Introduction to Natural Resources and Ecology Systems

8040/36 weeks

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Acknowledgments

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Correlations to the Virginia Standards of Learning were reviewed and updated by the following:

- Leslie R. Bowers, English Teacher (ret.), Newport News Public Schools
This course serves as the introductory-level course for the Natural Resources Career Pathway. Students will explore environmental science, conservation management, and the study of natural resources to develop the knowledge and skills required for employment in occupations and careers related to ecology, forestry, and wildlife and natural resources management.

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<td>Identify the different types of natural resources.</td>
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<td>Research historical figures who played a prominent role in shaping how natural resources are viewed and used today.</td>
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**Protecting the Environment**

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<td>Describe aquatic habitats.</td>
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<td>Describe common fish and aquatic species in a given area.</td>
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</table>
Describe aquatic inventory/sampling methodologies.

Exploring Energy Resources and Consumption

Analyze various energy sources.

Contrast various forms of renewable and non-renewable energy sources.

Explain the global economic impact of energy use and depletion.

Explaining Land Use

Explain the effect of major land development on the environment and ecosystems.

Explain zoning classifications and the effects of zoning.

Design a community to minimize adverse effects on the environment.

Interpret land-use maps.

Analyze a comprehensive plan for a community.

Exploring Government Policies, Agencies, and Regulations

Describe current environmental policies/regulations.

Identify local, state, and federal conservation, natural resource, and environmental regulatory agencies and programs.

Describe water-use planning and water rights policies.

Developing Mechanical Skills Related to the Natural Resources Systems Pathway

Explain the need for safety in Natural Resources Systems Pathway.

Demonstrate safe use of tools, materials, and equipment for use in natural resources.

Utilize tools in managing natural resources.

Identify marked safety areas.

Identify the location and use of eyewash stations.

Identify the location of the posted evacuation routes.

Demonstrate knowledge of SDS.

Demonstrate the use of protective clothing and equipment.

Demonstrate standard measurement techniques used in natural resource systems.

Demonstrate cartographic skills, tools, and technologies to aid in developing, implementing, and evaluating natural resource management plans.

Demonstrate the use of hand tools, portable power tools, and equipment.

Demonstrate the use of chemicals.
Curriculum Framework

Exploring Leadership Skills through FFA

Note: Competencies 39-43 have been added to ensure compliance with federal legislation: National FFA Organization's Federal Charter Amendments Act (Public Law 116-7, https://www.congress.gov/116/plaws/publ7/PLAW-116publ7.pdf). All inquiries may be sent to cte@doe.virginia.gov. Students are provided opportunities for leadership, personal growth, and career success. Instruction is delivered through three major components: classroom and laboratory instruction, supervised agricultural experience (SAE) program, and student leadership (FFA).

Task Number 39

Identify the role of supervised agricultural experiences (SAEs) in agricultural education.

Definition

Identification should include

- defining an SAE program as an opportunity for students to consider multiple careers and occupations in the agriculture, food, and natural resources (AFNR) industries, learn expected workplace behavior, develop specific skills within an industry, and apply academic and occupational skills in the workplace or a simulated workplace environment
- researching the Foundational SAE
  - career exploration and planning
  - personal financial planning and management
  - workplace safety
  - employability skills for college and career readiness
  - agricultural literacy
- researching the Immersion SAE
  - entrepreneurship/ownership
  - placement/internships
  - research (experimental, analytical, invention)
  - school business enterprises
  - service learning
- developing a plan to participate in an SAE, based on personal and career goals
- researching available awards and degrees, based on SAE participation.
Teacher resource:
- **SAE Resources**, National Council for Agricultural Education

**Process/Skill Questions**

- What are examples of SAEs related to this course and in the AFNR industries?
- Where can a copy of the Virginia SAE Record Book be found?
- What is an Immersion SAE?
- How does a placement/internship SAE differ from an ownership/entrepreneurship SAE?
- How does an SAE provide relevant work experience and contribute to the development of critical thinking skills?
- How is the SAE an extended individualized instructional component of a student’s Career Plan of Study?
- How can an SAE be used to provide evidence of student growth and participation in authentic, work-related tasks?
- What are the four types of SAEs?
- What are the advantages of participating in work-based learning experiences and projects?
- How does one choose an appropriate SAE in which to participate?

**Task Number 40**

**Participate in an SAE.**

**Definition**

Participation should include

- developing, completing, or continuing a plan to participate in an SAE as a work-based learning experience, based on personal and career goals
- documenting experience, connections, positions held, and competencies attained, using the **Virginia SAE Record Book**
- researching available awards and degrees, based on SAE participation.

**Teacher resources:**

- **FFA SAE**
- **The Agricultural Experience Tracker**
- **Virginia SAE Record Book**

**Process/Skill Questions**

- What are the advantages of participating in work-based learning experiences and projects?
- How do SAEs help prepare students for the workforce?
- What are some examples of SAEs in AFNR?

**Exploring Leadership Opportunities through FFA**

**Task Number 41**

**Identify the benefits and responsibilities of FFA membership.**
**Definition**

Identification should include

- **benefits**
  - listing opportunities to participate in community improvement projects and career development events (CDEs) and leadership development events (LDEs)
  - exploring leadership development opportunities

- **responsibilities**
  - researching the responsibilities of FFA officers, committees, and members
  - locating resources that guide participation in FFA activities
  - explaining the FFA Creed, Motto, Salute, and mission statement
  - explaining the meaning of the FFA emblem, colors, and symbols
  - explaining significant events and the history of the organization.

