Tree ID

Adapted from: An original Creek Connections activity.
Creek Connections, Box 10, Allegheny College, Meadville, PA 16335

Grade Level: Basic, intermediate, or advanced

Duration: 20-45 minutes

Setting: Classroom

Summary: Students identify various types of leaves from common Pennsylvania trees. They distinguish between trees that are found near waterways versus those that are only found in the uplands.

Objectives: Students will be able to identify many common Pennsylvania trees and categorize trees based on their proximity to waterways.

Vocabulary: riparian zones, buffer, climax community, succession, invasive species, native species, taxon, binomial name, dichotomous key, out-compete, leaf terminology (simple vs. compound, alternate vs. opposite, lobed, serrated)

Related Module Resources:
- "Riparian Buffer Basics" Fact Sheet
- Articles: "Trees and the Bay," "Wood in Water: The Forest's Critical Gift to the Life of a Stream"

Materials (Included in Module):
- Mystery Tree Leaves Binder
- Mystery Tree Sheets
- Tree ID Data Sheets
- "Streamside-Upland Moisture Gradient" overhead transparency
- 4 Tree Finders (dichotomous keys)
- 3 Eastern Trees Peterson Field Guides
- 3 National Audubon Society Field Guide to Trees-Eastern Region
- 2 Tree Identification Books
- Overhead transparencies of Figures1, 2 & 3, and 4.

Additional Materials (NOT Included in Module):
- Dry erase marker, overhead projector

ACADEMIC STANDARDS:

(ECOLOGY AND ENVIRONMENT)

7th Grade
4.1.7.D. Explain and describe characteristics of a wetland.
- Recognize the common types of plants and animals.

**NOTE: Riparian areas frequently contain wetlands or are considered to be wetlands.*

4.3.7.C. Explain biological diversity.
- Explain the complex, interactive relationships among members of an ecosystem.
- Explain how diversity affects ecological integrity of the natural resources.

4.4.7.C. Explain agricultural systems' use of natural and human resources.
- Analyze the needs of plants and animals as they relate to climate and soil conditions.

4.7.7.A. Describe diversity of plants and animals in ecosystems.
- Select an ecosystem and describe different plants and animals that live there.

10th Grade
4.1.10.C Describe the physical characteristics of a stream and determine the types of organisms found in aquatic environments.
- Identify terrestrial and aquatic organisms that live in a watershed.

4.1.10.D. Describe the multiple functions of wetlands.
- Analyze wetlands through their indicators (e. g., soils, plants, hydrology).

4.3.10.C Explain biological diversity as an indicator of a healthy environment.
- Explain species diversity.
- Analyze the effects of species extinction on the health of an ecosystem

12th Grade
4.6.12. A. Analyze the interdependence of an ecosystem.
- Understand how biological diversity impacts the stability of an ecosystem.

4.7.12. A. Analyze biological diversity as it relates to the stability of an ecosystem.
- Examine and explain what happens to an ecosystem as biological diversity changes.
- Explain the relationship between species' loss and bio- diversity.

(SCIENCE AND TECHNOLOGY)

7TH Grade
3.3.7.A. Describe the similarities and differences that characterize diverse living things.
- Explain how to use a dichotomous key to identify plants and animals.

10th Grade
3.3.10.A Explain the structural and functional similarities and differences found among living things.
- Identify and characterize major life forms according to their placement in existing classification groups.
- Describe organizing schemes of classification keys.
- Identify and characterize major life forms by kingdom, phyla, class and order.

BACKGROUND:

Riparian zones are the areas adjacent to waterways. Ideally, these areas are biologically diverse and consist of trees, shrubs, and grasses that create a **buffer** between the waterway and adjacent land use. Forested riparian buffers are most desirable and are generally

the **climax community** of undisturbed streamside areas. A climax community is a community that has reached a stable composition as a result of **succession**, or the replacement of populations in a community by better-adapted populations over time. However, succession in many riparian areas has been disrupted by land uses such as agriculture, industry, mining, and construction, and forested climax communities have not been reached. Now that the countless benefits of riparian buffers, including water quality protection, wildlife habitat, and erosion and flood mitigation (reduction), are becoming better known, many landowners and government agencies are seeking to restore riparian buffers throughout Pennsylvania. Before doing so, however, they need to familiarize themselves with the types of trees that are typically found in riparian forests. This helps them determine which trees to plant in the restored riparian buffer.

