

## Soils learning objectives

## Standard of Learning

One of our most important natural resources is soil. This resource is often overlooked by students and teachers interested in environmental issues. Professional conservationists, however, recognize the importance of soil in natural resource management and the interrelationships between soil, water, and other resources. Soil provides a growth medium for all plant life on our planet, including food and energy resources. Soil also provides habitat, filters water, and is used in constructing buildings.

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| 1. Describe why soil is an important, dynamic resource.   | ES 7                          |
| 2. Describe basic soil properties and soil formation factors.   | ES 5,9                        |
| 3. Understand soil drainage classes and know how wetlands are defined.  | ES9; BIO 3                    |
| 4. Determine basic soil properties and limitations, such as mottling and permeability, by observing a soil pit or profile.  | ES 1,2,3,5                    |
| 5. Identify types of soil erosion and discuss methods for reducing erosion.   | ES 1,2; BIO 9                 |
| 6. Discuss how soil is a factor in, or is impacted by nonpoint source pollution.  | ES 1,2; BIO 9                 |
| 7. Derive information from a soil survey and explain the interaction between soil type and plant communities (species composition, successional patterns) as well as suitability for various land use practices.  | ES 1,2 3<br>LS 12<br>BIO 7    |
| 8. Explain the diagnostic significance of soil color. Be able to describe how soil color is measured and what processes produce different colors.   | CH 3,4<br>ES 5                |
| 9. Describe the factors which influence soil texture and structure and be able to explain how these properties influence a soils permeability, ability to retain water and nutrients and tendency to erode. Explain how this further influences the hydrologic and nutrient cycles in an ecosystem. | CH 3,4<br>ES 5,7<br>BIO 3     |
| 10. Discuss the effects of various land uses on soils and the long term consequences to productivity and ecosystem function.  | LS 12<br>ES 1,2,3,5,7<br>BIO9 |
| 11. Develop an understanding of the soil properties that affect soil health and soil quality.   | LS 12<br>ES 1,2,3,5,7,9       |
| 12. Determine the health and quality of the soil in the field.  | LS 12<br>ES 1,2,3,5,7,9       |
| 13. Develop an understanding of, and the ability to apply the Land Capability Classification System in an effort to protect farmland from urban pressure.   | LS 12<br>ES 1,2,3,5,7,9       |
| 14. Develop an understanding of the soil's impact on the hydrologic cycle.  | ES 4,9                        |

## Soils Practice Exercises

Choose a site. Using a soils map, locate soil map units on the site. Color code types by drainage classifications. Discuss soils in relationship to land use. Determine if the land was modified to accommodate present use or how it might have to be modified for proposed uses. Discuss pros and cons of these modifications.

Dig a soil pit or go to an area where there is excavation going on (get permission if needed). Safety is paramount. Students and teachers must not enter pits that are more than waist deep. Pits or vertical banks can cave in, causing serious injury or death! Look at the soil profile and measure the soil horizons. Determine soil properties and depth to high water table. Check your results with a soil survey. What limitations may be apparent in using a soil survey in this small area?

Identify an area that is eroding. Determine what is causing the erosion and develop a proposal to stop the erosion.

Prime farmland is a classification used by the US Department of Agriculture to identify soils which are excellent for crop production. What are the characteristics of prime farmland soils? Research and identify prime farmland soils in Virginia. Determine where most of the prime farmland soils are located. How is this information being used by the State? By farmers?

Land use decision-makers need to take soil types into consideration. Discuss the merits of depth to water table as it applies to: 1) on-site septic systems; 2) establishment of a tree farm; 3) underground storage tanks; 4) vegetable production; and 5) construction of new soccer fields.

## Wildlife learning objectives

## Standard of Learning

Diverse wildlife populations are valuable from many standpoints: as indicators of a healthy ecosystem, for recreation, and for aesthetics. Understanding a species' requirements and habits is the first step in ensuring the continuing existence of that particular animal. Proper protection and management of an animal's habitat will encourage optimum populations.

