Dear Envirothon Educator:

We are so glad you are coaching a team in the Oklahoma Envirothon contest! Whether this is your first year in the program or you are a seasoned sponsor, we hope your students have an enriching educational experience. The Oklahoma Envirothon program is sponsored by OSU. As with many natural resource initiatives, our collective goals could not be accomplished without the work of numerous partner organizations. OSU has asked the Oklahoma Forestry Services (OFS) to provide the educational materials, expertise, and test questions for the Forestry portion of the Oklahoma Envirothon.

OFS has created the following study guide to help you prepare your students for the regional and state contests. Our agency's mission is to enrich the lives of all Oklahomans by protecting, restoring, and utilizing Oklahoma's tree and forest resources. We enact this mission every day in communities across the state with programs focusing on wildland fire, tree health, forest products, windbreaks and rural forestry, conservation education, and sustainable landscapes and community forestry. As your state forestry agency, we strive to combine the best forestry practices with creative, common sense management strategies that address the unique needs of the trees and forests found across our great state.

Our goal is to connect young Oklahomans with their tree and forest resources to inspire the next generation of tree planters and conservation stewards. Whether your students enter a natural resource profession or not, these young scholars will ultimately become tomorrow's voters, landowners, and leaders. Increasing their understanding of the complexities involved with forestry will help Oklahoma implement resilient resource management practices into the future.

Each question on the forestry exam is tied to one of the educational objectives listed in this study guide. Linked to each objective are various resources that your students can explore to familiarize themselves with a forestry concept and prepare your team for competitive success. On the final page of this guide, we share how to check out an Educator Tree Trunk, contact your local OFS forester, and list additional programs available for your classroom. OFS is always happy to answer questions, conduct a class visit, or lead your students on a forestry field trip to enrich their learning.

Thank you for using this resource to support forestry education in Oklahoma. You are teaching, guiding, and forming our state's future natural resources professionals and decision makers. We sincerely appreciate all you do as an integral part of the Envirothon program's success.

Oklahoma Envirothon Forestry Study Guide: Students should successfully complete the following learning objectives to prepare for the Oklahoma Envirothon Forestry Regional/State contests by studying the referenced resources and exploring additional scholarly sources (state and federal forestry agencies, university extension, peer reviewed publications etc.) to garner additional information and skills to further their understanding of the core forestry concepts listed below.

1. Tree Anatomy and Functions
    a. Students will be able to define and describe the major physiological functions of a tree, including:
        i. Photosynthesis – Respiration – Transpiration
    b. b. Students will be able to identify the anatomical structures of the tree and describe how water and nutrients flow through the tree
        i. Xylem – Phloem – Cambium – Sapwood – Heartwood – Growth ring – Chlorophyll – Mycorrhizae – Stomata – Chloroplasts – Bud – Meristem
    c. Students will be able to identify the major sections of the tree
        i. i. Roots – Trunk – Crown (Leaves and leaf tissue)

2. Tree Identification
    a. Students will be able to identify the trees of Oklahoma through:
        i. Parts of the tree(s): Bark, Leaves, Twigs, Buds, Flowers, Seeds
    b. Students will be able to classify whether specimens are native, nonnative, ornamental, or invasive species of trees and woody plants.
    c. Students will learn the key terms in identification:
        i. Dendrology – Genus & Species – Deciduous & Coniferous – Softwood & Hardwood – Leaf type, arrangement, shape, and composition – Broadleaf, needlelike or scale-like leaves – Whorled, pinnate, or palmate
    d. Students will become familiar with a dichotomous key and its use.

3. Tree Measurement
    a. Students will be able to collect the following measurements:
        i. Board-foot volume
        ii. Diameter at breast height
        iii. Total and merchantable height of the tree
        iv. Crown spread
    b. Students will be able to identify and properly utilize the following tools used in measuring trees:
        i. Clinometer (tree height) – Diameter or d-tape – hypsometer or Biltmore stick – Increment borer (tree age) – Prism (basal area)
    c. Students will be able to define the following key terms used to describe a tree's volume:
        i. Diameter at breast height – Log scale – Basal area – Merchantable – Board feet – Cubic feet – Cord