**Process/Skill Questions**

- How does one become an FFA member?
- What is the FFA’s mission and how does it accomplish its mission?
- What are the benefits and responsibilities of FFA membership?
- What five FFA activities are available through the local chapter?
- What are some significant events in FFA history? How have these events shaped membership over time?
- What is the FFA program of activities (POA), and how is it used?

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**Task Number 42**

**Describe leadership characteristics and opportunities as they relate to agriculture and FFA.**

**Definition**

Description should include

- examples of successful leaders
- types of leadership
  - autocratic
  - participative
  - laissez-faire
  - servant
  - followership
- positive leadership qualities and traits of successful leaders
- opportunities for participating in leadership activities in FFA
- demonstrating methods for conducting an effective meeting.

**Process/Skill Questions**

- Who are some successful leaders in the agriculture industry?
- What qualities make a successful leader?
- What are leadership traits?
- What is the difference between positive and negative leadership?

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**Task Number 43**
Apply for an FFA degree and/or an agricultural proficiency award.

**Definition**

Application should include:

- Identifying types of FFA degrees:
  - Greenhand
  - Chapter
  - State
  - American

- Identifying proficiency award areas:
  - Entrepreneurs
  - Placement
  - Combined
  - Agriscience research

- Exploring CDEs and LDEs related to this course
- Identifying all SAE criteria to be eligible for the award
- Identifying the type of award
- Applying for an FFA award.

**Teacher resource:**

- [FFA Agricultural Proficiency Awards](#)

**Process/Skill Questions**

- Where are the awards and their application criteria located?
- What are the benefits of winning an FFA award?
- What are the benefits and requirements of an FFA degree?
- What FFA awards are available?
- How does the FFA degree program reward FFA members in all phases of leadership, skills, and occupational development?
- What is the highest degree that can be conferred upon an FFA member at the national level?
- What are the requirements for a Greenhand FFA degree?

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**Understanding Natural Resource Management**

**Task Number 44**

**Define terms and key concepts related to natural resources, ecology, and environmental sciences.**

**Definition**

Definitions may include, but are not limited to:

- Abiotic and biotic factors
- Adaptation
- Atmosphere
- Biodiversity
- Biome
• carnivore
• carrying capacity
• climate
• communities
• competition
• conservation
• consumptive and non-consumptive uses
• distribution
• domestication
• dominant species
• ecology
• ecosystem
• emigration
• environment
• food web
• habitat
• herbivore
• homeostasis
• immigration
• invasive species
• minerals
• mortality
• natality
• natural resources
• niche
• non-renewable natural resources
• omnivore
• pollution
• population and population density
• predation
• preservation
• recycling
• renewable natural resources
• reusing
• selection
• species diversity
• succession
• sustainability
• terrestrial communities
• water cycle
• weather
• wildlife.

Process/Skill Questions

• What is the difference between renewable and non-renewable natural resources? What are examples of each?
• What factors affect the water cycle?
• What is the difference between sustainability and viability?
• Why is biodiversity important?
• What role do recycling, reusing, and reducing play in our daily lives, and what is the effect of these life choices?
• What are the major differences between preservation and conservation, and what influence do they have on our lives today and in the future?
• What role does carrying capacity play in the environment and in agriculture production?
• What effect does an invasive species have on a native species? Immediately? In the long term?
• What are the components of a food web?
- How does population density play a role in an ecosystem?
- What is the implication of natality and mortality on an ecosystem?
- What is the difference between abiotic and biotic?

Task Number 45
Identify the different types of natural resources.

Definition
Identification may include
- identifying the characteristics of a natural resource to determine its classification
- describing types of living species based on evolutionary traits
- classifying types of natural resources by source of origin, the state of development, and the renewability of the resources (e.g., biotic vs. abiotic, renewable vs. non-renewable, etc.)
- devising strategies for the preservation of natural resources based on their classification.

Process/Skill Questions
- Why is it important to classify natural resources?
- What is the importance of developing sustainable methods to manage resources and ensure they are maintained for future generations?

Task Number 46
Research historical figures who played a prominent role in shaping how natural resources are viewed and used today.

Definition
Research should include examining the following figures, but not limited to,
- Aldo Leopold
- Teddy Roosevelt
- John Muir
- Rachel Carson
- Gaylord Nelson.

Process/Skill Questions
- How are modern lifestyles related to the depletion of natural resources?
- How do modern lifestyles affect resource consumption and energy use?
- What are some strategies that can be used to mitigate the loss of a natural resource?
- How has technology affected the use and views of natural resources?
- How can management, protection, enhancement, and improvement of natural resources evolve through social considerations (e.g., establishment of national parks, influencing public opinion, waste reduction, reduction of energy consumption)?

AFNR Standards: NRS.02.03

Task Number 47
Explain principles and processes of ecological succession in different vegetation communities.

Definition
Explanation should include
- climax stage
- disturbance
- dominant species
- pioneer species
- competitive advantage
- primary and secondary succession.

Process/Skill Questions
- What are some examples of pioneer species?
- What is a dominant species?
- Why is competition so important to the stability of an ecosystem?
- How does a plant’s shade tolerance affect its role in succession?

Task Number 48
Explain the concept of tragedy of the commons.

Definition
Explanation could include
- definition of tragedy of the commons
- description of how an individual's use of natural resources affects others and the ways that use of natural resources can be regulated
- effects of overgrazing, soil erosion, and renewable and non-renewable resource usage.

Process/Skill Questions
- What are some examples of tragedy of the commons?
- How can use be regulated?
- How does tragedy of the commons explain current challenges in the economy?
- What is the current legislation regarding conservation as it relates to tragedy of the commons?
- What is one’s responsibility when using natural resources?

