs and needles were boiled with maple syrup to produce a beer high in vitamin C.

Cattail seeds were dried and ground for talcum powder. The pollen was used as flour, the leaves were woven into mats, and the fluffy mature heads were used for padding and insulation. Woven **corn husks** made excellent mats for sleeping or sitting on and were also made into baskets.

Crab apple juices were thought to ward off small pox , brought to America by colonists.

andelion leaves were cooked in early spring as a tonic; root tea was used for heartburn.

awthorn thorns were made into awls and needles.

Hemlock needles (high in vitamin C) were steeped for tea and the brew used to induce sweating and to treat colds and sore throats. The inner bark, high in tannic acid, was pounded and applied to swellings and sores.

Jewelweed was known as an antidote to poison ivy.

Pokeweed is poisonous in all its parts, but the roots were used externally, both powdered, as a poultice for cancer, and whole, placed on the palms, for fever. Dried leaves were used on wounds and the berries used for dye.
Red maple bark was boiled and the water used to treat eye ailments.
Rose hips were eaten fresh or dried; they are an excellent source of vitamin C. Many other berries were also eaten.
Snakeroot was used to treat snakebite.
Sugar maple was tapped and maple sugar made from the sap.
The resin from a **sweet gum** tree treated fever and wounds.
White pine inner bark was soaked until soft and applied to wounds, or was used internally to cure dysentery. The gum was applied to the skin for rheumatism and the tar for burns and for itching.
Willow bark, a source of aspirin, was used in tea for colds and fever.
Witch hazel was widely used. Bark was applied to the skin or chewed to freshen the mouth. A bark solution was rubbed on the legs to keep them limber.
Yarrow was used for stomach aches.

LIFE OF THE SPIRIT

Indians did not believe in ownership of the land, although they did establish hunting territories. The chief and the medicine man each had their own area of influence, and each was powerful. Indians believed in a Great Spirit who had given them the earth to live in harmony with its creatures. Bad events were seen as punishment for wrongdoing. The medicine man was powerful partly because he was believed to have influence over bad spirits, and medicine and magic were closely allied. When the medicine man called on a patient, he would chant and shake rattles to scare the bad spirit out of the patient's body; medicine would be administered as well.

Dreams were important for many reasons and often ruled Indian decisions. Fasting to purify the spirit and induce dreams for guidance was practiced in time of crisis. They believed that their knowledge of medicine came to them in dreams. Many legends and tales were created by the Indians, both to entertain and to explain natural events such as the coming of snow or the bright fall color of the leaves.

WALK PLAN

In this lesson, two themes can be illustrated. First, Indians viewed the natural world as an environment to be respected, used and enjoyed, but not damaged or exploited. They apologized to the rabbit for taking its life and thanked the Great Spirit daily. Second, Indians had a good way of life without the civilized comforts which we take for granted.

This is always an indoor walk. The materials list is an important key to success. Guides should do additional reading especially for this walk, as the children love to hear legends and stories too lengthy for inclusion here. This is the only curriculum which has no accompanying slide show.

Suggested materials list, which can be amplified by artifacts loaned by The Carnegie.

Some typical medicine plants and a bottle of witch hazel. Medicine man's pouch of rabbit skin. Masks.

Foods, dried or preserved : parched cord, maple syrup, dried berries, seeds and nuts, popcorn, dried pumpkin and wild rice. Gourd dippers and bowls.

Spear-heads, arrowheads, tools. Thorns for awls. Elderberry twigs for spiles. Basswood tree twigs. Cord made from Indian hemp plant.

Deer hide, antler. Quills for decoration, necklace, etc. Feathers of all sizes. (Woods Indians did not use the large warbonnets often pictured on Plains Indians). Beadwork; beads of seeds, stone, shells etc. Shells or wampum, especially mussels or clams.

Woven baskets - willow, ash, rush, etc. Cattails, leaves and heads. Paint pots of clay with natural paints for faces. Also, small stones split open which contain natural pigments. Pine needle dolls. Seedpod rattles.

Pair of clam shells for tweezers, used instead of shaving; Indians were never bearded.

Guides should wear any Indian jewelry which they may have.

The walk is usually divided into three general topics, although this arrangement can vary according to the materials available that day.

Medicine: Describe a visit of the medicine man. Show a sample of plants and talk about their uses. Play the medicine game with 3x5 cards (supplied) with the disease and its Indian cure on one side and the probable result of the treatment on the other. Each child must guess if her disease can be cured.

