Environmental Science and Natural Resources

Career Cluster: Environmental and Natural Resources

Cluster Big Idea:
- Sustaining life through the management of natural resources.

Cluster Enduring Understandings:
- Life is dynamic.
- Natural resources and environmental science are global economic systems.
- Human decisions affect the sustainability of natural resources.
- Natural resources serve a multifaceted to sustain or improve the quality to life.
- Studying natural resources and environmental science provides for a lifetime of knowledge and skills.

Cluster Essential Questions:
- What are natural resources?
- What is environmental science?
- How are natural resources and environmental science global industries?
- Why is natural resources considered a dynamic process?
- Why is environmental science considered a dynamic process?
- How does the study of natural resources and environmental science help develop life skills?
- In what ways do natural resources serve enhance the quality of life?

Standard Statement: Students will study agriculture and its relationship to natural resources and environmental science.

Performance Element ENR.01: Recognize the importance of natural systems and the need for the protection of natural resources.

Performance Indicator ENR.01.01: Identify and distinguish between human and natural resource management processes..

Basic	Proficient	Advanced
Identify and explain the components of natural resource systems (hydrologic cycle, forest succession, soil formation, carbon and nutrient cycles, etc.). Identify and explain human management processes including land and resource management. Identify the impacts of humans on natural systems processes.	Analyze the impacts of humans on natural systems processes. Identify the economic effects of natural catastrophic events and human mismanagement of natural resources. Define watershed boundaries and the interrelationships among watersheds. Examine the influence of weather and climatic factors, including global warming, on natural systems.	Develop a research/monitoring plan to inquire about a natural resource topic Conduct a research/monitoring activity for a natural resource topic Evaluate the results of a natural resource-related inquiry. Produce a technical report of results/findings. Examine and analyze the concepts, research, and processes, which have resulted in current agricultural techniques and practices including: nutrient management, no till, GIS nutrient mapping, and other agricultural stewardship practices and programs.

Performance Indicator ENR.01.02: Identify types of pollution (e.g. ground, surface water, air, noise, radioactive contamination, etc.) and their effects on the environment.

Basic	Proficient	Advanced
Identify sources of pollution in Delaware and the management and remediation practices employed to deal with the pollution. Distinguish between point and non point sources of pollution and give national and local examples of each. Identify risks associated with solid waste management accumulation and disposal.	Describe the environmental impact from industrial and non-industrial processes. Conduct tests to determine the extent of pollution. Describe ways in which pollution can be managed and prevented.	Research and discuss the contributions of the agricultural community and agricultural industries in lessening pollution through nutrient management and other environmental strategies and practices Plan and develop a pollution remediation, management or prevention plan.

Performance element ENR.02: Identify natural resource systems, processes and relationships		
Performance Indicator ENR.02.01: Identify and analyze ecosystem relationships		
Basic	**Proficient**	**Advanced**
Identify the biogeochemical Cycles (nitrogen cycle, carbon cycle**,** nutrient cycles) Describe population dynamics, primary and secondary producers Describe predator-prey relationships Identify grass and forb species Identify wildlife and fish species Identify and classify insects.	Diagram and explain biogeochemical processes. . Discuss factors that influence population density and population dispersion. Conduct a field inventory of local wildlife species.	Create and implement a management plan based on a population study for a local community of organisms.
Performance Indicator ENR.02.02: Recognize symptoms of animal and plant disease and use appropriate techniques to prevent their spread		
Basic	**Proficient**	**Advanced**
Identify observable diseases impacting plants and animals.	Describe how to report observance of disease infestations. Identify insect damage signs.	Research and describe how appropriate state agencies handled instances of animal and plant disease outbreaks. Use appropriate techniques and equipment when working with bio-hazards.
Performance Indicator ENR.02.03: Explore conventional and alternative supplies to define energy sources.		
Basic	**Proficient**	**Advanced**
Identify conventional energy sources and their environmental impact. Identify alternative energy sources and their environmental impact.	Describe how oil is extracted and processed. Describe with evidence the viability of alternative energy sources.	Describe the technology employed in the production of soy biodiesel. Evaluate the impact the burning of fossil fuels has on the environment.

		Evaluate the impact of alternative energy sources on the environment.

Performance Element ENR.03: Identify and participate in natural resource management, conservation, and preservation practices

Performance Indicator ENR.03.01: Demonstrate natural resource enhancement techniques, which protect and enhance the environment and communicate these practices to others.