Task Number 49
Describe the principles, threats to, and benefits of biodiversity.

Definition
Description should include
- definition of biodiversity
- effects of geographic location
- methods to promote and preserve biodiversity
- commercial, social, and economic benefits
- threats to biodiversity.
Process/Skill Questions

- What is biodiversity?
- How does biodiversity change as we move north or south of the equator?
- How does global latitude affect species diversity? In what ways can one manage an ecosystem to increase biodiversity?
- What creates a stable ecosystem?
- How does one measure biodiversity?

Task Number 50

Analyze how the level of biodiversity in an ecosystem influences the availability of natural resources.

Definition

Analysis should include

- explaining the influences of abiotic and biotic factors
- describing the components of a food web and the relationships between organisms (e.g., predator, prey, commensalism, mutualism, parasitism, consumer, producer, decomposer)
- explaining how biodiversity develops through evolution, natural selection, and adaptation
- explaining the importance of biodiversity to ecosystem function and availability of natural resources
- analyzing the interdependence of organisms within an ecosystem (e.g., food webs, niches, impact of keystone species, etc.)
- assessing the dependence of organisms on nonliving components (e.g., climate, geography, energy flow, nutrient cycling).

Process/Skill Questions

- What are some examples of mutualism, commensalism, predation, and parasitism in an ecosystem?
- How do abiotic factors affect an environment and an ecosystem?
- How do biotic factors affect an environment and an ecosystem?
- What is a keystone species?
- Why are some species in an ecosystem designated as keystone species?
- How do prey and predator interactions influence the food web?
- How does the carrying capacity of an environment affect the predator-prey relationship?
- How do migrant species play a role in the ecosystem?
- How can management choices improve an ecosystem?

Task Number 51

Analyze programs of supporting organizations and partners that play a role in natural resource management.

Definition

Analysis should include the difference between public, private, and professional organizations (e.g., Virginia Forestry Association [VFA], Virginia Department of Wildlife Resources [DWR], Ducks Unlimited, Society of American Foresters, The Wildlife Society, American Fisheries Society, National Audubon Society, Trout Unlimited).

Process/Skill Questions

- What is the difference between public, private, and professional organizations?
- What role do the various organizations play in managing natural resources?
- What are the positive and negative aspects of the various organizations?

Task Number 52

**Explain common ecological cycles as they relate to the environment.**

**Definition**

Explanation could include

- carbon cycle
- water cycle
- life cycle (e.g., amphibian, insects)
- nutrient cycle (e.g., phosphorous, nitrogen).

**Process/Skill Questions**

- How does the level of carbon dioxide in the atmosphere contribute to global climate change?
- How do agricultural products sequester carbon?
- How do agricultural products release carbon?
- How does the nitrogen cycle affect our ecosystem?
- How does the carbon cycle affect our lives?
- What is the water cycle and its implications in our daily lives?

Task Number 53

**Explain the safety procedures and programs associated with the outdoors.**

**Definition**

Explanation should include

- wild animals
- poisonous plants
- pathway obstructions and hazards
- equipment (e.g., mowers, chainsaws, trimmers or pruners, power tools)
- chemical
- waterways and boating (see Virginia Boater Education).
- hunting (see Virginia Hunter Education)
- appropriate dress and clothing for the current conditions.

**Process/Skill Questions**

- What are the safety procedures one should follow regarding the operation of a chainsaw, a lawn mower, a trimmer, or pruner?
- Where does one find the chemical safety procedures on a container?
- What are safety data sheets (SDS)?
- How can one educate the public about wild animals that might be encountered outdoors or in recreational areas?
- What poisonous plants and animals are commonly found in Virginia's outdoor recreation areas?
- How should pathway hazards be marked or improved?
- What chemical safety issues might arise in an outdoor recreation area?
Protecting the Environment

Task Number 54
Describe the composition of the atmosphere.

Definition
Description should include
- layers of the atmosphere
- gases and components that make up the atmosphere.

Process/Skill Questions
- What are the most common gases in the atmosphere?
- What are the four layers of the atmosphere?
- What is water vapor’s role in the atmosphere?
- Where is the concentration of gases the densest? What is ozone?
- How do chlorofluorocarbons affect the ozone layer of the Earth?
- How can one protect oneself from ultraviolet rays?
- What human activities cause ozone depletion?

Task Number 55
Identify ecological concepts and principles related to atmospheric natural resource systems.

Definition
Identification may include
- defining biogeochemical cycles
- classifying different kinds of biogeochemical cycles and the role they play in natural resources systems
- researching the role that the atmosphere plays in the regulation of biogeochemical cycles
- summarizing how climate factors influence natural resource systems
- analyzing the impact that climate has on natural resources and debating how this impact has changed due to human activity
- assessing the primary causes of climate change and designing strategies to lessen its impact on natural resource systems.

AFNR Standards: NRS.01.03

Task Number 56
Identify air pollutants, their sources, and their effects on the environment.
Definition

Identification should include

- a description of the six major pollutants (e.g., ozone, sulfur dioxide [SO₂], nitrogen dioxide [NO₂], carbon monoxide [CO], lead [Pb], particulate matter [PM])
- a description of the pollutants that result from combustion emissions
- methane and ruminant agriculture.

Process/Skill Questions

- What is smog?
- What is PM, and how does it get into the atmosphere?
- How does agriculture contribute to the amount of methane in the atmosphere?
- Which pollutants are considered to be “greenhouse gases”?
- Which pollutants result from agricultural practices?
- What are examples of natural air pollutants?
- What are other sources of air pollution?
- What is the effect of air pollution on human health?
- What can be done to reduce the amount of air pollution produced?

