Plant Families

Activity Overview
Students learn the science of taxonomy while studying plant families represented on their schoolyards, in an ecological restoration or in their region .

Objectives
Students will:

- Observe and identify flower, fruit, and leaf structures of plants
- Identify and recognize patterns and characteristics that group plants into families
- Understand the science of taxonomy in classifying and naming organisms

Subjects Covered
Science and Art

Grades
6 through 12

Activity Time
25 minutes per family

Season
Summer and Fall

Materials
Plant specimens in flower or seed, hand lens, observation sheets, and pencils.

State Standards
Science: C.4.1, C.4.2, C.8.1, C.8.2, C.8.4, C.8.6, C.12.5, C.12.6, F.4.3, F.8.1, F.8.2, F.8.4, F.8.5, F.8.7, F.12.1, F.12.4, F.12.5, F.12.6, F.12.7

Background
Why study plant families as part of the restoration process?

1. Learning characteristics common to a family helps with plant identification in the field.
2. Students learn taxonomy in the context of a real-life project.
3. Studying plant families helps students understand plant composition in a natural community.
4. Students will be able to develop a realistic species mix based on plant family composition in natural communities.
5. Themes relating to plant families are subjects for restoration research activities .

The plant families in the activity are:

1. Daisy family - Asteraceae
2. Rose family - Roseace
3. Bean families - Fabaceae, Caesalpiniaceae, Mimosaceae (Previously Leguminosae)
4. Grass family - Poaceae
5. Mint family - Labiatae
6. Milkweed family - Asclepiadaceae
7. Buttercup family - Ranunculaceae

8 . Sedge family - Cyperaceae

Preparation and helpful hints for the activity:

- Obtain plant specimens on the day before or the day of the activity. A list of potential species follows each family description . Plants appropriate for dissection are weedy or common, found along roadsides or in gardens . (Be aware that garden plants are often hybrids and may have more flower parts than plants growing in the wild.) Flowers may also be available from florists . Never collect plants from natural areas .
- Keep specimens cool and moist . Lay short-stalked flowers between moist sheets of paper toweling, put long-stemmed plants in a vase.
- If plants are no longer blooming, students can investigate seeds, seedheads, and seed dispersal mechanisms .
- Set up stations with representative species of each plant family . Give each station a number.

Activity Description
1. Divide the class into groups to evenly distribute students around the stations. Have students examine related specimens to determine distin-

guishing characteristics for each family. Instruct students to draw or write descriptions in the circle on the observation sheet that matches the station number .

2 . Rotate student groups through all stations. Allow five to ten minutes at each station.

3. Share as a large group what characteristics seem to identify each family.

4 . Confirm the identity of each family and discuss some key traits using the plant family information sheets.

5 . Discuss plant classification. See Earth Partnership for Schools activity, "Botany Bouquet" for more information.

Extensions

- Create a Venn diagram that displays similar and dissimilar characteristics of the different species observed in each plant family.
- Pass out one specimen at a time . Then use an overhead of plant diagrams to discuss characteristics of the family . As an alternative method, examine the specimen first, and then discuss characteristics of the family.
- Students can create a classroom set of drawings depicting common plants within various plant families.
- Students can find plants native to their region in each family.
- See Earth Partnership for Schools activity, "Taxonomy & Field Guide Warm-Up" for further more in depth coverage of plant parts.

Additional Resources

- Baumgardt, J. (1982). How to identify flowering plant families: A practical guide for horticulturists and plant lovers. Timber Press. Portland, Oregon.
- Kirt, Russell R. (1995). Prairie plants of the Midwest: Identification and ecology. Stipes Publishing Co. Champaign, IL.
- Lerner, C. (1989). Plant families. New York, NY. William Morrow and Company, Inc.
- Mirk, Walter. (1997). An introduction to the tall grass prairie of the Upper Midwest. The Prairie Enthusiasts, c/o Gary Eldred, 4192 Sleepy Hollow Trail, Boscobel, WI 53805.
- Newcomb, L. (1977). Newcomb's wildflower guide . Little, Brown & Co. Boston, MA.
- Runkel, S. T. & Roosa, D.M. (1989). Wildflowers of the tallgrass prairie-The Upper Midwest. Iowa State University Press. Ames, IA.
- Stokes, D. & Lillian. (1985). A guide to enjoying wildflowers. Little, Brown & Co. Boston, MA.

