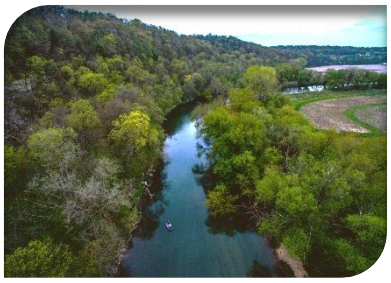
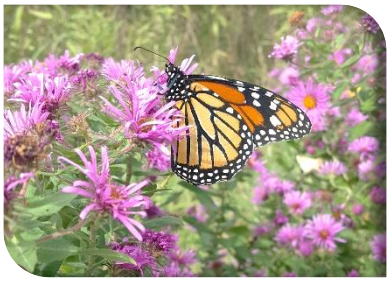
2019 Iowa Envirothon

Agriculture and the Environment: Knowledge & Technology to Feed the World





Conservation Districts of Iowa

ENVIROTHON

A NATURAL RESOURCE ENCOUNTER FOR THE NEXT GENERATION

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Introduction

This study guide is to be used with the 2019 Iowa regional and statewide Envirothon competitions. Students are expected to understand key concepts, terms, and applications of aquatic ecology, soils and land use, forestry, and wildlife conservation referenced in this guide.

Within each section are several key topics with their respective learning outcomes and study resources. Each learning objective shows cross references to their respective study resources (indicated by superscript numbers); most study resources cover multiple learning objectives within each section or key topic. Learning objectives and key topics were developed using NCF Envirothon curriculum guidelines, which can be found at https://www.envirothon.org/wildlife-guidelines, and were modified for the Iowa Envirothon competitions.

Students are also required to use the national Envirothon standards and study resources for this year's current issue, "Agriculture and the Environment: Knowledge & Technology to Feed the World." These resources can be found at the following website: https://www.envirothon.org/media/attachments/2018/11/02/2019-ncf-envirothon-ci-resources-11-02-2018.pdf

Part 1: Aquatic Ecology

Key Point 1: Aquatic Species: Fish, Invertebrate, and Plant Identification

- Be able to identify native and non-native aquatic fauna using pictures and preserved specimens. Also recognize the habitats they occur in and what their feeding habits are (carnivore, herbivore, omnivore, etc.).[1-7]
  - Fish (ID by sight) [1,2,3,4]
    - Largemouth Bass
    - Bluegill
    - Channel Catfish
    - Rainbow Trout
    - Chub Sucker
    - Fathead Minnow
    - Asian Carp spp.
  - Invertebrate (ID by sight)[5,6,7]
    - Water flea
    - Mayfly
    - Dragonfly
    - Zebra Mussel
- Be able to identify the following native and non-native aquatic vegetation and the habitats they occur in.[8-10]
  - Aquatic Plants (ID by sight)[8,9,10]
    - Algae (plankton, filamentous, stoneworts)

- Floating (duckweed, watermeal)
- Emergent (cattails, rushes, arrowhead)
- Submersed (coontail, pondweed, water milfoil)

Key Point 2: Aquatic Ecology

Learning Objectives

- Be familiar with Iowa's aquatic communities (ponds, lakes, rivers) and the general habitat requirements and adaptations of their respective plants and animals.[11-17]
- Understand basic ecological concepts and terminology.[11-17]
- Understand the different levels of natural systems (species, population, etc.) and how they interact with each other.[11,16,17]
- Understand the factors that limit fish populations and impact habitat suitability.[11-16]
- Understand the term "biodiversity" and why it is important to humans and fisheries.[11,16,17]
- Understand how the population dynamics of aquatic species affect ecosystem health and function.[3,7,8,16,17]

Key Point 3: Aquatic Conservation and Management

Learning Objectives

- Understand the major threats to aquatic conservation and how conservationists work to address them.[18-24]
- Be familiar with common practices used to manage and improve habitat in Iowa's aquatic systems.[12-15,21,22]
- Understand the impacts of introduced invasive species and human activities on aquatic habitats and populations, and how conservationists work to remedy these challenges.[13, 18-22]
- Understand how aquatic conservation benefits humans and fisheries.[11,15,16,21,22]
- Understand the role of federal and state agencies, non-governmental organizations, and anglers in conserving wildlife.[21,22]
- Understand the significance and purpose of special listings for threatened and endangered species. [23,24]

