

## Student Study Guide



**Current Issue for 2019**

**“Agriculture and the Environment: Knowledge & Technology to Feed the World”**

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**Learning Objectives and Resources for Idaho Envirothon 2019**

(Additional objectives or resources may be added in the future, visit <http://idahoenvirothon.weebly.com/> for regular updates)

# AQUATIC ECOLOGY:

## Key Point 1—Abiotic factors

### Learning Objectives:

1. Know the processes and phases for each part of the water cycle and understand the water cycle's role in soil nutrient erosion, salinization of agricultural lands, and climatic influences.
2. Understand the concept and components of a watershed and be able to identify stream orders and watershed boundaries. Know the features of a healthy watershed and an unhealthy watershed.
3. Know how to perform and interpret chemical water quality tests and understand why aquatic organisms and water quality is affected by the physical, chemical and biological conditions of the water.

### Suggested Activities:

1. Use topographic maps to investigate the concept of a watershed, identify a river’s watershed system, and delineate the watershed of a given area. Be able to describe how different land uses and watershed characteristics can affect water runoff, water flow, types of stream habitats and management approaches.
2. Investigate and find out who is using the water in your watershed and become familiar with historic stream and river levels to learn if levels are increasing or decreasing. Use stream assessment data to determine the health of your watershed.
3. Conduct chemical water quality tests to determine the temperature, dissolved oxygen, pH, phosphorus, alkalinity, nitrogen, and dissolved oxygen percent saturation of a water sample and explain why these test results are indicators of water quality and can be used to assess and manage aquatic environments.

### **Resources**:

1. [USGS Water Science Basics: What is the Water Cycle?](http://ga.water.usgs.gov/edu/watercycle.html) , [USGS Water Science Basics: What is the Water Cycle?](http://ga.water.usgs.gov/edu/watercycle.html)  https://water.usgs.gov/edu/watercycle.html
2. [Basic concepts on Watersheds, https://www.epa.gov/hwp/basic-information-and-answers-frequent-questions](https://www.epa.gov/hwp/basic-information-and-answers-frequent-questions)
3. [How to Read a Topographic Map and Delineate a Watershed](https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_014819.pdf), https://www.nrcs.usda.gov/Internet/FSE\_DOCUMENTS/nrcs144p2\_014819.pdf
4. [Georgia Adopt a Stream Manual](https://adoptastream.georgia.gov/manuals), https://adoptastream.georgia.gov/manuals

## Key Point 2—Biotic factors

### Learning Objectives:

1. Understand the dependence of all organisms on one another and how energy and matter flow within an aquatic ecosystem.
2. Understand the concept of carrying capacity for a given aquatic ecosystem, and be able to discuss how competing water usage may affect the ability of the system to sustain wildlife, forestry and anthropogenic needs.
3. Identify common, rare, threatened and endangered aquatic species as well as Aquatic Nuisance Species (ANS) through the use of a key.
4. Know how to perform biological water quality monitoring tests and understand why these tests are used to assess and manage aquatic environments.

### Suggested Activities:

1. Describe the habitat needs of three specific aquatic animals, and compare and contrast the flow of energy in three different aquatic food chains.
2. Create a visual display of rare and endangered aquatic species. Explain how human activities are causing species imperilment and specify actions being taken to protect these species.
3. Conduct a biological stream assessment by collecting macro-invertebrates. Stream Data sheets (key point 1, resource 4) should be used to record and analyze information. Explain why these organisms are biological indicators that help us determine the health of a stream or waterway.

### Resources:

1. [Introduction to Watershed Ecology: Watershed Academy Web, [Introduction to Watershed Ecology: Watershed Academy Web,](http://cfpub.epa.gov/watertrain/pdf/modules/WatershedEcology.pdf)](http://cfpub.epa.gov/watertrain/pdf/modules/WatershedEcology.pdf)  http://cfpub.epa.gov/watertrain/pdf/modules/WatershedEcology.pdf
2. NOAA – Endangered Species Conservation, https://www.fisheries.noaa.gov/topic/endangered-species-conservation
3. [EPA An Introduction to Freshwater Fishes as Biological Indicators, pages 3-12](https://nepis.epa.gov/Exe/ZyNET.exe/P1002J1W.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTXT%5C00000006%5CP1002J1W.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=4), https://nepis.epa.gov/Exe/ZyNET.exe/P1002J1W.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTXT%5C00000006%5CP1002J1W.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=4
4. [Georgia Adopt a Stream Manual](https://adoptastream.georgia.gov/manuals), https://adoptastream.georgia.gov/manuals
5. [WV Save Our Streams’ Benthic Macro-invertebrate field guide](http://www.dep.wv.gov/WWE/getinvolved/sos/Documents/Benthic/WVSOS_MacroIDGuide.pdf), [WV Save Our Streams’ Benthic Macro-invertebrate field guide](http://www.dep.wv.gov/WWE/getinvolved/sos/Documents/Benthic/WVSOS_MacroIDGuide.pdf), http://www.dep.wv.gov/WWE/getinvolved/sos/Documents/Benthic/WVSOS\_MacroIDGuide.pdf

## Key Point 3—Aquatic Environments

### Learning Objectives:

1. Identify aquatic and wetland environments based on their physical, chemical and biological characteristics.
2. Know characteristics of different types of aquifers, and understand historical trends and threats to groundwater quantity and quality.
3. Understand societal benefits and ecological functions of wetlands.
4. Understand the functions and values of riparian zones and be able to identify riparian zone areas.

### Suggested Activities:

1. Describe the physical, chemical and biological characteristics of a stream, river, pond, lake and wetland.
2. Explain how different types of aquifers are indicators of water quantity and water quality. Describe how subsidence and salt-water intrusion are related to the falling water table in many aquifers.
3. Describe three functions of wetlands, and explain how these functions are met in the absence of wetlands.
4. Describe three functions of riparian zones and explain how the removal of or damage to the riparian zone would affect water quality and specific aquatic food chains.

## Key Point 4—Water Protection and Conservation

### Learning Objectives:

1. Understand how education programs and enforcement agencies are working together to protect aquatic habitats and preventing those who use our waterways from inadvertently transporting Aquatic Nuisance Species ANS from one river to another.
2. Interpret major provincial and /or federal laws and methods used to protect water quality (i.e. surface and ground water). Utilize this information to propose management decisions that would improve the quality of water in a given situation.
3. Be familiar with the Federal, Provincial and state agencies that provide oversight of water resources, and understand that Geographic Information Systems (GIS) is a useful and important tool in the management of water resources.
4. Identify global and local sources of point and non-point source pollution and be able to discuss methods to reduce point and non-point source pollution.
5. Understand the interaction of competing uses of water for water supply, hydropower, navigation, wildlife, recreation, waste assimilation, irrigation, and industry.
6. Know the meaning of water conservation, and understand why it is important every time you turn on a faucet.

