



Lessons from the Bay

## Succession and Forest Habitats

### How is the Chesapeake Bay watershed affected by forest loss and fragmentation?

#### Objectives

Students will

- identify the effects of loss and fragmentation of forest habitat on migratory songbirds
- evaluate the benefits of forests to wildlife and watershed resources
- compare the percentage of forested land in the Chesapeake Bay watershed of the 17th century to the percentage forested today
- research succession of a forest over a 200-year time span and construct a timeline that charts the plants, animals, and key historic events occurring during the growth of the forest
- compare the amount of time it takes to cut down a forest to the time it takes for one to grow to maturity
- collect data on trees in the schoolyard and use the information to predict how many birds will be found in the schoolyard
- devise a plan to improve habitat for migratory songbirds in the schoolyard.

#### Background

It is estimated that, at one time, 90 percent of the Chesapeake Bay watershed was covered with forests. Today less than 60 percent is forested. Not only has the watershed lost a third of its forests since 1607, but also many that remain are fragmented. Fragmentation occurs when a forest of many acres is divided into smaller sections by the building of roads, housing developments, and shopping centers. Forest loss and fragmentation negatively impact forest wildlife, the water resources throughout the watershed, and the Chesapeake Bay itself.

The loss of forests means the loss of invaluable environmental benefits. Forests are highly effective in providing food and shelter for wildlife, shading and cooling stream water for fish, reducing erosion and flooding, filtering pollution out of rain runoff, and cleaning the air by removing carbon dioxide and releasing oxygen. Large areas of forest provide more specific benefits. Some wildlife need large unbroken areas of forest to survive; others use unbroken forests as travel corridors. When forests are fragmented, wild animals do not have as much cover from predators. They are more likely to encounter

#### Related Standards of Learning

Science:

3.1.a; 3.1.h; 3.1.j; 3.6.b; 3.6.c;  
3.8.b; 3.10.a; 3.10.b; 3.10.d; 4.1.a;  
4.1.h; 4.5.d; 4.5.e; 4.5.f; 4.9.a;  
4.9.d; 5.1.a; 5.1.h; 5.7.f; 5.7.g; 6.1;  
6.2.d; 6.7.a

Mathematics:

3.3; 4.3.a; 3.9; 4.2; 4.4.b; 4.6.a;  
4.6.b; 4.7; 5.2; 5.4; 5.9; 6.9; 5.8.d

English:

3.1; 3.3; 3.6; 3.7; 3.10; 3.11; 4.1;  
4.5; 4.6; 4.7.b; 4.7.c; 4.7.d; 4.7.e;  
4.7.g; 4.8; 5.1; 5.6; 5.7; 5.8; 6.1;  
6.2; 6.4; 6.7; 6.8

History and Social Science:

VS.1.b; VS.1.d; VS.1.h; USI.1.a;  
USI.1.b; USI.1.c; USI.1.d; USI.1.e;  
USII.1.a; USII.1.b; USII.1.c;  
USII.1.f; USII.2.b

#### Time Required

Three 45-minute sessions

#### Materials

- Flute's Journey, by Lynne Cherry (see Resources)
- history books
- 1 or more cameras
- paper and crayons
- string and index cards
- measuring tapes and meter sticks
- Internet access or tree identification guides

For each student:

- "Forests key to health of Chesapeake Bay," by Kathryn Reshetiloff (see Resources)

For each group:

- several large sheets of poster paper
- drawing and writing materials
- sections of How the Forest Grew, by William Jaspersohn (see Resources)
- clipboard (optional)

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humans and our litter, pesticides, and other toxic pollutants. Fragmentation also provides a foothold to invasive non-native species of plants and animals. With more forest edges, there are more opportunities for the non-native species to enter the forest ecosystem. This often upsets the balance within the ecosystem, as invasive species compete with native ones for food, water, and space.

The natural growth of a forest, from a field to a mature forest, is called *succession*. Just as individual animals and plants go through distinct lifecycle stages, so do forest ecosystems. Many trees have longer life cycles than humans, so we do not often think about how long it takes for a forest to grow back after we cut it down. Softwood trees such as pines take 40–45 years to reach maturity, and hardwood trees such as oaks take 80–100 years. A forest can be cut down in weeks; however, it can take up to 150 years for the forest to return to maturity, going through succession to reach what is called its mature, final, or climax stage.