Aquatic Study Resources

1. Iowa Fish – Iowa Wildlife Series (free digital download) https://store.extension.iastate.edu/product/2143
2. Iowa Fish Species https://www.iowadnr.gov/Fishing/Iowa-Fish-Species
3. Iowa Invasive Fish https://www.iowadnr.gov/Fishing/About-Fishing-in-Iowa/Fighting-Invasive-Species/Invasive-Fish
4. Fish Identification Key https://www.seagrant.wisc.edu/fish-id/
5. Macroinvertebrate Identification Key

https://stroudcenter.org/macros/key/

6. Iowa Insects, Spiders, and other Invertebrates – Iowa Wildlife Series (free digital download) https://store.extension.iastate.edu/product/2144
7. Iowa Aquatic Invasive Invertebrates https://www.iowadnr.gov/Fishing/About-Fishing-in-Iowa/Fighting-Invasive-Species/Aquatic-Invasive-Invertebrates
8. Aquatic Plant management – Managing Iowa Fisheries (free digital download) https://store.extension.iastate.edu/product/4765
9. (Video) Aquatic Plant Management https://store.extension.iastate.edu/product/14863
10. Texas A&M Aquatic Plant Identification Guide https://aquaplant.tamu.edu/plant-identification/
11. Iowa Waterways – Biological Communities (free digital download) https://store.extension.iastate.edu/product/2119
12. Iowa Ponds https://www.iowadnr.gov/Fishing/About-Fishing-in-Iowa/Iowa-Ponds
13. Water Quality – Managing Iowa Fisheries (free digital download) https://store.extension.iastate.edu/product/4756
14. Farm Ponds – Managing Iowa Fisheries (free digital download) https://store.extension.iastate.edu/product/4757
15. Restoring Iowa Streams – Managing Iowa Habitats (free digital download) https://store.extension.iastate.edu/product/4752
16. Iowa Wetlands – Biological Communities (free digital download) https://store.extension.iastate.edu/product/2118
17. Iowa Reptiles and Amphibians – Iowa Wildlife Series (free digital download) https://store.extension.iastate.edu/product/2142
18. Fighting Invasive Species https://www.iowadnr.gov/Fishing/About-Fishing-in-Iowa/Fighting-Invasive-Species
19. Aquatic Invasive Species of Iowa https://www.invasivespeciesinfo.gov/us/iowa
20. Aquatic Invasive Species https://www.boat-ed.com/iowa/handbook/page/28/Aquatic-Invasive-Species/
21. Iowa Habitat Loss and Disappearing Wildlife – Iowa Environmental Issues Series (free digital download) https://store.extension.iastate.edu/product/Iowa-Habitat-Loss-and-Disappearing-Wildlife-Iowa-Environmental-Issues-Series
22. Aquatic Habitat Conservation and Management in the Midwest https://www.fws.gov/midwest/fisheries/aquatic-habitat-cons-mgmt.html
23. Iowa's Threatened and Endangered Species https://www.iowadnr.gov/Conservation/Iowas-Wildlife/Threatened-and-Endangered
24. Iowa County Distribution of Federally Threatened, Endangered, Proposed and Candidate Species https://www.fws.gov/midwest/endangered/lists/iowa_cty.html

Part 2: Soil/Land Use

Key Point 1: Properties of Soil and Soil Formation

Learning Objectives:

- Identify the 5 soil forming factors
  - Key terms: Parent Material, Climate, Living Organisms, Landscape Position, Time. Also, it's important to know Human Influence can affect soil formation. Know how the soil forming factors can affect different soil types. For example, how would a soil developed in loess vs glacial till be different? How would soils that developed in a forest be different from soils developed in a prairie?
- Soil Texture vs Soil Structure. What are the differences between the two?
- Soil textural triangle
  - Key terms: Be able to read and determine soil texture given percent sand, silt, and clay.
- Soil Horizons
  - What do the letters mean for identifying soil horizons—O, A, B, E, C, R.
  - What are Additions, Losses, Translocations, and Transformations. In what soil horizons do these occur?
  - What do the colors of soil tell you about drainage class (e.g. brown vs gray)?

Key Point 2: Soil Ecosystem

Learning Objectives:

- Understand Soil Health Principles and how it relates to healthy soil.
  - Little or no soil disturbance, Diverse crop rotations, living roots most of the year, year-round residue on the soil surface, incorporating livestock.
- Understand soil biology
  - Understand basic soil biology like the soil food web and how it affects the soil.

