



Unit Series Lesson Plan

Texas Arbor Day | High School

Teach with Texas Project Learning Tree

The Texas Arbor Day Unit Series for 9th-12th grade engages high school students in a comprehensive exploration of forest ecosystems, soil science, and sustainable forest management.

Through a variety of hands-on activities and field investigations, students will gain a deeper understanding of tree identification, soil analysis, wildlife habitats, and the role of certification in promoting sustainable forestry. This unit is designed to inspire students to become informed stewards of the environment, equipped with the knowledge and skills necessary to protect and manage our natural resources responsibly.

Teacher Resources

Texas Forest Literacy Framework

A Texans guide to learning and teaching about trees, forests, and related natural resources and environments.



<https://tfsweb.tamu.edu/TexasForestLiteracyPlan/>

Workshops and Professional Development

Texas Project Learning Tree helps you master teaching about our environment. Learn more about training with TexasPLT.



<https://www.texasforestry.org/programs/environmental-education>



Unit Series Week Plan

Texas Arbor Day 2024

Grade Levels: 9th-12th

Unit Topic: Texas Arbor Day - Trees & Forest Ecosystems

Texas Arbor Day is Friday, November 1, 2024

Key Learning Areas	Skills
<ul style="list-style-type: none">• Tree Identification• Soil Science• Water Conservation• Wildlife Habitats• Sustainable Forest Management	<ul style="list-style-type: none">• Observation and Classification• Critical Thinking• Scientific Inquiry• Collaboration and Communication• Creative Problem Solving



Week Summary

Texas Arbor Day Unit Series

Monday

Summary:

Students work in teams to identify common Texas trees by their leaves. They'll explore their environment, collect leaf samples, and classify them based on shape and structure.

Main Activity: If It Leafs Like a Texan Tree

Time: 50 minutes

Tuesday

Summary:

Students conduct a laboratory investigation comparing soils from multiple locations to examine organic content, pH, nutrient levels, texture, and invertebrate populations. Through this analysis, they will explore the significance of soil in forest management.

Main Activity: Solving for Soil

Time: 50 minutes

Wednesday

Summary:

Building on soil & water concepts, this lesson explores tree survival needs. Students discuss how all living things need specific resources to thrive. Understanding trees' needs (space, sunlight, water, soil) helps us care for our forests and create a healthy balance for plants.

Main Activity: Nature's Water Filter

Time: 50 minutes

Thursday

Summary:

Students will explore how forests provide essential habitats for wildlife. They will then conduct a field investigation to identify animal signs within a local ecosystem.

Main Activity: Habits and Habitat

Time: 50 minutes

Friday

Summary:

This activity explores forest certification as a tool for sustainable forest management. Students will compare different certification systems, identify their benefits and drawbacks, and brainstorm additional ways to protect forests.

Main Activity: Fostering Friendly Foresting

Time: 50 minutes

If It Leafs like a Texan Tree

This activity is a team-based scavenger hunt where students explore their environment to find leaves with specific characteristics for common Texan trees. Working together, they practice classifying leaves based on features like edges, arrangement, and types (simple vs. compound). With this activity students become more familiar with common species in our Texas forests!

Learning Outcomes

- Classify leaves based on various features.
- Characterize leaves using the correct terminology.
- Identify common Texan trees.

Vocabulary

- **Tree types:** Conifer, and deciduous
- **Edge types:** smooth, lobed, and toothed
- **Compound leaf Types:** pinnately and palmately
- **Arrangement:** alternate, opposite, and whorled
- **Leaf parts:** petiole, rachis, and bed

Materials & Prep

- Pruning shears (one per team)
- Optional Reference materials from TAMFS Resources
 - How to ID: <http://texastreeid.tamu.edu/content/howToID/>
 - ID by Leaf: <http://texastreeid.tamu.edu/content/idByLeaf/>
 - Tree ID Mobile App: <https://texasforestinfo.tamu.edu/MobileApps/MyTreeID/>
- Teacher-made list of leaf characteristics to find (one per team) - Sample Lists below (modify based on difficulty)

Appendix A - Easy

- Find a leaf with a smooth edge (entire).
- Find a leaf with a lobed edge.
- Find a leaf with a toothed edge.
- Find a simple leaf.
- Find a compound leaf.
- Find a leaf with an opposite arrangement.
- Find a leaf with an alternate arrangement.

