# 2026 Iowa Envirothon Study Guide Adapted From NCF-Envirothon Learning Objectives

**How to Use this Guide**

This guide is intended to provide basic yet comprehensive information on each topic covered in the Envirothon event. It is a compilation of numerous publications and other resources from a variety of Federal, State, Local, and private agencies and organizations. It is intended to:

1. Give all teams a common starting point.
2. Provide readily accessible information for team coaches who may be unfamiliar with certain topics.
3. Alert coaches and students to the various agencies and organizations that are involved in the natural resources field.

The learning objectives below are adapted from the NCF-Envirothon learning objectives to align with topics covered in the Iowa Envirothon competition and to provide some structure for team training. However, this guide is not intended to be a complete or definitive guide to each topic. It is hoped that as teams develop their competencies and skills, they will seek out additional information.

## Forestry and Prairie

**Students will be able to:**

### Plant Biology

1. Explain the fundamentals of plant biology as they apply to trees and other common plants, including:
    a. Anatomy
    b. Life cycles
    c. Reproduction
    d. Growth habits
    e. Adaptations
2. Describe the evolution of different plants, and how their unique adaptations help them to thrive in their environments.
3. Explain the formation and function of different types of tissues found in trees and other plants (including xylem, phloem, cambium, cuticle, stomata, vascular bundle, apical meristem, and lateral meristem).
4. Explain the chemical processes that take place within plants (including their fundamental importance, basic chemical reaction equations, and impact on plant survival), such as:
    a. Photosynthesis
    b. Nutrient use

### Plant Biology Resources

- Tree Anatomy 101
  https://naturalresources.extension.iastate.edu/forestry/tree_biology/101.html
- Iowa's Nature Series – Plants (March 2021)
  https://store.extension.iastate.edu/product/16127

**Forest/Prairie Ecology**

1. Describe the major types of forests and prairies found in Iowa.
2. Diagram the energy flow in a forest and prairie ecosystem and describe the relationships between trophic levels.
3. Explain how forested ecosystems benefit water quality.
4. Identify and describe the roles of mycorrhizal fungi in forest ecosystems.

**Forest/Prairie Ecology Resources**

- Tree Anatomy 101
  https://naturalresources.extension.iastate.edu/forestry/tree_biology/101.html
- Iowa's Nature Series – Forests (May 2021)
  https://store.extension.iastate.edu/product/16122
- Iowa's Nature Series – Prairies (Sept 2021)
  https://store.extension.iastate.edu/product/16123
- About Prairies - Iowa Prairie Network
  https://www.iowaprairienetwork.org/prairie-history

**Plant Communities**

1. Explain how different plant communities provide different types of habitat and describe the importance of this habitat variety to wildlife.
2. Apply concepts of landscape ecology to plant communities, including:
    a. Conditions affecting the distribution of plant species
    b. Effects of disturbance on an ecosystem and its impact on plant species
    c. Patterns and spatial differences in landscape, growing conditions, and vegetation type

**Plant Communities Resources**

- Iowa's Nature Series – Forests (May 2021)
  https://store.extension.iastate.edu/product/16122
- Iowa's Nature Series – Prairies (Sept 2021)
  https://store.extension.iastate.edu/product/16123

**Forest and Society**

1. Describe how unsustainable uses of forest, grasslands, and other plant communities can affect overall ecological health.
2. Identify major legislation (local and national) and international agreements pertaining to forests, grasslands, and other plant communities, and describe how they provide protection for natural resources.
3. Describe common forestry practices, including thinning, harvesting, and regeneration methods.
4. Describe the different types of forest management.
5. Explain the role of forests and other plant communities on watershed health.

**Forest and Society Resources**

- Iowa's Nature Series – Forests (May 2021)
  https://store.extension.iastate.edu/product/16122
- Iowa's Nature Series – Prairies (Sept 2021)
  https://store.extension.iastate.edu/product/16123
- Forestry Management Basics – NC Forestry Association
  https://www.ncforestry.org/education/education-materials/forest-management-basics
- Forestry Management for Landowners
  https://www.fs.usda.gov/managing-land/private-land/landowner-resources
- Planting and Maintaining a Healthy Tree
  https://www.iowadnr.gov/media/677/download?inline

**Field Skills**

1. Identify common local trees and plants by leaves, bark, branching patterns, buds, fruit, and other characteristics
2. Identify common plant pests and diseases, describe how they are spread, the symptoms seen in plants, and the methods of control.

