



## ★ TREE AND FOREST HEALTH ★

History has shown us the risk of planting too many of the same species in the urban forest. Cities and forests have lost many millions of trees to foreign or species-specific diseases and insect pests. Exotic tree species can sometimes invade our forest landscapes and crowd out native species.

### Goal & Objectives

**Goal:** Students will demonstrate ways to keep trees and forests healthy.

**Objectives:** Students will

1. Determine the qualities of a healthy forest.
2. Specify the causes of the major disruptions to a healthy forest.
3. Provide reasons why forests health is important.
4. Conduct a research investigation on forest health; complete a report and present conclusions to the class.
5. Evaluate the health of the campus landscape and name ways to maintain its health.
6. Evaluate their *Tree and Forest Health* experience.

### Content Area TEKS/STAAR

**Language Arts:** 5.13 (B) interpret factual or qualitative presented in maps, charts, illustrations, graphs, timelines, tables, and diagrams.

5.24 (A) follow the research plan to collect data from a range of print and electronic resources (e.g., reference texts, periodicals, web pages, online resources) and data from experts;

5.27 (A) listen to and interpret a speaker's messages (both verbal and nonverbal) and ask questions to clarify the speaker's purpose or perspective.

**Mathematics:** 5.14 (B) solve problems that incorporate understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness.

5.14 (D) use tools such as real objects, manipulatives, and technology to solve problems.

**Science:** 5.9 (A) observe the way organisms live and survive in their ecosystem by interacting with the living and non-living elements.

5.9 (C) Predict the effects of changes in ecosystems caused by living organisms.

**Social Studies:** 5.25 (C) express ideas orally based on research and experiences.

**Technology Applications:** b (3) (D) acquire information appropriate to specific tasks.

b (4) (A) identify information regarding a problem and explain the steps toward the solution.

### Materials

- Tablet(s) or computer(s) with internet access
- Projector and screen
- Whiteboard or chart paper and markers
- Tree Trails Portfolio, Learning Log/Journal
- (Optional) Materials for tree simulation props (construction and/or chart paper, markers, paper plates, etc.)
- (Optional) Cameras or camera phones

### Time & Resources

Preparation Time: 1-2 hours

Instructional Time: 3 sessions, 45 minutes each

- Tree Cross Sections handout
- Signs of Unhealthy Trees Guide handout
- Investigative Report Outline handout
- List of Investigative Procedures handout
- List of Research Topics handout
- (Optional) Media Presentation Instructions handout
- Texas A&M Forest Service Forest Health  
<http://tfsweb.tamu.edu/foresthealth/>
- Texas Chapter International Society of Arboriculture  
<http://isatexas.com/>
- The Benefits of Prescribed Fire Video  
<http://www.nature.org/ourinitiatives/habitats/forests/howwework/maintaining-fires-natural-role.xml>
- Fighting Fire with Fire  
<http://goodfires.org/fire>

## I. Engage/Excite

- A. Large Group Discussion: Discuss and/or review how tree cookies (a thin slice or cross section of the trunk of a tree) are used by foresters to demonstrate the way the trunk of the tree functions; i.e., which part takes nutrition for the soil and distributes it to the rest of the tree and which parts send food from the leaves throughout the tree. Tell students that foresters also use cross sections for other reasons.
- B. Small Group Activity: Provide groups of two to three students with a Tree Cross Sections handout. or actual tree cookies. Tell students the tree cookie has important signs of tree health. Ask students why they think the tree rings sizes and markings are different. Have each group write their responses in their learning logs. Ask each group to share.
- C. Large Group Discussion continued: Lead the discussion to inform that foresters use the tree rings as a sign of the tree's life, its health and disruptions in its life.

*Teacher Tip: Add to the list, if students did not, signs that rings can tell if the tree had sufficient food, water, if it was crowded, if there was an insect invasion, disease, or fire, etc.*

- D. (Optional) Individual Activity: Have the students take the *Tree and Forest Health* pretest.