Appendix B - Harder

- Find a pinnately compound leaf.
- Find a palmately compound leaf.
- Find a leaf with a net-like vein pattern.
- Find a leaf with a parallel vein pattern.
- Find a conifer needle.
- Find a leaf with a glossy upper surface.
- Find a leaf with a hairy underside.



Monday Continued

Activity Details & Instructional Strategies:

1. **Review (Optional):** Briefly review leaf characteristics like simple vs. compound, opposite vs. alternate leaf arrangement, etc. Use past learning activities if applicable.
2. **Set Expectations:**
 - Remind students to collect at least 3 leaves per item, focusing on whole leaves for compound specimens.
 - Demonstrate proper pruning shear usage to avoid damaging trees (clean cuts, not tearing).
3. **Scavenger Hunt Setup:**
 - Define the boundaries of the exploration area.
 - Allocate 15 minutes for the activity.
 - Distribute scavenger hunt sheets and pruning shears to each team.
4. **Instructions & Grading:**
 - Explain that teams will need to find leaves matching each item on the list and present them upon returning.
 - Emphasize teamwork and collaboration as everyone receives the same grade.
 - Briefly mention avoiding young seedlings and terminal bud damage.
5. **The Hunt:**
 - Students head out to find leaves based on the scavenger hunt list.
6. **Back in the Classroom:**
 - Instruct students to lay out their collected leaves in the order of the list.
 - Allow them to use the same sample for multiple matching characteristics (optional, instructor's discretion).
7. **Evaluation & Debrief:**
 - Go through the scavenger hunt list, asking each team to present their corresponding leaf sample(s).
 - Conduct a follow-up quiz to assess understanding.

Assessment

This activity can be assessed in two ways. Students can be awarded points for each leaf they find that matches the list, with bonus points for leaves that fulfill multiple criteria. Additionally, a follow-up quiz can be administered to test their understanding of the learned leaf terminology and concepts.



Solving For Soil

Students conduct a laboratory investigation comparing soils from multiple locations to examine organic content, pH, nutrient levels, texture, and invertebrate populations. Through this analysis, they will explore the significance of soil in forest management.

Learning Outcomes

- Characterize soil based on its organic matter, acidity, nutrient content, and particle size distribution.
- Classify soil invertebrates using a dichotomous key.
- Explain the importance of soil in forest management, supported by observations.

Vocabulary

- clay
- invertebrate
- leaf litter
- loam
- macronutrient
- nutrient
- organic
- soil
- soil pH

Materials & Prep

Preparation

1. Select at least two sites with varying characteristics (e.g., grassland, forest, agricultural land) to collect soil samples. Potential sites include your school grounds or nearby areas. Obtain necessary permissions before collecting samples.
2. At each chosen site, gather a 12-inch soil core and the top layer of organic matter (litter) from a one-square-meter area. Place the soil core in a one-gallon sealable bag and the litter in a large plastic bag. Dry the soil cores in an oven at 55°C for four days.
3. Prepare the soil analysis kits (pH, nitrogen, phosphorus, potassium) and necessary equipment for each student group on lab benches. Make copies of the student lab guides.

Materials for each group

- Safety goggles
- Porcelain crucible with lid
- Needle probe
- Bunsen burner
- Ring stand and clamp
- Matches
- Asbestos pad

- Soil test kit
- Large aluminum tray
- Screw-cap vial
- Tweezers or forceps
- "[Soil Lab Procedures](#)" - page 25 of OFRI
- "[Soil Lab Data Sheet](#)" - page 29 of OFRI
- "[Key to Soil and Leaf Litter Invertebrates](#)" page 30 of OFRI

Materials for Instructor

- Asbestos gloves
- Tongs



Activity Details & Instructional Strategies:

1. **Introduction to Soil:** Discuss the nature of soil, its significance, and the specific soil information required by forest managers.
2. **Soil Analysis:**
 - Divide students into pairs or small groups, and provide each group with a soil sample and a corresponding leaf litter sample for analysis.
 - Guide students through the lab procedures using the "Soil Lab Procedures" student page:
 - Determining soil organic matter content by drying and weighing.
 - Measuring soil pH using a soil test kit.
 - Assessing soil macronutrient levels with a soil test kit.
 - Determining soil texture by feel or using a soil texture triangle.
 - Observing and identifying soil invertebrates using a provided key.
 - Using the provided equipment, students will record their observations and data on the "Soil Lab Data Sheet."
 - To identify any observed invertebrates, students can reference the provided "Key to Soil and Leaf Litter Invertebrates."
3. **Facilitate a class discussion on:**
 - **Soil Variations:** Compare soil properties (organic matter, pH, nutrients, texture, and invertebrates) across different sites and interpret the findings.
 - **Forest Management:** Evaluate site suitability for commercial tree production and identify potential management challenges.
 - **Recreational Use:** Assess site appropriateness for various recreational activities based on soil characteristics.