**Field Resources**

- Emerald Ash Borer
  http://www.iowatreepests.com/eab_home.html
- Identification of Hardwood Trees in Iowa (May 1996)
  https://www.iowadnr.gov/media/6770/download?inline
- Looking for Emerald Ash Borer in Iowa (April 2015)
  https://store.extension.iastate.edu/product/14307

# Aquatic Ecology

**Students will be able to:**

## Hydrosphere

1. Describe the physical and chemical properties of water that affect aquatic ecosystems and how they do so.
2. Identify different types of water bodies in Iowa, how they are formed, and where they are found.
3. Differentiate the types of wetlands and describe their characteristics

## Hydrosphere Resources

- Iowa's Nature Series - Aquatic Environments (March 2021) https://store.extension.iastate.edu/product/16124
- Iowa Wetlands https://naturalresources.extension.iastate.edu/files/inline-files/iowa_wetlands_accessible_reduced_size.pdf

## Aquatic Ecosystems

1. Identify the biotic and abiotic components of aquatic ecosystems
2. Diagram an aquatic food web and describe the flow of energy within it.
3. Describe the importance, functions, and characteristics of watersheds/catchment areas.
4. Describe the basics of hydrology, including
    a. Impact of landscape factors on water movement
    b. Runoff
    c. Interactions between surface water and groundwater
    d. Impact of landscape factors on water movement

## Aquatic Ecosystems Resources

- Iowa's Nature Series - Aquatic Environments (March 2021) https://store.extension.iastate.edu/product/16124
- Iowa Agriculture Water Alliance (IWAW) - “What is a watershed”, New 2026 https://www.iaagwater.org/what-is-a-watershed/
- National Environmental Education Foundation (NEEF) – “Lesson 1: Watershed Basics”, New 2026 https://www.neefusa.org/water/lesson-1-watershed-basics

**Organisms**

1. Describe the roles of producers, consumers, and decomposers in various aquatic ecosystems and identify their trophic levels
2. Describe the role of cyanobacteria in aquatic ecosystems and their role in harmful algal blooms.

**Organisms Resources**

- Iowa's Nature Series - Aquatic Environments (March 2021) https://store.extension.iastate.edu/product/16124
- National Environmental Education Foundation (NEEF) – "Lesson 1: Watershed Basics", New 2026 https://www.neefusa.org/water/lesson-1-watershed-basics

**Aquatics and Society**

1. Describe the basics of water quality and water quality improvement.
2. Identify biotic and abiotic factors that impact water quality.
3. Identify best management practices to improve water quality and enhance aquatic habitat, such as riparian buffers.
4. Distinguish between point and nonpoint source pollution, and provide examples and management strategies for each.

**Aquatics and Society Resources**

- Explore More: Water Quality - Full Program (April 2012) https://www.youtube.com/watch?v=RMyCcWECbNE
- Otter Creek Success Story, Iowa DNR (YouTube) https://www.youtube.com/watch?v=5WKAES7ysYI&list=PLwHjhP4BtLzZ-Ybc4aQSAXYnv0BCCo9NO&index=2
- Iowa Watershed Approach – Home page https://iowawatershedapproach.org
- Clean Water Iowa – "Practices" link https://www.cleanwateriowa.org/ag-conservation-practices
- "A win-win": The impact of the Iowa Watershed Approach (YouTube) https://www.youtube.com/watch?v=M4yh2PlhPuQ&t=4s
- Iowa Nutrient Reduction Strategy: Aiming to Improve Water Quality (March 2023) https://store.extension.iastate.edu/product/16734
- Water Quality Monitoring and the Water Quality Initiative (July 2022) https://www.iaenvironment.org/webres/File/Water%20Quality%20Monitoring%20and%20the%20Water%20Quality%20Initiative_June%202022(1).pdf
- Clean Water Iowa – "Urban Conservation Practices" link, New 2026 https://www.cleanwateriowa.org/urban-conservation-practices
- Iowa Nonpoint Source Management Plan, pages 4-5, New 2026

https://www.iowadnr.gov/media/4229/download?inline

- Iowa's Private Wells Overrun With Agricultural Contaminants, New 2026
  https://www.iaenvironment.org/newsroom/water-and-land-news/iowas-private-wells-overrun-with-agricultural-contaminants