### Suggested Activities:

1. List at least 3 Aquatic Nuisance Species ANS, and describe their effects on an aquatic ecosystem. Consider what can happen when predator ANS are imported, and develop a plan for the eradication of a target ANS.
2. Site water protection laws at a mock hearing to decide whether a permit should be given to build a new shopping mall along a river.
3. Explain how Geographic Information Systems (GIS) are being used to help communities assess water quality and watershed health information.
4. Compare water usage in different regions of Canada and the United States and propose actions to help countries strike a balance between supply and demand in order to realize maximum benefit from our water resources.
5. Design a comprehensive water conservation plan for your home and the watershed below your home. This should include groundwater replenishment, securing sediment on your property, managing non-point source pollution and following the path of good quality water as it leaves your property on its way to the sea.
6. Many dams are used to provide low cost electricity at the critical time of day when there is peak demand for electricity. Today a major issue is deciding which is more important to the economy, low cost energy or improving/restoring the ecology of a river. Evaluate the issue and develop recommendations for conservation groups and utility executives.

### Resources:

1. [What are Aquatic Nuisance Species (ANS)?](http://www.anstaskforce.gov/ans.php)  http://www.anstaskforce.gov/ans.php
2. [ANS Task Force](http://www.anstaskforce.gov/default.php), http://www.anstaskforce.gov/default.php
3. [Conservation of Great Lakes Wetlands: Environment Canada](http://www.ec.gc.ca/nature/default.asp?lang=En&n=E366BABA-1&printerversion=true), <http://www.ec.gc.ca/nature/default.asp?lang=En&n=E366BABA-1&printerversion=true>
4. [Summary of the Federal Clean Water Act](https://www.epa.gov/laws-regulations/summary-clean-water-act), https://www.epa.gov/laws-regulations/summary-clean-water-act
5. [The Quality of Our Nation’s Water](http://pubs.usgs.gov/fs/FS-116-99/pdf/fs-116-99.pdf), http://pubs.usgs.gov/fs/FS-116-99/pdf/fs-116-99.pdf
6. [GIS and Hydrology](http://en.wikipedia.org/wiki/GIS_and_Hydrology), <http://en.wikipedia.org/wiki/GIS_and_Hydrology>
7. [Water Resources](http://en.wikipedia.org/wiki/Water_resources), <http://en.wikipedia.org/wiki/Water_resources>
8. [Water Conservation](http://en.wikipedia.org/wiki/Water_conservation), <http://en.wikipedia.org/wiki/Water_conservation>
9. [Polluted Runoff: Nonpoint Source Pollution](http://www.epa.gov/owow_keep/NPS/whatis.html), http://www.epa.gov/owow\_keep/NPS/whatis.html

# FORESTRY:

## Key Point 1—Tree Physiology and Tree and Shrub Identification

### Learning Objectives:

1. Know the parts and tissues of a tree, and be able to explain the growth cycle and life cycle of a tree.
2. Understand the processes of photosynthesis and respiration and how they are important to the growth and reproduction of trees.
3. Identify common tree species without a key, and identify specific or unusual trees and shrubs through the use of a key.

### Suggested Activities:

1. Identify trees and shrubs using leaf and seed samples.

### Resources:

1. [Tree Physiology](http://www.envirothon.org/files/PhysiologyofTrees2.pdf), http://www.envirothon.org/files/PhysiologyofTrees2.pdf
2. Tree Cookies, https://idahoforests.org/content-item/tree-cookies/
3. Forestry Terms, https://idahoforests.org/content-item/wood-words/
4. [Trees of Idaho](https://idahoforests.org/wp-content/uploads/2017/01/treesofidaho.pdf), https://idahoforests.org/wp-content/uploads/2017/01/treesofidaho.pdf

## Key Point 2—Forest Ecology

### Learning Objectives:

1. Know the typical forest structure canopy, understory and ground layers and crown classes.
2. Understand forest ecology concepts and factors affecting them, including the relationship between soil and forest types, tree communities, regeneration, competition, and primary and secondary succession.
3. Identify the abiotic and biotic factors in a forest ecosystem, and understand how these factors affect tree growth and forest development. Consider factors such as climate, insects, microorganisms, and wildlife.

### Suggested Activities:

1. Identify and describe the life cycle of forest pests and invasive plants and describe their impact to a forest ecosystem. Research integrated pest management strategies for selected pests.
2. Draw food webs of a mature deciduous forest and a mature coniferous forest. Explain how wildlife habitat relates to the forest community and describe the niches of various organisms that live in both of these forest ecosystems.
3. Examine a “tree cookie” or core sample taken with an increment borer to determine the age, growing conditions, insect and disease damage, and past weather conditions.
4. Project Learning Tree Activity 7, Understanding Fire: Explore patterns of change brought about by fires in a forest ecosystem.

### Resources:

* 1. Managing Forests for Fish and Wildlife, ftp://ftp-fc.sc.egov.usda.gov/WHMI/WEB/pdf/Forests.pdf
	2. [Dendrochronology,](http://www.envirothon.org/pdf/CG/dendrochrono.pdf) http://www.envirothon.org/pdf/CG/dendrochrono.pdf
	3. [Project Learning Tree Activity 7: Understanding Fire](http://www.envirothon.org/pdf/CG/forestry_ecology_PLT_activity_7.pdf), http://www.envirothon.org/pdf/CG/forestry\_ecology\_PLT\_activity\_7.pdf

## Key Point 3—Sustainable Forest Management

### Learning Objectives:

1. Understand the term silviculture, and be able to explain the uses of the following silviculture techniques: thinning, prescribed burning, single tree and group tree selection, shelterwood method, clear-cutting with and without seed trees, and coppice management.
2. Explain the following silviculture systems: clear-cutting , seed tree method, evenaged management, unevenaged management, shelterwood and selection.
3. Understand the methodology and uses of the following silviculture treatments: Planting, weeding, pre-commercial thinning (PCT), commercial thinning and harvesting.
4. Know how to use forestry tools and equipment in order to measure tree diameter, height and basal area.
5. Understand how the following issues are affected by forest health and management: biodiversity, forest fragmentation, forest health, air quality, aesthetics, fire, global warming and recreation.
6. Understand how forestry management practices and policy affect sustainability.
7. Understand how economic, social and ecological factors influence forest management decisions.
8. Learn how science and technology are being utilized in all aspects of forest management.

### Suggested Activities:

1. Use the following forestry tools and know how they are used in forest management. clinometer, increment borer, diameter tape, biltmore stick, abney level, and compass, prism and relescope.
2. Use a variety of volume tables to calculate the volume of lumber for several different tree species.
3. Project Learning Tree Activity 8, Fire Management: Learn the many interdependencies of forests and fire in healthy ecosystems.
4. Compare two different forest types. For example: an eastern hardwood forest in PA to a conifer forest in Oregon. Identify economic, social and ecological factors that affect how both of these forests are managed.
5. Explain the Information Technology used to monitor and productively manage forests, and give specific examples of how this technology is being utilized in all aspects of forest management.