Assessment

Provide the following prompt: Imagine you have inherited a 100-acre parcel of land. Your soil sample represents a small piece of this property. Based on your soil analysis, write a 1-2 page report describing your land's potential. Consider the soil's characteristics and how they might influence your land management decisions. Support your ideas with evidence from your soil analysis.



Nature's Water Filter

Building on their understanding of soil composition, students will explore the role of forests in water conservation. Through a hands-on experiment, they will compare the water filtration capabilities of different soil types.

Learning Outcomes

- Predict how different soil types will influence water filtration rates.
- Compare and contrast the water absorption and runoff patterns of various soils and soil cover conditions.
- Explain the role of forests in protecting drinking water sources.

Vocabulary

- absorption
- runoff
- soil filtration

Materials & Prep

Materials:

- Texas A&M Forest Service "[Forest Fast Break: Water](#)" video
- Materials for each soil filtration model, one per group:
 - 2-liter plastic bottle
 - 6-oz can that is taller than wide
 - Stopwatch (or stopwatch app for smartphone or tablet)
 - Clear plastic cups or other containers
- Materials for soil filtration model, per class:
 - A variety of soil materials (for example, fine-grained sand, bark chips, topsoil, clay, mulch, dried leaves, pieces of sod)
 - Graduated cylinders
 - Utility knife
- "Soil Filtration Investigation" student page (Pg 8, 9 and 10 of OFRI)

Preparation:

- Create copies of the student lab sheet for each group.
- Construct a soil filtration model for each group of four using a 2-liter plastic bottle. Cut the bottle lengthwise to form a trough shape. Prop one end of the bottle up on blocks or books to create a 25-40 degree angle. Label each model with a unique number and place a collection cup at the bottom to capture runoff.



Wednesday Continued

Activity Details & Instructional Strategies:

Introduction

- **Engage** students with the "Forest Fact Break: Water" video to introduce the topic of forests and water. For a deeper dive, consider showing the "Oregon's Forests and Water" video.
- **Explain** the investigation: Clearly articulate the learning goal: to understand how different soil types affect water filtration and runoff.

Experiment and Data Collection

- **Group formation:** Divide students into groups of four and provide each with a "Soil Filtration Investigation" worksheet and a soil filtration model.
- **Soil selection:** Assign or allow groups to choose different soil materials to fill their models.
- **Hypothesis generation:** Encourage each group to predict how their chosen soil will affect water filtration rates.
- **Experiment setup:** Guide students in setting up their models, ensuring the can is securely placed in the soil and the collection cup is positioned correctly.
- **Data collection:** Instruct students to measure filtration time, runoff volume, and water clarity, recording results on their worksheets. Calculate percentage runoff and absorption.

Data Analysis and Discussion

- **Data sharing:** Have groups share their findings with the class, creating a collaborative data set.
- **Data visualization:** Guide students in plotting filtration time, percent absorption, and water clarity on the provided graph.
- **Discussion:** Facilitate a class discussion to analyze results, addressing questions about runoff, water quality, and soil properties. Encourage students to reflect on their hypotheses and suggest improvements.

Assessment

Have students write a short reflection on their soil filtration experiment. Ask them to describe their results and explain what their findings suggest about the role of soil in protecting water quality.



Habits and Habitats

Students will explore how forests provide essential habitats for wildlife. They will then conduct a field investigation to identify animal signs within a local ecosystem.

Learning Outcomes

- Analyze how forest structure influences the presence of different wildlife species.
- Research the characteristics and signs of various forest animals.
- Conduct a field investigation to identify evidence of wildlife in a specific habitat.

Vocabulary

- cover
- disturbance
- free water
- habitat structure
- metabolic water
- scat
- snag*
- stand*
- vertebrate

Materials & Prep

Materials

- "[Wildlife Signs](#)" page 29 of OFRI
- "[Wildlife Inventory](#)" page 30 of OFRI
- Large master map or sketch of study site
- Thermometer
- Measuring tape and/or string
- Position markers or stakes
- Graph paper for mapping plot area
- Clipboards

Preparation

- Species selection: Compile a list of wildlife species commonly found in your local area for student research assignments.
- Site identification: Choose a suitable study site, such as a nearby park or forest. Determine the age of the forest to target specific wildlife species.
- Site mapping: Create a large-scale map of the study site by projecting or sketching it onto butcher paper.



