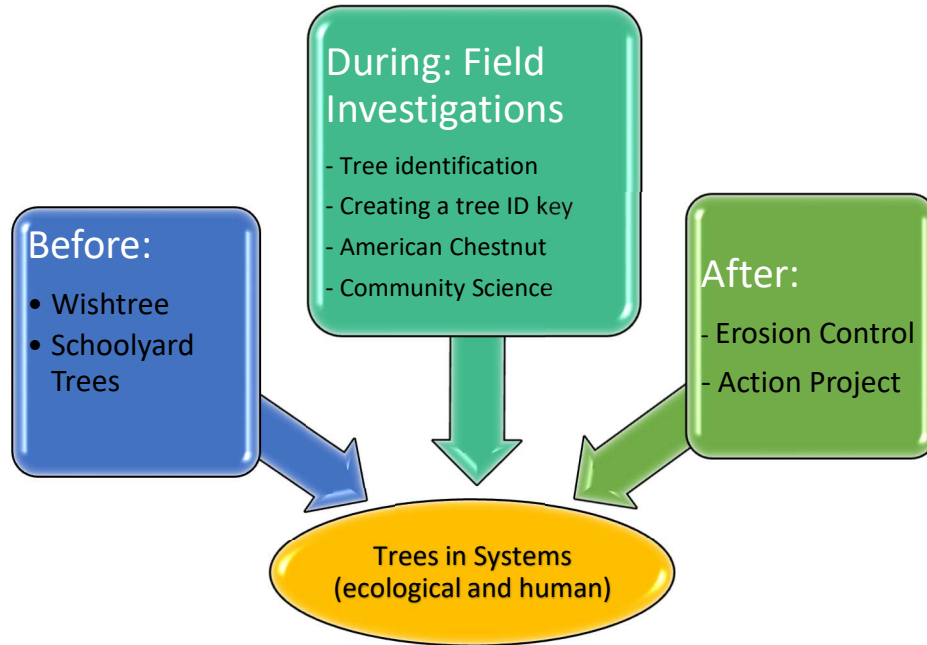


ARBOR SLEUTH



Your students will be visiting Blandy to engage in a field investigation focused on trees, tree characteristics and identification, and trees as part of ecological and human systems.

To enhance classroom connections, we have developed this lesson cluster. Field investigations are more meaningful to students when they are integrated into their curriculum. This lesson cluster can be used to: increase depth of knowledge by synthesizing a variety of components in a systems approach, promote creativity in language arts and science, increase global awareness through a local action project. **Before-visit** activities create literacy connections, and increase student awareness of trees in their schoolyard. With the **after-visit** activities, students synthesize concepts learned in the field with erosion control experiment and recommendations on schoolyard habitat improvement.



ARBOR SLEUTH

BEFORE 1: WISHTREE

VA Standards Addressed: English (2017): 5.4, 5.5, 5.7, 5.9, 6.4, 6.5, 6.9, 7.4, 7.5,7.7, 7.9, 8.5, 8.7, 8.9

Lesson Preparation & Safety:

Check for safety hazards on the grounds prior to conducting classes outdoors. Teachers are encouraged to make their own observations before teaching the activity. You may want to consult with an expert for identification of the trees & shrubs in your schoolyard.

Instructional Strategy:

1. Outside: Students choose a tree or other organism to observe then record their observations.
2. Students read an excerpt from *Wishtree*. Ask: What do we know about “Red”?
3. In pairs, diagram information about the character “Red” into “fact” and “Character” (or participant developed sort).
4. Use discussion to draw connections between fact and character development – how is background information collected?
5. Instruct: Now that you have read the excerpt, return to your tree and silently make more observations – note physical appearance, behavior, and attributes of the organism. Look for interactions with other organisms. Work with your partner to think more deeply, what do you wonder about this organism that could be answered through research or testing? Next, begin to develop character traits and personality based on your observations.
6. Return to the classroom. Students develop a short story about their organism based on the observation sessions.