Assessments

- Identify one representative for each plant family.
- List one characteristic of each family that makes that particular family unique.
- Identify one feature per family that potentially may improve the species' ability to survive and reproduce successfully and discuss why.

Daisy Family: Asteraceae (as-ter-AY-see-ee)

- The daisy family has the largest number of species in the prairie and is one of the leading families in woodlands.
- Some say a prairie should be called daisyland rather than grassland because 25% of the species are daisies compared to about 10% grasses . However, what the grasses lack in number of species, they more than make up in number of individuals.
- Plants tend to be aggressive and aggregate through reproduction of short rhizomes, examples include sunflowers and common goldenrod.
- Some species, such as thistle, produce antibiotic chemicals that repress growth of other species within their colonies.

Flowers

- What looks like a single flower is really a cluster of many tiny flowers called florets. There may be just a few florets or many hundred in a cluster.
- Florets grow on top of a head or receptacle. The head is backed by a group of leaves that look like green sepals.

Ox-eye Sunflower, Heliopsis helianthoides

Florets

- Disk floret is located in the center of the receptacle.
- Petals - 5 petals fuse to form a tube around the stamens and pistil.
- Stamens - 5 stamens fuse into a tube
- Pistil - 1 pistil sticks out above the stamens.
- Stigma - the stigma splits into 2 branches that resemble golden arches.
- Ray florets form a ring that surrounds the disk florets.
- Petals - 5 petals form a tube at the base then flattens out to form a long tongue. Ray florets may or may not have male and female parts.
- Flowers with only disk florets are thistles, white snakeroot, Joe-pye weed, and blazing stars.
- Flowers with only ray florets are dandelion, wild lettuce, lion's foot, and rattlesnake root.
- Flowers with both disk and ray florets are yellow coneflower, coreopsis, woodland sunflower, and asters.

Fruit

- The fruit is a small, hard seed.
- Often a pappus is attached to the top of the fruit. The pappus helps disperse seed

away from the parent plant.

- Bristles are a type of pappus that hook on to fur or clothing . Examples include burdock and beggar ticks.
- A parachute-like pappus disperses seed in the wind . Examples are dandelion, blazing stars, goldenrods, and thistles.

Leaves

- Leaves are alternate, occasionally opposite, usually toothed, lobed or divided.

Typical Examples

- Plants native to North America:
- Purple coneflower, pale purple coneflower, Black-eyed Susan, wild quinine, ragweed, yarrow, prairie dock, Joe-pye weed, blazing stars, goldenrods, and asters.
- Non-native plants:

  Common yarrow, giant ragweed, mayweed, spotted knapweed, Russian knapweed, yellow star thistle, ox-eye daisy, chicory, Canada thistle, bull thistle, small flower galinsoga, prickly lettuce, tansy ragwort, sow thistle, dandelion, and cocklebur.

Sawtooth Sunflower, Helianthus sgrosseserratus

- Cultivated plants:
- Edible sunflowers, lettuce, garden asters, daisies, and zinnias.
- Common and garden plants to use for dissection:
- Garden daisies, dandelion, ox-eye daisy, chamomile, black-eyed Susan, coreopsis, and sunflowers.

Rose Family: Rosaceae (row-ZAY-see-ee)

Flowers in the rose family are very similar, however, fruits vary considerably, depending upon where the flower parts are arranged on a floral cup . Both humans and animals relish the great variety of fruits in the rose family—from apples to strawberries, raspberries and cherries.

Flowers

- Most flower parts are in groups of 5—5 sepals, 5 petals, and many stamens in rings of 5 . There may be one pistil or many.