### Resources:

1. Woodland Management: Measuring your Forests, http://extension.umd.edu/sites/extension.umd.edu/files/\_docs/programs/woodland-steward/FS629-WdlndMgtMeasuring.pdf
2. [Forest Stewardship -Timber Harvesting: PSU Bulletin 7](http://www.envirothon.org/pdf/CG/forest_stewardship_timber_harvesting.pdf), http://www.envirothon.org/pdf/CG/forest\_stewardship\_timber\_harvesting.pdf
3. [Forest Stewardship –BMPs: PSU Bulletin 12](http://www.envirothon.org/pdf/CG/forest_stewardship_bmps.pdf), http://www.envirothon.org/pdf/CG/forest\_stewardship\_bmps.pdf
4. [Project Learning Tree Activity 8, Fire Management](http://www.envirothon.org/pdf/CG/PLT_activity_8.pdf), http://www.envirothon.org/pdf/CG/PLT\_activity\_8.pdf
5. [Forest Health](http://www.envirothon.org/pdf/CG/forest_health.pdf), http://www.envirothon.org/pdf/CG/forest\_health.pdf
6. [Technology in the Forest](http://www.envirothon.org/pdf/CG/technology_in_the%20_forest.pdf), http://www.envirothon.org/pdf/CG/technology\_in\_the \_forest.pdf

## Key Point 4—Trees as an Important Renewable Resource

### Learning Objectives:

1. Understand the importance and value of trees in urban and community settings, and know the factors affecting their health and survival.
2. Understand the economic value of forests and know many of the products they provide to people and society.
3. Explain the “Ecosystem Services” provided by trees, and understand why trees and forests are important to human health, recreation, wildlife, and watershed quality.

### Suggested Activities:

1. Create a display showing the value of trees in both urban and suburban settings. Identify the factors that affect their health and survival, and explain how to properly care for trees in an urban environment.
2. Make a list of products and by-products that come from your home and are made from trees. Describe the chemical and physical properties of trees used in making these products.

### Resources:

1. [Products from Trees](http://www.envirothon.org/pdf/CG/forest_products.pdf), http://www.envirothon.org/pdf/CG/forest\_products.pdf, http://www.envirothon.org/pdf/CG/forest\_products.pdf
2. [Benefits of Community Trees and Forests](http://www.envirothon.org/pdf/CG/benefits.pdf), http://www.envirothon.org/pdf/CG/benefits.pdf
3. [Trees and Ecosystem Services](http://www.envirothon.org/pdf/CG/trees_and_ecosystem.pdf), http://www.envirothon.org/pdf/CG/trees\_and\_ecosystem.pdf
4. [Roles of Plants/Roles of People](http://www.naturewithin.info/UF/UFdefined.html), http://www.naturewithin.info/UF/UFdefined.html

# SOILS/LAND USE:

## Key Point 1—Physical Properties of Soil and Soil Formation

### Learning Objectives:

1. Understand the importance of soils and appreciate the relatively small amount of usable soil that exists on Earth.
2. Know the five soil forming factors, and understand how they influence soil properties.
3. Understand the origin and types of soil parent materials.
4. Understand basic soil forming processes: additions, losses, translocations, and transformations.
5. Recognize and understand features of Soil Profiles, and be able to use this information to determine basic soil properties and limitations.
6. Identify and describe soil characteristics (texture, structure, and color- using Munsell color charts).

### Suggested Activities:

1. Generate a list of reasons why soils and the study of soil science is important to sustaining life on Earth, and explore how much soil available on Earth is for human use.
2. Describe the five factors of soil formation and be able to explain how each factor affects the soil profile.
3. Conduct a field analysis by digging or using an auger to examine a soil pit. Determine soil characteristics and properties, by describing soil horizons and recording data.
4. Use soil profile information to compare soil samples from agriculture cropland, wetland, forest and an urban area, and explain why there are differences in water table, permeability, runoff, infiltration and water holding capacity.
5. Estimate percent sand, silt, and clay for soil samples collected and determine texture class using the texture triangle. Explain how texture is important in soil fertility and soil management.

Resources:

1. [Why Soil is Important](http://www.envirothon.org/pdf/CG/Why_Soil_is_Important.pdf), http://www.envirothon.org/pdf/CG/Why\_Soil\_is\_Important.pdf
2. [How Much Soil is there?](http://www.envirothon.org/pdf/CG/How_Much_Soil_Is_There.pdf), http://www.envirothon.org/pdf/CG/How\_Much\_Soil\_Is\_There.pdf
3. [From the Surface Down](http://www.envirothon.org/pdf/CG/NRCS_From_the_Surface_Down.pdf), http://www.envirothon.org/pdf/CG/NRCS\_From\_the\_Surface\_Down.pdf
4. [Soil Formation and Classification](http://www.envirothon.org/pdf/CG/Soil_Formation_and_Classification_NRCS.pdf), http://www.envirothon.org/pdf/CG/Soil\_Formation\_and\_Classification\_NRCS.pdf
5. [Factors Affecting Soil Development](http://www.envirothon.org/pdf/CG/Factors_Affecting_Soil_Development.pdf), http://www.envirothon.org/pdf/CG/Factors\_Affecting\_Soil\_Development.pdf
6. [Guide to Texture by Feel](http://www.envirothon.org/pdf/CG/Guide_to_Texture.pdf), http://www.envirothon.org/pdf/CG/Guide\_to\_Texture.pdf
7. [Soil Field Analysis](http://www.envirothon.org/pdf/CG/soil_field_analysis.pdf), http://www.envirothon.org/pdf/CG/soil\_field\_analysis.pdf
8. [Description of Soils: Soil Surveys, Chapter 3](http://soils.usda.gov/technical/manual/contents/chapter3.html)], http://soils.usda.gov/technical/manual/contents/chapter3.html
9. [State Soils: NRCS](http://soils.usda.gov/gallery/state_soils/), http://soils.usda.gov/gallery/state\_soils/

## Key Point 2—Soil Ecosystems

### Learning Objectives:

1. Recognize that biological diversity is important for soil health and hence plant, human and environmental health.
2. Understand how the hydrologic, carbon and nutrient cycles relate to soil management.
3. Recognize that understanding soil ecosystems is important to soil management.

### Suggested Activities:

1. Construct a Burlese funnel to learn about the diversity of life living in the soil. Draw a soil food web showing the 5 tropic levels and discuss why biodiversity is important to healthy soil. (note: some important soil organisms will not show up in the Burlese funnel, but they should be included in the trophic level diagram.)
2. Draw the nitrogen, carbon and phosphorus cycles and identify the types of organisms (flora and fauna) involved in these cycles. Identify their roles in decomposition and nutrient cycling.
3. Discuss the decomposition and transformations of organic matter, toxins and pesticides. Discuss the importance of microorganisms, and what would occur if they were not present in the food chain.
4. Discuss how Integrated Pest Management can affect biological diversity.

**Resources:**

1. [Instructions for making a Burlese Funnel](http://www.sciencebuddies.org/science-fair-projects/project_ideas/EnvSci_p042.shtml), http://www.sciencebuddies.org/science-fair-projects/project\_ideas/EnvSci\_p042.shtml
2. [Nutrient Cycles](http://www.envirothon.org/pdf/CG/nutrient_cycles.pdf), http://www.envirothon.org/pdf/CG/nutrient\_cycles.pdf

[Carbon](http://www.envirothon.org/pdf/CG/carbon_sequestration.pdf)
[Phosphorus](http://www.envirothon.org/pdf/CG/phosphorus_fact_sheet.pdf)
[Nitrogen](http://www.envirothon.org/pdf/CG/nitrogen_factsheet.pdf)

1. [Soil Biology-Soil Biology Primer Chapters,](https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/biology/) https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/biology/

## Key Point 3—Chemical Properties of Soil and Soil Fertility

### Learning Objectives:

1. Understand the procedure for taking a soil sample and conducting nutrient analysis.
2. Know that plants must receive essential micronutrients and macronutrients from the soil in order to be healthy, and understand that soil fertility relates to the physical and chemical properties of the soil in addition to the quantity of nutrients.
3. Understand why soil fertility reflects the physical, chemical and biological state of the soil.