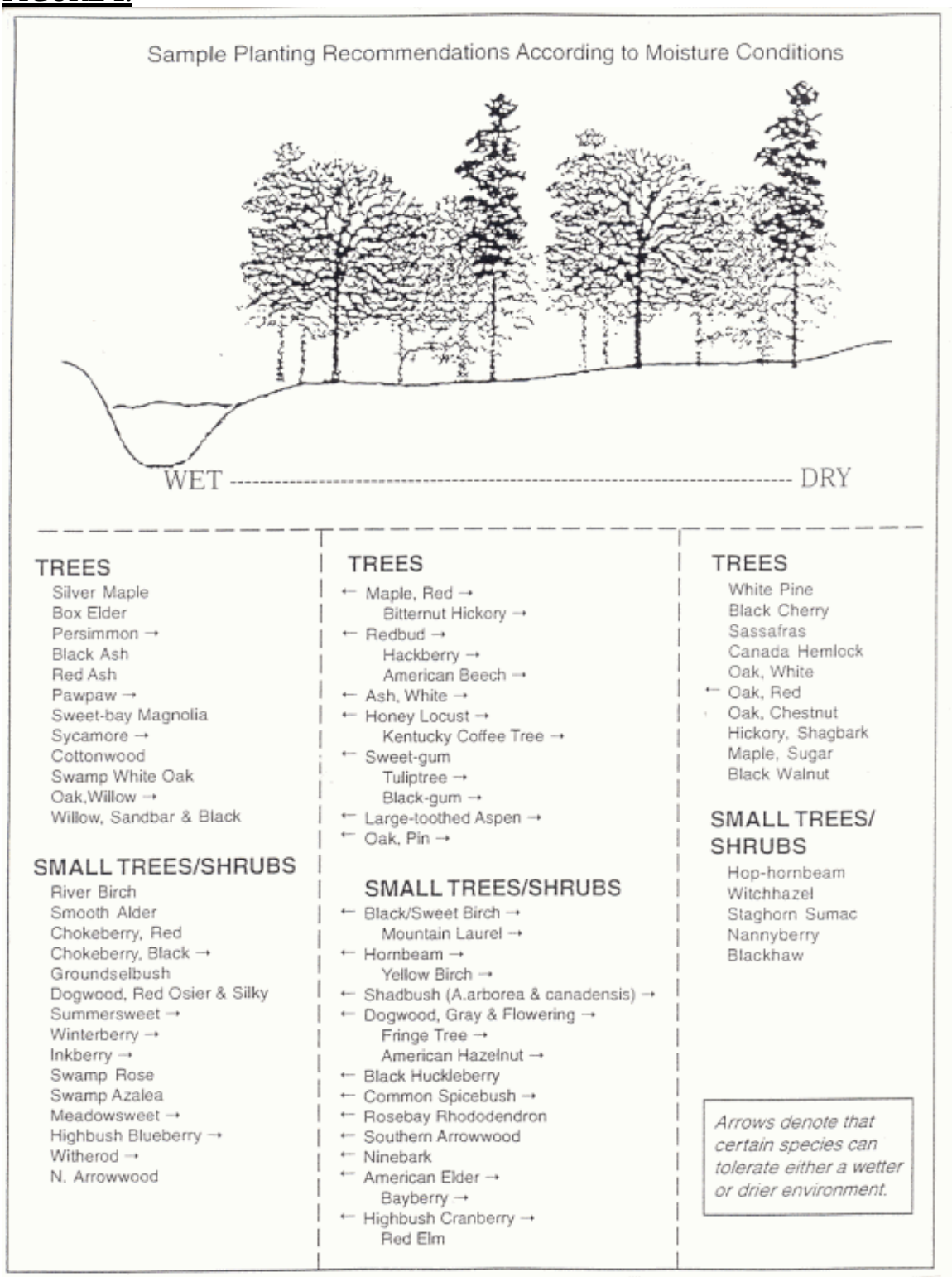
When planning a restoration effort, it is important to select trees that are appropriate for the conditions at the planting site. For example, riparian areas are low-lying and often inundated during high stream flow conditions. Therefore, riparian trees must be moisture tolerant or water loving. Furthermore, the climate of the planting site must be taken into consideration. For example, the moisture tolerant mangroves characteristic of the Florida Everglades would not be successful in the cooler riparian areas of the Northeast. According to the United States Department of Agriculture (USDA), of the more than 150 species of trees found in Pennsylvania, silver maple, box elder, persimmon, black and red ash, magnolia, sycamore, cottonwood, swamp white and willow oak, and sandbar and black willow do best in the wettest conditions right next to waterways. Slightly farther away from waterways in somewhat drier areas, red maple, bitternut hickory, American beech, white ash, honey locust, tulip tree, and pin oak, among others, thrive. Upland in even drier conditions, white pine, black cherry, sassafras, hemlock, red, white and chestnut oak, shagbark hickory, sugar maple and black walnut flourish. Various species of small trees and shrubs also tolerate different moisture conditions and would be appropriate to plant in riparian areas. (See Figure 1. for more information.)