ARBOR SLEUTH

I'm not just a tree. I'm a home. A community.

Folks nest on my branches. Burrow between my roots. Lay eggs on my leaves.

And then there are my hollows. Tree hollows-holes in a trunk or branch-are not uncommon, especially in trees like me who've been around awhile.

Hollows can be small enough for tiny salt-and-pepper chickadees or a family of deer mice. Or they can be quite large, big enough for an open-minded bear.

Of course, I'm a city tree. We don't get a lot of bears around here, unless they're of the teddy variety. But I've hosted more than my share of raccoons, foxes, skunks, opossums, and mice. One year I was home to a lovely and exceedingly polite porcupine family.

I've even sheltered a person. Long story. (I have lots of those, stored up the way a squirrel hoards acorns.)

Hollows happen for many reasons. Woodpeckers. Fallen branches. Lightning. Disease. Burrowing insects. In my case, I have three hollows. Two medium-sized ones were made by woodpeckers. The largest one happened when I was quite young. I lost a large branch that was weakened by wet snow during a nor'easter. It was a big wound, slow to heal, and my spring leafing that year was paltry, my fall color pale (and, frankly, embarrassing).

But eventually the hole healed, widened with the help of insects, and now, about four feet off the ground, I have a deep oval hollow.

Hollows offer protection from the elements. A secure spot to sleep and to stash your belongings. They're a safe place. Hollows are proof that something bad can become something good with enough time and care and hope.

Being a home to others isn't always easy. Sometimes I feel like an apartment complex with too many residents. Residents who don't always get along.

Still, We make it work. There's a lot of give-and-take in nature. Woodpeckers hammer at my trunk, but they also eat annoying pests. Grass cools the earth, but it also bickers with me over water.

Every spring brings new residents, old friends, and more chances for compromise. This spring in particular has seen quite the baby boom. Currently, I am home to owl nestlings, baby opossums, and tiny raccoons. I am also visited regularly by the skunk kits who live underneath the front porch of a nearby house.

This is unprecedented. Never have I sheltered so many babies. It just doesn't happen. Animals like space. They like their own territory. Normally, there would be arguing. Perhaps even a stolen nest or a midnight battle.

And certainly, there've been some disagreements. But I've made it clear that eating your neighbors will not be allowed while I'm in charge. Me, I don't feel crowded at all having so much company.

Making others feel safe is a fine way to spend your days.



ARBOR SLEUTH

It's hard to talk to trees. We're not big on chitchat.

Trees do talk to some folks, the ones we know we can trust. We talk to daredevil squirrels. We talk to hardworking worms. We talk to flashy butterflies and bashful moths.

Trees have a rather complicated relationship with people, after all. One minute you're hugging us. The next minute you're turning us into tables and tongue depressors.

Perhaps you're wondering why the fact that trees talk wasn't covered in science class, during those Mother Nature Is Our Friend lessons.

Don't blame your teachers. They probably don't know that trees can talk. Most people don't.

Nonetheless, if you find yourself standing near a particularly friendly-looking tree on a particularly lucky-feeling day, it can't hurt to listen up. Trees can't tell jokes.

But we can certainly tell stories.

And if all you hear is the whisper of leaves, don't worry. Most trees are introverts at heart.

As you've probably noticed, I'm more talkative than most trees. This is new for me. I'm still getting the hang of it.

Nonetheless, I've always known how to keep a secret. You have to be discreet when you're a Wishtree. People tell trees all kinds of things. They know we'll listen.

It's not like we have a choice.

Besides, the more you listen, the more you learn.

Bongo says I'm a busybody, and I suppose she has a point. She's my best pal, a crow I've known since she was nothing but a pecking beak in a speckled egg.

We disagree sometimes, but that is the way of all friends, no matter their species.

I think Bongo is too pessimistic for such a young bird. Bongo thinks I'm too optimistic for such an old tree.

It's true. I am an optimist. I prefer to take the long view on life. Old as I am, I've seen both good and bad. But I've seen far more good than bad.

