2027 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 Iowa 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 that could be covered in the Iowa Envirothon competition and to provide some structure for team learning. However, this guide is not intended to be a complete or definitive guide to each topic. As teams develop their competencies and skills, we hope they will seek out additional information.

Forestry and Prairie

Plant Biology

- 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
- 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).
- 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. Respiration
    c. Nutrient Use

Forest/Prairie Ecology

- List the biotic and abiotic components of a forest and prairie ecosystem
- Describe the major types of forests found in Iowa:

    a. Softwood
    b. Hardwood
    c. Savanah
- Explain the structure of a forest ecosystem and explain the role of vertical stratification in a forest ecosystem.

Plant Communities

- Describe successional change in an ecosystem over time, including changes in species composition, shade tolerance, and interactions with disturbances.
- Describe the role of fire in a forest and prairie ecosystem.
- Explain how different plant communities provide different types of habitats and describe the importance of this habitat variety to wildlife.

Forest and Society

- Describe the ecosystem services provided by forests, grasslands, and other plant communities
- Describe different types of forest management.
- Explain the role of forests and other plant communities in watershed health.

Field Skills

- Identify common local trees and plants by leaves, bark, branching patterns, buds, fruit, and other characteristics.
    2027 Regional Prairie Plant ID List:
        - Indian grass
        - Little bluestem
        - New England aster
        - Pale purple coneflower
    2027 Regional Tree ID List:
        - Bur oak
        - Douglas fir
        - Ponderosa pine
        - Red oak
        - Red maple
        - Serviceberry
        - White pine
- Identify common invasive species, plant pests, and diseases.
        - Burning bush
        - Garlic mustard
        - Honeysuckle
        - Spongy moth
        - White mulberry

Forestry and Prairie Resources

About Prairies, Iowa Prairie Network
https://www.iowaprairienetwork.org/prairie-history
All About Minnesota's Forests and Trees: A Primer– Chapter 2: Forest Ecosystems, Minnesota DNR (2008), New 2027
https://files.dnr.state.mn.us/forestry/education/primer/chaptertwo.pdf
How Agroforestry Improves Water Quality, USDA Forest Service, New 2027
https://www.fs.usda.gov/nac/topics/water-quality.php
Identification of Conifer Trees in Iowa, Iowa DNR (May 1996), New 2027
https://www.iowadnr.gov/media/6771/download?inline
Identification of Hardwood Trees in Iowa, Iowa DNR (May 1996)
https://www.iowadnr.gov/media/6770/download?inline
Iowa's Nature Series – Forests, Iowa State University Extension and Outreach (March 2021)
https://store.extension.iastate.edu/product/16122
Iowa's Nature Series – Plants, Iowa State University Extension and Outreach (March 2021)
https://store.extension.iastate.edu/product/16127
Iowa's Nature Series – Prairies, Iowa State University Extension and Outreach (March 2021)
https://store.extension.iastate.edu/product/16123
Iowa Tree Pests – Spongy Moth, IDALS, New 2027
http://www.iowatreepests.com/gm_home.html
On-Farm Forestry Field Guide for Iowa, Iowa State University Extension and Outreach (June 2026) (pages 18-31), New 2027
https://shop.iastate.edu/extension/farm-environment/natural-resources-and-environment/forest-management/for427.html
Prairie Strips, Sand County Foundation, New 2027
https://scf-web.files.svdcdn.com/production/uploads/publications/Prairie-Strips-2024.pdf?dm=1705508947
The World Beneath Your Feet, Iowa Living Roadway Trust Fund (June 2012) (pages 17-22), New 2027
https://secure.iowadot.gov/lrtf/docs/WorldBeneath.pdf
Tree Anatomy 101, Iowa State University Extension and Outreach (March 2019)
https://naturalresources.extension.iastate.edu/forestry/tree_biology/101.html

Aquatic Ecology

Hydrosphere

- Identify different types of water bodies found in Iowa and describe their characteristics.
- Differentiate the types of wetlands found in Iowa and describe their characteristics.

Aquatic Ecosystems

- Identify the biotic and abiotic components of aquatic ecosystems.

- Explain how seasonal changes in temperature, water level, flow rate, nutrient sources, nutrient availability, runoff, and inputs occur in aquatic ecosystems.
- Describe the importance, functions, and characteristics of watersheds/catchment areas
- Describe the basics of hydrology, including:
    a. Impact of landscape factors on water movement
    b. Runoff

Organisms

- Describe the roles of producers, consumers, and decomposers in various aquatic ecosystems and identify their trophic levels.
- Identify the major characteristics of fish, amphibians, and other aquatic animals.
- Describe the role of cyanobacteria in aquatic ecosystems and their role in harmful algal blooms.