### Suggested Activities:

1. Collect a representative soil sample from a piece of land (preferably your own) as an introduction to soil testing. Conduct soil test experiments to measure pH and determine the amounts of plant available nitrogen (N), Phosphorus (P),and Potassium (K) in soil samples collected from different locations such as: cropland, forested area, and in a flood plain. Record your data, and analyze and compare results.
2. Explain the ABC’s of Nutrient Management, and how Nutrients and Plant Health, Pest, Profits and the Environment relate to healthy soil.
3. \Explain why soil fertility reflects the physical, chemical and biological state of the soil.
4. Compare and contrast the benefits and risks of using nutrients from a synthetic fertilizer with those from a natural source.

### Resources:

1. Soil Sampling, http://www.extension.uidaho.edu/publishing/pdf/EXT/EXT0704.pdf
2. \[Soils and Fertilizers](http://www.extension.uidaho.edu/mg/resources/handbook/MGH05.pdf), http://www.extension.uidaho.edu/mg/resources/handbook/MGH05.pdf
3. Nutrient Management, https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/ecoscience/mnm/?cid=stelprdb1044741

## Key Point 4—Soil Conservation and Land Use Management

### Learning Objectives:

1. Compare different land uses and conservation practices and their impact on soils and erosion.
2. Understand how soil is impacted by point & non-point source pollution & the importance of soil management to agriculture and clean water.
3. Understand that soil management and environmental protection requires agricultural and resource managers to use spatial tools such as Geographic Information Systems (GIS), and Global Positioning Systems (GPS) in order to make the best possible resource decisions.
4. Learn about career opportunities and the role of government in the management of natural resources.

### Suggested Activities:

1. Identify or recommend Best Management Practices to maximize agriculture production and control water movement to prevent erosion and pollution on construction sites, residential development and cropland.
2. In a land use planning discussion, identify types of soil erosion and explain how soil is a factor in non-point source pollution, and describe how soils can be used to clean up pollutants.
3. Become familiar with the Universal Soil Loss Equation (USLE), and learn how it used to estimate the soil erosion rates of a selected construction site and cropland field.
4. Practice using topographic and thematic maps to uncover mysteries about the cultural and physical geography of the Earth.

[USGS Map Mysteries Activities](http://www.envirothon.org/pdf/CG/usgs_map_mysteries_activities.pdf).

### Resources:

1. [Urban Soil Primer](https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/urban/?cid=nrcs142p2_053993), https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/urban/?cid=nrcs142p2\_053993[Soil Erosion: Causes and Effects](http://www.envirothon.org/pdf/CG/soil_erosion.pdf)
2. [Revised](http://www.envirothon.org/pdf/CG/using_the_USLE.pdf) Universal Soil Loss Equation 2 (Rusle2), https://www.ars.usda.gov/southeast-area/oxford-ms/national-sedimentation-laboratory/watershed-physical-processes-research/research/rusle2/revised-universal-soil-loss-equation-2-overview-of-rusle2/
3. \[Careers in Soil Science](https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054277),

<https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054277>

## Key Point 5—Web soil surveys & Soil Surveys

### Learning Objectives:

1. Access and use published and on-line soil data and other resources to learn how land use affects soil, and the limitations of local soils.
2. Understand the eight Land Capability Classes and how they are important in determining appropriate land use.
3. Understand soil drainage classes and be able to recognize the characteristics of hydric soils and know how soils fit into the definition of wetlands.

### Suggested Activities:

1. Download your local area’s soil survey map to learn the limitations that local soils have for septic systems, foundations, agriculture, and future development.
2. Describe the eight Land Capability Classes and use a soil profile and site description to determine land capability class.
3. Visit your local land planning office and ask how GIS and GPS systems are used in making land use planning and development decisions. Explain how GIS and GPS can be used in learning about the soil characteristics in a wetland soil.

### Resources:

1. [Web Soil Survey,](http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) https://websoilsurvey.nrcs.usda.gov/app/HomePage.htm
2. [Land Capability Classification](http://www.envirothon.org/pdf/2012/2012ce_soils_resources/KP4.3land_capability_classification%5B1%5D.pdf), http://www.envirothon.org/pdf/2012/2012ce\_soils\_resources/KP4.3land\_capability\_classification%5B1%5D.pdf
3. \[Hydric Soils](https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/hydric/?cid=nrcs142p2_053961), https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/hydric/?cid=nrcs142p2\_053961
4. \[Site Fingerprinting](http://www.envirothon.org/pdf/CG/site_fingerprinting.pdf), http://www.envirothon.org/pdf/CG/site\_fingerprinting.pdf

# WILDLIFE:

## Key Point 1—Knowledge of Wild Birds, Mammals and Habitats

### Learning Objectives:

1. Identify wildlife species using mounted specimens, skins/pelts, pictures, skulls, silhouettes, decoys, wings (waterfowl), scats, tracks, animal sounds, or other common signs. Animal tracks may be original or molds made of the prints. Wildlife signs may be real or reproduced.
2. Use a key or field guide to identify wildlife species or signs. Wildlife species or signs may be presented in any form as described above.
3. Identify general food habits (herbivore, omnivore, carnivore), habitats (terrestrial, aquatic, fossorial), and habits (diurnal, nocturnal) using skull morphology and/or teeth.

### Resources:

1. This resource to be used as a reference: [Idaho Species Diversity Database](https://idfg.idaho.gov/species/), <https://idfg.idaho.gov/species/>
2. [Outdoor Action Guide to Animal Tracking: pages 1 – 6](http://www.princeton.edu/~oa/nature/tracking.pdf), http://www.princeton.edu/~oa/nature/tracking.pdf

## Key Point 2—Wildlife Ecology

### Learning Objectives:

1. Know the meaning of “habitat”, and be able to name the habitat requirements for wildlife and the factors that affect wildlife suitability.
2. Know and understand basic ecological concepts and terminology.
3. Understand the difference between an ecosystem, community and population. Be able to explain how communities interact with their non-living surroundings to form ecosystems.
4. Understand wildlife population dynamics such as birth, mortality, age-structure, sex ratio, and mating systems. Understand the impact of limiting and decimating factors of common wildlife species on wildlife management.
5. Recognize that all living things must be well-adapted to their native environment in order to survive. Be able to identify, describe and explain the advantages of specific anatomical, physiological and/or behavioral adaptations of wildlife to their environment.
6. Know the meaning of the term “Biodiversity”, and understand why biodiversity is important to people and wildlife.
7. Understand the importance of the 3 levels of biodiversity: genetics, species and ecosystem or community, and understand the implications of biodiversity loss at each level.