So Bongo and I agree to disagree. And that's fine. We're very different, after all.

Bongo, for example, thinks the way we trees name ourselves is ridiculous. As is the custom with crows, Bongo chose her name after her first flight. It may not be her only name, however. Crows change names on a whim. Bongo's cousin, Gizmo, has had seventeen names.

Sometimes crows adopt human names; I've seen more Joe Crows than I've seen sunny days. Sometimes they name themselves after things that catch their fancy: Poptop, Jujube, DeadRat. They'll name themselves after aerobatic maneuvers: DeathSpiral or BarrelRoll. Or after colors: Aubergine or BeetleBlack.



ARBOR SLEUTH

BEFORE 2: Trees in your Schoolyard **modified from PLT's Trees in Trouble**

Overview: Students practice observation skills as they assess the trees in and around their schoolyard. This information will be reviewed after the Blandy visit when students will create a report on schoolyard habitat improvement. Objectives: Students will recognize symptoms of unhealthy trees and describe possible causes.

VA Standards addressed: Science (2018): 5.1, 6.1, 7.1

Instructional Strategy

Background: Trees require some of the same things people and other animals need to grow and thrive, For example, they need plenty of water, nutrients, room to grow, and a stress-free environment. If these requirements are not met, a tree may grow slowly or even die. When a person is ill, we look for symptoms to help us identify what is wrong. Similarly, distressed trees exhibit symptoms that can help determine the problem. Loss of vigor, discolored or misshapen leaves, insect bore holes and weeping wounds are all signs that something is wrong. The student pages provide specific information about signs you might find and what they might tell you about the tree's health.

Getting Ready: Plan a trip on the school grounds, in a park, in the woods, or along a tree-lined street. Make copies of student pages.