Task Number 57

Describe current methods used to reduce air pollutants and improve air quality.

Definition

Description could include

- catalytic converter
- control emissions
- reusing and recycling
- building inspection
- proper maintenance of equipment
- reduction in the use of pesticides
- discontinuation of the use of aerosols
- adherence to codes and laws regarding outdoor burning.

Process/Skill Questions

- What purpose does a catalytic converter serve?
- Who enforces outdoor burning laws?
- What are alternatives to pesticide use?
- How do recycling and reusing products reduce pollution?
- What is the impact of outdoor burning?
- How can we educate the public about the effects of air pollution?
- How can one reduce one’s contribution to air pollution?

Task Number 58

Describe the soil formation process and components of soil.

Definition

Description should include

- soil-forming factors (e.g., parent material, climate organisms, topography, time)
• soil origins (e.g., alluvial, marine, loess, glacial, organic deposits)
• related key terms and concepts (e.g., micronutrients, macronutrients, minerals, pore space, bedrock, humus, topsoil, weathering).

**Process/Skill Questions**

- How is the material content of soil determined?
- What natural processes create soil?
- How does glacial activity affect soil formation?
- How does the composition of soil affect crop production?
- What role do living organisms have on soil quality?
- What are the differences among alluvial, marine, loess, glacial, and organic deposits, and its influence on the soil?
- What role does humus play in soil quality?
- How does soil type determine use?

**Task Number 59**

**Evaluate soil texture and soil properties.**

**Definition**

Evaluation should include the use of the textural triangle and the field test methods.

**Process/Skill Questions**

- What are the soil particles from smallest to largest?
- How does one use a soil texture triangle?
- How does one use the ribbon method?
- What soil particles are measured using the ribbon method?
- What is the purpose of determining soil texture and soil properties?

**Task Number 60**

**Demonstrate procedures for collecting soil samples and conducting soil tests.**

**Definition**

Demonstration should include

- ensuring equipment is free from contaminants
- choosing a random pattern of testing area
- sampling soil from root zone
- ensuring the sample is free from organic debris
- mixing the sample well.

**Process/Skill Questions**

- Why is it important to conduct a soil test prior to planting?
- How can one change soil pH?
- What effect does pH have on soil nutrients and plants?
- What plant species typically grow in acidic or alkaline conditions?
- Why is it important to use clean equipment?
- At what depth does one take soil samples?
- Why should organic matter be removed from the soil sample?
- How does one determine the sample area?
Task Number 61
Explain techniques associated with soil management.

Definition
Explanation should include

- identifying the physical and chemical properties of soil
- describing how soil quality directly affects water quality, biodiversity, wildlife habitat, plant growth, and crop production
- explaining how to improve soil quality
- analyzing a plot of land to determine which soil management techniques would be most applicable
- devising a soil management plan to minimize erosion and maximize biodiversity, plant productivity, and the formation of topsoil
- describing how maintenance and enhancement of soil quality maintains maximum efficiency in crop productivity over time by enhancing nutrient cycling and encouraging site-specific application of nutrients and pesticides. It protects water and air quality and preserves the beneficial functions of the soil in specific ecosystems.

Process/Skill Questions

- What types of data, information, and results are provided in a soil analysis?
- What is the difference between chemical, physical, and biological aspects of the soil?
- Why is lime applied to land? Sulfur?
- Why is prior knowledge of plant species important for nutrient recommendations?
- How often should one take a soil sample of one’s land if one wants to grow vegetable or grazing crops?
- How does one best support biological health and diversity in soil?
- What is the effect of soil pH on plant growth?
- Why is soil biology important to soil quality?
- What are the major nutrients needed for plant growth?
- How can one use the information provided in a soil analysis to properly manage the soil and/or land?

AFNR Standards: NRS.01.05

Task Number 62
Examine best management practices for improving soil health.

Definition
Examination should include

- the current state of the soil (e.g., organic matter, macronutrient, micronutrient availability)
- the planned use of the soil
- soil management practices (e.g., no-till farming, cover crops, addition of organic matter).
- What is organic matter?

Process/Skill Questions

- What positive effects does organic matter have on soil?
- What soil conservation methods are available?
• What is the estimated cost for implementing best management practices in a given location?
• What are the environmental costs to not using best management practices for a given area?
• What causes the soil to be depleted of nutrients needed for plant growth and development?

AFNR Standards: NRS.01.05

Task Number 63
Describe erosion, its effects on the environment, and prevention methods.

Definition
Description should include
• process of erosion by water, wind, ice, or human activity
• types of water erosion (e.g., rill, sheet, gully)
• effects of erosion on agricultural production
• effects of erosion on water quality
• physical properties of soil that allow for wind erosion
• conditions that are favorable to wind erosion
• effects of wind erosion on soil
• methods to protect soil from eroding (e.g., the use of vegetation, geotextiles, mulch, retaining walls, windbreaks, cover crops, buffer strips).

Process/Skill Questions
• What effect does erosion have on production capability?
• What are the best management practices for reducing and controlling water and wind erosion?
• What is sedimentation?
• How does water erosion affect the environment?
• How does wind erosion affect the environment?
• What is accelerated erosion?
• What are the most significant anthropogenic causes of erosion?

AFNR Standards: NRS.01.05

Task Number 64 (O)
Test water percolation.

Definition
Test should include
• definition of water percolation
• use of a procedure to determine a quality percolation rate
• analysis of the results of a percolation test.

Process/Skill Questions
• What does water percolation determine?
• What time span indicates adequate water percolation?
• What types of soils typically indicate good water percolation?
• What effect does water percolation have on production agriculture and ecosystems?