Planting guides, such as Figure 1 below, are useful places to start when planning a riparian restoration tree planting effort. It is also important to be able to identify common Pennsylvania tree species. For example, one could purchase saplings or seeds at a home and garden store; however, to save money, one could also collect saplings or seeds to plant from natural riparian areas. Although the store bought varieties would most likely be labeled with the plants' common names, the collected saplings or seeds would not be.

Another important reason to identify trees is that riparian areas, because of their position along waterways, an ideal route for the dispersion of seeds, are increasingly subject to being overrun by **invasive species**. Invasive species are aggressive weed pests that propagate and **out-compete** other plants. These species must be eradicated or they can severely disrupt ecosystems by replacing **native species** (species that have grown naturally in an area since before 1600 and were not introduced by man) and destroying habitat for wildlife. Pennsylvania is home to numerous species of invasive trees, including silk tree, tree of heaven, princess tree, white poplar, common buckthorn, Norway maple, black locust, French tamarisk, sycamore maple, empress tree, and callery pear. Identifying trees helps us locate invasive species so that they can be destroyed.

Whatever the need for identification may be, field guides and dichotomous keys make the task of identifying trees much easier.

FIGURE 1.



Source: USDA Stream Side Management: Riparian Buffer Zones Fact Sheet

Tree identification relies on the fact that all trees, indeed all living things, can be divided into categories based on their characteristics. These categories, or taxonomic ranks, form a hierarchy of classification. The major taxonomic ranks are as follows, proceeding from the higher, more inclusive ranks to the lower, less inclusive ones: kingdom, phylum, class, order, suborder, family, subfamily, genus, and species. A **taxon** or taxonomic name is a name used for a group of naturally related organisms. A taxon may be used for a group at any taxonomic rank. For example, red maple, silver maple, sugar maple, and other maples represent specific members of *Acer*, a taxon recognized as a genus. The name maple is a common name that varies among languages and in regional usage. *Acer* is an internationally accepted scientific name based on rules of nomenclature. Scientific names most often have Latin or Greek derivatives. Basing the scientific naming process on a neutral language enables scientists around the world to have a common understanding of a single organism.

A **binomial name** (or two-name name) is used for the scientific name of a species. It is composed of the name of the genus to which the organism belongs, followed by its species name. The genus name is capitalized, while the species name is not; both names are italicized. For example, *Acer saccharum* is the scientific name for the sugar maple. .