Basic	Proficient	Advanced
Identify and involve appropriate organizations and agencies involved in resource management. Identify characteristics of a healthy wildlife habitat.	Demonstrate wildlife enhancement techniques Examine habit preservation and restoration programs and projects including: CREP, Aglands Preservation, and others. Visit a Delaware site which protects and publicizes the agricultural heritage of Delaware such as: Greenbank Mill, Delaware Agricultural Museum and Village, Abbotts Mill Nature Center, and other Delaware facilities. Describe techniques used in the harvesting of wildlife. Implement silvicultural practices.	Create a habitat management plan. Conduct a survey of a local habitat and devise a comprehensive management plan for its maintenance and improvement. Volunteer in a natural resource area. Plan, develop and maintain vegetative erosion control programs Develop gardens and habitats for wildlife Develop a school conservation plan

Performance Indicator ENR.03.02: Interpret Laws Pertaining to Natural Resource Management and Protection

Basic	Proficient	Advanced
Identify laws associated with natural resource systems. Define mitigation. Identify Delaware superfund sites and research mitigation and remediation histories.	Identify the purposes of laws associated with natural resource systems. Explain the regulations in local Delaware laws. Explain the requirements of national environmental laws including the Clean Water Act, SDWA, Clean Air Act, and others.	Demonstrate mitigation techniques for natural resources.

Performance Indicator ENR.03.03: Communicate natural resource information to the general public.

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Basic	Proficient	Advanced
Identify ways in which a message regarding natural resources may be communicated to the public.	Create a multi-media presentation designed to communicate natural resource information to the public. .	Create a multi-media presentation designed to communicate natural resource information to the public. Explain the requirements of national environmental laws including the Clean Water Act, SDWA, Clean Air Act, and others.

Performance Element ENR.04: Use the appropriate skills needed to conduct environmental research, assessment, and fieldwork.

Performance Indicator ENR.04.01: Apply cartographic skills to natural resource activities.

Basic	Proficient	Advanced
Identify and interpret features on aerial photos and satellite images. Identify pressures on natural resources and land use Demonstrate how to use maps to identify directions and features, calculate actual distance and determine the elevations of points. Explain the importance of surveying and mapping for environmental service systems.	Using a variety of map types, interpret map features and legends, determine scale, distance, and direction. Using a topographical map, identify watershed boundaries, elevation, and terrain features. Conduct resource inventories and population studies to assess resource availability and health. Explain surveying and mapping principles and identify and explain the use of equipment for surveying and mapping.	Employ Global Positioning System and Geographic Information Systems technologies to inventory features in natural resource management. Demonstrate surveying and cartographic skills to make site measurements and map facility accesses and infrastructure.

Performance Indicator ENR.04.02: Monitor a natural resource area to obtain environmental data for evaluation and stewardship.

Basic	Proficient	Advanced
Establish sample plots and points. Describe the use of resource inventories and population studies. Collect data concerning resource availability and health Maintain databases of resource data Prepare a technical report	Discuss the procedures for conducting resource inventories and population studies. Perform instrumental analysis using spectrometer, chromatograph, O_2 meter, and other available instruments. Calibrate analytical instruments. Gather meteorological data as an environmental assessment tool. Use computers or graphing calculators to interface with chemical analytical instruments.	Conduct resource inventories and population studies to assess resource availability and health. Interact with a national/international data collection mechanism such as GLOBE to share and contribute world-wide data. Operate basic laboratory equipment and environment monitoring instruments (e.g., pH meter, compound microscope/dissecting microscope, turbidmeter, conductivity meter, etc.).

Performance Indicator ENR.04.03: - Learn and observe laboratory and field safety practices.		
Basic	**Proficient**	**Advanced**
Describe and demonstrate appropriate use of Personal Protective Equipment (PPE). Obtain and interpret MSDS materials. Learn and practice use of safety facilities and equipment. Know field hazards and dress appropriately for protection.	Use field equipment in an appropriate and safe manner.	Demonstrate appropriate responses to accidents and injuries that occur in an outdoor environment. Demonstrate appropriate responses for disasters involving biohazardous materials.

Performance Element ENR.05: Recognize the importance of soil and water as essential to the survival of all living things.

Performance Indicator ENR.05.01: Describe soil compositions and properties to demonstrate knowledge of soil science.