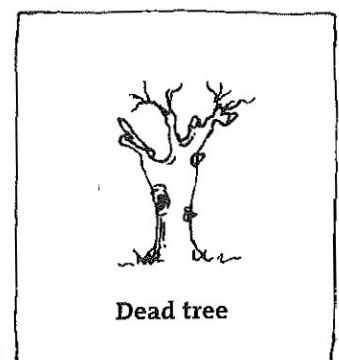
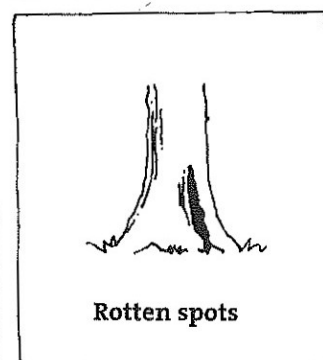
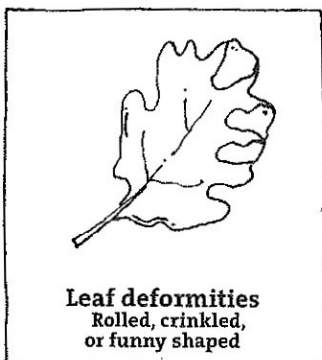
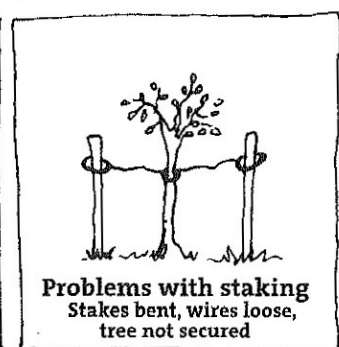
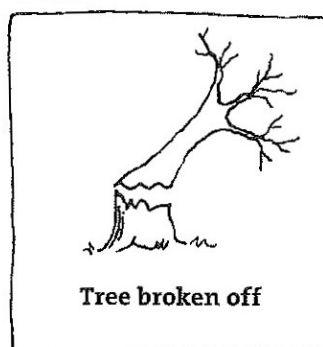
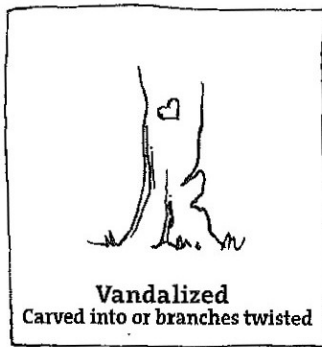
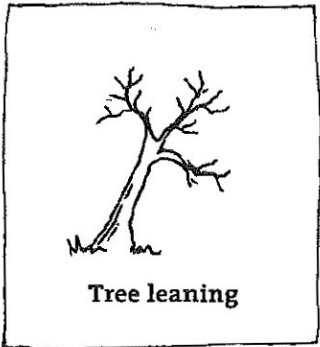
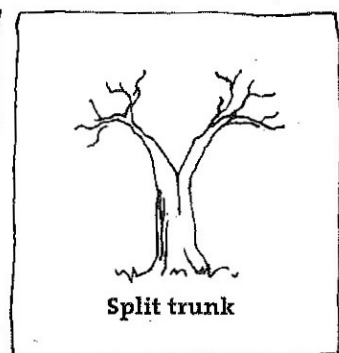
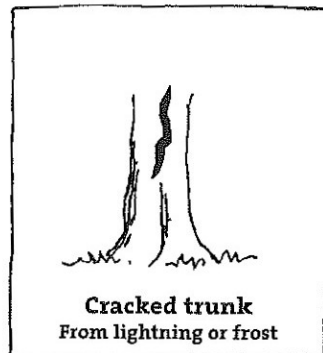
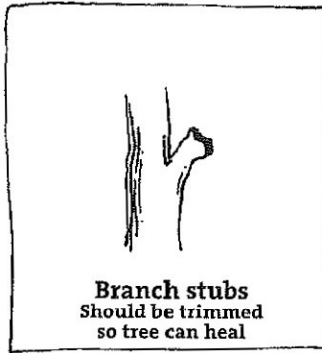
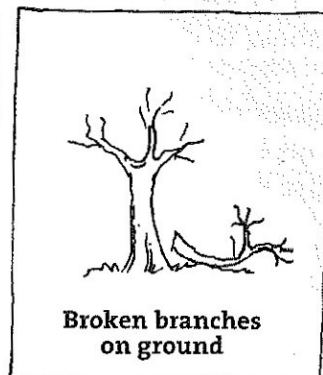
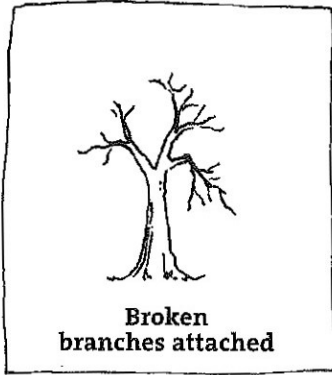
Doing the Activity:

PART A: Neighborhood Checkup

1. As a group, discuss what causes a person to get sick or become unhealthy. Responses might include poor nutrition; unclean water; a lack of food or water; toxic substances like smoke or drugs, disease, and physical injury. Students should also think of ways to prevent or combat these things, like proper diet, regular exercise, and safe behavior. With older students, ask them to name several human diseases or illnesses and their causes, symptoms, and cures.
2. Compare elements that keep humans healthy with those that keep trees healthy. (You can use a T-chart on a white board or Smart Board.
3. Tell students that they will become "tree-tectives" (tree detectives) and search their neighborhood for healthy and unhealthy trees.
4. Students should use the "tree-Tectives Trouble Guide" and "Reading Leaf Symptoms" student pages to identify symptoms of unhealthy trees. They should take additional notes and make sketches of their findings such as broken branches; unusual leaf colors or shapes; holes; trunks damaged from scratches, carvings, or graffiti; or uprooted, fallen trees that still appear to be alive.
5. Have students hypothesize about what caused the damage. Note that some problems may be more common in certain regions than in others.