Food: Discuss growing, gathering and preserving of food (no grocery stores) and the utensils for cooking and serving, including all the samples present. Bring some foods not available to Indians, such as the potato, and ask the children to guess if an Indian might have eaten them.

General living: Weapons, houses, clothing, jewelry, anything with an artifact present which doesn't fit under the other two categories. Talk of the Indians' attitude towards the natural world as something to be shared, not dominated or abused. Ask the children what they think about reliance on dreams as a guide to actions.

Glossary

Bibliography

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GLOSSARY

(See also Pictorial Glossary)

Abdomen. Rear section of main body division (insect).
Algae. Single celled form of plant with no stem, leaf or root structure, mostly aquatic.
Antennae. Pair of sensory organs on insect head.
Anther. Knob-like end of stamen which holds pollen.
Anus. Posterior opening of the alimentary tract in animals.
Asexual. Reproduction without union of egg and sperm; plant propagation by budding, grafting, shoots, division.
Axil. Angle where leaf joins stem.
Bloom. Waxy or powdery whitish coating on fruit, stem or leaf. Also, blossom.
Bract. Modified leaf associated with flower.
Calyx. Outer flower part, composed usually of leaflike sepals, supporting the petals.
Capsule. Dry fruit which splits into parts when mature.
Carbohydrate. Any of several compounds (sugar, starch, etc) composed of hydrogen, carbon and oxygen, basic to the food chain.
Carpel. Simple pistil, or one part of compound pistil.
Catkins. A number of small scaly-bracted flowers in a long and often drooping cluster.
Cephalothorax. First subdivision of a spider's body.
Chitin. Horny substance forming outer covering of insect and crustacean.
Chlorophyll. A green substance in leaves which captures the sun's energy and makes photosynthesis possible.
Chrysalis. Pupa of a butterfly.
Clone. A descendant derived asexually from a single parent.
Cocoon. Woven silk case covering moth pupae.
Corolla. The showy inner floral part, composed of petals.
Diatom. Tiny aqueous plant, a unicellular brown alga.
Disk flower. Tiny tubular flowers forming the buttonlike center of the composite family, as in a daisy; usually surrounded by ray flowers.
Dormancy. Resting or inactive state.
Drupe. Fleshy fruit with hard stone in center (cherry).
Ephemeral. Fleeting; used of spring woodland flowers which bloom briefly and die before tree foliage emerges.
Exfoliate. Coming off in thin layers, as in tree bark.

Exoskeleton. External supporting structure of insect.
Filament. Thread-like stalk, part of stamen.
Floret. Small flower, usually one of a cluster.
Frass. Debris and excrement from insect larva.
Frond. Expanded leafy portion of a fern.
Gill. Respiratory organ of aquatic animal.
Hawk. Attack by swooping and striking.
Herb. Any non-woody plant. Also, a plant used for medicine or for flavor and aroma.
Honeydew. Sugary liquid discharge of various insects, especially aphids.
Hybrid. Cross-breed of two species.
Inflorescence. Flower cluster, especially of grasses.
Key: A winged fruit or samara, as in maple tree.
Lanceolate. Narrow and pointed, like a lance head.
Lenticel. Corky spots on young bark originating as breathing pores; may be circles or stripes.
Mandibles. Jaws of insect, normally used for chewing.
Metamorphosis. Transformation process undergone by insects as they undergo a distinctive change from larval to adult form.
Molt. Shedding of confining outer layer of body shell (insects) or replacement of feathers (birds).
Node. Place on stem which normally bears a leaf, a knob-like enlargement .
Omnivorous. Eating both animal and vegetable diet.
Ovate. Egg-shaped.
Oviparous. Producing eggs that hatch outside the mother's body.
Ovipositor. Egg-laying organ of female insect at rear of her abdomen.
Ovule. Tiny structure which after fertilization becomes a seed.
Palmate. Radially lobed (leaf), as fingers from a hand.
Palp. Sensory structure associated with mouth (insects).
Panicle. Elongated compound flower cluster, branched.
Pedipalps. Paired appendages on cephalothorax of spider, usually leg-like in female; enlarged at tip in male and used to transfer sperm.
Perfoliate. Leaf appears to be pierced by stem.
Petiole. Leafstalk.

Pheromones. Hormones controlling social and sexual behavior of insects and other animals; sex attractant used by female moth to lure males.