Scientists often identify organisms in a taxonomic group by the prominent feature or features the individuals share. For example, species in the genus *Acer* are grouped together because they all have opposite lobed leaves. When identifying an organism, specifically a tree, in nature, it is helpful to note characteristics such as the shape and pattern of its leaves or needles, its flowers and fruit, and its bark. (See Figures 2, 3 and 4 for the terminology associated with these tree parts.) For this activity, trees will be identified based on their leaves. Some of the leaf terminology used to describe leaf characteristics are *simple* (the leaf is a single blade and is not composed of leaflets), *compound* (the leaf is composed of three to twelve leaflets), *opposite* leaves grow directly across from each other on twigs, and *alternate* leaves grow singly and are staggered on the twig. Leaves come in a variety of shapes such as *narrow*, *elliptic, heart-shaped*, or *lobed*. *Lobed* leaves have deep indentations but are not divided into distinct leaflets. Leaf edges can be toothed (irregularly or regularly) smooth, or wavy-edged.

The most precise way to identify a tree is to use a **dichotomous key.** A dichotomous key is a biological tool for identifying unknown organisms to some taxonomic level. It is constructed of a series of choices describing characteristics of that particular organism. One of the choices describes the unknown tree, while the rest do not. Each choice will lead to another set of choices until finally only one choice is left, which is the correct identification of the tree. The statements typically begin with broad characteristics and become narrower as more choices are required.

In this activity, we will focus on identifying numerous common Pennsylvania trees based on their leaves. The leaves were collected in October and November; hence, many of the leaves have lost their chlorophyll and have turned a brown, red, yellow, or orange color. Nonetheless, the shapes of the leaves are unaltered and information about the other major characteristics of the 'mystery trees' is provided to facilitate identification.

OVERVIEW:

Students work in groups to identify laminated tree leaves using field guides and/or dichotomous keys. Students then present their leaves to the class, stating the common and scientific names, the characteristics that were most useful for identification purposes, and the preferred habitat and moisture preferences of each species.

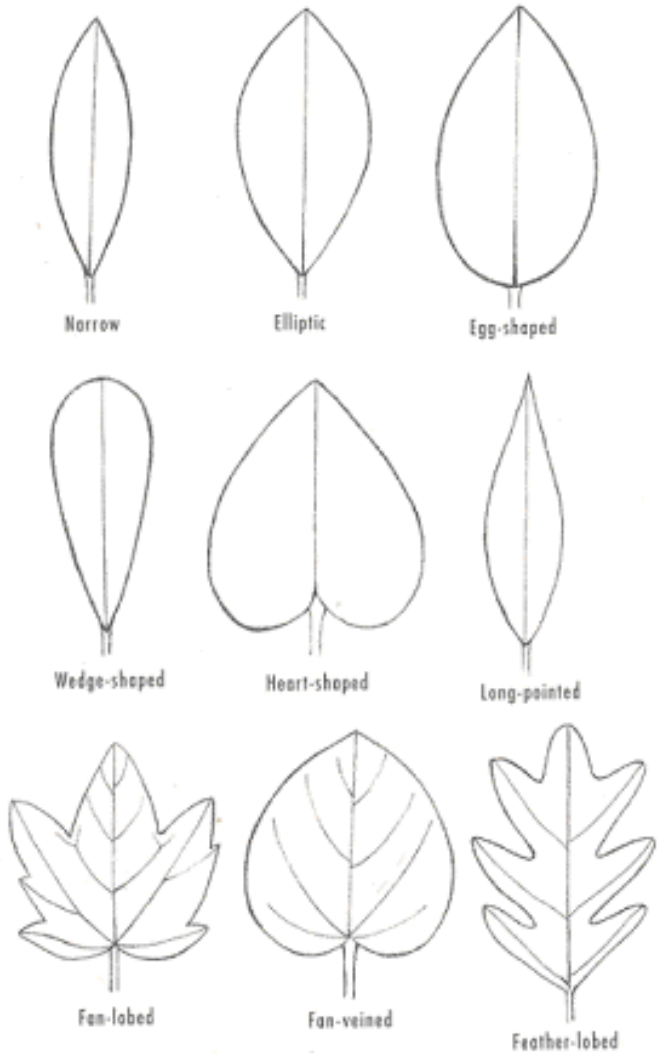


FIGURE 4. Leaf shapes.