**Field Skills**

1. Identify common local aquatic animal species, including fish, reptiles, amphibians, and mammals.
2. Identify common aquatic macroinvertebrates and their tolerance to pollution.
3. Identify invasive aquatic species

**Field Skills Resources**

- Iowa's Nature Series - Aquatic Environments (March 2021)
  https://store.extension.iastate.edu/product/16124
- Iowa Fish Species
  https://www.iowadnr.gov/things-do/fishing/iowa-fish-species
- Iowa Benthic Macroinvertebrate Flow Chart
  https://iowaee.org/wp-content/uploads/2025/02/Benthic-Flow-Chart-vMar2018.pdf

## Wildlife

**Students will be able to:**

**Wildlife Biology**

1. Distinguish between major taxonomic classifications of Iowa wildlife, their typical roles in ecosystems, and their habitat requirements (including mammals, birds, fish, reptiles, amphibians, and insects).
2. Identify the anatomy of various Iowa wildlife species and describe the functions of anatomical parts, part#467886newicularly special adaptations.
3. Provide examples of physical and behavioral adaptations (such as mimicry, camouflage, freeze response, hibernation, special organs, etc.) and how these adaptations benefit wildlife.
4. Explain the difference between generalist and specialist species and provide examples of each.

**Wildlife Biology Resources**

- Iowa's Nature Series – Invertebrates (March 2021)
  https://store.extension.iastate.edu/product/16125
- Iowa's Nature Series – Vertebrates (March 2021)
  https://store.extension.iastate.edu/product/16126
- Mammals of Iowa Field Guide, pages 100-131 (April 2018)

https://store.extension.iastate.edu/product/15391

**Wildlife Ecology**

1. Identify the essential components of a habitat and recommend a suitable habitat for local wildlife species.
2. Identify biotic and abiotic factors in ecosystems and how they are related to wildlife habitat requirements, ecosystem variation, and wildlife conservation.
3. Describe the roles of producers, consumers, and decomposers in various ecosystems and identify their trophic level.
4. Diagram a food web and describe the flow of energy within it.
5. Identify common wildlife diseases, their causes, and their effects.

**Wildlife Ecology Resources**

- Iowa's Nature Series – Prairies (Sept 2021) https://store.extension.iastate.edu/product/16123
- Iowa's Nature Series – Vertebrates (March 2021) https://store.extension.iastate.edu/product/16126
- Iowa DNR Wild Turkey Brochure, New 2026 https://www.iowadnr.gov/media/6998/download?inline
- Chronic Wasting Disease https://www.iowadnr.gov/things-do/hunting-trapping/types-hunting-trapping/deer-hunting/deer-health/chronic-wasting-disease

**Wildlife, Conservation, and Society**

1. Recognize important issues facing wildlife on a local and state/provincial scale
2. Define keystone species and describe their roles and functions within ecosystems.
3. Define invasive and exotic species, describe their characteristics, name examples, describe how they are spread, and explain their impact on local ecosystems

**Wildlife, Conservation, and Society Resources**

- Iowa DNR Wildlife Section https://www.iowadnr.gov/places-go/wildlife-management-areas
- 3 Billion Birds Gone - Iowa Ornithologists' Union (April 2022) https://www.youtube.com/watch?v=ajS276bJ5GE
- Iowa DNR Wild Turkey Brochure, New 2026 https://www.iowadnr.gov/media/6998/download?inline

**Field Skills**

1. Identify common local wildlife species.
2. Identify wildlife by their communication methods (bird and frog calls, etc.).

3. Identify exotic and invasive species.

**Field Skills Resources**

- Mammals of Iowa Field Guide, pages 76-103 (April 2018) https://store.extension.iastate.edu/product/15391
- Iowa Bats (August 2018) https://store.extension.iastate.edu/product/15456
- Listen for bird calls with the DNR's avian biologist (May 2020) https://www.facebook.com/watch/?v=553283672240708
- Amphibians and Reptiles of Iowa http://www.herpnet.net/Iowa-Herpetology
- Iowa's Nature Series – State Symbols (March 2021) https://store.extension.iastate.edu/product/16129

## Soil and Land Use

**Students will be able to:**

**Geology**

1. Explain the impact of geomorphology on landforms and landscapes, and how these processes relate to soil formation
2. Identify unique geological features of the state of Iowa.