Floral Cup

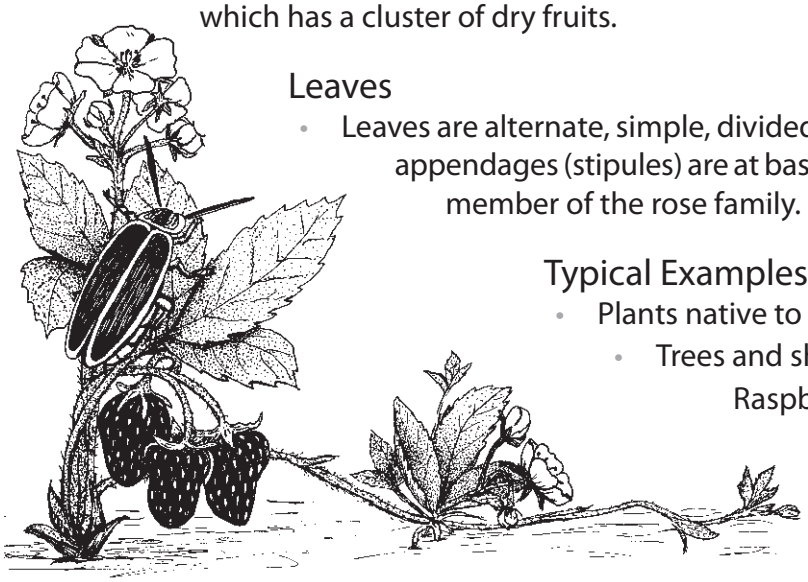
- Most rose plants have a floral cup that grows beneath the flower.
- The floral cup may be a shallow saucer, deep bowl or a tube.

Fruit

- The types of fruits include achenes, pomes, drupes, capsules, and follicles.
- The shape of the floral cup and how the flower is fertilized determines fruit type.

Types of Fruit

- Rose hip - A rose hip is a deep floral cup that encloses many small dry fruits .
- The juicy parts of apples, peaches, cherries, and pears are floral cups . The seeds in the core are the real fruits.
- Some floral cups remain small and do not grow around the fruits . An example is cinquefoil, which has a cluster of dry fruits.



Wild Strawberry, Fragaria virginiana

Leaves

- Leaves are alternate, simple, divided or lobed, and sharply toothed . Usually 2 appendages (stipules) are at base oft the leaf stalk. Stipules often identify a member of the rose family.

Typical Examples

- Plants native to North America
- Trees and shrubs:

Raspberry, blackberry, wild rose, potentilla, hawthorn, plum, crab apple, amelanchier, and mountain ash.

- Herbaceous plants:
  Strawberry, prairie smoke, cinquefoil, avens, and Indian physic.
- Non-native plants:

Rough cinquefoil, sulfur cinquefoil, and multiflora rose.

- Common and garden plants to use for dissection: Potentilla shrubs, shrub roses, crab apples, and cinquefoil.

Mint Family: Labiatae (lay-bee-AY-tee)

Beebalm, Monarda fistulosa

Labiatae comes from the word lip, which describes the shape of the flower. Mints are aromatic. The odor comes from oil produced in many small glands on the surface of the leaves and stems. Botanists believe aromatic oils deter animals and insects from feeding on the foliage. For humans, the pungent fragrance and flavor is used for making tea, candies and gum, flavoring for food, and air fresheners.

Flower

- Five petals join together at the base to form a tube.
- The tube splits into 2 parts—two upper petals form the upper lip, three lower petals form the lower lip.
- The flowers are small—numerous flowers grow in clusters.
- Some flowers are found on the top of the plant, others form a wreath where the leaves attach to the stem.
- The number of stamens will vary.

Fruit

- A single flower produces 4 little nutlets.

Stem

- A square stem identifies the mint family. Feel the ridges by rolling the stem between your fingers.
- "All mints have square stems but not all square stems are mints." Cupplant, a member of the daisy family has a square stem, also.

Leaves

- Leaves are opposite, may be toothed or lobed, but not divided.

Typical Examples

- Plants native to North America: Dragonhead, dotted mint, mountain mint, dragonhead, ber-

gamot, spearmint, hyssop, hedge nettle, and lopseed.

- Non-native plants: Creeping Charlie, hemp nettle, henbit, motherwort, heal all, bugleweed, and catnip.
- Culinary plants: Basil, thyme, marjoram, peppermint, and oregano.
- Common and garden plants to use for dissection: Bugleweed, henbit, grassleaf pennyroyal, bergamot, and garden mints.

Bean Families: Fabaceae (fa-Bay-see-ee) Bean family, Caesalpiniaceae (se-sal-pi-NAY-see-ee) Senna family, Mimosaceae (mi-mo-SAY-see-ee) Previously Leguminosae (le-gyu-men-NO-see)

The bean family recently was divided into three new families. Botanists split the bean family into three separate families based on different kinds of flowers in the family . Originally the family name, Leguminosae, described the typical fruit of the family—a legume. A legume is a pod with two or more seeds . Legumes fix nitrogen in the soil on account of a symbiotic relationship with bacteria. The bacteria, Rhizobium, attach to nodules on the roots of the plants . The bacteria acquire food from the plant, and in return produce nitrogen . This relationship benefits the entire ecosystem . For example, the biomass of a typical prairie is 4,000 lb./acre, a prairie with a high percentage of legumes will weigh in at 8,000 lb. / acre . That's double the weight!