Source: Petrids, George A. and Janet Wehr. Peterson's Field Guide to Eastern Trees. New York: Houghton Mifflin, 1988.

PROCEDURE:

Teacher Preparation:

1. Make copies of the "Tree ID Data Sheet" for all of your students.

2. Procure an overhead projector and have the "Streamside-Upland Moisture Gradient" overhead transparency ready to go.

3. Locate the tree field guides and dichotomous keys in the module.

Student Activity:

1. Have students imagine that they are planning to restore the riparian buffer next to the stream on their property. They are trying to decide what type of trees to plant immediately next to the water, which to plant in slightly drier conditions, and which to plant in the driest upland section of their buffer. They just visited an intact riparian forest buffer and collected leaves throughout the buffer but forgot to separate them by proximity to the waterway and have not yet identified the trees.

2. Have students brainstorm the types of leaf and/or tree characteristics that would be helpful when identifying trees and generate a list on the board. Use this as an opportunity to introduce students to the leaf terminology they will encounter when identifying leaves e.g., **simple** vs. **compound**, **alternate** vs. **opposite**, **lobed**, **serrated**, etc.

3. Divide the class into groups and distribute an equal number of Mystery Tree Leaves Binder and descriptions to each group as well as a "Tree ID Data Sheet" to each student. Each group should also receive a field guide (Peterson's Guide to Eastern Trees, Audubon Field Guide to Trees-Eastern Region, or The Tree Identification Book) or a dichotomous key (Tree Finder). *Note to teacher: Some species are not identified in all three of these guides. When handing out the leaves, consult the table below for leaves not to give to groups with certain guides.*

Leaf #	Common Name	Do not give to groups with these guides:
9	Witch Hazel	Tree Finder, The Tree Identification Book
13	Great Rhododendron	Tree Finder, The Tree Identification Book
15	Thicket Hawthorn	The Tree Identification Book, Peterson's Guide
18	Black Maple	The Tree Identification Book
19	Alternate Leaf Dogwood	Tree Finder, The Tree Identification Book
20	Downy Hawthorn	The Tree Identification Book
23	Domestic/Common Pear	The Tree Identification Book
27	White Willow	The Tree Identification Book
30	Domestic/Common Apple	The Tree Identification Book
34	Dotted Hawthorn	The Tree Identification Book

4. Have students use their field guide and/or dichotomous key to identify the trees to which the leaves belong. Each laminated leaf is numbered. There is additional information on the " Tree ID Data Sheets" next to the number corresponding to the number on the laminated leaf to help students correctly identify their leaves. Have

students use this information and their observations of the leaves themselves to identify the tree from which each of the leaves came. Have students record their guesses (common name and scientific name) on their "Tree ID Data Sheets" next to the corresponding number.

5. After they've identified a leaf, have the students determine if the tree is an invasive species by consulting the list at the bottom of their "Tree ID Data Sheets." Students should do this for all of the leaves that their group was assigned.

6. Have students prepare to present their leaves to the class, mentioning the common and scientific names of each tree leaf and describing what leaf characteristics were most instrumental in helping them identify each leaf. They should also read the information under moisture and habitat preferences on their Data Sheets so that they can correctly place their tree along the Streamside-Upland Moisture Gradient.

7. Have each group present their leaves. Have the "Streamside-Upland Moisture Gradient" overhead transparency projected so that students can write the names of their trees in an appropriate location on the gradient at the end of their presentation of each tree leaf. Use a dry-erase marker to write on the overhead transparency.

DISCUSSION:
Which leaves were easiest to identify? Most difficult?
Allow students to respond.