Task Number 65 (O)
Demonstrate how to use a soil survey.

Definition
Demonstration should include use of maps, tables, and information included in a local soil survey.

Teacher resource:

Process/Skill Questions
• What information is included in a soil survey?
• What are soil surveys commonly used to determine?
• Where can one find soil surveys?
• What are the limits to a soil survey?

Task Number 66
Describe the characteristics of water and the processes of the hydrologic cycle.

Definition
Description should include
• major properties and characteristics of water
• groundwater and surface water interactions
• major characteristics of the hydrologic cycle
• how the properties of water affect the hydrologic cycle.

Process/Skill Questions
• What elements make up water?
• What characteristics of water are the result of hydrogen bonding?
• What are the various sources of water and how do we use these resources?
• What is the relationship between water and land?
• What are several ways water gets into the atmosphere?
• How is the hydrologic cycle affected by the physical properties of water?
• How do the properties of water affect the hydrologic cycle?
• What role does groundwater play in our daily lives?
• How does surface water interact with groundwater?
• How is the hydrological cycle related to water storage?

Task Number 67
Explain the ecological concepts and principles of aquatic natural resources.
Definition

Explanation should include

- definition of watershed
- identification of local watershed/watersheds in Virginia
- identification of the components of a watershed (e.g., physiography, climate, hydrology, ecological resources, land alterations, sources)
- summary of the roles and properties of watersheds
- description of the importance of groundwater and surface water to natural resources
- analysis of how different classifications of ground and surface water affect ecosystem function.

Process/Skill Questions

- What happens to precipitation when it falls on land?
- What are some characteristics of a healthy watershed?
- What are some factors that affect water infiltration?
- What role does agriculture play in a watershed?
- What is one’s effect on the watershed?
- What are the effects of watershed characteristics on the environment?
- What implications can a watershed have on human health?
- How can we improve a watershed?
- How can others be educated about improving a watershed?

AFNR Standards: NRS.01.04

Task Number 68

Delineate a watershed.

Definition

Delineation should include

- interpreting a topographic map to identify features of a watershed
- identifying the outlet or downstream point of a watershed, headwaters, or watercourse
- determining a watershed boundary.

Process/Skill Questions

- What are the implications from runoff on a watershed?
- What is a contour interval?
- How do contours relate to water flow?
- How do humans and human-built ecosystems affect or influence a watershed?
- Why is it important to delineate a watershed?

Task Number 69

Explain the importance of wetlands to an ecosystem.

Definition

Explanation should include

- the legal definition of a wetland
- types of wetlands (e.g., marshes, swamps, bogs, fens)
- characteristics of a wetland (e.g., vegetation, soils, hydrology)
Task Number 70
Explain the function, advantages, and disadvantages of flood-control structures and their impact on an ecosystem.

Definition
Explanation should include
- the need for flood controls
- the ways that floods can be controlled (e.g., dam, levee, floodplain)
- how flood-control structures function using the physical properties of water
- potential ecosystem impact from flood-control structures.

Process/Skill Questions
- What are the benefits and consequences of flooding to an ecosystem?
- What have been some advantages and disadvantages of flood-control structures?
- How can the properties of water be manipulated to prevent an area from flooding?
- What strategies need to be employed to protect areas that are prone to flooding?

AFNR Standards: NRS.01.04

Task Number 71
Explain the various methods of water treatment to meet national drinking water standards.

Definition
Explanation should include
- boiling
- chemical disinfection
- ultraviolet light
- carbon filtration
- reverse osmosis
- distillation.

Process/Skill Questions
- What are the benefits from water treatment?
- What contaminants can be removed from the use of each water-treatment method?
- What is the water quality standard for water treatment?

- benefits of wetlands (e.g., water control and quality, habitat, recreation).
• What processes does the local water-treatment facility use?
• How can water be made potable in the field?

Task Number 72 (O)
Analyze water quality indicators of a given body of water or aquatic habitat.

Definition
Analysis should include, but not be limited to, testing water for
• chemical sampling (e.g., pH, nitrates, nitrites, ammonia, dissolved oxygen)
• physical sampling (e.g., temperature, clarity, turbidity, biological indicators).

Process/Skill Questions
• What types of water pollutants are monitored?
• How are these pollutants identified?
• What are some ways to monitor water pollutants?
• How can macroinvertebrates help determine the health of a waterway?
• Why does chemical analysis of a water sample only provide a snapshot of water quality?
• What is the effect of poor water quality on an ecosystem?
• What is the effect of good water quality on an ecosystem?
• How does temperature affect dissolved oxygen levels?
• What equipment is needed to test water quality?
• How can excess nutrient harm a waterway?
• Why is it important to know the quality of water?

Task Number 73
Explain how total maximum daily load (TMDL) is calculated and its effects on watersheds.

Definition
Explanation could include
• defining TMDL, point, and non-point source pollution
• identifying sources of point and non-point source pollution
• identifying the effects of pollutants (e.g., nutrients, sediment) on a body of water and aquatic life
• defining eutrophication.

Process/Skill Questions
• What is the difference between point source and non-point source pollution?
• How is TMDL calculated?
• How does eutrophication negatively affect the ecosystem?
• Why were TMDLs imposed?
• What effect do pollutants have on aquatic life? On the environment?
• What state agency oversees TMDLs?

Task Number 74
Examine methods of residential and municipal wastewater treatment systems.

Definition
Examination should include
- septic systems
- drain fields
- municipal systems
- gray water disposal.

Process/Skill Questions
- What method is the local town/city using?
- What is the purpose of wastewater treatment?
- What is considered when selecting a water treatment system?
- What types of residential wastewater treatments are there?
- What type of filtration methods are used?
- How is the location of the treatment system selected?
- How would soil type affect the location?