Photosynthesis. The process through which plants containing chlorophyll use the sun's energy to create carbohydrates from carbon dioxide and water.

Phylum. A division used in classification of living beings; the phylum is a subdivision of a kingdom and is further subdivided into class, order, family, genus, and species.

Pinna. Primary division of a pinnate frond (fern).

Pinnate. Compound, with leaflets arranged on each side of a common axis.

Pistil. Central female part of flower, consisting of ovary at base, stalk or style, and tip or stigma.

Pistillate. Flower having a pistil; female.

Plastron. Bottom shell of a turtle.

Predaceous. Preying on other animals.

Proboscis. Prolonged set of mouthparts, as in insects.

Pupa. Stage between larva and adult of insects which undergo complete metamorphosis

Pupate. To become a pupa and be in the transformation stage between larva and adult.

Raceme. Cluster of flowers, each on its own stem, arranged singly on a stalk.

Ray flowers. Strap-like flowers encircling disk flower in composite family, as in daisy.

Samara. Winged fruit or key.

Sepal. Segment of calyx or small modified leaf, usually green.

Sessile. Stalkless.

Spadix. Club-shaped stalk bearing tiny flowers (arum family).

Spathe. Leaflike sheath partly enclosing spadix (arum family).

Spile. Tap or spout inserted into maple tree to guide sap.

Spinneret. Spider's appendage through which silk is extruded, located underneath rear part of body.

Spore. Primitive, reproductive single cell, microscopic.

Spp. Species; a closely allied group of birds, plants, etc.

Stamen. Male flower part, containing pollen in season on anther (knob-like end of stamen).

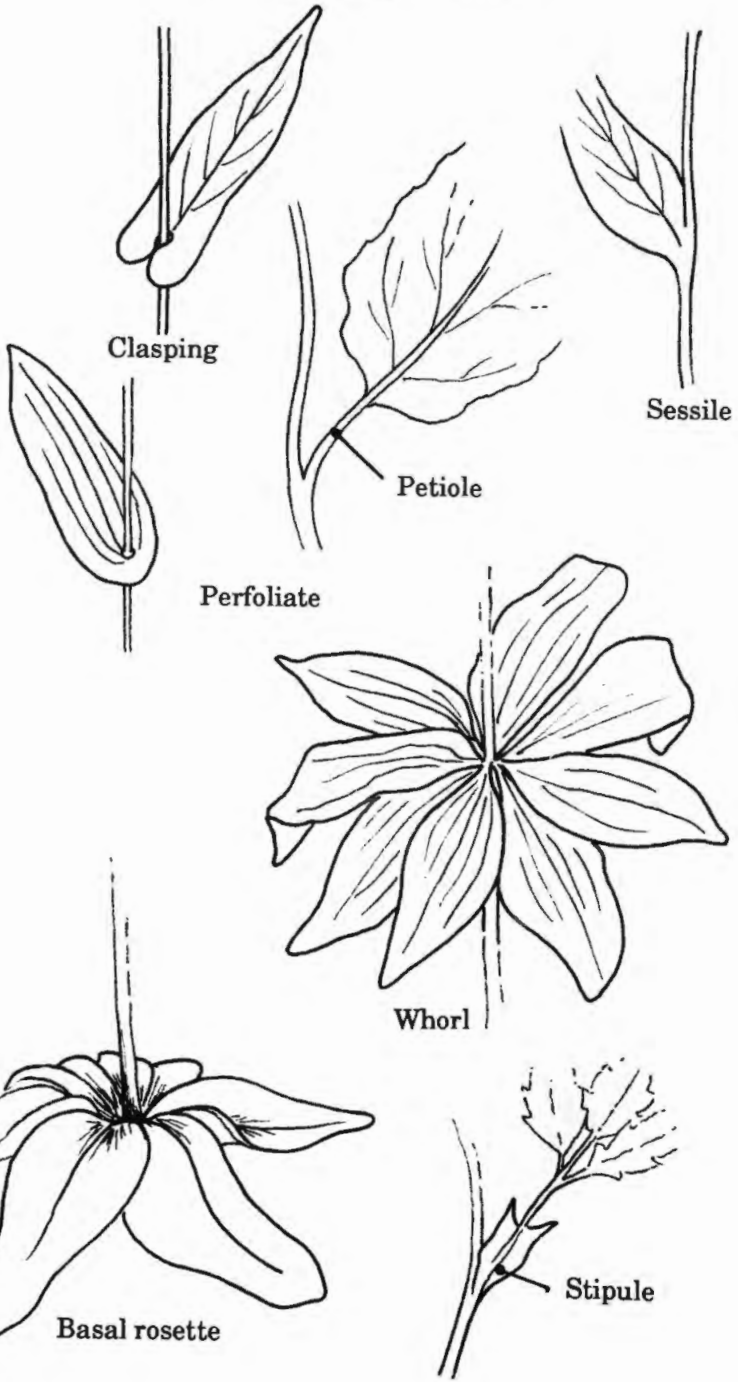
Staminate. Having stamens; male.