A forest on land that has been completely cleared through farming, fire, or clearcutting goes through six stages in succession:

- Stage 1 –field of annual grasses and wildflowers\*
- Stage 2 –meadow of annual and perennial plants\*
- Stage 3 –brush which includes shrubs and softwood (pine) seedlings\*
- Stage 4 –pioneer forest composed of softwood (pine) trees
- Stage 5 –middle stage forest with some immature hardwood trees
- Stage 6 –final, mature, or climax forest with many large, mature trees as well as some dead, decaying ones and some seedlings growing to take their places

\*pre-forest stages

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### Procedures

#### Session 1 (45 minutes)

*Conduct this session in the classroom.*

1. Read aloud Lynne Cherry’s book *Flute’s Journey*. Stop periodically to discuss migration and the impact forest loss and fragmentation have on migratory birds like Flute. Impacts may include, for example, decreased food source, greater competition for less territory, increased vulnerability to predators, and the threat of lawn chemicals.

2. Hand out copies of “Forests key to health of Chesapeake Bay” (see Resources). Read the article aloud, or have students read it themselves—individually or with partners. If you think vocabulary may be a problem, discuss the challenging words and their meanings prior to reading.
3. As students read, have them use crayons or highlighters to color-code the following:
  - benefits of forests (in yellow, perhaps)
  - animals in forest ecosystems (in orange, perhaps)
  - plants in forest ecosystems (in green, perhaps)
4. Direct students to list forest benefits. Then have the students share their lists and discuss them.
5. Next, discuss the layers of the forest, such as canopy, understory, and shrub.
6. Compare the estimated historical maximum percentage of forested watershed land (90 percent) to the percentage of forested land that exists today (less than 60 percent). Explain to students that *cent* comes from a word meaning “hundred” and therefore *percent* means “per hundred.” So “50 percent” is the same as the fraction 50/100. Have students write the two percentages from the article as fractions and compare them.

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#### Session 2 (45 minutes)

*Conduct this session in the classroom.*

1. Write this chart on the board:

Tree	Years to Maturity	Avg. Life Span
Softwood (e.g., pine)	40–45	Over 100 years
Hardwood (e.g., oak, maple)	80–100	Hundreds of years

Ask students to compare these numbers to the number of years it takes a human to reach maturity (adulthood).

2. Divide the class into five groups. Explain the term *succession* (see Background). Then assign each group to a different stage of succession described in William Jaspersohn’s book *How the Forest Grew*. Have each group look at a different section.
  - Meadow (pp. 7–13)
  - Brush (pp. 14–19)
  - Pioneer forest (pp. 20–30)

- Middle stage forest (pp. 31–37)
  - Final/climax forest (pp. 38–51)
3. Read aloud the first page of text (page 5) in *How the Forest Grew*. Note that this book spans a period of 200 years. Ask the group assigned to the “Final/climax forest” stage to read the beginning of the first sentence on page 46 (“By the year 1927, which was one hundred and fifty years after the forest had begun...”). Ask students to determine the year the forest began ( $1927 - 150 = 1777$ ). Before groups begin to work together, ask them to skim through their assigned section of the book to find the years of the forest’s life in which their stage takes place. Then on bulletin board paper, create a chart based on the groups’ findings such as the following:

Stage	Years after Forest Began	Year
Field abandoned (Beginning)	0	1777
Meadow	2 or 3 (see <i>How the Forest Grew</i> , p. 9)	1779 or 1780
Brush	5 (see p. 14)	1782
Pioneer forest	25 (see p. 20)	1802
Middle stage forest	83 (see p. 37)	1860
Final/Climax forest	150 (see p. 46)	1927

4. Direct the groups to read their assigned sections of *How the Forest Grew* and find information about the forest habitat as it existed during their assigned stage (e.g., how it looked, what animal and plant life inhabited it). Provide each group with poster paper and other drawing materials. Instruct them to draw and label the elements of their stage’s forest habitat. Give extra sheets of poster paper to the three forest stage groups (i.e., pioneer, middle stage, and final/climax) so that they can make their drawings taller than the meadow and brush stages drawings.
5. Next, tell each group to use history textbooks or other references to find an important historic event that occurred in the year their stage started. (See “Using the Library Media Center for Project Research” and “Using the World Wide Web for Project Research” on pages 55–58 of the **Project Action Guide**.) Tell them to illustrate and label the event on another sheet of poster paper.
6. Finally, create a timeline spanning 200 years, and label it with the dates that define each stage of the forest. Then align each forest stage poster

and each historic event poster with the corresponding dates on the timeline.

7. Discuss the timeline. Ask students how long it takes for a forest to grow. Ask how long it takes to cut a forest down. Compare these lengths of time. Ask how old the students would be when a forest that begins its growth today is a pioneer forest, a middle stage forest, and a climax forest.

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### Session 3 (45 minutes)

*Perform these steps in preparation for the Session 3 activity.*

Choose 5–10 trees of different species in the schoolyard, if possible. For each tree, write a number on an index card and punch a hole through the card. Run a string through the hole and tie the cards onto the trees you have chosen.