White Wild Indigo, Babtisia alba

Flowers (Fabaceae family)

- The unusual flowers identify members of this bean family.

Petals

- Flowers have five petals, some petals are fused.
- Two lower petals, called the keel, are fused except at the tips.
- Two petals, called wings, surround the keel.
- The 5th petal is on top and is called the top petal.

Stamens

- Ten stamens are tucked inside the keel.
- Some flowers have 10 stamens that form a tube; others will have 9 stamens joined and one single stamen.

- The flower is structurally designed with spring-set stamens, for cross-pollination by bees . The visiting bee lands on the keel (fused lower petals), which trigger the stamen cluster to snap up, showering the bee's hairy body with pollen dust .

Pistil

- A single pistil is tucked inside the two lower petals.

Fruit

- The fruit is a pod.
- Often when the fruit dries, it splits along two edges of the pod . Some pods do not break open at all; others break apart at the joints between each seed.

Leaves

- Leaves are alternate, compound in groups of three or several divided leaflets. Two appendages, called stipules, are located at the base of the leaf stalk.

Typical Examples

- Plants native to North America: Trees and shrubs: Black locust, honey locust, redbud, Kentucky coffee tree, mesquite, sensitive brier, and wisteria .
- Herbaceous plants: Wild indigo, lupine, tick-trefoil, white and purple prairie clovers, milkvetch, ground nut, Texas bluebonnet, and bush clover.
- Non-native plants: Black medic, Kudzu vine, narrowleaf vetch, Scotch broom, Spanish broom and yellow and white sweet clover, Bird's foot trefoil, and red clover.

White Wild Indigo, Babtisia alba

- Agriculture and garden plants: Peas, beans, soybeans, peanuts, lentils, lima beans, alfalfa, and clovers.
- Common and garden plants to use for dissection: Bird's foot trefoil, red clover, garden lupine, beans, peas, and sweat peas.

Grass Family: Poaceae

Grasses are one of the most important plant families to people and animals. Grasses are directly or indirectly the chief source of food for man and animals. Grasses provide all grains and cereals—corn, wheat, rice, oats, rye, barley, and others. Wheat has been cultivated for more than 7,000 years. Rice is a main staple for more people than any other plant in the world. Sugar cane has long been used for sugar. Forage grasses such as brome grass and timothy feed livestock. Grass is a valuable wildlife food. Grasses are used in lawns, golf courses, and ornamental gardens. Visually, native grasses dominate the prairie. Grasses spread by rhizomes and stolons, and grow in bunches or as dense masses that form sod.

Flowers

- The florets are small, reduced in size, and born on dense spikes or open clusters.
- Spikes or clusters are composed of units called spikelets. Spikelets may have one or more florets. Two empty bracts called glumes are at the base of the spikelet.

Bracts

- Instead of sepals or petals, a grass floret is surrounded by a second pair of bracts. Bracts are small, modified leaves that grow just below the flower. The lemma bract is on the outside; the palea bract is tucked inside.

Stamens

- Three stamens are hidden inside the bracts until the florets are ready to bloom.

Pistil

- A single pistil is hidden inside the bracts until the florets bloom.
- The stigma is usually split into two feathery branches.
- Grasses are typically pollinated by the wind, but interestingly, you will see insects on the flowers when they are blooming. Take note of this when you see grasses bloom.

Bottlebrush Grass, Hystrix patula

Fruit

- The fruit of the floret is a single grain.

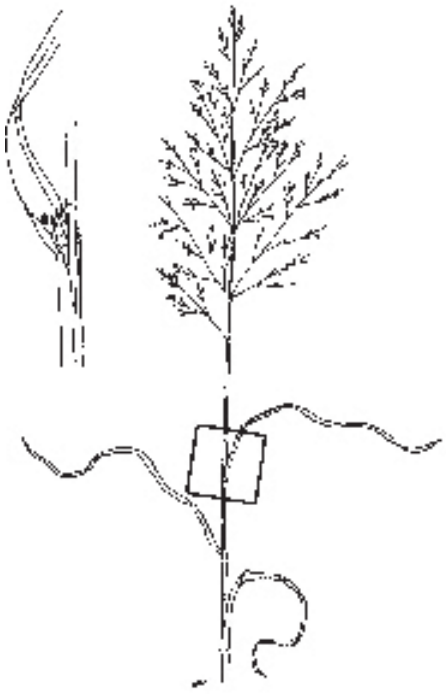
Stem and Leaves

- The leaves are usually long and narrow . The base of the leaf, called the sheath, wraps around the stem.
- A small membranous part called a ligule is located where the leaf attaches to the stem. Ligule type often identifies species.
- The stem is frequently hollow between the nodes (The node is the place where the leaf attaches to the stem).