Stipule. Small leaflike appendage at base of leafstalk.

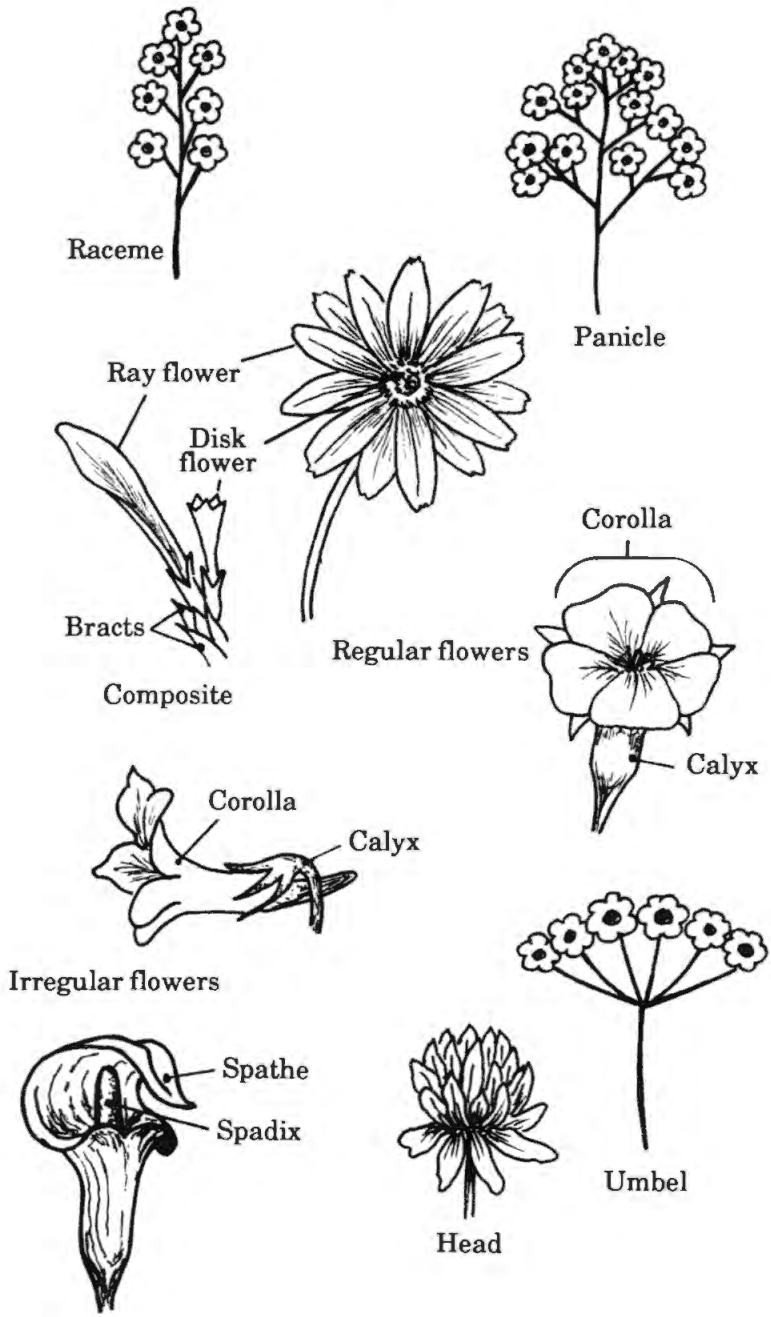
Stoop. To pounce or swoop down, as a hawk.