Key Point 3: Chemical Properties of Soil and Soil Fertility

Learning Objectives:

- Understand Soil pH
  - What is the difference between acidity and alkalinity?
  - How would you increase or decrease pH (think about sources of H+ ions and the use of ammonium based and limestone fertilizers)?
  - What pH range do most crops prefer?
- Understand basic Nitrogen and Carbon cycles
- Know basic on synthetic fertilizer vs. biological nutrient cycling

Key Point 4: Soil Conservation and Land Use Management

Learning Objectives:

- What is soil erosion?

    - Be able to explain the different types of erosion.
        - Wind and water
    - Factors that cause erosion on our landscape.
- What conservation practices help control erosion?
    - Key terms: Terraces, Basins, Cover Crops, Waterways, Ponds
- Crop Rotations
    - Key Terms: corn/soybean, hay, pastures
- What is land capability class and subclass?
    - What do the letter of subclass denote?

Key Point 5: Web Soil Surveys and Soil Surveys Key

Learning Objectives:

- Be able to use the web soil survey or soil survey report book
    - Use reports generated from web soil survey to answer basic questions

Soils Study Resources

1. From the Surface Down, Published by the USDA-NRCS http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053238.pdf
2. Soil Biology Primer. See Soil Biology Primer Chapters: Overview, Soil Food Web, Food Web & Soil Health, Soil Bacteria, Soil Fungi, Soil Protozoa, Soil Nematodes, Soil Arthropods and Earthworms http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/health/biology/
3. Soil Quality Indicator Facts Sheets http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/health/assessment/?cid=stelprdb1237387
4. Farming in the 21st Century, Published by the USDA-NRCS http://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=stelprdb1245068&ext=pdf
5. Understanding Erosion with the Revised Universal Soil Loss Equation http://www.5counties.org/docs/roadedu/2012_5c_roads/rusle.pdf
6. Web Soil Survey https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Part 3: Forestry

Key Point 1: Tree Physiology and Structure

Learning Objectives:

- Identify the parts and tissues of a tree.

- Key terms: Crown, trunk, roots, root hairs, branches, flowers, seeds, bark, phloem, cambium, xylem, heartwood, and meristem.

- Understand the processes of photosynthesis, respiration, tree growth, regeneration, and the uptake of nutrients and water.
  - Key terms: glucose, fructose, chlorophyll, stomate, root cap, energy allocation, meristem, and mycorrhizae.
- Be able to describe the abiotic and biotic factors affecting the growth and health of trees.
- Learn the different leaf & bud arrangements, leaf composition, leaf shapes, mast types, and landscape positions of trees.
  - Key terms: opposite, alternate, hard mast, soft mast, upland, and bottomland.

Key Point 2: Tree Identification and Common Pests and Diseases

Learning Objectives:

- Be able to identify the following native tree species using a combination of leaves, bark, and seeds. Also know the landscape positions each tree can occur in and their mast type.
  - *Scientific names are provided for study purposes only as common names differ between regions, no need to memorize scientific names*

  - **Iowa Native Hard Mast Trees:**
    - Bur Oak **(State Tree of Iowa)** *Quercus macrocarpa*
    - Northern Red Oak *Quercus rubra*
    - Shagbark Hickory *Carya ovata*
    - Black Walnut *Juglans nigra*
  - **Iowa Native Soft Mast Trees:**
    - Sugar Maple *Acer saccharum*
    - American Elm *Ulmus americana*
    - White Ash *Fraxinus americana*
    - American Sycamore *Platanus occidentalis*
    - Kentucky Coffeetree *Gymnocladus dioicus*
    - Eastern Cottonwood *Populus deltoides*
    - Honey Locust *Gleditsia triacanthos*
    - River Birch *Betula nigra*
    - Black Cherry *Prunus serotina*
    - Eastern Red Cedar *Juniperus virginiana*
    - Basswood *Tilia americana*

- Be able to identify the following invasive/introduced trees and shrubs, what makes them so successful, and their impacts on the native ecosystem. Understand the difference between invasive and introduced species.