Task Number 75
Analyze an agricultural industry’s effect on its surrounding ecosystems.

Definition
Analysis could include local and global environmental issues such as
- public land and water use
- water, soil, and air quality
- loss of habitat (e.g., deforestation, urbanization)
- population growth
- watersheds (e.g., restrictions, agricultural, commercial)
- wildlife populations
- invasive species
- natural events
- energy production (e.g., coal mining, hydraulic fracturing, renewable energies).

Process/Skill Questions
- How is our demand for fossil fuels affecting the environment?
- How does habitat fragmentation influence an ecosystem?
- What regulations govern the use of natural resources?
- What behaviors contribute to water pollution?
- What are the major local environmental issues in the community?
- How can hydraulic fracturing affect water quality?
- How does overpopulation affect ecosystems?
- What types of best management practices should be considered regarding issues related to loss of habitat, overpopulation, pollution, wildfires, exotic and invasive species, extreme weather conditions, and recreational use of natural resources?
- How does habitat loss affect wildlife populations?
- What effect do environmental regulations have on the agricultural industry, on life in general, and in the future?
- What affect does water quality have on life?
- Why is protecting the watershed important?
Managing Forest Resources

Task Number 76

Compare the major types of forests in Virginia, the United States, and the world.

Definition

Comparison should include the characteristics of tropical, temperate, and boreal forests.

Process/Skill Questions

• Where are the different types of forests located in the world?
• How are the forests distinctly different in terms of vegetation? Growth? Use?
• What characteristics are used to determine the types of forests?
• What are the major differences among the types of forests?

Task Number 77

Analyze basic tree structure and growth.

Definition

Analysis of structure and growth processes should include

• parts of the tree and their functions (e.g., trunk, branch, crown, leaves, bark, roots, seeds, flowers, cones).
• growth processes (e.g., photosynthesis, respiration, nutrient, and water movement throughout the tree).

Process/Skill Questions

• How does a tree transport water and nutrients to all of its parts?
• How does a tree grow in diameter? Height?
• What is heartwood, and what is its purpose?
• What are some influencing factors that affect tree growth?
• What are the products and reactants of photosynthesis? Respiration?
• What is the purpose of sapwood?

Task Number 78

Identify common trees native to Virginia.

Definition

Identification should include common tree species native to Virginia according to bark, leaf shape, arrangement, and venation, and fruit.

Teacher resources:

• VA FFA Forestry Contest (List of Virginia trees) (https://www.vaffa.org/forestry)
Process/Skill Questions

- What are the methods used to identify tree species?
- What are the three common branch arrangements?
- What is the difference between simple, and palmate, pinnately, and bipinnately compound leaves?
- What are the different types of margins on leaves?
- What are three families of trees native to Virginia?
- What 15 native trees are around your school/area?

Task Number 79

Examine the major threats to forests, including biotic, abiotic, and human-induced threats and their effect on the forest.

Definition

Examination should include

- common forest diseases
- invasive species (e.g., insects, pathogens, plants, animals)
- urbanization
- environmental pollutants
- climate change (e.g., extreme weather events [hurricanes, flooding, ice storms], prolonged droughts)
- wildfire.

Process/Skill Questions

- How do tree diseases (hardwoods and softwoods) affect forestry practices from forest, to factory, to sales?
- What is an invasive species?
- What invasive species pose a threat to Virginia forests?
- What effect do invasive species have on the forestry industry?
- What are some biological and chemical control methods for forest insects?
- How has urbanization affected forestry health?
- What factors make forests more susceptible to invasive species?
- How can invasive species change the makeup of a forest?

Task Number 80

Describe forest products, including those made from wood and other products from trees.

Definition

Description should include products made from the following parts of the tree:

- Wood
- Bark
- Cellulose
- Sap (gums and resins)
- Fruit
- Leaves
• Seed

Process/Skill Questions
• What products are made from the various parts of a tree?
• How does the tree species determine the product produced? Give examples of specific products and the tree species used to make them.
• How is a log sawn into lumber?
• How many different products can one obtain from trees?

Task Number 81
Describe non-timber forest products (NTFPs).

Definition
Description could include
• definition of NTFP
• medicinals and botanicals (e.g., ginseng, black cohosh)
• forest based food products (e.g., fruits, nuts, mushrooms)
• woody decorative plants
• saps and resins.

Process/Skill Questions
• What are some useful foods, substances, materials, and/or commodities obtained from forests other than timber?
• Why are NTFPs, important to the economy?
• How would one use the forest to cultivate and create demand for the pawpaw or persimmon?

Task Number 82
Demonstrate various methods of measuring standing timber.

Definition
Demonstration may include the use of the following equipment:
• Biltmore stick
• Calipers
• Diameter tape
• Clinometers

Process/Skill Questions
• What is pacing and how is it used when measuring timber volume?
• What is diameter at breast height (DBH)? What is the standard height, and why is it important?
• What is the distance of a chain?

Task Number 83
Determine the value and volume of a given tract of land.
Definition

Determination of the value and volume of a given tract of land may include, but is not limited to,

- knowing the area of the forest or wooded land tract
- identifying and finding the volume of each tree
- adding the volume of all the softwood and hardwood trees separately within a given tract
- measuring land area
- calculating the worth of a given land area based on given values.

Teacher resource:

- VA FFA Forestry Contest (Value & Volume) (https://www.vaffa.org/forestry)

Process/Skill Questions

- What tools are used to measure the volume of standing timber?
- What are the species and the volume of each standing tree?
- What are some sampling and measuring practices that can influence the accuracy of a partial timber cruise?
- How can topography affect one’s measurements?