Style. Slender part of the pistil, connecting stigma and ovary.
Sucker. A shoot from roots or lower stem of a plant.
Tendril. Slender, flexible appendage of climbing plants used to attach plant to a support.
Territorial. Behavior in which male stakes out an area and protects it during the breeding season.
Thermal. Rising current of warm air, used by vultures and hawks to soar aloft.
Thorax. Division of body between head and abdomen (insect).
Tubercle. Small, knob-like projection in some caterpillars.
Umbel. Umbrella-like flower cluster with all flower stalks radiating from a common point.
Vector. Organism which transmits disease.
Viviparous. Bearing live young (instead of laying eggs).
Whorl. Three or more leaves radiating from a single point.

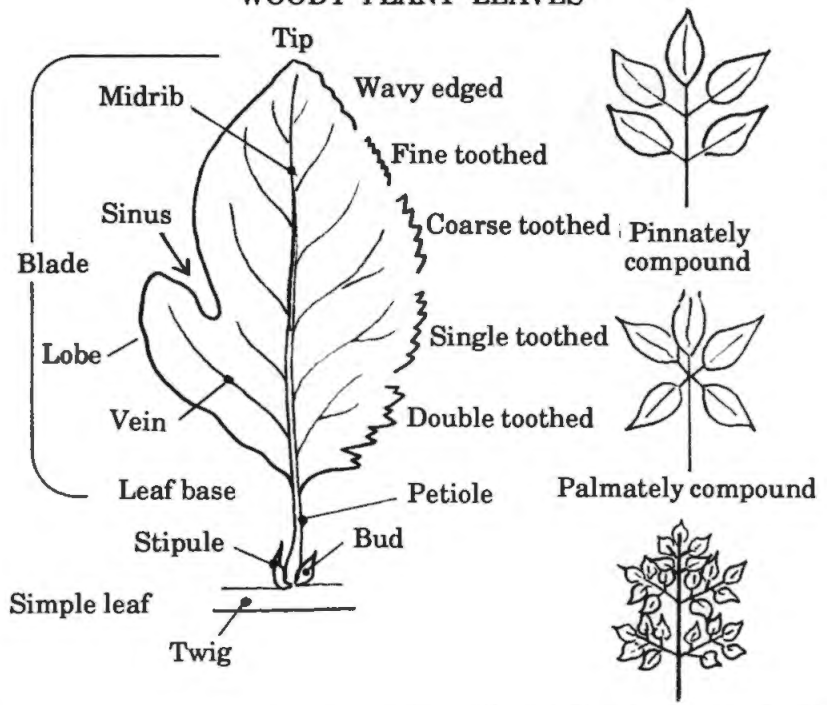
HERBACEOUS LEAVES

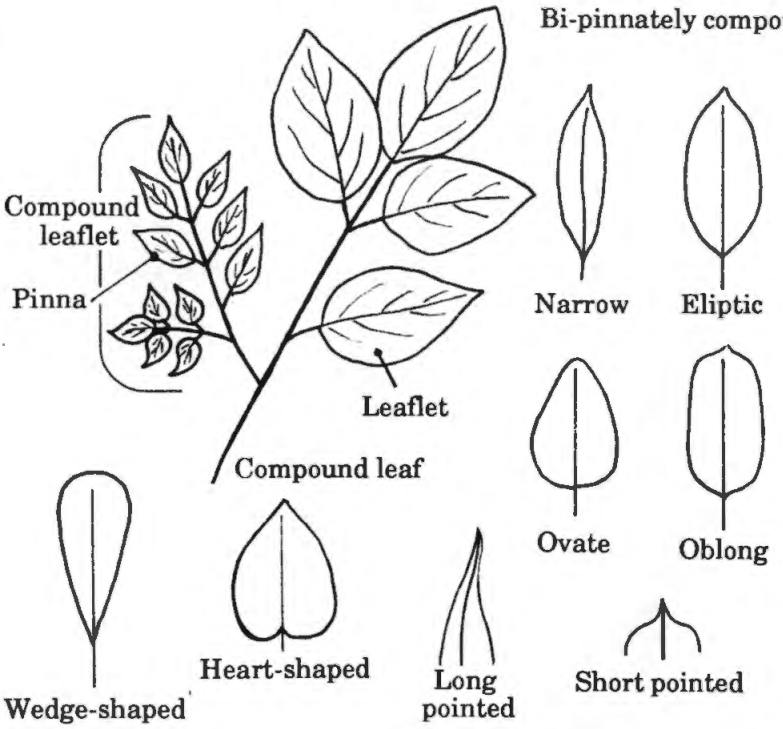


FLOWER PARTS



WOODY PLANT LEAVES





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