SOILS/LAND USE

Soils/Land Use Key Point 1—Physical Properties of Soil and Soil Formation

National Science Standards Correlation: http://www.envirothon.org/pdf/CG/SoilsNSS1.pdf

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.
1. Describe the five factors of soil formation and be able to explain how each factor affects the soil profile.
2. 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.
3. 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.
4. 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/files/curriculum/soil/Why_Soil_is_Important_sm.pdf

2. How Much Soil is there?
   http://www.envirothon.org/files/curriculum/soil/KP1.2How_Much_Soil_Is_There%5b1%5d.pdf

3. From the Surface Down https://www.youtube.com/watch?v=knrmCbctGEA
4. Land Capability Classification:
   http://www.envirothon.org/files/curriculum/soil/KP4.3land_capability_classification[1].pdf
5. Soil Formation and Classification
   https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054278
6. Guide to Texture by Feel
   https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054311

7. Soils Texture Calculator- https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2_054167
8. Soil Field Analysis - http://www.envirothon.org/pdf/CG/soil_field_analysis.pdf
9. State Soils: NRCS - https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=stelprdb1236841
10. Soil Landscapes of Canada-http://sis.agr.gc.ca/cansis/nsdb/slc/index.html

Soil/Land Use Key Point 2—Soil Ecosystems

National Science Standards Correlation: http://www.envirothon.org/pdf/CG/SoilsNSS2.pdf

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
2. Nutrient Cycles - http://www.envirothon.org/pdf/CG/nutrient_cycles.pdf
3. Soil Biology - http://soils.usda.gov/sqi/concepts/soil_biology/biology.html
4. Integrated Pest Management http://www.envirothon.org/files/curriculum/soil/KP2.4integrated_pest_management[1].pdf
5. Soil Biology and Land Management http://www.envirothon.org/files/curriculum/soil/KP2.5Soil_Biology[1].pdf

National Science Standards Correlation: http://www.envirothon.org/pdf/CG/SoilsNSS3.pdf

Learning Objectives:
1. Understand the procedure for taking a soil sample and conducting nutrient analysis.
6. 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.
7. 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 Testing - https://extension.umd.edu/hgic/topics/soil-testing
2. Plant Nutrients - http://landresources.montana.edu/nm/documents/NM2.pdf
3. Nutrient Management
   https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/landuse/crops/npm/

   https://extension2.missouri.edu/mg4

Soils/Land Use Key Point 4—Soil Conservation and Land Use Management

National Science Standards Correlation: http://www.envirothon.org/pdf/CG/SoilsNSS4.pdf

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 http://www.envirothon.org/files/curriculum/soil/11_urban_soil_primer.pdf
2. Soil Erosion: Causes and Effects- http://www.envirothon.org/files/curriculum/soil/soil_erosion.pdf
3. Using the Universal Soil Loss Equation (USLE)- http://passel.unl.edu/pages/informationmodule.php?idinformationmodule=1088801071&topicorder=15&maxto=16
4. Careers in Soil Science- http://www.envirothon.org/files/curriculum/soil/KP3.4careers_in_soil_science%5b1%5d.pdf

Soils/Land Use Key Point 5—Web soil surveys & Soil Surveys

National Science Standards Correlation: http://www.envirothon.org/pdf/CG/SoilsNSS5.pdf

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: know how to access and use soil data
   http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm
2. National Soils Data Base (NSDB): Know how to access and use soil and landscape data of Canada- http://sis.agr.gc.ca/cansis/nsdb/index.html
3. Land Capability Classification –
   http://www1.udel.edu/FREC/spatlab/oldpix/nrcssoilde/Descriptions/landcap.htm
4. Hydric Soils -
   https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/hydric/?cid=nrcs142p2_053961
5. Site Fingerprinting - http://www.envirothon.org/pdf/CG/site_fingerprinting.pdf

Additional Soil Resources

- Additional soils information may be found at: https://www.soils.org/