### Suggested Activities:

1. Draw a map of an area and identify sources of food, water and shelter available to wildlife. Select a wildlife species, and assess whether the area on your map will provide suitable habitat for this species. If any part of the habitat is lacking, explain what you could do to improve the habitat for this species?
2. Explain the relationship between the Pyramid of Numbers and the Pyramid of Biomass. Relate this exercise to an actual habitat to help you understand how much land area is needed to support life at each level of the food chain. Lesson: [Ecological Pyramids](http://sfr.psu.edu/youth/sftrc/lesson-plans/wildlife/9-12/pyramid).
3. Create a detailed display to show examples of different types of food chains and illustrate the interdependence of organisms within a food web. Include terms such as tropic levels, predator, prey, scavengers, decomposers, omnivore, insectivore, herbivore, carnivore, producer, primary consumer, secondary consumer and tertiary consumer.
4. Explain the term “ecosystem” and give examples of different types of ecosystems. Describe a type of ecosystem and explain the importance of a keystone species. Draw food chains that include a specific keystone species and discuss what might happen if this species were removed from the food chain or if their populations diminished.
5. Select several wildlife species common to your area and list potential limiting and decimating factors for each. Visit a natural area, park, forest, and/or farm and assess the area to determine which of the limiting and decimating factors on your list would actually impact your selected species. For example, water may be a potential limiting factor, but the area you visit may have an abundance of water. Therefore, water would not be a limiting factor on this area and would have no impact.
6. Explain why your state or province is so diverse and explain what is being done to protect the biodiversity of wildlife. Include the following vocabulary to help you explain your answer: biodiversity, keystone species, native, endemic, habitat, biome, and food web.
7. Compare and contrast the behavioral and physiological adaptations of specific animals that live in two different environments. Explain why these animals are well-adapted to survive in their particular environment and include wildlife biology terms to describe specific adaptations.
8. Explain the three levels of biodiversity and give several reasons why biodiversity is important to wildlife and people. Select examples of species in your area that have become locally extinct and explain what causes loss of biodiversity. What can be done to gain biodiversity?

###

### Resources:

1. [4-H Wildlife Project: The Wildlife Ecologist, pages 8-16](http://sfr.psu.edu/youth/sftrc/lesson-plan-pdfs/wildlife-ecologist), http://sfr.psu.edu/youth/sftrc/lesson-plan-pdfs/wildlife-ecologist
2. [Glossary of Important Wildlife Terms](https://www.envirothon.org/wildlife-glossary), https://www.envirothon.org/wildlife-glossary
3. [Organization of Life: Species, Population, Communities and Ecosystems](http://www.physicalgeography.net/fundamentals/9d.html), http://www.physicalgeography.net/fundamentals/9d.html
4. [Clemson University: The Basics of Population Dynamics,](https://www.uaex.edu/environment-nature/wildlife/youth-education/TR%20Basics%20Population%20Dynamics.pdf) https://www.uaex.edu/environment-nature/wildlife/youth-education/TR%20Basics%20Population%20Dynamics.pdf
5. [Animal Adaptions for Winter,](http://www.canr.msu.edu/news/animal_adaptations_for_winter) http://www.canr.msu.edu/news/animal\_adaptations\_for\_winter

## Key Point 3—Conservation and Management of Wildlife

### Learning Objectives:

1. Know the preferred habitat types and specific habitat requirements of common wildlife species. Understand how this knowledge helps us to better protect both the land and the wildlife species that depend on it.
2. Understand the difference between biological and cultural carrying capacity, and be able to identify social and ecological considerations where human use of land conflicts with wildlife habitat needs.
3. Identify common wildlife management practices and methods that are being used to manage and improve wildlife habitat.
4. Understand the role of federal, state and provincial Fish and Wildlife Agencies in the management, conservation, protection, and enhancement of fish and wildlife and their habitats.
5. Know that all states and provinces have a hunting safety course and mandatory hunter education program developed specifically for each state or provincial government’s hunting and wildlife agency.

### Suggested Activities:

1. Explain the meaning of the terms "migration route" and "flyway”. Know the four major North American flyways and understand the importance of these routes to migratory land, water and shore birds.
2. Determine which common wildlife species in your area depend on open land, woodland and wetland habitat for their survival. Identify the various types of habitat within open lands, woodlands, and wetlands, and explain the importance of these specific habitats to common wildlife species within your area.
3. Explain why human use of land is the major reason for habitat loss. Provide examples of habitat destruction, fragmentation, and degradation and explain how wildlife species survival is threatened by habitat loss in your area.
4. Research and analyze controversial issues in order to understand the relationship between wildlife, economics and society. Penn. State School of Forest Resources: [The Social and Economic Impact of Wildlife and Natural Resource Management Lesson Plan](http://sfr.psu.edu/youth/sftrc/lesson-plans/wildlife/9-12/impact), https://ecosystems.psu.edu/youth/sftrc/lesson-plans/wildlife/9-12/impact
5. Make a list of wildlife management practices and strategies that will restore or improve habitat for each of the following land uses: cropland, grassland, woodland, wetland, pond/lake, and urban setting (backyards, greenways, urban parks). Include specific wildlife species that will benefit from each wildlife practice or strategy.
6. Make a list of the Federal and State Fish and Wildlife Agencies within your state or province. Determine how each protects and manages the wildlife resources of your area, and describe activities and programs that are undertaken to protect and manage wildlife and their habitats.
7. Explain regulated trapping procedures and discuss the issues that are involved in trapping furbearing animals. Research and explain the dilemma of biological carrying capacity vs. cultural carrying capacity in your discussion.
8. Explain how Wildlife Managers are using Satellite Remote Sensing, GPS and GIS in Conservation and Wildlife Management. Give an example explaining the benefits of using this technology in remote areas.

### Resources:

1. [Flyways of the Americas, https://www.audubon.org/birds/flyways](https://www.audubon.org/birds/flyways)
2. [USFWS Migratory Birds and Habitat Program: Migratory Bird Treaty Act, https://www.fws.gov/birds/policies-and-regulations/laws-legislations/migratory-bird-treaty-act.php](file://C:\\Users\\ghitz\\AppData\\Local\\Microsoft\\Windows\\Temporary Internet Files\\Content.Outlook\\P3ES9H1R\\USFWS Migratory Birds and Habitat Program: Migratory Bird Treaty Act, https:\\www.fws.gov\\birds\\policies-and-regulations\\laws-legislations\\migratory-bird-treaty-act.php)
3. [Woodland Fish and Wildlife, http://woodlandfishandwildlife.com/](file:///C%3A%5CUsers%5Cghitz%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CTemporary%20Internet%20Files%5CContent.Outlook%5CP3ES9H1R%5CWoodland%20Fish%20and%20Wildlife%2C%20http%3A%5Cwoodlandfishandwildlife.com%5C)
4. [Habitat Management Practices,](https://ag.tennessee.edu/fwf/craigharper/Documents/2018WHEP-web-WMPs.pdf) https://ag.tennessee.edu/fwf/craigharper/Documents/2018WHEP-web-WMPs.pdf
5. [This resource is to be used as a reference: Online Idaho Department of Fish and Game - Education](https://idfg.idaho.gov/education)
6. [Trapping and Furbearer Management in North American Wildlife Conservation pages 4-20](http://files.dnr.state.mn.us/recreation/hunting/trapping/na_furbearer_mgt.pdf), <http://files.dnr.state.mn.us/recreation/hunting/trapping/na_furbearer_mgt.pdf>