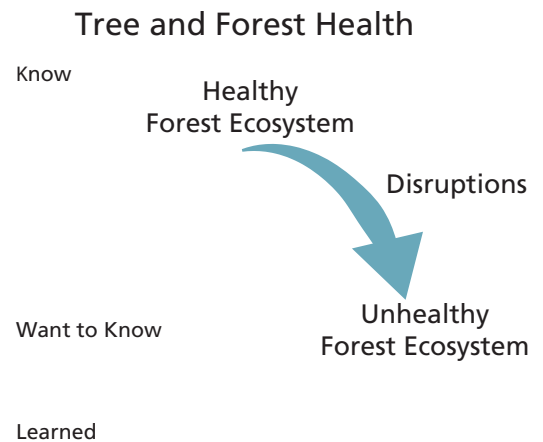
*Teacher Tip: Explain that the test is only to make sure the learning activities are appropriate and not something they already know. The pretest will help them know more about what they will be learning.*

*To administer the tests by paper, copy from the teacher lesson module. To administer the test electronically, recreate the test in an online survey program. Free programs allow the creator to see results from a class set.*

## II. Explore

- A. Large Group Discussion: Develop a concept chart for Tree and Forest Health. Include Healthy Forest Ecosystem, Disruptions (insects, diseases, etc.) and Unhealthy Forest Ecosystem. Let students know they will be investigating the meaning of each term. Add KWL to the concept chart and ask students "What they *Know*" about:

1. How and why a healthy forest is important to the ecosystem. Record their responses under Healthy Forest Ecosystem.
2. What are signs of disruptions to trees, plants and animals that affect the ecosystem. Record responses under Disruptions.
3. What are the signs of an unhealthy ecosystem. Record responses under Unhealthy Ecosystem. Let students know they are going to find answers to these questions about forest health and its importance to ecology. Afterwards they will check the chart for what they knew and learned.



## II. Explore continued

- B. Large Group Activity: Activate “Team Forest Investigators” to investigate Forest Health. Discuss the positive results such an Investigation Team could have. They will work in small groups of four or five and create an investigative documentary to answer the questions posed about what they “Want to Know” about forest health (from the KWL chart).
- C. Large Group Exploration: Before they begin their online investigation, they will start with an exploration of their own school grounds. Provide all students with a Signs of Unhealthy Trees handout, pictures and list of symptoms of unhealthy trees such as cavities in trunks or branches, many broken branches, unusual leaf shapes or colors, numerous branches without leaves, damage from carvings or lawn equipment, insect presence or evidence such as leaf chewing and rolling, holes in the bark, sawdust, etc., slime oozing from trunk or branches, mushrooms or other fungi growing from trunk, branches or roots. Take students outside with their guides to look for signs of healthy and unhealthy plants and trees and anything they think is important to the health or harm of the plants and trees. Students may make drawings or take photos of their findings.
- D. (Optional) Individual activity: Students may take their search home and look in their neighborhood and add their findings to their group’s lists.
- E. Large Group Discussion continued: Have the students return to the classroom and lead a discussion of their findings. Tell students to keep their notes in their Portfolios to include in their research investigation to get to the bottom of causes for unhealthy forests. Let students know how important they are as scientific researchers. They will take on the important investigative task to “Find the Real Culprits of the Sick Forests.”

## III. Explain

- A. Large Group Discussion continued: Provide each group with a list of Investigative Procedures and explain each step. Each group will:
  - a. Be responsible for a chapter of the investigative documentary and present to the class. They will use their laptops/tablets and go online to generate their report.
  - b. Read the narrative provided by Texas A&M Forest Service Forest Health sections, which reports factors contributing to forest health such as heat, drought, flooding, lightning, animal damage, construction damage, soil compaction, wildfire, etc.
  - c. Be given a list of online resources to use for their specific chapter.
  - d. Write a synopsis of their findings to develop their chapter. They may incorporate any resources into their report. They may include photos, graphs or other graphics as supporting evidence for their conclusions. The chapter should include evidence found on their investigative campus trip.
- B. Large Group Discussion: Explain how the students will work in small groups to investigate, report findings, write their investigative report and present their report as a chapter of the documentary. They will research five major topics: overcrowding, helpful insects, harmful insects, disease and invasive species. Provide each group with a Investigative Report Outline format to write their synopsis.
- C. Large Group Discussion continued: Project the Texas Chapter International Society of Arboriculture website and go to Arbor Pod and select Detective Dendro and ask students to

### III. Explain continued

find an investigation to view. This is an example of the type of investigation they will conduct. Later they may want to send an inquiry to Detective Dendro to investigate. ISA requests; "If you want to know more, please contact us at [eLearning@isa-arbor.com](mailto:eLearning@isa-arbor.com)."

