



Teacher Guide 3: Drivers of Change & Solutions

This guide gives teachers and educators ideas and strategies for using the World Resources Institute's interactive mapping tool, SeeSouthernForests.org, in 9th-12th grade classrooms. The guide follows individual state standards for earth/environmental science, biology, geography, and social studies for six southern U.S. states: Arkansas, Florida, Georgia, Mississippi, North Carolina, and Tennessee. These standards can be found on the Teacher's Page section of the website (www.SeeSouthernForests.org/teachers), along with big ideas, guiding questions, and other resources that may be useful for incorporating the website into the classroom. This guide also makes frequent reference to the Southern Forests for the Future publication, which can be read and downloaded under the "Discover Southern Forests" tab in the green menu bar on the homepage of the SeeSouthernForests.org website.

I. SUBURBANIZATION

Sample Activity: Assess human population growth and its impact on regional and local forest ecosystems.

- Using the "hybrid" map and the "suburbanization" map theme, have students track the growth of urban and suburban areas in the South using the interactive timeline.
- Have students zoom into their local city or town using the "find an area" tool on the mapping tool interface. Begin with the latest satellite year and have students identify one or more familiar buildings, such as their school, home, or a familiar landmark. As the map is projected, use the drawing tools on the screen to mark the buildings. Then, have students mark the boundaries of the closest forested areas or reserves.
- Move the timeline forward by decade to show changes in urbanization and land cover. At each decade, ask students to describe changes they see. What was built by that date? Where were the boundaries of forested areas at that time? How much land was lost to suburbanization during that decade? In what geographic directions has growth occurred? Students can also look at the underlying historic satellite images from 1975, 1990 and
- 2000 to compare what the suburbanization map shows.
 - To change the year of the satellite image, locate the gray tool bar near the top right of the screen.
 - Click on the downward arrow to the right of the tab labeled "satellite latest," and select the appropriate year. The satellite image of the year selected will show up as the background image.
- To focus on one site, have students choose a building or housing development that was built in the past ten years (or since they were born) and research what was on the site before then. Then use the interactive timeline to compare the land cover at different time periods.
- Extend the learning by having students create a regional timeline using the supplemental file "Human-Environmental Interactions Throughout History." This file can be downloaded from the teacher landing page of the SeeSouthernForest.org website.

- The accompanying case studies (red pins) provide additional examples of how suburbanization has encroached upon forests. Photos and satellite images can be found in the individual case studies and in the Gallery section of the website to enhance this activity. There are satellite images available for one major metropolitan area per state.
- Compare the tree species map to the suburbanization map theme. What are the major tree species that face the most risk of loss over the coming decades?
- Download a free version of Google Earth. Use Google Earth to find both current and historic aerial photos of areas in your communities. How have forested areas changed? Roadways? Housing? Waterways? Schools? What will the future look like?

As a supplementary activity on land use changes, reference the Project Learning Tree module “Exploring Environmental Issues: Places We Live.” Activity 3 titled “Mapping Your Community Through Time” has students investigating the environmental components of their community and describing the development of their community through time.

II. FIRE

Sample Activity: Compare and contrast prescribed burning to wildfires in the South.

- Assign students to read the fire section of the “Drivers of Change” chapter from the *Southern Forests for the Future* publication (page 46), along with the “Prescribed Burning and Wildfires” case study and the “Fire Frequency in Southern Forests” case study on the website.
- Points to emphasize:
 - Southern forests adapted over millennia to coexist with fire of both natural and human origin.
 - Fire is a natural part of many forest

ecosystems and can be an important, beneficial asset to forest health. For example, frequent low-intensity fires are critical for maintaining the flowering plant diversity of longleaf pine forests.