## Key Point 4—Issues Involving Wildlife and Society

### Learning Objectives:

1. Understand how non-native (exotic), Western Rangeland Management: Balancing Diverse Views threaten our environment and the biodiversity of many wildlife species. Understand that non-native (exotic), invasive plants impact wildlife habitat and thus have a tremendous impact on native wildlife.
2. Learn about the complexities of decision-making in making land use decisions that affect wildlife, and understand that wildlife resources are under constant pressure caused by human population growth, environmental degradation, and habitat reduction.
3. Know that Wildlife species are subject to diseases resulting from exposure to microbes, parasites, toxins, and other biological and physical agents.
4. Understand the terminology and factors that affect threatened and endangered wildlife species. Know the meaning of extinct, extirpated, endangered, threatened, candidate species and reintroduction.
5. Identify the characteristics that many extinct and endangered species possess, and be able to identify many species wildlife that are endangered and threatened.
6. Understand the role of the Endangered Species Act in helping to conserve endangered and threatened species. Know the organizations and agencies responsible for listing and protecting endangered species on global, federal, state and provincial levels.

### Suggested Activities:

1. Give specific examples of non-native (exotic), Western Rangeland Management: Balancing Diverse Views in your area and describe how they have altered habitats, threatened ecosystems, and impacted wildlife. Explain what is being done to increase awareness and facilitate effective prevention and management of non-native (exotic) Western Rangeland Management: Balancing Diverse Views.
2. Explain the three major kinds of habitat loss. Give examples of how human activity is the biggest threat to wildlife habitat and also discuss how people can have a positive impact on wildlife habitat and biodiversity.
3. HIPPO is an acronym that represents the five major threats to biodiversity, which are caused by human activity. Design a poster to illustrate the HIPPO concept and factors that bring about the loss of biodiversity.
4. Name and describe two examples of diseases that are critically impacting Wildlife and explain why controlling emerging wildlife diseases have become a high-priority concern in the United States and Canada. Explain the life cycles of these diseases and how they can be transmitted to humans.
5. Identify and describe factors that threaten and endanger wildlife species in your area. Explain what actions are being taken by various agencies and interest groups to improve the chance of survival for specific threatened and endangered species. Also, determine what practical measures private citizens can take to assist in the recovery of threatened and endangered species.
6. Select several endangered species and create a display to describe the characteristics that have made these species more vulnerable. Discuss state, provincial and federal efforts being taken to protect these species.

### Resources:

1. [Introduced Species: The Threat to Biodiversity and What Can Be Done](http://www.actionbioscience.org/biodiversity/simberloff.html?print) (see learn more links at the end of article for additional information) <http://www.actionbioscience.org/biodiversity/simberloff.html?print>
2. [National Wildlife Federation,](https://www.nwf.org/educational-resources/wildlife-guide/)  https://www.nwf.org/educational-resources/wildlife-guide/
3. [Emerging Wildlife Diseases](https://www.usgs.gov/centers/nwhc/science/emerging-wildlife-diseases), https://www.usgs.gov/centers/nwhc/science/emerging-wildlife-diseases
4. This resource is to be used as a reference: [USGS Vector-borne Diseases and Zoonotic (transmitted between animals and humans) Diseases](http://health.usgs.gov/vector_zoonotic/), http://health.usgs.gov/vector\_zoonotic/
5. [Endangered Species Handbook: Vanishing Species -What is Threatening Species?](http://www.endangeredspecieshandbook.org/pdfslive/esh_4-36.pdf) , http://www.endangeredspecieshandbook.org/pdfslive/esh\_4-36.pdf
6. [Idaho’s Endangered Species,](https://www.fws.gov/idaho/promo.cfm?id=177175746) https://www.fws.gov/idaho/promo.cfm?id=177175746
7. [USFW Service Endangered Species Act (ESA)](http://www.fws.gov/endangered/esa-library/pdf/ESA_basics.pdf) , http://www.fws.gov/endangered/esa-library/pdf/ESA\_basics.pdf

# CURRENT ISSUE:

## Agriculture and the Environment: Knowledge and technology to feed the world

There are many articles that estimate the population of the Earth to be approximately 9 billion by the year 2050.  One of the primary concerns for the agricultural industry is how will farmers be able to grow enough food to feed this growing population, while also protecting natural resources such as soil, water, air, wildlife, and forestry resources.

Students will learn the concepts of how agriculture and all natural resource areas are interrelated, and how the use of new technologies are key to increase food production.   Key Points will include:

* Understand the importance of moving toward sustainable farming systems to conserve natural resources, mitigate climate change, reduce erosion and protect water quality and quantity, and promote pollination;
* Comprehension of farming practices that build soil organic matter such as composting, crop rotations, cover crops, conservation tillage, and management intensive grazing systems to improve soil health;
* Understand integrated pest management and biological pest control techniques used to prevent insect pest, disease, and weed problems;
* Understand the role of new technology: agricultural biotechnology; precision agriculture; and using UAV (drones, GIS, etc.) to increase farm efficiency for food production.

### **Key Points (KP):**

1. Understanding how agroecosystems function and the services they provide.
2. Understanding the importance of soil health as the foundation of a healthy ecosystem.
3. Understanding sustainable agriculture on large and small farm operations, as well as the indicators of sustainable farming.
4. Understanding how sustainable and best management farming practices enhance and protect soil health, water quality and quantity, and biodiversity; as well as manage insect pests, disease, and weeds.
5. The differences of local, regional, and national foods systems that are vital to grow food for an ever increasing world population; and the importance of each food system.
6. New technologies that help provide more efficient agriculture production.

### **Learning Objectives:**

1. Understand how agroecology applies ecological principles to agricultural systems by considering productivity, ecosystem impacts, and social responsibility.- **KP #1**
2. Understand the indicators of soil health, including physical, chemical and biological properties and its role in the agroecosystem- **KP #2.**
3. Define sustainable agriculture, including comparing and contrasting sustainable practices on large and small farm operations- **KP #3**
4. Understand the importance of moving toward sustainable farming systems to conserve natural resources, mitigate climate change, reduce erosion and protect water quality and quantity; as well as and promote pollination- **KP #4**
5. Understand farm management practices to build soil organic matter, such as: composting, crop rotations, cover crops, conservation tillage, and management intensive grazing systems to improve soil health.- **KP #4**
6. Understand best management practices that improve water quality and reduce water use such as conservation tillage, cover crops, plant selection, precision agriculture, water re-use, and sub-surface drip irrigation.- **KP #4**
7. Understand integrated pest management and biological pest control techniques used to prevent insect pest, disease, and weed problems.- **KP # 4**
8. Knowledge of the role pollinators play in farming and ways to attract them.-**KP#4**
9. Describe the economic, social, and environmental benefits of sustainable agriculture to local communities, as well as to regional and global food systems.**KP #5**
10. Understand the role of new technology: agricultural biotechnology; precision agriculture; using UAV (drones, GIS, etc.) to increase farm efficiency for food production.- **KP #6**
11. Understand the risks and benefits of agricultural biotechnology.- **KP #6**