Task Number 84

Analyze various silvicultural practices to include techniques associated with sustainable forestry (e.g., timber stand improvement, diversity improvement, reforestation).

Definition

Analysis should include, but not limited to, the following:

- Harvesting techniques
- Regeneration methods
- Site preparation
- Necessary equipment for forest operations
- Recommended Best Management Practices (BMPs)
- Forest management plan that improves the habitat while sustainably maximizing the amount of timber that can be harvested.

Teacher resource:


Process/Skill Questions

- What is silviculture?
- What are some silviculture practices that improve forest production?
- What are some factors that determine which harvesting method is used?
- What equipment is needed for each method of harvesting trees?
- How is artificial regeneration of a forest different from natural regeneration?
- What are a tree’s stages of growth from planting to harvesting?
- How does the final use of a tree affect its harvest method?

AFNR Standards: NRS.01.05
Task Number 85

Explain safety practices used in the forest industry.

Definition
Explanation should include the importance of wearing proper personal protective equipment (PPE), using each piece of equipment as intended, following operating procedures, and following Occupational Safety and Health Administration (OSHA) guidelines.

Process/Skill Questions
- What PPE should be worn while working with and/or handling equipment used in the forestry industry?
- What safety measures should be taken when operating equipment used in the forestry industry?
- What is the primary purpose of OSHA?
- What is the proper procedure for operating any forest harvesting equipment?

Task Number 86

Identify fire management strategies used in natural resource systems.

Definition
Identification may include
- differentiating between desirable and undesirable fires and researching the role fire plays in a healthy ecosystem
- explaining techniques used to fight wildfires, managing prescribed fires, and ensuring human safety
- explaining the benefits of a controlled burn
- forest fire prevention methods and programs
- forest fire suppression tools and techniques
- concepts associated with the ignition and behavior of fire triangles
- developing a prevention plan for harmful fires for a particular region.

Process/Skill Questions
- Why is it important to ensure that firefighter and public safety is the highest priority for all fire management activities?
- How are fire management strategies used to reduce wildland fire risk to private and public property?
- Why is it important to refine management practices by improving knowledge and understanding of fire through research and monitoring?
- Why is it important to develop and maintain staff expertise in all aspects of fire management?
- What are some environmental factors influencing fire management?
- When should a prescribed fire be used?
- What is the purpose of a prescribed fire?
- What is the difference between fire prevention and fire suppression?
- What are some examples of fire prevention and fires suppression techniques?
- What agencies oversee fire prevention/suppression?

AFNR Standards: NRS.01.05
Managing Wildlife Resources

Task Number 87
Examine classification levels within the science of taxonomy as a way to classify wildlife organisms.

Definition
Examination should include

- the purpose of classification
- an understanding of each division
- the ability to classify organisms.

Process/Skill Questions

- What is a hierarchical structure?
- What are the different classification levels in the science of taxonomy?
- Why does the classification of animals determine how different animals live in their environments?

Task Number 88
Analyze the status of wildlife populations.

Definition
Analysis should include determining whether wildlife species

- are endangered
- are extinct
- are threatened
- have been extirpated
- have reintroduction capability
- have been affected by invasive species.

Process/Skill Questions

- What is the difference between extinct, endangered, and threatened species of wildlife?
- What is the effect of an animal going extinct?
- What species of animals in Virginia are on the endangered or threatened list?
- What animals have become extinct in Virginia?
- How is extirpated and extinct different?
- What are common invasive wildlife species in Virginia?
- How do invasive species affect wildlife populations and ecosystems?
- What are ways to control invasive species in an ecosystem?
- What factors influence the establishment and spread of invasive species?
- What are the appropriate steps to prevent or minimize the effect of invasive species?
- How does one evaluate the presence and effect of invasive species on natural resources and create a plan to prevent, control or eliminate invasive species from the habitat?
- What is required to reintroduce a species?

Task Number 89
Identify types of native wildlife species and their habitat requirements.

**Definition**
Identification should include
- defining *habitat*
- characteristics
- locations
- habitats
- feeding patterns
- spawning/mating patterns
- species (i.e., amphibians, fish, reptiles, mammals, and birds).

**Process/Skill Questions**
- What are the habitat requirements of wildlife?
- What factors contribute to the reduction of animal populations?
- What are the physical characteristics of different species?
- How do physical characteristics of an animal species influence where and how they live?
  - What they eat?
- How do anthropogenic activities have an effect on animal populations?

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**Task Number 90**
Differentiate between population ecology, population density, and population dispersion and the importance of these concepts to natural resource systems.

**Definition**
Differentiation should include
- factors influencing population density and population dispersion in natural resource systems
- comparisons of various methods of wildlife sampling
- information about the length, weight, age, and sex/maturity of wildlife
- techniques for wildlife preservation.

**Process/Skill Questions**
- What is a given specie’s life history (e.g., description, geographic distribution, habitat, reproduction and growth, patterns in activity, behavior, stressors)?
- What quantifiable method (e.g., observation, counting) of monitoring a species can be used?
- Why is a sampling design an important part of data collection?
- How do humans affect wildlife populations?
- Why is monitoring wildlife populations important?

**AFNR Standards:** NRS.01.06

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**Task Number 91**
Describe the steps in establishing and managing wildlife habitats.
Definition

Description should include

- identifying the target population
- identifying survival requirements and sources (e.g., food, water, cover, a place to rear young)
- management techniques for sustained survival and population growth.