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| 1. Identify basic survival needs of both terrestrial and aquatic wildlife (food, water, shelter, and reproductive cover);  | LS 4,7<br>BIO 5         |
| 2. Identify common mammals, birds and fish and be able to associate common mammals, birds and fish with their appropriate habitat(s);  | LS 5, BIO 5,7           |
| 3. Identify various common signs of wildlife, such as scat, tracks, skulls (using a skull key), antlers, birdcalls, scrapes, etc.;   | LS 5, BIO 5,7           |
| 4. Use a field guide (i.e. understand how field guides are arranged by families when looking for species with similar characteristics; understand how to look for various field marks, and how to interpret range maps); | LS 5, BIO 7             |
| 5. Describe specific adaptations of terrestrial and aquatic wildlife to their environment and their role in the ecosystem;   | LS 7,8,9<br>BIO 5,9     |
| 6. Describe predator-prey relationships and identify examples.   | LS 7,8,9,11,12<br>BIO 9 |
| 7. Understand the dynamics of basic food webs and cite examples.   | LS 7,8,9<br>BIO 9       |

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| 8. Identify limiting factors that affect wildlife population growth and identify factors that can enhance population growth;  | LS 6,7,8,9,11,<br>12,14; BIO 9                                     |
| 9. Explain the concept of carrying capacity   | LS 6,7,8,9,11,<br>12,14; BIO 9                                     |
| 10. Suggest ways that a given habitat (terrestrial OR aquatic) can be improved for a common wildlife species;   | LS 4,5,6,7,8,9,<br>10,11,12,14<br>BIO 1,7,9                        |
| 11. Describe the potential impact to an ecosystem by the introduction of a non-native plant or animal species;  | LS 4,5,6,7,8,9,<br>10, 11,12,14<br>BIO 9                           |
| 12. Distinguish between a poor, good, better and best habitat (i.e. the student should understand the characteristics that make up the best habitat, such as food value, clumping, structure, edge effect, corridors, etc., and using those characteristics should be able to compare/contrast one habitat with another to determine which is more suitable for a general group of wildlife species, such as songbirds, mammals, amphibians, fish, etc.); | LS 4,5,6,7,8,9,<br>10, 11,12,14<br>BIO 5,7,9                       |
| 13. Evaluate the suitability of a given habitat for a designated wildlife species, when given a description of that particular species' habitat needs;  | LS 4,5,6,7,8,9,<br>10, 11,12,14                                    |
| 14. Understand general wildlife laws/regulations that govern what a person can or cannot possess, collect or purchase (the student should be aware of the most common types of permits that cover possession and collection);   | ES 7   |
| 15. Describe major factors that contribute to the endangerment of species (concepts such as habitat fragmentation, habitat loss, decline in water quality, etc.) and the methods used to improve the populations of threatened and endangered species;  | PS 1; LS 6, 7,<br>8,9; BIO 5,7, 9<br>ES 7                          |
| 16. Discuss various ways that the public and wildlife managers can help in the protection, conservation, and management of wildlife populations and the habitats they depend on.  | ES 1,2,3,7; PS<br>1; BIO 1,5,7,9<br>LS 4,5,6,7,8,9,<br>10,11,12,14 |

### **Wildlife Practice Exercises**

Using a field guide to birds, identify two raptor species and determine their habitat requirements. Do the same for two waterfowl species and two passerine species.

Choose a large mammal and track its food chain down to its lowest possible component.

List the animals likely to be found in a mature forest.

Name 1 fur-bearer found in your area of Virginia. Determine whether there is an open trapping season on them and be able to discuss why or why not. Check the current hunting regulations, list the maximum number of deer legally allowed by one person in Virginia.

Go to the woodlot and list four habitat types found there. Identify at least one species that uses each habitat type. Evaluate each habitat for how well it meets each species' basic needs. Make management recommendations to improve the habitat for a specific species.

Find a wetland that shows evidence of present or past beaver activity.