  - **Invasive and Introduced Trees/shrubs:**
    - Tree of Heaven *Ailanthus altissima*
    - Bush Honeysuckle *Lonicera spp.*

- Autumn Olive — *Elaeagnus umbellate*
- European Buckthorn — *Rhamnus cathartica*
- White Mulberry — *Morus alba*
- White Poplar — *Populus alba*

- Be able to identify the symptoms and treatment/prevention methods of common tree pests/diseases.
  - Emerald Ash Borer (EAB)
  - Oak Wilt
  - Dutch Elm Disease

Key Point 3: Forest Ecology and Management

Learning Objectives:

- Be able to describe the structural components of a typical forest, as well as crown classes within a forest stand.
  - Key terms: overstory/canopy, midstory, understory/shrub layer, forest floor, dominant, codominant, intermediate, and suppressed.
- Be able to distinguish between primary and secondary succession, and know Iowa's main natural disturbance throughout history. Be able to describe the importance of fire in the forest ecosystem, and the role of prescribed fire in forest management.
  - Key terms: Pioneer species, intermediate species, and climax communities.
- Define silviculture, and describe the stand dynamics of Iowa's forests. Know four timber management techniques, and be able to match them with the different stand dynamics.
  - Key terms: Uneven-aged, two-aged, even-aged, clearcut, shelterwood, group selection, and single tree selection.
- Be able to name some issues that are affecting Iowa's forest health and management, in both rural and urban settings.
- Describe the different ways a forest/trees are valuable to humans and the ecosystem.

Forestry Study Resources:

1. https://www.extension.iastate.edu/forestry/publications/PDF_files/F-374.pdf
2. http://www.envirothon.org/files/PhysiologyofTrees.pdf
3. https://drive.google.com/file/d/0Bwi3c-f1WyAgM0hja1ItY0NWSVE/view
4. https://www.extension.iastate.edu/forestry/tree_biology/101roots.html
5. https://www.nrs.fs.fed.us/fmg/nfmg/bl_hardwood/def.html
6. https://www.extension.iastate.edu/forestry/iowa_trees/trees/index.html
7. https://plants.usda.gov/java/
8. https://www.mortonarb.org/trees-plants/tree-and-plant-advice/help-diseases/oak-wilt
9. https://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/downloads/What-is-the-EmeraldAshBorer.pdf

10. https://www.mortonarb.org/trees-plants/tree-and-plant-advice/help-diseases/dutch-elm-disease
11. https://www.fs.fed.us/foresthealth/protecting-forest/invasive-species/
12. http://ufdcimages.uflib.ufl.edu/IR/00/00/18/11/00001/FR06300.pdf
13. http://www.uky.edu/~jmlhot2/courses/for350/Stand%20Descriptions%20and%20Supporting%20Material_UT%20Clatterbuck.pdf
14. https://drive.google.com/file/d/0Bwi3c-f1WyAgM0hja1ItY0NWSVE/view
15. http://www.envirothon.org/pdf/CG/forestry_ecology_PLT_activity_7.pdf

Part 4: Wildlife

Key Point 1: Wildlife and Plant Identification

Learning Objectives

- Be able to identify the following native wildlife using pictures, mounted specimens, skins/pelts, tracks, and/or sounds. Also know the habitats they occur in and what their feeding habits are (carnivore, herbivore, omnivore, etc.).[1-6,8,10]
  - Birds (ID by sight and call) [1]
    - Northern Cardinal
    - Red-tailed Hawk
    - Wood Duck
    - Eastern Meadowlark
    - Bobolink
  - Mammals (ID tracks as well) [2,3]
    - White-tailed deer
    - American beaver
    - Badger
    - Opossum
    - Coyote
  - Reptiles and Amphibians (ID by sight only) [4]
    - Plains Garter Snake
    - Painted Turtle
    - American Toad
    - Bullfrog
    - Eastern Tiger Salamander

- Be able to identify the following native plants and know the habitats they occur in.[5-6,8,10]
  - Native Grasses [5,8]
    - Big Bluestem
    - Indiangrass
    - Little Bluestem
    - Prairie Cordgrass
    - Sideoats Grama
  - Native Wildflowers [5,8]

        - Pale Coneflower
        - Gray-headed Coneflower
        - Purple Prairie Clover
        - Common Milkweed
        - Prairie Blazing Star

- Be able to identify the following invasive plants that harm Iowa's natural ecosystems.[6]
    - Canada Thistle
    - Leafy Spurge
    - Reed Canarygrass
    - Common Teasel
    - Crown Vetch