Identifying Features of Some Grasses When They are Not in Bloom or Seed

- Big Bluestem: The lower leaves are covered with a silky hair. Young shoots are somewhat flattened. Lower leaves curl when dry. Nodes tend to be bluish. Stems are solid, not hollow. Leaves are 1/4 to 1/2 inch wide and up to 2 feet long.
- Little Bluestem: Little bluestem grows in clumps. Basal shoots are flattened and bluish-green in color. The leaves are usually folded, and usually not hairy. Leaf blades are 1/4 inch wide and 4 to 8 inches long.
- Switch grass: A prominent nest of hairs is located where the leaf blade attaches to the sheaf.
- Indian Grass: Indian grass has a sharp, claw-like ligule.

Typical Examples of Grass Plants

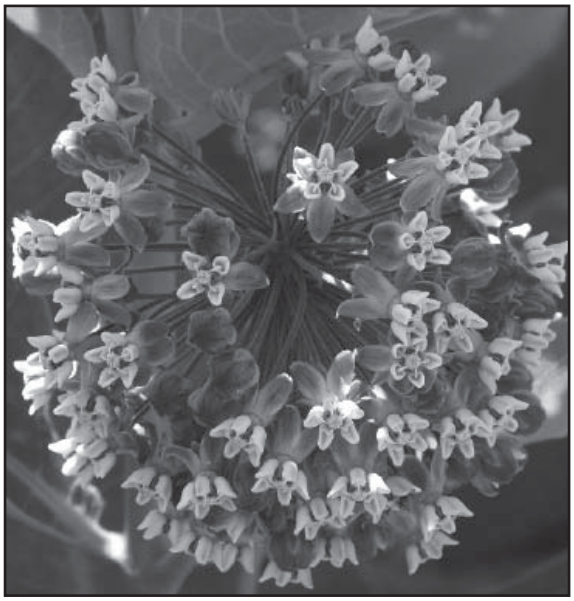


Switch Grass, Panicum virginiatum

- Plants native to North America: Dropseed, bottlebrush grass, wild rice, side oats, buffalo grass, Canada wild rye, and grasses listed above.
- Non-native plants: Timothy, Kentucky bluegrass, reed canary grass, quackgrass, wild oat, cheat grass, Bermuda grass, crabgrass, barnyard grass, foxtail, and common reed.
- Grasses to use for dissection: Any

Milkweed Family: Asclepiadaceae (a-skle-pe-a-DAY-see-ee)

The milkweed family is very large and consists of perennial herbs and climbing shrubs. Members of the family are largely tropical with Africa having the greatest concentration. Simple leaves and a milky juice in the stems and leaves identify milkweeds. This white-colored substance is a bitter tasting, toxic compound that protects the plants from being eaten by most insects. Monarch larva are unaffected by the compounds and actually prefer eating the tissues of these plants. A build up of the toxic compounds in their bodies protects monarchs from predation as larva and adults .



Common Milkweed, Asclepias syriaca

Flowers

- Flowers are small, numerous and clustered in an umbel.
- Flower parts are in groups in five.

Sepals

- Five sepals are partially joined.

Petals

- Five down-turned petals are partly joined.

Nectarhoods

- Nectarhoods are complicated structures, which involve the petals, stamens, and stigma.
- Nectaries in the nectarhoods secrete nectar that feeds the insects.
- Five upright nectarhoods are attached to the petals.

Stamens

- Five stamens are united at the base. Two pollen bags are united with a thin, sticky thread . These "saddlebags" adhere to the heads and legs of insect visitors.

Pistil

- A single pistil has a large, five-lobed stigma.

Fruit

- The fruit is a pair of follicles, usually only one matures. A follicle is a dry fruit that splits along one side.
- The seeds are flattened and crowned with tufts of long silky hairs.