## Aquatics learning objectives

## Standard of Learning

Water and water resources affect every facet of our lives, from business to pleasure to actual survival. The protection of our water resources, both quantity and quality, is vitally important. To properly protect these resources, we must first understand them and the factors that impact them.

1. Identify the processes and phases for each part of the water cycle. LS 4,10; BIO 3; ES 4,7
2. Describe the chemical and physical properties of water and explain their implications for freshwater and saltwater ecosystems. LS 6,10,11,12; BIO 3, ES 4,7, 9,11
3. Analyze the interaction of competing uses of water for water supply, hydropower, navigation, wildlife, recreation, waste assimilation, irrigation, industry and others. BIO 3,9; ES 4,7; LS 9,10,11, 12,14
4. Discuss methods of conserving water and reducing point and nonpoint source pollution. BIO 1,3,9; ES 4.7
5. Identify common macroinvertebrates through the use of a key and explain why macroinvertebrates are such a good indicator of water quality in an area. BIO 3,7,9; LS 4, 5,6,7,8,9, 11,14
6. Delineate the watershed boundary for a small water body. BIO 7
7. Briefly describe the benefits of wetlands, both function and value. BIO 7,9; LS 123
8. Be able to explain the different types of aquifers and how each type relates to water quality and quantity. LS 12; BIO 3; ES 4,7,9,11
9. Describe the benefit of riparian areas, both function and value. LS 12; BIO 5,7,9; ES 4,7,9,11
10. Describe the changes to the aquatic ecosystem based on alteration to the aquatic habitat. BIO 3,7,9; ES 4,7,9,11; LS 8,9,11,12,14
11. Know the methods used to assess and manage aquatic environments and utilize water quality information to assess the general water quality of a given water body. This includes sampling techniques and water quality parameters used to monitor point and nonpoint source pollution. PS 1; BIO 1,3,7,9; ES 1,2,3,4,7, 11
12. Be familiar with major methods and laws used to protect water quality, both surface and ground water and utilize this information to make management decisions to improve the quality of water in a given situation. PS 1; BIO 1,7,9; ES 1,2, 3,4,7,11

## **Aquatics Practice Exercises**

Choose a small watercourse near your school using the USGS topographic map. Outline the watershed boundary surrounding that feature. What is the major land use?

Using the Water Quality Classifications Guide of Virginia, choose five streams in your county. Determine the present potential quality of the water. Find out what general types of macroinvertebrates are likely to be found in those classifications.

Choose a wetland in your county. Determine the main functions of the wetland. Make a list of the different land uses around the wetland - then list possible impacts by pollution to the wetlands from those land uses.

Go to a local stream or river. By observing the stream bottom, determine from a field guide what fish are likely to breed there. Do the same for a local pond based on the estimated water depth. Find out which areas in your town are stocked with fish each year.

In your community, find examples of three types of wetlands. Identify three species of plants in each.

## **Envirothon Forestry learning objectives**

## **Standard of Learning**

The science of forestry is a lot more than just the study of botany. Forests are dynamic ecosystems, with numerous factors influencing their development. It is important to understand the cause and effect relationships that impact individual trees, as well as forest community development and growth. Forest communities are precious natural resources that, for example, support wildlife, influence water quality, and provide numerous marketable goods. Forest management is challenging work that requires a clear understanding of forestry dynamics.

