Table Rocks Curriculum
Plant Identification

Objective: Students will investigate general plant structures as well as the characteristics and methods ***botanists*** use to identify and classify different species. Students will examine various plant specimens in preparation for field identification during their Table Rock hike. Students will also gain a basic understanding of ***dichotomous keys*** and their use.

Benchmarks Targeted: 2 and 3 (Grades 4-8)
Oregon Standards Achieved:

Subject Area: Life Science
- **Common Curriculum Goals:** Organisms: Understand the characteristics, structure, and functions of an organism.
  - **Benchmark 2:** Group or classify organisms based on a variety of characteristics. Describe basic plant and animal structures and their functions.
  - **Benchmark 3:** Describe and explain the structure and functions of an organism in terms of cells, tissues, and organs. Identify differences and similarities between plant and animal cells.

Subject Area: Scientific Inquiry
- **Common Curriculum Goals:** Collecting and Presenting Data: Conduct procedures to collect, organize and display scientific data.
  - **Benchmark 2:** Collect, organize, and summarize data from investigations.
  - **Benchmark 3:** Collect, organize, and display sufficient data to support analysis.
- **Common Curriculum Goals:** Analyzing and Interpreting Results: Analyze scientific information to develop and present conclusions.
  - **Benchmark 2:** Summarize, analyze, and interpret data from investigations.
  - **Benchmark 3:** Summarize and analyze data including possible sources of error. Explain results and offer reasonable and accurate interpretations and implications.

Length of Lesson: 45 minutes to one hour

Materials:
- ✓ Appendix A, B, and C (included)
- ✓ "So Ya Wanna Be a Botanist?" activity sheet (included at end of Botany chapter)
- ✓ "Parts of a Plant" and "Parts of a Flower" diagrams (included at end of Botany chapter)
- ✓ Trees To Know In Oregon, Oregon State University Extension Service (optional)
- ✓ Botany guide book (optional)
- ✓ Plant specimens (clippings and, if possible, photos of the entire plant)
- ✓ Pencils
- ✓ Scissors
- ✓ Tweezers
- ✓ Rulers
- ✓ Hand lenses

Key Vocabulary: ***botany, botanist, dichotomous key, petal, pistil, sepal, stamen***

Background:

What is *Botany*?

Botany is the study of plants. Studying plants is important because of the vital role they play in maintaining the health of our planet. Among many things, plants provide food, habitat, oxygen, shade, shelter, regulate climate, prevent erosion, and keep water systems clean and healthy. All species depend on plants for their survival. Plants also offer tremendous value as resources for humans. In addition to the plants that we depend on for building materials, textiles, and food staples, over 100 types of medicines used today come from plants! Furthermore, plants are important for their aesthetic value, i.e., the beauty they provide in gardens, landscaping, and nature.

What Do *Botanists* Do?

Scientists who study plants are called ***botanists***. ***Botanists*** are experts in the identification and classification of plant species. ***Botanists*** study the ecological relationships of plants including the habitats where they are typically found and their interactions with other organisms. ***Botanists*** identify and classify plants by making detailed observations of their structures. Characteristics of roots, stems, leaves, and reproductive structures (e.g., cones or flowers) provide useful information for ***botanists***. It may be a good idea to introduce students to some of the variations in leaves (margins, shape, size, location on stem) and reproductive parts they are likely to encounter in the plants they examine (see Appendix A and "Parts of a Plant" and "Parts of a Flower" diagrams).

Botanists not only identify plant species, they also classify species into groups based on their evolutionary relationships. Species which are more closely related and which have diverged more recently from a common ancestor are grouped together. By comparing a species with its closest relatives, we may be able to see its unique adaptations in a new light. This helps us understand a plant species role in an ecosystem.

What is a *dichotomous key*?

When ***botanists*** encounter an unfamiliar plant, they often use a ***dichotomous key*** to identify it. A ***dichotomous key*** is a series of questions about the plant, each with two possible answers. As the botanist progresses through the key, the field of possibility is gradually narrowed until the plant's identity is known. Students will use a ***dichotomous key*** in this activity.

Procedure:

Preparation:

It is recommended you complete the "Pollination Partners" activity to familiarize students with plant parts and adaptations plants have with their pollinators before attempting this activity.

Many plant identification books include a ***dichotomous key***. The book <u>Trees to Know in Oregon</u> has a great example. To practice using a key prior to identifying plants create a ***dichotomous key*** using students in your class. Refer to Appendix B for an example. Draw the key on the board where all students can see it. Select one of the students from the key for the class to practice "keying out." Each branching point in the diagram represents a question with two possible answers; guide the students through these questions until they arrive at the subject's identity.