What resource was most helpful in identifying the leaves? *Tree Finder, field guide, prior knowledge, etc.*

How does one use a dichotomous key to identify unknowns, in this case, tree leaves?
Have the groups that used the Tree Finders explain the use of a dichotomous key to the rest of the class.

What were some of the similarities and differences among leaves of the same species? Among leaves of different species? *For differences among leaves of the same species, have students notice that leaves from of the same species are generally similar but could have minor or even major differences in shape, size, etc. Fore example, white mulberry and sassafras leaves come in a wide variety of shapes. Show examples of these leaves to the class. Compare leaves of the same species that have major differences to human being—we are all members of the species Homo sapiens but are very diverse. You might want to go into a brief discussion of biodiversity at this point. For differences among leaf species, let students brainstorm.*

Have any of you noticed any of these leaves on school grounds or in your yards? If so, what were the moisture conditions like where the tree was located?
Allow students to respond.

How many different kinds of trees did we identify today? What is the scientific term for "many different kinds of living things"? *Count the number of tree species identified. Biodiversity.*

If you were going to plant a riparian forest buffer, which trees would you plant in moist streamside areas? In slightly drier conditions? In the upland? Would you plant one type of tree in each of these moisture zones or would you plant a mixture of species? Why? *Refer to the location of trees along the Streamside-Upland Moisture Gradient. It would be best to plant a variety of tree species in each moisture zone so that the riparian forest buffer is more biologically diverse. The greater the biodiversity of the buffer, the more robust and stable it is. Biologically diverse buffers and ecological communities in general are also better able to adapt to changing conditions and to resist pests.*

What would happen if you accidentally planted invasive species? *They might outcompete the native species and potentially lead to the local extinction of some of these native species. This would seriously disrupt the ecology of the area, mainly by destroying the habitat of organisms that lived in or around the native species and by destroying the food source of organisms that fed on the native trees.*

EVALUATION:

- Name four tree characteristics that are used to identify trees.
- Draw an example of a compound leaf, a simple leaf, a lobed leaf, a serrated leaf, and opposite and alternate leaves.
- Select several "mystery" leaves from the laminated collection and have students use their field guides and/or dichotomous keys to correctly identify them.
- Give students various scientific tree names and have them identify which word refers to the genus and which word refers to the species.

EXTENSIONS AND MODIFICATIONS:

- Instead of using the Mystery Tree Leaves Binder, allow the students to work on the Mystery Tree Identification sheets.
- Visit a local riparian forest buffer and use the field guides and/or dichotomous keys to identify the trees there. Have students create diagrams mapping the prevalence of different trees species at different distances from the waterway. Compare these findings to those of the main "Tree ID" activity. You may want to invite a forester, arborist, or naturalist to assist your class in the field.
- Have students collect leaves on school grounds or from the riparian buffer of a nearby stream, press and laminate them, and assemble them into a "field guide" for that particular site.
- Have students investigate the biology of why some tree species are more or less suited to moist conditions.
- Have students identify trees on the school grounds. In particular, if there are any trees on school grounds that correspond to the Mystery Tree Leaves Binder, have students draw a map of the school grounds and label the types of trees they recognize.

- If invasive species are among the trees in a local riparian forest buffer, work with the local Conservation District to develop and carry out an eradication plan if appropriate.
- Collect seeds from riparian species at a local riparian forest buffer and attempt to germinate and grow them in different moisture conditions. Keep track of which species do best in wetter or drier conditions.
- Part B of the Eco-Tones Riparian Buffers Module Activity would fit nicely as a follow up to this activity. In the Eco-Tones activity, students conduct an experiment to compare tree diversity between a riparian ecotone and an upland forest. Although tree identification is not obligatory for the Eco-Tones activity, the new tree knowledge gained by students in the Tree ID activity would certainly be applicable.

NOTES (PLEASE WRITE ANY SUGGESTIONS YOU HAVE FOR TEACHERS USING THIS ACTIVITY IN THE FUTURE):