Gather materials for the activity: camera, yardsticks, paper and peeled crayons for bark rubbing, measuring tape, and clipboards with paper and pencils.

*Conduct this session in the schoolyard.*

1. Direct students to get back into the five groups they were in for Session 2. Point out the trees you labeled. Explain that each group will gather data that will help them identify the trees. Assign one role to each group, and explain how each will do its job:
- The **tree shape group** will photograph each tree to record its branching patterns and overall habit.
  - The **bark group** will photograph the bark of each tree to record its color. They will place paper over the bark and rub it with a crayon to record its texture.
  - The **leaf group** will gather five leaves from each tree and photograph one leaf from each tree.
  - The **trunk circumference group** will use the measuring tapes to measure the circumference of each tree at a height of 50 cm above the ground.
  - The **tree height group** will find the approximate height of each tree using a traditional First American method. A group member finds the point at a distance from the tree where, when the student faces away from the tree and bends to touch his or her

toes, the top of the tree is just visible between the tops of his or her legs. The distance between that point and the base of the tree is approximately equal to the height of the tree. (This method is reliable because the student's sight line to the treetop meets the ground at approximately a 45-degree angle; thus a right isosceles triangle is formed, and the base of the triangle is equal to the height.) Group members then will alternate placing meter sticks end-to-end from the determined point to the base of the tree. This measurement will be a close estimation of the tree's height.

2. Before students begin, tell them that they can go to the trees in any order they wish. Impress upon them to take good, clear notes so that later they will be able to connect the tree number with its set of leaves, its photograph, and its bark rubbing.
3. Have students use guidebooks (see Resources) to identify each tree. (Alternatively, if a digital or instant camera was used, students may identify the trees in their photographs by using an online tree identification guide such as *Tree Fact Sheets* at [http://www.cnr.vt.edu/dendro/dendrology/syllabus/biglist\\_frame.htm](http://www.cnr.vt.edu/dendro/dendrology/syllabus/biglist_frame.htm).) Advise students to look in the guides for information on the trees' benefits to wildlife. *Does the tree provide good nesting sites, cover, nuts, seeds, or berries?* Discuss the students' findings.
4. Ask students to count or estimate the total number of trees in the schoolyard. Ask students, considering their data, how favorable a habitat the schoolyard is for birds. *How much food, shelter, and protection from predators does the schoolyard provide? What things could you do to help migratory songbirds like Flute?* Some possibilities include
  - preserving existing forests or trees since it takes so long to grow new ones
  - preserving an area and allowing it to go through natural succession to become a forest
  - planting new trees to provide food, cover, and places for birds to raise young
  - planting native shrubs and wildflowers that provide food and cover
  - installing birdhouses, birdbaths, and birdfeeders.

(See Jan Mahnken's *The Backyard Bird-lover's Guide*, in Resources, for specifics on

birdfeeders and food, birdhouses, providing water, and what plants to plant for birds.)

5. Compile all the data and photos students collected into a tree guide for the school. It could be made available for students to borrow to see if they have any of the same types of trees near their homes.

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## Resources

*American Forests*.

<<http://www.americanforests.org>>.

Bell, C. Ritchie, and Anne H. Lindsey. *Fall Color Finder: A Pocket Guide to the More Colorful Trees of Eastern North America*. Chapel Hill: Laurel Hill Press, 1991. ISBN 0960868828. (See <<http://www.laurelhillpress.com>>.)

"Building an Outdoor Classroom." Project Action Guide. *Lessons from the Bay*. 39–40.

Carlstrom, Nancy W., and Ed Young. *Goodbye Geese*. New York: Philomel, 1991. ASIN 0399218327.

Cherry, Lynne. *Flute's Journey: The Life of a Wood Thrush*. San Diego: Gulliver Books, 1997. ISBN 0152928537.

Chesapeake Bay Foundation. "If a Tree Falls in a Forest." *Watershed Action for Virginia's Environment (WAVE)*. (See <<http://www.cbf.org/home>>, or contact the Virginia Office: Capitol Place, 1108 E. Main Street, Suite 1600, Richmond, VA 23219; phone 804-780-1392.)

Edlin, Herbert L. *The Tree Key: A Guide to Identification in Garden, Field, and Forest*. London: Frederick Wayne, 1979. ISBN 0723220352.

Ehlert, Lois. *Red Leaf, Yellow Leaf*. New York: Harcourt, 1991. ISBN 0152661972.

Ehlert, Lois. *Feathers for Lunch*. New York: Harcourt, 1990. ISBN 0152305505.

*Forests Forever*. CD-ROM interactive forestry tour. Interactive Training Media, 2002. <[http://www.itm-info.com/forestry\\_series/](http://www.itm-info.com/forestry_series/)>.