**Geology Resources**

- Iowa's Nature Series – State Symbols (March 2021) https://store.extension.iastate.edu/product/16129
- Iowa Geological Survey – Landforms of Iowa, New 2026 https://iowageologicalsurvey.uiowa.edu/iowa-geology/landforms-iowa

**Soil Structure and Function**

1. Define the five soil-forming factors and describe their influence on a particular soil.
2. Identify different types of parent material and how they are formed (such as residual material, eolian deposits, alluvial and marine deposits, colluvial deposits, volcanic deposits, glacial deposits, and organic deposits).
3. Describe how different soil components (mineral composition, organic matter, particle size, et cetera) affect the properties of a soil.
4. Connect a variety of soil processes to observed soil characteristics. (For example, the incorporation of organic matter resulting in darker topsoil and improved soil structure.)

5. Identify the different particle sizes in a soil (sand, silt, and clay) and describe how their proportions influence soil properties.
6. Identify different types of erosion and recommend management practices to prevent and mitigate erosion.
7. Describe how pH affects soil health, nutrient availability, and other soil properties.
8. Describe the following soil properties and their importance:
    a. Density
    b. Porosity
    c. Permeability
    d. Cation exchange capacity
    e. Salinity
    f. Shrink-well capacity
    g. Friability
    h. Plasticity

**Soil Structure and Function Resources**

- Daily Erosion Project
  https://www.dailyerosion.org
- From the Surface Down, Published by the USDA-NRCS (2010)
  https://www.nrcs.usda.gov/sites/default/files/2022-11/from-the-surface-down.pdf
- Conservation Choices - Soil Health Practices (April 2017)
  https://www.nrcs.usda.gov/sites/default/files/2022-09/SoilHealthPractices.pdf
- Iowa Soil Health Field Guide, Soil Health Concept, pages 4-19, 53-57 (Aug 2017)
  https://store.extension.iastate.edu/product/Iowa-Soil-Health-Field-Guide
  https://isuaamncus122stg.blob.core.windows.net/shop/CROP3089A.pdf
- Soil Judging In Iowa, pages 5-16 (February 2021)
  https://store.extension.iastate.edu/product/Soil-Judging-in-Iowa
- Soils – Iowa Nature Series – WL17b (March 2021)
  https://store.extension.iastate.edu/product/Soils-Iowas-Nature-Series

**Soil Ecology**

1. Describe the roles and services of soil organisms (including microorganisms, fossorial animals, fungi, et cetera) in the overall health and functioning of the soil.

**Soil Ecology Resources**

- Soil Health Assessment
  https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soils/soil-health/soil-health-assessment
- Iowa Soil Health Field Guide, Soil Health Concept, pages 4-19, 53-57 (Aug 2017)

https://store.extension.iastate.edu/product/Iowa-Soil-Health-Field-Guide
https://isuaamncus122stg.blob.core.windows.net/shop/CROP3089A.pdf

**Soils, Land Use, and Society**

1. Identify key stakeholders, agencies, and organizations that oversee soil resource protection and land use management, such as local conservation districts, state/provincial agencies, and national environmental and conservation agencies.

**Soils, Land Use, and Society Resources**

- Conservation Choices - Soil Health Practices (April 2017)
  https://www.nrcs.usda.gov/sites/default/files/2022-09/SoilHealthPractices.pdf

**Field Skills**

1. Identify characteristics of a soil pit or soil sample, including horizons, color, structure, texture, and special features.
2. Measure slope using a clinometer or other field tool.
3. Use a soil survey (online and paper copy) to assess soil properties and conditions, such as drainage class and limitations on selected uses.
4. Use a soil triangle to evaluate the texture of a soil.
5. Utilize field tools to provide on-site soil analysis, including:
    a. Auger
    b. Munsell soil color chart
    c. Compass
    d. Particle sieve
    e. pH test kit
    f. GPS

**Field Skills Resources**

- From the Surface Down, Published by the USDA-NRCS (2010)
  https://www.nrcs.usda.gov/sites/default/files/2022-11/from-the-surface-down.pdf
- Soil Judging In Iowa, pages 5-16 (February 2021)
  https://store.extension.iastate.edu/product/Soil-Judging-in-Iowa
- Web Soil Survey - Accessing Web Soil Survey (April 2020)
  https://www.nrcs.usda.gov/sites/default/files/2022-08/WSS-brochure-print-at-home.pdf