- Natural fires are caused by lightning strikes.
- Early Europeans used fire as a land management tool until around the 1930s. The federal government started using fire suppression as an objective of public forestry programs in the United States because fire was considered a waste of timber and a threat to humans because of the fire and smoke hazards.
- Have students read pages 23-35 in the *Southern Forests for the Future* publication, which discuss the historic use of fire by Native Americans. Emphasize that Native Americans regularly set fires to clear brush and understory growth in order to facilitate travel, improve game habitat, and make it easier to hunt and grow food.
- Have students create a concept map showing cause-effect relationships of fire to forest ecosystems, such as longleaf pine savannahs. For example, prescribed burning (a cause) reduces fuel load and often prevents wildfires from spreading (an effect). You may also have students compare and contrast the difference between low-intensity burn fires and wildfires.
- Have students consider how the forest ecosystems would be different without fire, whether natural or prescribed. For example, fire suppression alters forest density and species composition. It also increases the probability of high-intensity wildfires that burn large acres of forest because it allows “fuel” to build up in the forest that allows the fires to burn stronger and longer. How could more fires affect soil? Animals? Plants? If these organisms adapted to low-intensity fire, they will likely be stressed by high-intensity fire.

- Ask students to consider how changes in climate may affect fires. (Changes in climate and the drought cycle may increase the probability of longer and more intense fire seasons in the South.)

As a supplementary activity on forest fires, reference the Project Learning Tree program “The Changing Forest: Forest Ecology.” Activity 7 entitled “Understanding Fire” has students explore the patterns of change in forest ecosystems due to fires. Activity 8 titled “Fire Management” has students explore why fire is part of a healthy forest ecosystem.

III. PESTS AND PATHOGENS

Sample Activity: Overview of protection

Begin by introducing the definition of pests and pathogens:

- Pests are insects and other invertebrates that are detrimental to ecosystems from a human perspective. (Emphasize that “pests” play a role in ecosystems and that negative designations -- such as “pest” or “weed” -- reflect human perspectives and cultural attitudes about the environment.)
- Pathogens are organisms such as fungi and bacteria that cause disease.
- Both can affect the health of forest ecosystems in positive and negative ways.
 - Positive: In some circumstances, a pest or pathogen can speed up decomposition and ecological succession in a forest.
 - Negative: In some circumstances, a pest or pathogen can kill trees of susceptible species, stunt tree growth, change forest species mix, reduce biological diversity, and/or increase the risk of wildfires, among other effects.
 - One example is the American chestnut blight, which decimated all the chestnuts in

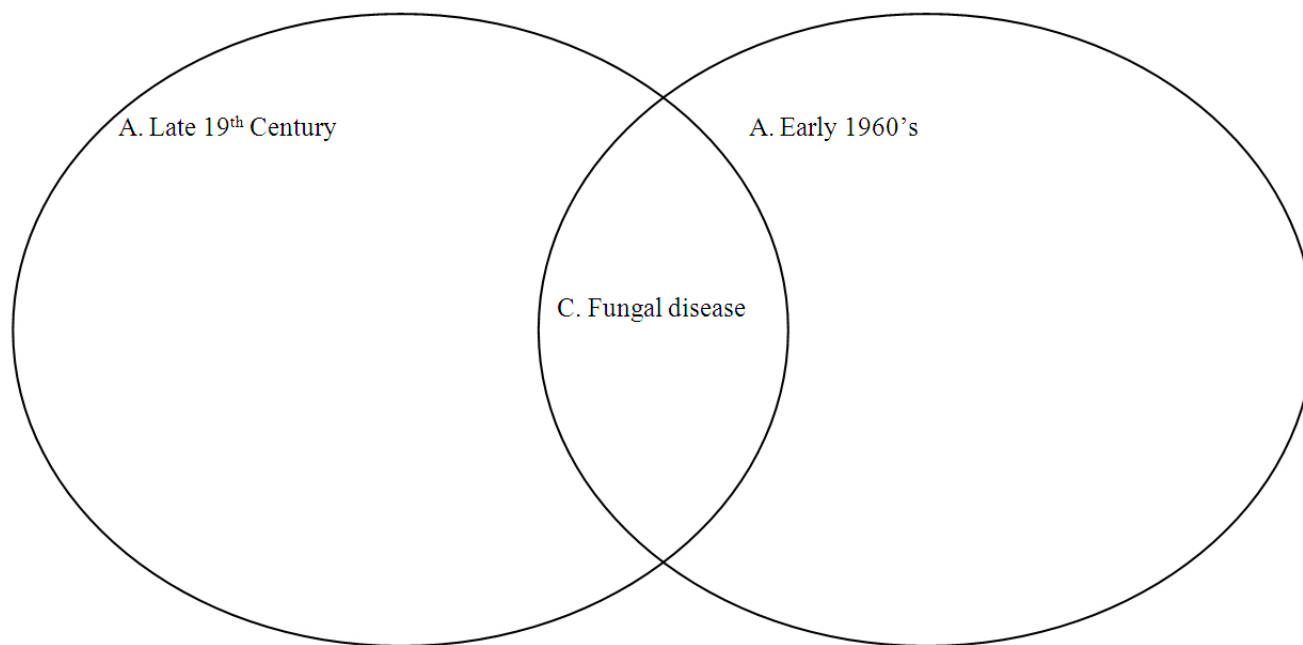
eastern North America in the early part of the 20th century. At its peak, an estimated four billion American chestnuts—up to one-fourth of the hardwood tree population—grew within its range. See box 4.1 on page 43 in the *Southern Forests for the Future* publication for more information.