*Teacher Tip: Provide a research report format of your choice. The report should include the following information and may be written in five paragraphs. The following is an example you may use.*

*Title: Investigative Documentary on the Real Culprit of Sick Forests*

*Chapter: Name of Investigation*

*Section I. Purpose of investigation*

*Section II. Hypothesis predicting the results*

*Section III. Research procedures*

*Section IV. Findings to include possible causes for the disruption (drought, etc.)*

*Section V. Conclusions*

*Investigators: Names of students*

D. Large Group Discussion: Provide each group of students with a list of their topic and the internet resources. The title, chapters and the resources to use are:

1. "Overcrowded, Make Room"

- Find "Thinning young pines to prevent insects and disease" article on the Texas A&M Forest Service Forest Health website under Miscellaneous
- Fires make room for new trees and prevent wildfires, review Fighting Fire with Fire on the Good Fires website.
- The Benefits of Prescribed Fire Video

2. "Insects: the Good and the Bad and the Ugly"

- Find insect information on the Texas A&M Forest Service Forest Health website under Insects
- "Useful and Ugly Insects" such as Barklice and "Ugly Insects" that are not harmful such as the Hickory Horned Devil and Giant Walkingsticks.

3. "Insects: the Good and the Bad and the Ugly"

- Find insect information on the Texas A&M Forest Service Forest Health website under Insects
- "Harmful and Ugly Insects" to certain trees such as Pine Regeneration Weevils and one "Ugly Insect."

4. "Difficult Diseases"

- Find disease information on the Texas A&M Forest Service Forest Health website under Diseases
- Students should carefully read and report the information in the first paragraphs about how diseases occur (remaining trees are weakened by drought, floods, wildfire, etc.) and how to prevent them and keep the forest healthy. Examples of the conditions contributing to these diseases are found in the sections about the particular disease: Oak Wilt, Root Rot, etc.



### III Explain continued

#### 5. "Invasive Awfuls"

- Find invasive species information on the Texas A&M Forest Service Forest Health website under Invasives
- Students should report why invasive species are harmful to our forests, found in the first few paragraphs (decrease biodiversity by threatening the survival of native plants and animals). Encourage this group to select a pest (Emerald Ash Borer) and a plant from South Texas.

### IV. Extend/Elaborate

- A. Large Group Activity: Provide a "stage" for each group to present their Chapter. Remind students of proper and appropriate audience etiquette. Remind them that each group contributes to the whole class learning experience. Sharing gives everyone input to a class project. Students should save their questions until each group has finished their report. Have students display their visuals, audios and their completed report.
- B. Large Group Discussion: After the presentations, allow students to generate conclusions about healthy and unhealthy trees and the disruptions. Record responses on the Tree and Forest Health chart.
- C. (Optional) Large Group Activity for Media Production: Explain to students that they will make a media production out of the investigative documentary report. Tell students you will help facilitate the production but they will be the directors, producers, writers and performers. Explain the Media Presentation Instructions and/or provide each student with the Media Presentation Instructions handout. Discuss the directions and ask each group to assign roles for their group.

*Teacher Tip: These are the suggested Presentation Instructions. Each group will appoint a:*

- 1. Director to introduce the Chapter Question, coordinate the performers and close the presentation.*
- 2. Producer to coordinate the research, produce the order/sequence of the presentation and present the first section of the chapter.*
- 3. Writer to gather and compile the information, record the script and present the second section of the chapter.*
- 4. Assistant Producer and Writer to help with the script, the production and conclude the presentation.*
- 5. Performers: This is a suggestion for the performers but the group may decide a different order. All students in the group should have an individual role.*

*You may want to record the presentation and/or have another class, guests, parents visit the performance. You may want to appoint a student(s) to write a playlist and provide it to students and guests. You will introduce the production and the performers and provide the final closure and acknowledgments as appropriate. You may want to divide the five presentations into two days of five to eight minute reports.*

- D. (Optional) Small Group Activity: During their presentations, the students may role play a healthy



#### IV. Extend/Elaborate continued

tree becoming unhealthy due to their specific type of disruption. One or two student(s) play(s) the tree, one or two student(s) play(s) the culprit or disrupter and one student narrates the event where the tree changes from healthy to unhealthy. Students may make and use props for their roles. For example, tree with brown paper trunk and green hair, disrupter with paper plate face of bug or disease or invasive species and narrator with microphone.