Aquatics and Society

- Describe the basics of water quality and water quality improvement.
- Explain why it is important to take the entire watershed/catchment area into account when planning for water quality
- Identify best management practices for improving water quality and enhancing aquatic habitat
- Identify threats to aquatic ecosystems, such as pollution, biomagnification of toxins, erosion, development, invasive species, excess nutrients, thermal shock, et cetera

Field Skills

- Identify common aquatic animal species, including fish, reptiles, amphibians, and mammals.

    2027 Regional Aquatic Animal ID List:
    - American bullfrog
    - Blue-spotted salamander
    - Boreal chorus frog
    - Eastern tiger salamander
    - Painted turtle
    - Smallmouth bass
    - Ornate box turtle
    - Topeka shiner
- Identify common aquatic macroinvertebrates and their pollution tolerances.
    - Dragonfly
    - Mayfly
- Identify invasive aquatic species.
    - Zebra mussel
    - Silver Carp
    - White perch

Aquatic Ecology Resources

A Complete Field Guide of Iowa Herpetology, Amphibians and Reptiles of Iowa
http://www.herpnet.net/Iowa-Herpetology/
Ag Conservation Practices, Clean Water Iowa
https://www.cleanwateriowa.org/ag-conservation-practices
Iowa Benthic Macroinvertebrate Flow Chart
https://iowaee.org/wp-content/uploads/2025/02/Benthic-Flow-Chart-vMar2018.pdf
Iowa Fish Species, Iowa DNR
https://www.iowadnr.gov/things-do/fishing/iowa-fish-species
Iowa's Nature Series - Aquatic Environments, Iowa State University Extension and Outreach (March 2021)
https://store.extension.iastate.edu/product/16124
Iowa Nutrient Reduction Strategy: Aiming to Improve Water Quality, Iowa State University Extension and Outreach (March 2023)
https://store.extension.iastate.edu/product/16734
Iowa Wetlands, Iowa State University Extension and Outreach (March 2021)
https://naturalresources.extension.iastate.edu/files/inline-files/iowa_wetlands_accessible_reduced_size.pdf
Lesson 1: Watershed Basics, National Environmental Education Foundation (NEEF)
https://www.neefusa.org/water/lesson-1-watershed-basics
Living in Water Chapter 4, Texas Parks & Wildlife New 2027
https://tpwd.texas.gov/education/resources/aquatic-science/tas/chapters/chapter-4/
Sustaining Healthy Freshwater Ecosystems – Requirements for Freshwater Ecosystem Integrity, Ecological Society of America, (pages 3-7) (2003) New 2027
https://esa.org/wp-content/uploads/2013/03/issue10.pdf
Urban Conservation Practices, Clean Water Iowa
https://www.cleanwateriowa.org/urban-conservation-practices
What is a watershed, Iowa Agriculture Water Alliance (IWAW)
https://www.iaagwater.org/what-is-a-watershed/

Wildlife

Wildlife Biology

- Distinguish between major taxonomic classifications of wildlife, their typical roles in ecosystems, and their habitat requirements (including mammals, birds, fish, reptiles, amphibians, and insects).
- Identify the anatomy of various Iowa wildlife species and describe the functions of anatomical parts, particularly special adaptations.
- Identify the different stages in a species' life cycle and describe how each stage relates to the species' biology, behavior, adaptations, habitat requirements, and ecological niche.
- Provide examples of physical and behavioral adaptations (such as mimicry, camouflage, freeze response, hibernation, special organs, et cetera) and how these adaptations benefit wildlife.
- Describe the significance of migration in the life cycle of certain wildlife species.

Wildlife Ecology

- Identify the essential components of a habitat and recommend suitable habitat for local wildlife species.
- Identify biotic and abiotic factors in ecosystems and how they are related to wildlife habitat requirements and ecosystem variation.
- Describe the roles of producers, consumers, and decomposers in various ecosystems and identify their trophic levels.
- Define carrying capacity and identify the limiting factors that can influence wildlife populations.
- Explain the importance of pollinators in natural and agricultural ecosystems.

Wildlife, Conservation, and Society

- Recognize important issues facing wildlife on a local and state/provincial level.
- Define keystone, umbrella, game, non-game, and indicator species and describe their roles and functions within ecosystems.
- Define invasive and exotic species, describe their characteristics, name examples, describe how they are spread, and explain their impact on local ecosystems.