### **Resources:**

**Key Point # 1 Resources**

1. Biodiversity, conservation and agriculture sustainability towards a new paradigm of ‘eco-agriculture’ landscapes: <https://www.envirothon.org/images/2019/Biodiversity-Conservation-and-Agricultural-Sustainability.pdf>
2. Study: Bio-energy decisions involve wildlife habitat and land use tradeoffs: <https://www.envirothon.org/images/2019/Bioenergy-Decisions-Involve-Wildlife-Habitat-and-Land-Use-Trade-offsERIN.pdf>
3. Could soils help save the climate? <https://www.envirothon.org/images/Could-soils-help-save-the-climate.pdf-ERIN.pdf>
4. 4.Ecosystem services and agriculture: tradeoffs and synergies: <https://www.envirothon.org/images/2019/Ecosystem-Services-and-Agriculture--Tradeoffs-and-Synergies.pdf>
5. 5.Linking Ecologists and Traditional Farmers in the Search for Sustainable Agriculture: <https://www.envirothon.org/images/2019/Ecologists-and-Traditional-Farmers-in-the-Search-for-Sustainable-Ag.pdf>

**Key Point # 2 Resources**

1. Soil Has a Microbiome, Too: <https://www.envirothon.org/images/2019/Soil-Has-a-Microbiome-Too-ERIN2.pdf>
2. Soil Health Growers: <https://www.envirothon.org/images/2019/Soil-Health-Growers-Checklist.pdf>
3. 3. Soil Health and Soil Health Institute Featured on American Farmer TV Series (Video) 9 Minutes: <https://www.youtube.com/watch?v=Eo8kUio-ERA>
4. The Hope in Healthy Soil’ Video Series (Video): <https://www.youtube.com/watch?v=TucmtBLmeyU&index=8&list=PL4J8PxoprpGaCb1k93_Y5pOm9b-9V1pMX>

**Key Point # 3 Resources**

1. Beyond conservation agriculture: <https://www.envirothon.org/images/2019/Beyond-Conservation-Agriculture.pdf>
2. North Carolina Farm Family Awarded for Conservation Practices: <https://www.envirothon.org/images/North-Carolina-Farm-Family-Awarded-for-Conservation-Practices_ERIN.pdf>
3. Why Industrial Farms Are Good for the Environment: <https://www.envirothon.org/images/Opinion-_-Why-Industrial-Farms-Are-Good-for-the-Environment_ERIN.pdf>
4. Organic farming not always best for the planet: <https://www.envirothon.org/images/Organic-farming-not-always-best-for-the-planetERIN.pdf>
5. What Is Sustainable Agriculture: <https://www.envirothon.org/images/What-Is-Sustainable-AgricultureERIN.pdf>
6. Sections to focus on in “Beyond Conservation Agriculture”: <https://www.envirothon.org/images/2019/Sections-to-focus-on-in-Beyond-Conservation-Ag.pdf>

**Key Point # 4 Resources**

1. A Diversity of Bees Is Good for Farming: <https://www.envirothon.org/images/2019/A-Diversity-of-Bees-Is-Good-for-FarmingAnd-Farmers-Wallets.pdf>
2. Cover Crops – Organic Farming: <https://www.envirothon.org/images/2019/Cover-Crops-for-Organic-Farms.pdf>
3. Farming for Bees: <https://www.envirothon.org/images/2019/Farming-for-Bees.pdf>
4. Forest farming economic, environmental benefits: <https://www.envirothon.org/images/2019/Forest-farming-can-bring-economic-environmental-benefits-to-WNC-ERN.pdf>

**Key Point #5 Resources:**

1. Can m meat actually be eco-friendly?<https://www.envirothon.org/images/2019/Can-meat-actually-be-eco-friendlyERIN.pdf>
2. Sharing North Carolina Agribusiness Exports with the World <https://www.envirothon.org/images/2019/Sharing-North-Carolina-Agribusiness-Exports-with-the-WorldERIN.pdf>
3. Urban Agriculture Could Potentially Produce a Tenth of the World's Food. Is Grass Really the Best Use for Your Yard? <https://www.envirothon.org/images/Urban-Agriculture-Could-Potentially-Produce-a-Tenth-of-the-Worlds-Food.-Is-Grass-Really-the-Best-Use-for-Your-YardERIN.pdf>

**Key Point #6 Resources:**

* 1. A controversial technology could save us from starvation … if we let it: <https://www.envirothon.org/images/A-controversial-technology-could-save-us-from-starvation_if-we-let-itERIN.pdf>
	2. Papers suggesting that biotech crops might harm the environment … <https://www.envirothon.org/images/2019/Battlefield.pdf>
	3. Biotechnology Frequently Asked Questions: <https://www.envirothon.org/images/2019/Biotechnology-FAQs.pdf>
	4. Engineering Honesty: USDA Moves to Disclose “GMOs”: <https://www.envirothon.org/images/2019/Engineering-Honesty_-USDA-Moves-to-Disclose-GMOs-EDITED.pdf>
	5. Opinion- When Genetic Engineering is an environmentally friendly choice: <https://www.envirothon.org/images/OPINION_-When-genetic-engineering-is-the-environmentally-friendly-choice-ERIN.pdf>
	6. The Future of Agriculture: <https://www.envirothon.org/images/2019/The-Future-of-Agriculture.pdf>
	7. Next Generation –USDA…Learning Opportunities for new farmers 7 ranchers <https://www.envirothon.org/images/2019/Next-Gen_USA-Today.pdf>
	8. Ag Technology <https://www.envirothon.org/images/2019/Tech-Savvy---NC-Ag-Technology.pdf>
	9. Breaking Ground <https://www.envirothon.org/images/2019/USA-Today_Breaking-Ground.pdf>

# Sample Test Questions:

**NOTE:** These are “sample” questions”. The tests will likely be multiple choice but may contain an essay question depending on presenters choice.

## Aquatic Ecology Sample Test Questions

1. The aquatic plant in this pan was taken from the middle of this river. Please identify the plant using the key.
2. List 4 negative impacts which would result if this plant were replaced by Eurasian Watermilfoil (*Myriophyllum spicatum*)?
3. List 4 methods used to reduce or eliminate an invasive aquatic plant and explain briefly the disadvantages of each.
4. The macroinvertebrate samples in this pan were collected from this river. Chemical data have been collected from this site on several occasions. The data indicate no obvious problem; however the diversity and number of intolerant species are both low. Please explain.
5. The cover canopy is almost complete further upstream, but here the river is exposed to the sun. Describe 4 differences you would expect between the two sites and why.
6. Identify the insects using the available key. You will receive one point for the correct order and one point for the correct family. You may use either the common or scientific names.
7. Describe 2 environmental impacts of reduced stream flows from surface water withdrawals for snowmaking.
8. Looking at the map provided, please list 5 potential sources of human water use along this river.
9. What trout (common name) is native to this river? What are 3 potential impacts of introducing another trout species to this river?
10. Adhesion and cohesion are two important properties of water. Define each and describe one way each of these properties function in the environment.
11. The water cycle has a number of different features. One of these is the aeration zone. Describe the hydrologic functions of the aeration zone.
12. Oxygen is an important requirement for all aquatic insects. How do some insects utilize environments where dissolved oxygen is not plentiful?
13. List four ways wetlands are beneficial to water quality and environmental diversity.
14. Conserving water benefits the environment in many ways. List 10 ways you can personally conserve water.
15. Many people view hydropower as a non-polluting, renewable source of electrical energy. Describe two reasons why generating dams might be harmful to the environment.