Activity:
Start by reviewing the "Parts of a Plant" and "Parts of a Flower" diagram with your students. For this activity, collect plant specimens beforehand and bring them into the classroom. If possible, collect plants included in the key in Appendix C. The species in this key are common in our region and in the spring should be easy to find and collect in your school yard or at a local park. For tree species, if you have copies of the book Trees to Know in Oregon for students to use, you can bring in specimens of native trees and use the key in that book (most ornamental species found in gardens and city parks are nonnative and therefore will not be found in guidebooks to the plants of our region). For each plant, try to bring in stems with flowers or cones (reproductive structures) as well as leaves. You may also want to bring in photographs so students can see what the entire plant looks like. In the classroom, divide students into teams of two or three members and have each group investigate one or more plant specimens. Have students use the "So Ya Wanna Be a Botanist?" activity sheet to make detailed notes of their plant.

Grades 6-8: Direct each team of students to investigate a mystery plant. Encourage students to make observations of as many characteristics of the plant as possible before they begin the keying process. Use the "So Ya Wanna Be a Botanist?" activity sheet to aid students in making observations. Making a diagram or sketch of the plant may also be useful. Next, have the students use the key in Appendix C or, if it is a tree, use the book Trees to Know in Oregon to determine the identity of their tree. You can use a botany guidebook to help identify plants. Have them observe and identify as many specimens as time and attention spans permit.

Adaptations:
Start mystery plants from seeds in the classroom and incorporate information about plant biology. Make sure to include plant structure, life cycle, adaptations, and habitat requirements for each plant. Once the mystery plants are grown, have students identify them using field guides. Keep a record of the seeds you planted to verify student identifications.

Extensions:

- Students can create an informational display about the plant they investigated. Students might choose one native plant and one nonnative plant to compare and contrast. Displays could be presented at the school.
- On your Table Rock hike, instruct students to look for plants they are already familiar with from this lesson.
- **Grades 6-8:** Bring in another set of plant specimens (nonnative species are acceptable) and have students work in groups to create a dichotomous key to identify the plants. The actual identities of the plants do not need to be known; they can simply be referred to as Plant #1, #2, etc. This exercise will allow students to practice identifying plant parts and familiarize themselves with different types of plants.

- **Grades 6-8:** Once students have correctly identified their plants, they might research these plants native habitats, adaptations, seed dispersal, predators, symbiotic relationships (e.g., mutualism or parasitism), medicinal qualities, or economic values. Students can then give short oral presentations to the class. A good resource for this kind of information is the USDA website: <http://plants.usda.gov/>.

Discussion Questions:

Why is it important for *botanists* to identify and study plants?
Many plant species worldwide remain undocumented or have not been studied. Scientists estimate that at least one-sixth of the world's plant species are still unknown to science. That means that there are at least 50,000 plant species still waiting to be discovered! These plants could provide valuable resources to humans as food or medicine. Because plants play a vital role in the health of our planet, it is also important we understand the specific niche (or role) they fulfill in their native environments. In addition, their aesthetic values have inspired botanists, artists, and gardeners alike. Plants bring beauty to our lives by enriching our innate curiosity about the natural world.

Using the plants the students explored, what structures or characteristics were the most useful in the identification process?
*Answers based on students observations. Students may mention stem structure (woody vs. herbaceous), leaf shape, leaf texture, number of **petals**, number of **stamens** or **pistils**, growth form (herb, shrub, tree, vine), flower color, arrangement of flowers in clusters.*

Were there certain types of leaves or flowers (or other structures) that were common to more than one plant?
Students may mention cones, needles, compound leaves, or composite flowers (e.g., dandelions, daisies, and sunflowers), among other things.

Why might some plants have different shaped, scented, or colored flowers?
Differences in flowers often are adaptations to different pollinators (see info in the "Pollination Partners" lesson, also included in the Botany chapter).

References:

Jensen, Edward C., and Charles R. Ross. Trees to Know in Oregon. Corvallis: University of Oregon Extension Service, 2003.

PLANTS Database. 29 October, 2007. United States Department of Agriculture, Natural Resources Conservation Service.13 February 2008 <http://plants.usda.gov>.

Proctor, John and Susan Proctor. Color in Plants and Flowers. New York: Everest House Publishers, 1978.

Tangley, Laura. "Flowering Finds in Our Own Backyards." Fall Line: Consulting Foresters/Timberland Managers. 2002. Fall Line Consultants, LLC. 10 March 2008 <http://home.flash.net/~falline/ocrEndangered.htm>.