Field Skills

- Identify common local wildlife species.
  2027 Regional Wildlife ID List:
  - Barred owl
  - Cedar waxwing
  - Dark-eyed junco
  - Eastern chipmunk
  - Eastern cottontail
  - Eastern milk snake
  - Franklin's ground squirrel
  - Thirteen-lined ground squirrel
  - Virginia opossum
  - White-tailed jackrabbit

Wildlife Resources

A Complete Field Guide of Iowa Herpetology, Amphibians and Reptiles of Iowa
http://www.herpnet.net/Iowa-Herpetology/

Iowa's Forest Birds, Iowa State University Extension and Outreach (August 2020) New 2027
https://shop.iastate.edu/extension/farm-environment/natural-resources-and-environment/conservation/wl16.html

Iowa's Nature Series – Invertebrates, Iowa State University Extension and Outreach (March 2021)
https://shop.iastate.edu/extension/farm-environment/natural-resources-and-environment/conservation/wl17f.html

Iowa's Nature Series – Vertebrates, Iowa State University Extension and Outreach (March 2021)
https://shop.iastate.edu/extension/farm-environment/natural-resources-and-environment/conservation/wl17g.html
Mammals of Iowa Field Guide, Iowa State University Extension and Outreach (pages 3-31) (April 2018)
https://shop.iastate.edu/extension/farm-environment/natural-resources-and-environment/conservation/wl6.html
Pollinators in Iowa: A Guide to Bees, Butterflies, Moths, and Beneficial Insects, Iowa Living Roadway Trust Fund (pages 3-11, 14-17, 46-51, 74-77) New 2027
https://secure.iowadot.gov/lrtf/docs/pollinatorsiniowa.pdf
The Science of Surviving Winter, Iowa Natural Heritage Foundation (January 2026) New 2027
https://www.inhf.org/about-us/blog/2026/01/06/the-science-of-surviving-winter
Wildlife Action Plan, Iowa DNR
https://www.iowadnr.gov/programs-services/iowas-wildlife/wildlife-action-plan
Wildlife Management Concept and Terms, University of Arkansas System, New 2027
https://acrobat.adobe.com/id/urn:aaid:sc:US:c1c6371d-1f0c-4951-8b0d-21c6b5cb3834

Soil and Land Use

Geology

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

Soil Structure and Function

- Define the five soil-forming factors and describe their influence on a particular soil.
- 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).
- Describe how different soil components (mineral composition, organic matter, particle size, et cetera) affect the properties of a soil.
- 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.)
- Identify the different particle sizes in a soil (sand, silt, and clay) and describe how their proportions influence soil properties.
- Identify different types of erosion and recommend management practices to prevent and mitigate erosion.
- Describe how pH affects soil health, nutrient availability, and other soil properties.
- Describe the following soil properties and their importance:
    a. Density
    b. Porosity
    c. Permeability
    d. Cation exchange capacity

e. Salinity
f. Shrink-swell capacity
g. Friability
h. Plasticity

Soil Ecology

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

Soils, Land Use, and Society

- 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.

Field Skills

- Identify characteristics of a soil pit or soil sample, including horizons, color, structure, texture, and special features.
- Measure slope using a clinometer or other field tool.
- Use a soil survey (online and paper copy) to assess soil properties and conditions, such as drainage class and limitations on selected uses.
- Use a soil triangle to evaluate the texture of a soil.
- 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

Soil and Land Use Resources

Conservation Choices - Soil Health Practices (April 2017)
https://www.nrcs.usda.gov/sites/default/files/2022-09/SoilHealthPractices.pdf Aug 2017)
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
Iowa Geological Survey – Landforms of Iowa,
https://iowageologicalsurvey.uiowa.edu/iowa-geology/landforms-iowa
Iowa Nature Series – Soils, Iowa State University Extension and Outreach WL17b (March 2021)
https://store.extension.iastate.edu/product/Soils-Iowas-Nature-Series
Iowa's Nature Series – State Symbols, Iowa State University Extension and Outreach (March 2021)
https://store.extension.iastate.edu/product/16129
Iowa Soil Health Field Guide, Soil Health Concept (pages 4-19, 53-57)
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 1-13) (August 2026)
https://store.extension.iastate.edu/product/Soil-Judging-in-Iowa

The Past, Present and Future of Iowa Soils (August 2025) New 2027
https://www.inhf.org/about-us/blog/2025/08/21/the-past-present-and-future-of-iowa-soils

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