## Forestry Sample Test Questions

1. Identify the following points on the tree cookie/cross section. Provide the correct name of the part and its function.
2. Forests are comprised of coniferous and deciduous trees. Please define each term and give two examples of these tree types/classifications.
3. List 5 environmental benefits from trees.
4. Wood constitutes an important part of the lives of people worldwide. In the United States alone, each individual (man, woman, or child) uses over 2,000 lbs of wood products per year. Please list 4 products derived from each of the following tree components.
	1. Paper/Pulp
	2. Cellulose
	3. Bark
	4. Gums & Resins
5. Trees are also important in providing for humans and wildlife. Please list 5 foods that are produced in forests.
6. Ecological succession is the gradual change in plant and animal communities over time. Primary and Secondary succession are apparent in Massachusetts forests. In what state of succession is this forest? Explain how you made that assessment.
7. In a Secondary Succession, identify the plant/tree species in each stage (list 2 examples) and offer wildlife examples that are dependent upon this stage (list 2 examples).
8. Tree species have a complex set of habitat requirements that foresters often call the "Four Factors of Site" (i.e., climate, location, soil composition, and animal interactions). Please list these requirements for three of the 5 marked species.
9. The evolution of a forest ecosystem is affected by human and natural factors. Please identify which of the following are natural factors affecting succession.

|  |  |
| --- | --- |
| Lightning | Farming |
| Wind | Disease/Blights |
| Logging | Volcanic Eruption |
| Road Building | Arson |

1. The forest habitat can be symbiotic or competitive. Symbiotic - forming a relationship in which one organism or both can benefit from the actions or characteristics of the other. Competitive - where one organism thrives at the expense of another. Offer 2 examples of each relationship relative to the site before you.
2. Forest ecology is the study of the complex interactions between the organic and inorganic elements of a forest ecosystem. Define/explain organic and inorganic and provide 2 examples of each as they relate to the forest ecosystem.
3. What role does the nutrient cycle play in the forest ecosystem?
4. Explain photosynthesis as it relates to the lifecycle of a tree? (Use a diagram and language to complete your answer)
5. Identify the 4 life zones in forest stratification. Define them and offer wildlife examples.
6. Using the information provided in the Forest Resources documents, what would provide a greater financial return to the landowner if this area were harvested? Explain your answer.

## Soil/Land Use Sample Test Questions

1. You have been given an assignment to conduct a Soil Survey on a parcel of land indicated by the B on the provided topo sheet and you are at a site indicated by an A. You will be traveling to the site in a 2 x 4 pickup. List the route you would travel to reach the site that is the most direct (least mileage / kilometers).
2. The letter C on the attached USGS topographic map represents which geomorphic landform?

|  |  |
| --- | --- |
| Drumlin | Terminal Moraine |
| Esker | Outwash Plain |
| Floodplain | Kame Terrace |

1. At the testing site (at the pit) what geomorphic landform is represented? Use the possibilities listed in question 2. Give indication why.
2. What is the textural group (sandy, loamy, clayey) of the soil at the following depths?
03 Inches (07.62 cm)
12 Inches (30.48 cm)
24 Inches (60.96 cm)
36 Inches (91.44 cm)
3. Determine the Munsell colors of the following 4 samples (color books and soil samples on table near the pit).
Well drained
Moderately well and somewhat
poorly drained
Very poorly drained
4. What is the drainage class of the soil pit?
5. From a soils perspective, is this a wetland site? Justify your answer.
6. Would you expect the reaction (pH) of the subsoil to be above pH 7 or below? Assume a natural setting, with no amendments added. Justify your answer.
7. Would you expect high or low aggregate stability on this site and why?
8. What is the slope range surrounding the pit? What's the slope range from here to the Fish and Wildlife Building? What is the slope indicated by the flagged sticks?
9. The map unit symbol you are in HgB. What is the name of the map unit? Is the map unit considered prime farmland?
10. Using the information determined from the soil pit and site, and the soil survey report, which general soil map unit would you assume we are in?
11. PaB - Paxton fine sandy loam, 3 to 8 percent slopes, is a map unit in the soil survey for this area. Is it suitable for septic tank use? Why or why not?
12. At what depth is the seasonal high water table in the pit and what did you base your answer on?
13. Which of the following are most responsible for giving color to soils? (pick 2)
Nitrogen
Calcium
Magnesium
Organic Matter
Iron
Aluminium

## Wildlife Sample Test Questions

1. (a) Identify the species (skull). (b) Identify the consumer group to which this animal belongs. (c) What part of the skull led you to make your choice as to the consumer group?
2. Using the key provided, identify the following mammals.
3. Name 2 primary reasons why the wolf became extinct in the Northeastern United States.
4. Wildlife often need more than one type of habitat to meet their specific needs. Many species require both upland and wetland habitats to meet their life requisites. Describe 2 habitat components found around the test site that provide for the different stages of the following species:

|  |  |
| --- | --- |
| A. | American Woodcock |
| B. | Red-Spotted Newt |

1. List 3 plants around the test site that provide food for wildlife. Also name one wildlife species that feeds on each and identify the part of the plant it utilizes.
2. White-tailed deer are which of the following:

|  |  |
| --- | --- |
| A. | Nocturnal |
| B. | Diurnal |
| C. | Crepuscular |

1. Describe a riparian corridor and give two examples of why the are important.
2. List habitat factors that may serve to limit the following species:

|  |  |
| --- | --- |
| A. | Beaver |
| B. | Spotted Salamander |

1. Dead trees or snags are beneficial to many wildlife species. Identify two species that utilize snags and explain how they use them.
2. What is mast and why is it an important food? List 3 wildlife species that feed on mast.
3. Bald eagles are nesting again in the Northeastern United States after an absence of over 50 years. Explain why the bald eagle became endangered and why it has recovered. Please define the term biomagnification.
4. Forest A has been planted with red pine. The trees are all the same age. The forest canopy is dense and the understory is open. Forest B has a mix of tree species that are a mix of ages. The canopy is relatively open and the shrub layer and ground layer of vegetation is well-developed. Which forest will have more wildlife and why?
5. Explain the difference between biological carrying capacity and cultural carrying capacity. Give an example in which they might differ.
6. What four factors would you evaluate to determine the biological carrying capacity of this area for white-tailed deer?
7. Surviving the winter in the wild in the cold Northern regions of North America is challenging. Please list 3 strategies for surviving harsh cold winters and give an example for each.

**

 *(Additional objectives or resources may be added in the future, visit* [*http://idahoenvirothon.weebly.com/*](http://idahoenvirothon.weebly.com/) *for regular updates)*