Activity Details & Instructional Strategies:

Wildlife Signs

1. **Begin** by introducing the concept of wildlife habitat and explain that many animals avoid human contact, making direct observation difficult. Instead, we rely on indirect evidence or signs to detect their presence. Elicit ideas from students about possible wildlife signs (e.g., tracks, scat, nests). Inform students that they will become wildlife detectives, using signs to study a local area.
2. **Assign animals:** Divide students into pairs or small groups and assign them specific animals to research.
3. **Wildlife sign research:** Provide students with "Wildlife Signs" worksheets and allow time to investigate the various signs associated with their assigned animals. Then facilitate a class discussion for students to present their finding on animal signs.

Wildlife Inventory

1. **Site selection:** Introduce the study site, displaying a map to help students visualize the area. Determine if a focused study or a broader survey is more appropriate. Decide on the size and shape of the study plots (e.g., square, 1 meter). Provide students with materials to measure and mark plot boundaries.
2. **Data collection:** Distribute "Wildlife Inventory" worksheets to each group and review data collection protocols. Emphasize the importance of quiet observation and detailed recording. Guide students in establishing plots and conducting observations. Remind them to record weather conditions and any signs of wildlife within the plot boundaries.
3. **Data sharing and analysis:** Encourage students to share their findings and look for patterns or trends in wildlife distribution and abundance.

Assessment

Have students reflect on their learning by writing a detailed summary about the role of forests as crucial habitats for wildlife. Encourage them to consider the specific adaptations animals have made to thrive in these ecosystems.



Fostering Friendly Foresting

Students examine forest certification as one approach for ensuring forest sustainability, and then identify other ways to be stewards of forests.

Learning Outcomes

- Define forest certification and its role in forest sustainability.
- Compare and contrast different forest certification systems.
- Identify benefits and drawbacks of forest certification.
- Brainstorm additional ways to be stewards of forests.

Vocabulary

- afforestation
- conservation value
- forest certification
- sustainable forest management
- tenure and use rights

Materials & Prep

- Whiteboard/Projector
- Markers/Pens
- "[Forest Certification Systems Compared](#)" worksheet, pages 8-13 of OFRI
 - include a brief description of each system (FSC, SFI, ATFS) and key criteria they focus on (environmental, social, economic)

Activity Details & Instructional Strategies:

Introduction:

- Ask students about certificates and what they signify. Discuss the concept of "certification" for products or programs. Briefly introduce forest certification as a tool to promote sustainable forest management. What criteria might be important for certification? List them on the board.

Developing Certification Criteria (15 minutes):

- Divide students into small groups and challenge them to create a list of criteria for a forest certification program. Encourage them to consider environmental, social, and economic aspects of the forest or forest product.
- Have groups share their criteria with the class. Discuss similarities and differences, prompting for justifications behind each point.



Activity Details & Instructional Strategies:

Forest Certification Systems (20 minutes):

- Briefly explain that different forest certification systems exist. Introduce the three main systems (FSC, SFI, ATFS) and their core focus areas.
- "Forest Certification Systems Compared" Worksheet:
 - Provide the modified worksheet with brief descriptions of each system and key criteria.
 - Students can work independently or in pairs to compare the systems using the worksheet and potentially online resources.
- Facilitate a discussion around the following questions:
 - How do forest certification systems help forests?
 - What are the benefits of certification for forest landowners and consumers?
 - Are there any potential drawbacks to forest certification?

Forest Stewardship Beyond Certification (5 minutes):

- Shifting Focus: Acknowledge that certification is one approach. Emphasize there are other ways to be responsible forest stewards.
- Brainstorming: Challenge students in pairs or small groups to brainstorm additional ways individuals and communities can contribute to forest sustainability.

Wrap-up and Assessment:

- Sharing Ideas: Have each group share some of their ideas for sustainable forest management practices.

Assessment

- Observe participation and understanding during discussions.
- Collect and review completed worksheets to assess students' grasp of different certification systems and key considerations for forest sustainability.

Differentiation

Scaffolding: Provide additional support to struggling students by highlighting specific criteria categories (environmental, social, economic) for their brainstorming activities.

Enrichment: Challenge advanced students to research specific forest management practices or controversies related to certification.