Leaves and Stem

- Leaves are usually opposite or whorled, simple and generally entire.
- The stem and leaves usually have a milky juice.

Typical Examples

- Plants native to North America: Butterfly weed, common milkweed, marsh milkweed, and blunt milkweed.
- Common plants to use for dissection: Common milkweed and scarlet milkweed (non-native).

Buttercup Family: Ranunculaceae (ra-nun-kew-LAY-see-ee)

Canada Anemone, Anemone canadensis

The family name, Ranunculaceae, means "little frogs" because buttercups often grow in frog habitats. Members of this family are prevalent on every continent except Antarctica. Field characteristics for many species include a cone-shaped receptacle with numerous pistils and stamens. Often petals are missing and colorful sepals take their place. Members of the family are mostly herbaceous, some are aquatic, and a few are woody shrubs and climbers.

Flowers

- The family shows a wide variety of flower types and pollination methods . Most plants are insect pollinated, such as columbine; some are wind pollinated, such as meadowrue. The annual plants are self-pollinated.

Petals and Sepals

- Usually flowers have five sepals and petals. Some species have three to fifteen sepals with twenty-three petals or none at all. If no petals are present, such as marsh marigold, the sepals are bright-colored and petal-like. Some flowers, such as columbine, have a long, narrow spur at the back.

Stamens

- The stamens are numerous, twenty to fifty stamens form rings around the pistils.

Pistils

- One to hundred pistils are arranged in circles on a cone-like structure.

Fruit

- The fruit may form a cluster of small, dry fruits, called achenes, or a fleshy berry or a many seed-

ed follicle.

- Seeds may be dispersed in the wind with long, feathery structures; or with hooked spines that attach to passing animals; or with an oil secretion that attracts ants.

Leaves

- Leaves are alternate, usually deeply divided, toothed or lobed. Leaf bases slightly wrap around the stem.

Typical Examples

- Plants native to North America: Pasque flower, marsh marigold, goldseal, clematis, columbine, hepatica, doll's eyes, meadowrue, larkspur, anemone, buttercups, water-crowfoot.
- Non-native plants:: Tall buttercup and creeping buttercup: Common and garden plants to use for dissection: Garden columbine, creeping buttercup, clematis, and delphinium.

Sedge Family: Cyperacea (cy-per-AY-see-ee)

Plants in the sedge family look very similar to grasses. You can distinguish sedges from grasses by looking at the stem. Grasses have round, usually hollow stems; sedges have angular, triangle-shaped stems with a spongy pith. Sedges are numerous through out the world and are usually found in damp places or at water edges. These herbaceous plants grow in tufted clumps or spread with creeping rhizomes and hairy, fibrous roots. The fruits furnish food for waterfowl.

Sedges are easy to identify by family because of their three-sided stems. It is very difficult to identify individual species with more than 4,000 species.

A type of paper called papyrus comes from a sedge that grew in marshes along the Nile during Egyptian times. It is now extinct.

Troublesome Sedge, Carex molesta

Flowers

- The flowers are very small and grouped in spikelets on a spike or panicle .
- Sometimes male and female flowers are on different parts of the spike.

Bracts

- Instead of sepals or petals, a sedge floret is

surrounded by bracts. Bracts are small, modified leaves that grow just below the flower.

Stamens

- Usually three stamens, rarely 1 or 6.

Pistil

- A single pistil with one style terminating in 2 or 3 stigmas.
- The ovary is surrounded by a persistent sac-like bract called a perigynium, which looks like a tiny seed. The mature perigynium is often topped by a beak.

Fruit

- The fruit of the floret is a nutlet.

Stem and Leaves

- The leaves are usually arranged in three vertical rows along a stem and closed.
- The stems are three-sided and triangular in cross-section. You can feel the edges with your fingers is you twirl a stem.
- The stem is frequently solid between the nodes. (The node is the place where the leaf attaches to the stem.)
- Plants native to North America: Bottlebrush sedge, porcupine sedge, prairie sedge, Pennsylvania sedge, fox sedge, woodland sedge, tussock sedge, dark green bulrush, great bulrush, and hardstem bulrush.
- Non-native plants: Purple nut sedge, papyrus, umbrella flat sedge, European lake sedge, rip gut sedge, bull sedge, and sugar grass sedge.
- Sedges to use for dissection: Any

Prairie Sedge, Carex Bicknelli

Plant Family Investigations