- “A Forest Grows.” *Let’s Explore and Research Nature (LEARN)*. (Environmental education lesson plans for field trips to Lake Anna State Park. Contact Lake Anna State Park: 540-854-5503.)
- Frost, Robert. *You Come Too*. 1959. New York: Owl Books, 2002. ISBN 0805069852. (Includes “A Young Birch,” p. 32, and “The Exposed Nest,” p. 48.)
- Giono, Jean, and Michael McCurdy. *The Man Who Planted Trees*. White River Junction: Chelsea Green, 1995. ISBN 0930031024
- Hiscock, Bruce. *The Big Tree*. 1991. Honesdale: Boyds Mill Press, 1999. ISBN 1563978105.
- Jaspersohn, William, and Chuck Eckart. 1980. *How the Forest Grew*. New York: Mulberry Books, 1992. ISBN 068811508X.
- Mahnken, Jan, and Jeffrey C. Domm. *The Backyard Bird-Lover’s Guide: Attracting, Nesting, Feeding*. North Adams: Storey, 1996. ISBN 0882669273.
- McGovern, Ann, ed. *Arrow Book of Poetry*. New York: Scholastic, 1965. ISBN 0590336711. (Includes David McCord’s “Every Time I Climb a Tree,” p. 66, and Rachel Field’s “Something Told the Wild Geese,” p. 85.)
- “Nothing Succeeds Like Succession,” “Plant a Tree,” and “Tree Lifecycle.” *Environmental Education Activity Guide*. Project Learning Tree. Washington: American Forest Foundation, 1995. (See <<http://www.plt.org/environmental-education-activity-guide>>.)
- Phillips, Roger. *Trees of North America and Europe: A Photographic Guide to More than 500 Trees*. 1978. New York: Random House, 1993. ISBN 0394735412.
- Politi, Leo. *Song of the Swallows*. 1948. New York: Aladdin, 1987. ISBN 0689711409.
- Preller, James, and Huy Voun Lee. *Cardinal and Sunflower*. New York: Harper Collins, 1998. ISBN 0060262222.
- Reshetiloff, Kathryn. “Forests key to health of Chesapeake Bay.” *Bay Journal* 8.9 (Dec. 1998). <<http://www.bayjournal.com/issue/6677>>.
- Robbins, Ken. *Autumn Leaves*. New York: Scholastic, 1998. ISBN 0590298798.
- “Story of Succession.” *The Changing Forest: Forest Ecology*. Project Learning Tree. American Forest Foundation, 1995. <<http://www.plt.org/environmental-education-curriculum>>.

### Classroom Assessment Suggestions

- Listing and discussion of forest benefits
- Researching and creating posters for forest succession timeline
- Collecting data on trees in the schoolyard and using it to identify trees and evaluate quality of bird habitat
- Generating ideas on how to improve habitat for migratory songbirds in the schoolyard

### Extensions for Students

- Implement one or more of the ideas to improve habitat for migratory songbirds in the schoolyard. Identify birds in the schoolyard before and after steps are taken to improve the habitat.
- Draw or paint a picture showing the five layers of a forest. Then make labels for each layer on cardstock, and use Velcro to attach the cards to the correct layers. Remove them and invite other students to try to label the layers correctly.
- Read Bruce Hiscock's *The Big Tree*. This excellent book details the growth of one maple tree from 1776 until today. It is skillfully written to include explanations of concepts such as photosynthesis, counting tree rings to find a tree's age, and pollination of maple blossoms. The book is illustrated and lends itself to being read aloud. Compare the timeline on the book's dedication page to the timeline made in Session 2.
- Read other children's literature and poetry about forests, trees, and birds (see Resources).
- Take a field trip to Lake Anna State Park or another state park to learn about forests and seed dispersal, as in the activity "A Forest Grows" (see Resources).
- Experience a virtual forest with *Come Walk With Me...On a Virtual Tour of the Forest or Forests Forever interactive CD-ROMs* (see Resources).
- See "Building an Outdoor Classroom" on page 39 of the **Project Action Guide**.

*Tree Fact Sheets*. Virginia Tech Dendrology Department.  
<[http://www.cnr.vt.edu/dendro/dendrology/syllabus/biglist\\_frame.htm](http://www.cnr.vt.edu/dendro/dendrology/syllabus/biglist_frame.htm)>.

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Virginia. Dept. of Forestry. *Forest Trees of Virginia*. Illustrated fieldguide to trees in Virginia. <<http://www.dof.virginia.gov/>>.

Watts, May T. *Tree Finder: A Manual for the Identification of Trees by Their Leaves*. Rochester: Nature Study Guild, 1991. ISBN 0912550015.

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