Appendix A: How to identify Trees and Shrubs

Plant Types:

- **Trees and Shrubs:** Trees are woody plants that typically have one main stem, or trunk, and are over 20 feet tall at maturity. Shrubs are also woody plants but they typically have multiple stems and are less than 20 feet tall at maturity.
- **Broadleaves:** Broadleaves have wide, flat leaves, seed producing fruit, and hard wood. Most broadleaved species in this area are deciduous which means they drop their leaves in winter. Some species, like the Pacific madrone or the manazanita, are evergreen.
    - **Conifer:** Many conifers have leaves shaped like needles and a few have leaves shaped like scales; for example, incense cedar. Conifers typically shed leaves throughout the year. Many grow well at high elevations where they are able to start growing as soon as temperatures rise above freezing. Some conifers are deciduous, such as the western larch, which drops its leaves in the winter. Conifers on the Table Rocks include ponderosa pine, Douglas fir, and incense cedar.
- **Evergreen:** Evergreen plants have leaves year-round and most have needlelike or scale shaped leaves. Some evergreen plants have broadleaves. The broadleaf evergreen plants that grow on the Table Rocks include Oregon grape, manzanita, buck brush, and Pacific madrone.
- **Deciduous:** Deciduous plants generally have broad leaves and drop their leaves seasonally. However, the western larch has needle-like leaves but is a deciduous conifer. Growing new leaves every year takes a lot of resources and deciduous trees typically grow in areas where the soil is nutrient-rich and water is available during the growing season (i.e., near bodies of water or regions that get plentiful summer rain). Examples of deciduous trees on the Table Rocks are white oak, black oak, and willow.
- **Needles vs. Deciduous Broad Leaves:** Most evergreen plants in this region have needlelike leaves. These leaf shapes minimize surface area and contain a thick, waxy covering helping conifers retain moisture during the hot, dry summers and cold, dry winters. Understory plants that live in shady environments often have deciduous broad leaves. Maximizing the surface area of the leaves is an adaptation that allows plants to absorb as much light as possible. Even within one species, individuals growing in the shade often have larger leaves than individuals in sunny areas. While hiking the Table Rocks, compare the leaf size of poison oak growing in the shade vs. in the sun.
- **Hairy Leaves:** Hairs on the leaf may be an adaptation to make it harder for herbivorous insects to reach the leaf surface. Hairs also may help minimize evaporative water loss by slowing air currents around the leaf, and they may shade the leaf, preventing overheating. Some hairy-leaved plants from the Table Rocks are Indian paintbrush, southern Oregon buttercup, lupine, Oregon sunshine, shaggy horkelia, and mountain mahogany.

- **Succulent Leaves:** These thick, fleshy leaves are specialized to store water, and often occur in plants that occupy arid habitats. Succulent leaves occur in many members of the stonecrop family, such as the familiar ornamental jade plant.

- **Some Unique and Extreme Leaf Adaptations:** The leaves of cacti are modified into spines and the thick green stem has taken over the job of photosynthesis. This is an adaptation to deter herbivores and minimize water loss as a thick stem is better able to retain water than foliage. The water hyacinth has leaves with bases that are swollen with air pockets, which function like buoys to help the plant float. In carnivorous plants such as the Venus fly-trap and the pitcher plant, the leaves are insect-catching devices.

Reproductive Structures: (refer to the “Parts of a Plant” and “Parts of a Flower” diagrams)

Cones:
Conifers predate the flowering plants. They have no flowers, but their ovules are borne on the cone scales instead of enclosed within the ovary of a flower. Pollen penetrates the cone scales while the cone is still closed; after fertilization and ripening of the ovules, the cone opens and the seeds are released.

Flowers:

- **Stamens and Pistils:** Flowers may be male (containing stamens but no pistil), female (containing at least one pistil but no stamens), or, most commonly, bisexual (containing both male and female parts). Most flowers have one pistil and several stamens, though in some primitive groups, flowers contain multiple pistils. Botanists use the number and positions of these sexual parts of the flower to help them identify and classify plants.

- **Petals:** Evolutionarily speaking, petals are modified leaves. Their function is to attract pollinators; hence their vivid colors and alluring fragrances. Petals of many flowers also have nectar-producing glands called nectaries. The petals collectively are known as the corolla. In many flowers, the petals have become fully or partially fused together. In the case of a partially fused corolla, we speak of the “corolla tube” (the fused portion) and “corolla lobes” (the free portions). Botanists use the number, shape, size, and degree of fusion of the petals to help them identify and classify plants.

- **Sepals:** In most flowers there is a second set of modified leaves beneath the petals. These are typically smaller than the petals and more green and leaf-like. They are called the sepals. As with petals, the sepals may be fused to each other to form a tube. Usually, the number of sepals is equal to the number of petals.