Dear Envirothon Educator:

We are so glad you are coaching a team in the Nebraska 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 Nebraska Envirothon program is sponsored by the Nebraska Association of Natural Resource Districts (NARD). As with many natural resource initiatives, our collective goals could not be accomplished without the work of numerous partner organizations. The NARD has asked the Nebraska Forest Service (NFS) to provide the educational materials, expertise, and test questions for the Forestry portion of the Nebraska Envirothon.

The NFS 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 Nebraskans by protecting, restoring, and utilizing Nebraska's tree and forest resources*. We enact this mission every day in communities across the tree planters' 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.

We hope your students learn about their neighborhood trees and gain an appreciation for the diversity and complexity of our state's forest resources—from the pine ridge in the northwest panhandle to the deciduous woodlands along the Missouri river and the countless community forests in every Nebraska city, town, and hamlet in between.

Our goal is to connect young Nebraskans 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 Nebraska implement resilient resource management practices into the future.

Each question on the regional and state forestry exams 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 NFS forester, and list additional programs available for your classroom. NFS 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 Nebraska. 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.

Sincerely,

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Nebraska Envirothon Forestry Study Guide: *Students should successfully complete the following learning objectives to prepare for the Nebraska 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. Overview of History
    a. Students will be able to describe the history of forestry and forest management in both the United States at large and in Nebraska including:
        i. Founding of the US Forest Service
        ii. Origin of Arbor Day
        iii. History of Nebraska's tree planting initiatives
    b. Students will be able to explain how historical decisions impact modern forest practices today.
2. 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. 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. Roots – Trunk – Crown (Leaves and leaf tissue)
3. Tree Identification
    a. Students will be able to identify the trees of Nebraska through:
        i. Parts of the tree(s): Bark, Leaves, Twigs, Buds, Flowers, Seeds
        ii. Form and shape
        iii. Location in the landscape (i.e., along a river, in a forest or woodland)
    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.
4. 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

d. Students will be able to define the following terms regarding measuring a stand of trees in a forest or windbreak and apply them correctly in collecting forestry data:

i. Stocking – Stand – Density

5. 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

6. 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 Nebraska's trees.

7. 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

8. Forest Policy

a. Students will identify the different values each person has for themselves that relate to different management strategies and utilization of our natural forest resources:

i. Aesthetics – Innate value – conservation ethic – Environmental health – Human health – Forest products – Recreation (hunting, fishing, hiking, camping, etc.) – Economic interests – Rural interests

ii. Define urban (or community) forest, and describe its importance to society, aesthetics, health, ecology, and monetary value

b. Students will explain how these different values can cause conflicts:

i. Identify several resource conflicts in your region

ii. Understand who manages Nebraska's natural resources and the responsibilities they each have. Identify the organizations, agencies, NGOs and others involved in setting policy:

1. Nebraska Forest Service (NFS) - USDA Forest Service (USFS) - National Park Service (NPS) - US Fish and Wildlife Service (USFWS) - US Army Corps of Engineers - Bureau of Land management (BLM) - Department of Natural Resources (DNR) - Natural Resources Conservation Service (NRCS) - University Extension (UNL) - Natural Resources Districts (NRD) - Environmental Protection Agency (EPA) - Nebraska Game & Parks Commission (NGPC)

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.*

- Nebraska: The Tree Planter's State
- University of Nebraska – Lincoln School of Natural Resources Tree Identification Cards
- USDA Forest Service Publications
- A Glossary of Common Forestry Terms, University of Tennessee Extension
- Glossary of Forestry Terms, North Carolina Forestry Association
- Definition of Terms, USDA Forest Service
- National 4-H Forestry Glossary
- National 4-H Forestry Youth Tree Manual
- National 4-H Forestry Youth Forests Manual
- National 4-H Forestry Youth Forest Recreation Manual

Suggested Curriculum: *Want to integrate standards-based field-tested forestry lessons into your teaching curriculum? Looking for lessons and activities that teach or support Nebraska 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. Jack Hilgert, NFS Conservation Educator, is the Nebraska 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 a Nebraska Project Learning Tree educator workshop and receive a copy of the curriculum! To learn more about Nebraska's Project Learning Tree program by contacting Jack Hilgert, jack.hilgert@unl.edu or 402-472-9727 or visiting nfs.unl.edu/education.