Tree-tective Trouble Guide



ARBOR SLEUTH

Student Page

Reading Leaf Symptoms

Trees can't tell us when they are sick. Instead, we must interpret the signs trees show to determine what and how serious their health problems are. The leaves usually show the first symptoms of disease, insect, or physical damage. By learning leaf-reading, you can diagnose your tree's condition. Here are some common leaf symptoms and their probable cause.

<p>Ragged leaves with holes in them. Suspect insect feeding, especially if it is summer and the leaves were not showing damage earlier. But if it is springtime, and the leaves never developed properly, chances are the damage is due to either low temperatures during the bud stage or being banged around by high winds as small leaves.</p>	<p>Leaves suddenly turn brown or black. If a frost occurred a day or two earlier, that's probably the cause. Sudden high temperatures in springtime also cause problems. If no temperature extremes are noted, suspect either a leaf or a stem disease. If the symptoms show up on a branch or two at a time, trunk or branch invasion or injury is probably the cause.</p>
<p>Spots or bumps on the leaves. Insects and mites cause most leaf swellings. Leaf spots are usually the result of disease or insect activity. Chemicals, such as sulfur dioxide from nearby coal burning plants, or improperly applied fertilizer or pesticides, can cause leaf blotches, too.</p>	<p>Leaves twisted or malformed. The most common cause for this is stray herbicide drift, but insects, mites, occasionally a disease, and sometimes low temperature injury can all produce similar-appearing symptoms.</p>
<p>Margins of leaves turn brown. Moisture deficiencies or high temperature stresses are usually to blame. Sometimes root or trunk damage, including injury from road salt, can be involved.</p>	<p>Light green or yellow leaves. Probably a "micronutrient" disorder, such as iron or manganese deficiency. Curiously, trees rarely show deficiencies of the major plant nutrients such as nitrogen and potassium.</p>
<p>Leaves turn fall-colored prematurely. A serious symptom suggesting trunk or root damage of some kind. Trees can withstand a certain amount of abuse to the leaves, but leaf injury becomes serious when: heavy losses occur two or more years in a row, early season loss causes a new flush of leaves, the tree is marginally hardy to the area, or the tree is under some form of stress, such as recent transplanting. Check with your county extension agent or you may need to call an arborist.</p>	<p>Sudden leaf drop If inner leaves are dropping during a dry spell, or if a few leaves fall from throughout the tree, it shouldn't be serious. Drought or squirrels may be to blame. But if leaves are dropping heavily from one branch and then another, there is a problem somewhere with the water-conducting system of the tree-probably disease, possibly insect borers.</p>

Gayle Worý UW-Extension plant pathologist Reprinted by permission of UW-Extension



ARBOR SLEUTH

DURING: Field Investigation

VA Standards addressed: Science (2018) 5.1, 6.1, LS.1, LS.3, LS.9, LS.11; Math (2016) 5.10

During your field investigation at Blandy, your students will engage in several indoor and outdoor lessons as they explore tree characteristics and ecological interactions with other organisms, including humans.

Below is an overview of the “typical” program activities to assist you with integrating this field investigation into the classroom experiences. Field investigations may change due to weather, volume of students, or adjusted through communication with Blandy educators.

- * **Tree Identification using a Dichotomous Key:** Students use a dichotomous key and hand lenses to observe and identify several tree species. They note distinguishing features and make close observations.
- * **American Chestnut Legacy:** A truly content integrated subject, the history and ecology of the American chestnut tree is explored. Students discriminate fine details between American Chestnuts, Chinese chestnuts and hybrid restoration trees and leaves. They explore the ecology, history, and status of American chestnuts in the Eastern U.S. by learning about restoration efforts.
- * **Making your own key:** Given six tree samples, students work in small groups to construct their own dicot key and then justify their reasons for the key’s structure. This allows students to investigate structural organization of trees using notable features.
- * **iNaturalist- Community Science:** Students conduct observational studies of plant species at the Arboretum and share this information with community science networks.