#### V. Evaluate

- A. Large Group Discussion: Review the Tree and Forest Health concept map. Ask why a healthy forest is important. Record their responses on the "What I Learned" portion of the KWL Chart. Include other ideas they have learned.
- B. Individual Activity: Have students review their Tree Cross Sections and write about the tree's life in their Learning Logs.
- C. Large Group Discussion: Discuss how the class can use their ideas to develop a class plan or list of ways to maintain and/or improve the forest health around their school or neighborhood. Have the students make a poster or bulletin of their plan to improve the forest health around their school or community and display it in the room, hall or on the school's website. They should also record their plans in their Learning Logs.
- D. Small Groups: Have each small group present their investigative report to another class and critique their own presentations.
- E. (Optional) Individual Activity: Have students take the *Tree and Forest Health* posttest. Have them compare their results to self-evaluate what they learned and what they did not know.

*Teacher Tip: You may use the results to determine the need for Extra Mileage/Attention.*

#### VI. Extra Mileage/Attention

- Extra Mileage:** Have students pose a hypothesis to investigate a question that they are interested in investigating. Have them conduct their research and present it at a convenient time for extra credit, a prize, a privilege, etc. Record in their Learning Log.
- Extra Attention:** Have students brainstorm ideas about their part of the report that they liked the most and why and the part they did not like, why and what they can do about their dislikes.

Tree Trails curriculum was developed by Texas A&M Forest Service in cooperation with Texas Urban Forestry Council and was supported by a grant from the USDA Forest Service.

# Student Assessment / Pretest and Posttest

## *Tree and Forest Health*

Directions: Answer the following questions by rating your response 1-5, with 5 being the highest.

Key: 1 = Not Sure    2 = Poor    3 = OK    4 = Good    5 = Great

- |    |  |   |   |   |   |   |
|----|--|---|---|---|---|---|
| 1. | I can write an investigative report.   | 1 | 2 | 3 | 4 | 5 |
| 2. | I can describe three disrupters to a healthy forest.   | 1 | 2 | 3 | 4 | 5 |
| 3. | I can analyze and explain the signs of an unhealthy forest.                                    | 1 | 2 | 3 | 4 | 5 |
| 4. | I can describe the results of an overcrowded forest.   | 1 | 2 | 3 | 4 | 5 |
| 5. | I can provide examples of a harmful forest disease.  | 1 | 2 | 3 | 4 | 5 |
| 6. | I can provide an example of a harmless forest insect.  | 1 | 2 | 3 | 4 | 5 |
| 7. | I can provide an example of a harmful invasive species.  | 1 | 2 | 3 | 4 | 5 |
| 8. | I can help my family learn more about how to improve and maintain a healthy forest.            | 1 | 2 | 3 | 4 | 5 |
| 9. | I am interested in knowing what I can do to help our forest ecosystem thrive and stay healthy. | 1 | 2 | 3 | 4 | 5 |

Comments:



# Media Presentation Instructions

Each group will appoint a:

1. **Director** to introduce the Chapter Question, coordinate the performers and close the presentation.

Group Member \_\_\_\_\_

2. **Producer** to coordinate the research, produce the order/sequence of the presentation and present the first section of the chapter.

Group Member \_\_\_\_\_

3. **Writer** to gather and compile the information, record the script and present the second section of the chapter.

Group Member \_\_\_\_\_

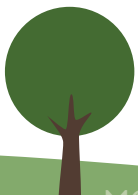
4. **Assistant Producer and Writer** to help with the script, the production and conclude the presentation.

Group Member \_\_\_\_\_

5. **Performers:** This is a suggestion for the performers but the group may decide a different order. All students in the group should have an individual role.