1. Identify common species of trees found in Virginia without the use of a key. ES 7; LS 5; BIO 7
2. Understand how the following issues are affected by forest health, and management: Biological diversity, forest fragmentation, air quality, aesthetics, fire, water quality, recreation and supply of wood products. BIO 5,7,9; LS 4,5,6,7,8,9, 10,11,12,14
3. Know how to recommend management practices based on landowner objectives, site and forest stand evaluations, and a forest inventory. This requires an understanding of silvicultural concepts and forest management practices, such as harvest methods and best management Practices. BIO 1,5,7,9; PS 1, ES 1,2,3; LS,4,5,6, 7,8,9,10,11,12,14
4. Know how to conduct a forest inventory. This requires an understanding of the use of tree measuring devices: clinometer/abney level, diameter tape, Biltmore stick, and land area measurement techniques and terms: acres, chains, pacing, topographic maps, compass. BIO 1; PS 1; ES 1,2,3; LS 4,5, 6,7,8,9,10, 11,12,14
5. Know how to conduct a site evaluation to determine its suitability for growing trees. This requires an understanding of the relationship between soil depth, slope percent, aspect, slope position and their effects on the growth and ecology of trees. BIO 3,5,7; LS 4,5,6,7,8,9,10, 11,12,14
6. Know how to conduct a stand evaluation, especially as it relates to forest management practices. This requires an understanding of disturbance factors, such as grazing and fire, forest type, stand origin, stocking and the size distribution of trees. LS 4,5,6,7,8, 9,10,11,12,14; BIO 7,9

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| 7. Know how to calculate the board-foot volume of timber and the dollar value of that timber per acre, based on a 1/10 <sup>th</sup> acre plot sample.         | BIO 1,9; PS 1;<br>ES 1,2,3; LS 4,<br>5,6,7,8,9,11,12 |
| 8. Understand how wildlife habitat relates to: forest communities and riparian zones (forest species, age, structure, food availability, cover, nesting, etc.) | LS 4,5,6,7,8,9<br>10,11,12,14;<br>BIO 9              |
| 9. Identify 5 physiographic provinces of Virginia and the timber type/forests associated groups found in them.   | LS 4,5,6,7,8,9<br>10,11,12,14;<br>BIO 9              |
| 10. Explain the role of riparian forest buffers in protecting watersheds.  | ES 1,2,3; LS 4,<br>5,6,7,8,9,10,11,<br>14; BIO 9     |
| 11. Identify and describe key reforestation programs.  | LS 7,8,9,10,11,14                                    |
| 12. Identify and describe forest conservation and/or forest protection laws.   | ES 7   |
| 13. Identify and describe the threats to Virginia's forest resources.  | PS 1; LS<br>6,7,8,9,11,12; BIO<br>5,7,9; ES 9        |

### **Forestry Practice Exercises**

Name the two of the most important soil features affecting tree growth in Virginia and describe the limitations that they place on tree growth. How do forests contribute to the development of soils? You may be asked, given a particular stand of trees at the test site, what kind of soil and environmental conditions must be present for that stand of trees to exist.

Go out to a stand of trees and identify all of them. Practice without using a key, if you can. Measure them and determine as much silvicultural information from them as possible. What environmental factors would be the greatest threat to the development of each tree type?

Identify a local stream that runs through a farm and a stream that runs through an urbanized neighborhood. What kind of vegetative buffer exists there? Describe the resultant effects on the water quality of these streams if vegetative buffer strips are developed or removed from along the streams.

Go into a wooded area and identify its stage of development. What benefits does it have for wildlife habitat? What kind of forest products could be derived from this area? If a developer were to come to this area, what recommendations would you give for its management?

Differentiate between a service forester, a consulting forester, and an industrial forester. You may want to call some foresters to discuss this with them. What kind of information could each of these foresters give you if you were interested in developing a management plan for your 30-acre woodlot?

## **Oral Presentation/English Learning Objectives**

Prepare for a concise, compelling presentation using available resources (Conduct research).

Using materials and information gathered in your research, construct and present a presentation to a diverse judging panel of resource and communications professionals.

Respond to questions from the judging panel at the conclusion of your presentation. Questions may be direct or indirect.

## **Standards of Learning**

Oral Language 10.1,  
Reading/Literature 9.3, 9.4, 11.4  
Writing 9.6, 10.7, 11.9  
Research 9.7, 11.9, 12.8

Oral Language 9.2,10.1, 11.1, 12.1  
Reading/Literature 11.4,  
Writing 11.7 11.8, ,12.7  
Research 12.8

Oral Language 9.2, 10.1, 11.1, 12.1  
Reading/Literature 11.4