ARBOR SLEUTH

AFTER 1: Trees in your Schoolyard- Take Action!

VA Standards Addressed: Science (2018) 5.1, 6.1, 7.1. English (2017) 5.7, 5.9, 6.7, 6.9, 7.7, 7.9

Instructional Strategy:

1. Reassess the schoolyard and the trees in it. Student investigation questions are:
 - What trees are on your campus?
 - What is the health of these trees?
 - Instruct students to review their notes from before the field investigation and add their reassessment to this document.
2. If your students found a “tree in trouble” in their schoolyard, they can adopt the tree as a service learning project or invite a tree expert (from a garden center, tree trimming company, or the local forestry department) to talk to your group about things they can do to help the tree.
3. Student Research- Use the questions to guide tree and shrub research.
 - What trees or shrubs can be added to the schoolyard?
 - How can you determine what trees or shrubs you could plant at school?
 - Who would you talk to at school to come up with a plan?
 - Some great online resources for tree and shrub research are:
 - <https://dof.virginia.gov/education-and-recreation/educator-resources/buy-an-id-book/>
 - <https://www.buyvatrees.com/>
 - <https://caseytrees.org/plant/school-tree-planting/>
4. Students research potential plants and consult with experts (Department of Forestry, a local arborist, building maintenance, so on) as to the feasibility of plantings in their schoolyard.
5. Students compose a persuasive paragraph or create a presentation to report on potential trees or plants to add. They should justify their reasoning using evidence from field experiences, experts, and research.



ARBOR SLEUTH

AFTER 2: Erosion Control Planning a Hillside Garden

Background: Review Part II: Using Plants to Slow Erosion found at this link <http://sciencenetlinks.com/lessons/soil-erosion/> specifically the **Planting a Hillside Garden** activity.

VA Standards Addressed: Science (2018) 5.1, 6.1, LS.1. Math (2016) 5.19, 6.12

Instructional Strategy: (Taken from <http://sciencenetlinks.com/lessons/soil-erosion/> accessed 12/17/18)

Using Plants to Slow Erosion: Divide students into groups. Each group will create a hillside garden that they think will work to slow erosion on the hillside using the material listed on the [Planning a Hillside Garden](#) student sheet. Students should follow these steps:

1. Use the activity sheet to plan their hillside garden. Save the sheets for final discussion.
2. Using measured proportions, plant their garden in the foil tin following their garden plan.
3. Grow their gardens with equal amounts of water for each garden. Decide as a group what that measurement should be for all gardens.
4. Once the garden has grown to the point where the roots have been established (two weeks should be plenty), student groups will test their garden for erosion.
5. To perform the erosion test, students should place their gardens on a block so that one end of the tray is elevated 3-4 inches. Then, they should place the opposite end on a catch bin (use aluminum foil or some other type of material that will catch the dirt and water runoff.)
6. Students should sprinkle the gardens with equal amounts of water and collect the runoff in the tray at the bottom. The amount of water will depend on how much and how long they pour. Several cups of water should produce enough runoff to test but they can add more if needed.
7. Now students should measure the amount of soil/plant runoff from each garden. Have them record this amount on their [Planning a Hillside Garden](#) student sheet. Then they should drain off the water and only measure the soil/plant runoff. Record amounts on the student sheet.
8. Refresh everyone's memory as to the central question for this lesson by writing it in a visible place: "What can be used on the hillside to slow or stop the soil erosion? Can it be stopped? To what extent can erosion be slowed or stopped?"
9. Discuss each group's results and have students write these on the garden plan sheets. Use these questions to stimulate discussion:
 - a. Which group had the least amount of runoff? Which group had the most?
 - b. How did your garden plans differ?
 - c. What might be the cause of this difference?
 - d. Can you see examples of the specific types of erosion you studied? Describe.
 - e. How would you plant your garden differently next time to limit the amount of lost soil more effectively?
 - f. How does this experiment relate to the real world?
 - g. Can you see any examples of erosion on or around your school grounds?