- Some pests and pathogens are native; others have been introduced from other regions of the United States or other continents.
- From the “Explore Maps” section of the SeeSouthernForests.org website, select the map theme titled “Pests & Pathogens.”
- Choose four invasive pests or pathogens.
- Group students in pairs. Assign each pair two of the four pests. Mix and match the pests among the pairs of students so that there are different comparisons (Ex: Pest 1 and 3, 2 and 3, 1 and 4).
- Have students research, compare and contrast their pests based on the following criteria:
 - How/when was the pest introduced?
 - How does the pest affect tree species?
 - Is the organism fungal (a pathogen) or caused by an insect (a pest)?
- Have students record their responses in a Venn diagram (Example below)

As a supplementary activity on invasive species, reference the Project Learning Tree program “The Changing Forest: Forest Ecology.” Activity 4 titled “Home Sweet Home” has students identify different non-native species that have been introduced to North America and the effects that these species have had. Activity 5 titled “Saga of the Gypsy Moth” can be used in conjunction with the gypsy moth case study located in the “Pests & Pathogens” map theme.

American chestnut blight

Butternut canker



IV. FORESTRY

Sample Activity: Research and compare three sustainable forestry initiatives: American Tree Farm System, Forest Stewardship Council, and the Sustainable Forestry initiative.

- Select the “Forestry” map theme from the “Select Map Theme” toolbox on the right side of the screen. Use the case studies denoted by the red pins entitled “American Tree Farm System,” “Forest Stewardship Council,” and “Sustainable Forestry Initiative.”
- Have students work in groups of three. One student in each group should read and research one of the sustainable forestry initiatives, guided by these questions:
 - Who created and supported the initiative? Why?
 - What are the initiative’s goals?
 - What are the criteria or standards for certification? What is measured or evaluated in terms of environmental protection, human needs/rights, economic

development, and other factors?

- How is certification verified?

- Groups should compare and contrast responses.

As a supplementary activity on forestry, reference the Project Learning Tree module “Global Connections: Forests of the World.” In activity 6 titled “Seeking Sustainability: A Global Response” students consider whether or not a forest is being sustainably managed, and learn about international initiatives for monitoring forest sustainability. This activity can be used in conjunction with the American Tree Farm System, Forest Stewardship Council, and the Sustainable Forestry Initiative case studies located in the “Forestry” map theme.

V. SOLUTIONS:

Sample Activity: Select a forest area (that is not already protected) in your county or state and develop a proposal to sustainably manage that area. This activity can be used in conjunction with the “Forestry” activity in this guide.

- Break your class into ten groups of three (assuming your class has 30 students), and using the solutions tab (examples) from the map themes box assign each group a case study to research.
- Use the ownership map on the SeeSouthernForests.org website to determine which areas are publicly protected, and which are privately protected. Focus on areas that are under private ownership but not formally protected. Perhaps pick an area that is adjacent to a protected area to show the value of connecting already existing lands.
- Have students look at the “wildness” map and see what areas are considered the most wild.
- Have students look at the “pest and disease” theme and see if their piece of land is under threat.
- Have students refer to the “Fire” theme and see if their area is one that is experiencing a wildfire.
- Have students refer to the “forestry” theme and see whether forestry is a significant industry in their region.
- Have groups brainstorm ways to sustainably manage and protect the forest area you’ve selected. Refer to chapter 5 from the *Southern Forests for the Future* publication for some ideas.
- Have each group present their proposal, then as a class, decide the best way to manage the forest area.



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