Basic	Proficient	Advanced
Describe soil geology. Describe composition of soil. Describe the biological properties of soil. Identify the physical properties of soil. Describe the chemical properties of soil. Test soil samples to determine soil characteristics. Explain the process of soil formation through weathering. Describe the biodiversity found in soil and the contribution of biodiversity to the physical and chemical characteristics of soil. Explain how the physical qualities of the soil influence the infiltration and percolation of water. Identify land uses, capability factors and land capability classes.	Explain classification of soil water. Explain the relationship between soil classifications and land use. Differentiate rock types and relate the chemical composition of mineral matter in soils to the parent material. Relate the activities of microorganisms in soil Identify the physical qualities of the soil that determine its use Use a soil survey to determine the land capability classes for different parcels of land in an area.	Plan , develop, and maintain erosion control programs. Evaluate the uses of soil microorganisms Conduct tests of soil to determine its use Design a master land-use management plan for a given area.

Performance Indicator ENR.05.02: : Investigate water sources and processes		
Basic	**Proficient**	**Advanced**
Describe the world's water supplies and discuss the many uses of water Demonstrate knowledge of hydrogeology by differentiating between groundwater and surface water. Discuss groundwater and surfacewater flow. Identify environmental hazards associated with groundwater and surface water supplies.	Describe characteristics of water that influence the biosphere and sustain life. Describe interactions between groundwater and surface water. Explain stream hydrology and structure and determine the different classes of streams. Explain geological and meteorological principles affecting groundwater and surface water supplies	Research and debate one or more current environmental issues associated with the supplies of groundwater and surface water. Classify and predict the behavior of local streams.
Performance Indicator ENR.05.03: Discuss properties, classifications, and functions in order to understand wetland principles.		
Basic	**Proficient**	**Advanced**
Describe the functions of wetlands and differentiate types of wetlands. Identify the major types of living organisms that inhabit wetlands. Explain the importance of wetland management, creation, enhancement and restoration programs.	Explain the criteria for classifying wetlands. Identify techniques used in wetland management, enhancement, and restoration programs.	Delineate wetlands Conduct a survey of the predominant species in a local wetland. Identify and participate a Delaware wetland advocacy program such as Adopt-A-Wetland and Stream Watch

Performance Indicator ENR.05.04: Discuss properties, classifications, and functions in order to understand watershed principles.		
Basic	**Proficient**	**Advanced**
Identify properties of watersheds Describe properties of watersheds and identify the boundaries of local watersheds. Define riparian zones and riparian buffers and	Explain watershed management. Explain principles on which watershed management is based. Identify techniques used in the creation, enhancement, and	Delineate watersheds Analyze the major ecosystem functions of a local watershed and develop a land management plan to protect the watershed.

explain their functions.	management of riparian zones and riparian buffers.	Create, enhance and manage riparian zones and riparian buffers.
Performance Indicator ENR.05.05: Perform chemical and biological analysis of water.		
Basic	**Proficient**	**Advanced**
Describe roles of microorganisms in the environment. Describe influence of environmental factors on microbes. Describe morphological characteristics used to identify aquatic species. Define wastewater.	Explain basic chemical principles (e.g., elements, compounds). Apply chemical laboratory skills. Conduct biomonitoring by identifying macroinvertebrates present. Apply microbiological principles and procedures Identify major local aquatic species. Diagram the steps in wastewater treatment.	Conduct a field inventory of local aquatic species. Demonstrate the use of instruments and equipment to treat wastewater.
Performance Element ENR.06: Recognize the importance of forest resources		
Performance Indicator ENR.06.01: Identify species and their ecological role in forest systems		
Basic	**Proficient**	**Advanced**
Describe morphological characteristics used to identify trees and other vegetation. Describe succession	Identify major local tree and other vegetative species. Give examples of primary succession and secondary succession species in a local community of organisms	Conduct a field inventory of major local tree and other vegetative species. Conduct a field study to determine the stages of ecological succession in a local community of organisms.
Performance Indicator ENR.06.02: Demonstrate the knowledge and skills essential to forest management		
Basic	**Proficient**	**Advanced**
Identify characteristics of a healthy forest Identify the types of products that can be derived by	Explain management techniques used in the forestry industry	Create a forest management plan

forest products	Identify common forest pests Describe the uses of forest products	