Group Members \_\_\_\_\_

\_\_\_\_\_





# Research Topics

## 1. "Overcrowded, Make Room"

- Find "Thinning young pines to prevent insects and disease" article on the Texas A&M Forest Service Forest Health website under Miscellaneous, <http://tfsweb.tamu.edu/foresthealth/>
- Fires make room for new trees and prevent wildfires, review Fighting Fire with Fire <http://goodfires.org/fire>
- The Benefits of Prescribed Fire Video, <http://www.nature.org/ourinitiatives/habitats/forests/howwework/maintaining-fires-natural-role.xml>

## 2. "Insects: the Good and the Bad and the Ugly"

- Find insect information on the Texas A&M Forest Service Forest Health website under Insects, <http://tfsweb.tamu.edu/foresthealth/>
- "Useful and Ugly Insects" such as Barklice and "Ugly Insects" that are not harmful such as the Hickory Horned Devil and Giant Walkingsticks.

## 3. "Insects: the Good and the Bad and the Ugly"

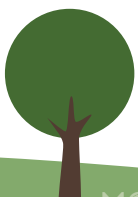
- Find insect information on the Texas A&M Forest Service Forest Health website under Insects, <http://tfsweb.tamu.edu/foresthealth/>
- "Harmful and Ugly Insects" to certain trees such as Pine Regeneration Weevils and one "Ugly Insect."

## 4. "Difficult Diseases"

- Find disease information on the Texas A&M Forest Service Forest Health website under Diseases, <http://tfsweb.tamu.edu/foresthealth/>
- Carefully read and report the information about how diseases occur and how to prevent them and keep the forest healthy. Examples of the conditions contributing to these diseases are found in the sections about the particular disease: Oak Wilt, Root Rot, etc.

## 5. "Invasive Awfuls"

- Find invasive species information on the Texas A&M Forest Service Forest Health website under Invasives, <http://tfsweb.tamu.edu/foresthealth/>
- Report why invasive species are harmful to our forests. Select a pest and a plant to highlight.



# Investigative Report Outline

*Title: Investigative Documentary on the Real Culprit of Sick Forests*

*Chapter: Name of Investigation*

*Section I. Purpose of investigation*

*Section II. Hypothesis predicting the results*

*Section III. Research procedures*

*Section IV. Findings to include possible causes for the disruption (drought, etc.)*

*Section V. Conclusions*

*Investigators: Names of students*



# Investigative Procedures

- a. You will be responsible for a chapter of the investigative documentary and present it to the class. You will use your laptops/tablets and go online to generate your report.
- b. You should read the narrative provided by Texas A&M Forest Service Forest Health sections, which reports factors contributing to forest health such as heat, drought, flooding, lightning, animal damage, construction damage, soil compaction, wildfire, etc.
- c. You will be given a list of online resources to use for your specific chapter.
- d. You will write a synopsis of your findings to develop your chapter. You may incorporate any resources into your report. You may include photos, graphs or other graphics as supporting evidence for your conclusions. The chapter should include evidence found on your investigative campus trip.

## Report Guidelines

*Title: Investigative Documentary on the Real Culprit of Sick Forests*

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*(find a fillable worksheet for the Report in the Tree Trails Resources section online)*



# Signs of Unhealthy Trees

Cavities in trunks or branches



Many broken branches or severe topping



# Signs of Unhealthy Trees

## Unusual leaf shapes or colors

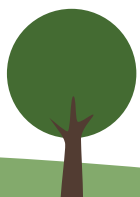


Pine attacked by engraver beetles



Squirrel damage

## Numerous branches without leaves



# Signs of Unhealthy Trees

## Damage from carvings or lawn equipment



## Insect presence or evidence such as leaf chewing and rolling, holes in the bark, sawdust, etc.



Soapberry borer infestation



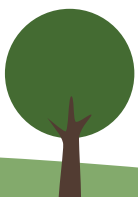
Engraver beetle galleries in loblolly pine bark



Caterpillars feeding



Boring dust in cedar elm



# Signs of Unhealthy Trees

## Slime oozing from trunk or branches



## Mushrooms or other fungi growing from trunk, branches or roots



Mushrooms on trunk



Brown fungus is Hypoxylon canker



Hypoxylon canker