Key Point 2: Wildlife Ecology

Learning Objectives

- Be familiar with Iowa's biological communities (prairies, woodlands, and wetlands) and the general habitat requirements and adaptations of their respective plants and wildlife.[8-10]
- Understand basic ecological concepts and terminology.[7-10]
- Understand the different levels of natural systems (species, population, etc.) and how they interact with each other.[7]
- Understand the factors that limit wildlife populations and impact habitat suitability.[8-10]
- Understand the term "biodiversity" and why it is important to humans and wildlife.[8-10]
- Understand how population dynamics and wildlife relationships (such as parasitism and mutualism, etc.) affect ecosystem health and function.[8,10]
- Understand the basic life cycle, migration, and habitat needs of the monarch butterfly, and the factors that threaten them.[12-13]
- Understand the basic requirements of native pollinators, and the factors that threaten them.[14]

Key Point 3: Wildlife Conservation and Management

Learning Objectives

- Understand the major threats to wildlife conservation and how conservationists work to address them.[8-12,16,19-21]
- Be familiar with common practices used to manage and improve wildlife habitat in Iowa's biological communities.[8-15]
- Understand the impacts of introduced and invasive species[8-11], diseases[19-21], and human activities[8-11] on wildlife habitat and populations, and how conservationists work to remedy these challenges.[8-21]
- Understand how wildlife conservation benefits humans and wildlife.[8-17,21]
- Be familiar with common practices and programs used to conserve wildlife on private lands.[8-15]
- Understand the role of federal and state agencies, non-governmental organizations, and hunters and anglers in conserving wildlife.[10,16,17,18]

- Understand the significance and purpose of special listings for wildlife species (threatened, endangered, etc.).[9]

Wildlife Study Resources

1. Cornell Lab of Ornithology: All About Birds
   https://www.allaboutbirds.org/
   (Use bird calls found by clicking the "listen" button on each species' overview page)
2. Mammals of Iowa Field Guide (free digital download)
   https://store.extension.iastate.edu/product/15391
3. Go Exploring: 14 Iowa Wildlife Tracks to Look For
   https://www.iowadnr.gov/About-DNR/DNR-News-Releases/ArticleID/166/Go-Exploring-14-Iowa-Wildlife-Tracks-to-Look-For
4. Amphibians and Reptiles of Iowa
   http://www.herpnet.net/Iowa-Herpetology/
5. Iowa Prairie Plants
   http://uipress.lib.uiowa.edu/ppi/index.php
6. Invasive Plant Species
   https://www.iowadnr.gov/Conservation/Forestry/Forest-Health/Invasive-Plants
7. The Organization of Life: Species, Populations, Communities, and Ecosystems
   http://www.physicalgeography.net/fundamentals/9d.html
8. Iowa Biological Communities (highlighted portions)
   http://cdiowa.org/get-involved/envirothon/
9. Iowa Biodiversity (highlighted portions)
   http://cdiowa.org/get-involved/envirothon/
10. Iowa Wildlife Management (highlighted portions)
    http://cdiowa.org/get-involved/envirothon/
11. Impacts and Control of Red Cedar Invasion in Iowa
    http://cdiowa.org/get-involved/envirothon/
12. Monarch Fact Sheet (highlighted portions)
    http://cdiowa.org/get-involved/envirothon/
13. Best Practices for the Monarch Butterfly (highlighted portions)
    http://cdiowa.org/get-involved/envirothon/
14. Conservation Choices: Pollinator Practices
    http://cdiowa.org/get-involved/envirothon/
15. Wildlife Conservation Practices for a Sustainable System
    http://cdiowa.org/get-involved/envirothon/
16. (Video) North American Model of Wildlife Conservation
    https://www.youtube.com/watch?v=eGZZ8C4Os2U
17. (Video) Iowa DNR: Your License Dollars, Your Legacy
    https://www.youtube.com/watch?v=TBceOogmLFA
18. (Video) This is the U.S. Fish and Wildlife Service
    https://www.youtube.com/watch?v=ofARYgeyi6g

19. (Video) Iowa Outdoors: Chronic Wasting Disease
    https://www.youtube.com/watch?v=6v5sbXuQG7U
20. (Video) Deer with EHD: The Iowa Agribusiness Report
    https://www.youtube.com/watch?v=lCmXoMS2aWU
21. Bats in Crisis
    https://www.youtube.com/watch?v=BzA2b92cWg4