4. Forest Ecology
    a. Students will be able to recall and sketch the natural cycles and systems that occur within the forest and their associated terminology:
        i. Water cycle – Carbon cycle – Decay and decomposition – Succession – Climax and Pioneer species
    b. Students will be able to define terms used to describe different ecological systems:
        i. Watersheds – Climate and microclimate – Environmental conditions – Sustainable use – Multiple use – Fragmentation – Ecosystem services
    c. Students will assess how natural events or man-made activities impact and influence a forest:
        i. Fire suppression – Climate change – Severe Weather – Flooding – Droughts – Insect infestations – Invasive tree pests – Urban expansion – Agricultural expansion

5. Forest Management
    a. Students will differentiate the various forest-type management practices utilized, such as those employed in conifer or deciduous forests:
        i. Sustainable use and its importance – Prescribed fire – Forest thinning– Silvicultural systems – Windbreak use, design and renovation – Urban/community forest management
    b. Students will learn to identify forest types, their understory components, and how management impacts forest health:
        i. Species identification for Forest Types – trees, shrubs, plants
        ii. Fire suppression – Fuel loading and fuel reduction
        iii. Insect and disease identification
    c. Students will list major non-native and invasive species that threaten Oklahoma's trees.

6. Tree and Forest Health
    a. Students will be able to classify the major types of forest health threats and describe examples:
        i. Biotic (Insects, Disease, Invasives) – Abiotic
        ii. Herbicide damage – Pine wilt – Walnut Twig Beetle & Thousand Cankers Disease – Ips Beetles – Emerald Ash Borer – Wildfire – Drought
    b. Students will be able to describe common treatments for pests:
        i. Integrated Pest Management (IPM) – Biological Control – Cultural Control – Insecticides – Fungicides – Herbicides
        ii. IPM and its action threshold, insecticide resistance, non-target impacts

Glossaries/Additional Resources: Below are some additional helpful resources that you might find useful as you delve into the above learning objectives. Several glossaries are included to assist in learning the jargon and terminology specific to forestry.

• Oklahoma Forestry Services

• Glossary of Forestry Terms, North Carolina Forestry Association

• National 4-H Forestry Handbook

Suggested Curriculum: Want to integrate standards-based field-tested forestry lessons into your teaching curriculum? Looking for lessons and activities that teach or support Oklahoma Envirothon learning objectives and state/national standards?

Project Learning Tree (PLT) uses trees and forests as windows on the world to increase students' understanding of the environment and actions they can take to conserve it. Since 1976, PLT has reached 138 million students and trained 765,000 educators to help students learn how to think, not what to think about complex environmental issues. Tony Pascall, OFS Education Coordinator, is the State Coordinator for this program which strives to empower educators to provide high-quality conservation and environmental education lessons as a part of their day-to-day work with youth.

Attend an Oklahoma Project Learning Tree educator workshop and receive a copy of the curriculum! To learn more about Oklahoma's Project Learning Tree program by contacting Tony Pascall, anthony.pascall@ag.ok.gov or 405-317-8322 or visiting ag.ok.gov/calendar.

Tree Trunks: Want to borrow specifically bundled educator kits with curriculum and materials to integrate forestry and conservation education into your work with students?

These trunks include a dendrochronology lesson are available free of charge for teachers and non-formal educators. Components include sections of tree trunks, or "cookies" that were taken from an Oklahoma tree that had been located adjacent to an Oklahoma Mesonet site. This allows for precise weather data comparisons with rings on the tree trunk. Go to https://ag.ok.gov/outreach-and-education/ for more information

Classroom Visits: Want to bring OFS to you? OFS can conduct an in-person or virtual classroom visit to present a lesson, an activity, or teach a skill to your students. The Oklahoma Forestry Service Conservation Education program provides in-person classroom visits to schools. Contact Tony Pascall, anthony.pascall@ag.ok.gov or 405-317-8322 for a menu of programs or to schedule your visit.

Contact Your Local Oklahoma Forestry Services Forester: Want to connect your students to their local forestry natural resource professionals? Need assistance teaching students' hands-on forestry skills such tree measurement and identification? Reach out to your local OFS forester for assistance! Find your county's assigned foresters and how to contact them at: https://ag.ok.gov/divisions/forestry-services/