> **Focus on Forests** high school curriculum is designed to foster student understanding of — and appreciation for — the forested lands of North America. The lessons provide students with opportunities for hands-on forest study and address concepts in biology, civics, ecology, economics, forest management, and other content areas. Students examine ecological systems of a forest; analyze interdependencies within a forest ecosystem; and explore factors, like fire, that shape the development of forests. As students explore forest issues and develop science content knowledge, they develop critical thinking skills and discover the importance of scientific analysis. Find out more about this excellent resource here.
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> *"This curriculum allows students to participate in activities that teach them the job skills of foresters and other natural resources professionals. I like to provide my students with career information that covers the entire spectrum, and they loved the hands-on learning outdoors!"*
> *– Kathey Roberts, 10-12th Grade Environmental Science Teacher*
> *Lakeside High School, Hot Springs, Arkansas*
>
> **Exploring Your Environment** is PLT's new flagship curriculum which includes 50 hands-on, multidisciplinary activities to connect children to nature and increase young people's awareness and knowledge about their environment. Activities include detailed step-by-step instructions, academic correlations, time and material requirements, and corresponding student worksheets with green career connections. This curriculum is designed to develop students' critical thinking and problem-solving skills. Topics include trees and forests, wildlife, water, air, energy, waste, climate change, invasive species, community planning, and more. The activities encompass the economic, ecological, and social aspects of environmental issues and are designed to help students learn how to think, not what to think. Find out more about this brand-new curriculum here.
>
> *"An important and engaging tool for teachers."*
> *– Kirkus Reviews*

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

The Nebraska Forest Service Conservation Education program has developed regional partnerships with organizations across the state of Nebraska called Affiliate Education Centers. These centers have agreed to provide conservation and environmental education resources to educators and the public, including Tree Trunks. Each organization houses educator trunks that can be checked out which include Project Learning Tree curriculum and additional materials to assist in lesson facilitation. Find your nearest Tree Trunks at your local NFS Affiliate Education Center. Contact the center coordinator to find out more details about check-out at each location.

Updated: December 2021

Forest Field Trips: *Want to immerse your students in a Nebraska forest as they learn about their local natural resources?*

The Nebraska Forest Service Conservation Education program provides field trips at two NFS properties, Prairie Pines Nature Preserve in Lincoln as well as Horning State Farm Demonstration Forest in Plattsmouth. Each field trip entails a two-hour guided experience of the property with staff and hands-on learning about the trees and forests featured at each location. Cost is $5 per person. Find out more information and schedule your group's field today! Contact Jack Hilgert, jack.hilgert@unl.edu or 402-472-9727 for more information.

Classroom Visits: *Want to bring NFS to you? NFS can conduct an in-person or virtual classroom visit to present a lesson, an activity, or teach a skill to your students.*

The Nebraska Forest Service Conservation Education program provides in-person classroom visits to schools within a two-hour driving distance of Lincoln, Nebraska. Additionally, the program provides virtual (zoom-based) classroom visits to any school in Nebraska. Both opportunities are free of charge. Contact Jack Hilgert, jack.hilgert@unl.edu or 402-472-9727 for a menu of programs or to schedule your visit.

Contact Your Local Nebraska Forest Service 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 NFS forester for assistance!*

Your Nebraska Forest Service has rural and community foresters stationed throughout the state of Nebraska. Each county has specific staff assigned to provide forestry assistance and programs within their area. Please feel free to reach out to these experts as a resource when introducing forestry materials to students or if you would like assistance teaching students specific forestry skills; do not hesitate to reach out to them. Find your county's assigned foresters and how to contact them at: nfs.unl.edu/foresters

Additional Questions: *Have any additional questions about Nebraska Envirothon's Forestry program? Contact us!*

- Jack Hilgert, Conservation Educator, Envirothon Co-chair jack.hilgert@unl.edu
- Rachel Alison, District Forester, Envirothon Co-chair rachel.allison@unl.edu