Process/Skill Questions

- What is a target population?
- What are the survival requirements for the target population?
- What are the food and water requirements of the selected wildlife species?
- What type of cover/nesting area does the wildlife species require?
- How was the wildlife habitat established? What are the initial population numbers found in the wildlife habitat?
- What are the basic needs of wildlife?
- What are the different types of wildlife habitats?
- What benefits do wildlife habitats provide humans?
- How can understanding key influences/laws shape the management and harvesting of wildlife species?
- How can maximum sustained yield, optimum yield, and adaptive resource management be used to manage and harvest wildlife species? What are their advantages and disadvantages?
- What are key limitations and concerns with regard to reintroduction or relocation projects as a management tool?

AFNR Standards: NRS.01.06

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Managing Aquatic Resources

Task Number 92

Describe fisheries in Virginia (e.g., commercial and sport fishing, farm-raised fish, hatcheries).

Definition

Description should include

- aquaculture
- hatcheries
- warm and cool water fisheries
- commercial fishing laws
- sport-fishing regulations.

Teacher resource:

- Virginia DWR State Hatcheries (https://dwr.virginia.gov/fishing/fish-stock/)

Process/Skill Questions

- What is aquaculture?
- How do fishing regulations protect the fish population?
- How do farm-raised fish vary from wild populations?
• How does a hatchery or a fish farm determine what fish to raise?
• How does location of a hatchery or fish farm determine the type of fish raised?
• What controversies exist in terms of commercial fishing?
• What role do fisheries play in Virginia’s economy?
• What role does aquaculture play in the economy?

Task Number 93
Describe aquatic habitats.

Definition
Description should include
• marshes
• tidal flats
• streams and rivers
• lakes and ponds
• oceans
• vernal pools.

Process/Skill Questions
• What is the difference between a marsh and wetland?
• What aquatic life will one find in each habitat?
• How do environmental issues affect aquatic habitats?
• What effect does acid rain have on aquatic habitats/species?
• What is the correlation between freshwater mussels and water quality?
• How are freshwater mussels dependent on fish?

Task Number 94
Describe common fish and aquatic species in a given area.

Definition
Description should include
• characteristics
• locations
• habitats
• feeding patterns
• spawning/mating patterns
• aquatic species (i.e., amphibians, bivalves, benthic macroinvertebrates, shellfish).

Teacher resource:
• Virginia DWR Virginia Fishes (https://dwr.virginia.gov/wildlife/fish/)

Process/Skill Questions
• How does temperature correlate to the species present?
• What effect does water quality have on the population?
• What man-made entities exist to benefit a species in a given area?
• How does pollution correlate to the presence/absence of a species?
• What role do macroinvertebrates play in the aquatic habitat? On the fish population and other aquatic species?
Task Number 95

Describe aquatic inventory/sampling methodologies.

Definition

Description should include

- information about the length, weight, age, and sex/maturity of fish
- techniques for fish preservation
- the use of a seine net for aquatic sampling
- comparisons of various methods of aquatic sampling
- examination of the Virginia Save Our Streams methods (e.g., pollution tolerant, somewhat pollution tolerant, pollution intolerant benthic macroinvertebrates)
- water quality measures (e.g., pH, dissolved oxygen, alkalinity, nitrates, nitrites).

Process/Skill Questions

- Why is inventory sampling important?
- What are the similarities and differences between passive and active methods of collection?
- How are unwanted fish removed from an area?
- How can silvicultural activities affect aquatic ecosystems?
- Why are benthic macroinvertebrates an indicator of water quality? How do fish species correlate to benthic macroinvertebrates?
- How do turbidity and algae affect the fish population?
- Why is determining water quality important?
- Why should one use both chemical and benthic macroinvertebrates together to determine water quality?

Exploring Energy Resources and Consumption

Task Number 96

Analyze various energy sources.

Definition

Analysis should include various energy sources such as the following:

- Biomass energy (biodiesel, ethanol)
- Wind energy
- Solar energy
- Geothermal energy
- Hydrogen
- Hydroelectric energy
- Nuclear energy
- Methanol
- Fossil fuels (coal, natural gas, oil)

Process/Skill Questions

- What are the advantages of using alternative energy sources? Disadvantages?
- What are the concerns about using biofuels?
- What are the advantages of biofuels?
• Which agricultural crops can be used for biofuels?
• How can waste from the animal industry be used for fuel?
• How can biomass be used as an energy source?
• How is ethanol produced?
• What effect does biofuel production have on food and feed supplies?
• What factors should be considered when deciding which alternative fuel is the best?
• What are the advantages of using alternative energy sources rather than traditional sources, such as fossil fuels?
• How can solar energy be used as an alternative energy source?
• How does a nuclear power plant operate?

Task Number 97
Contrast various forms of renewable and non-renewable energy sources.

Definition
Contrast should include
• accessibility
• geographic distribution
• cost
• sustainability
• equity
• advantages and disadvantages.

Process/Skill Questions
• What are the advantages and disadvantages of using coal?
• Why are liquid fuels more advantageous than coal or wood?
• What are the potential environmental consequences of locating, extracting, transporting, and burning petroleum?
• What effects does extracting natural gas have on the environment?
• What are the advantages and disadvantages of using nuclear power?
• Why might the use of solar power be limited in some areas?
• What are the positive and negative aspects of using hydroelectric power?
• What are some methods of obtaining hydrokinetic power?
• What are some adverse environmental effects of wind energy?
• How can agriculture benefit from wind power?
• What are the advantages and disadvantages of geothermal power?
• What is the difference between renewable and non-renewable resources?
• What are some examples of non-renewable resources? Renewable?
• How can the dependence on non-renewable resources be shifted to renewable energy resources?
• What are the major reasons for reliance on non-renewable resources?
• What will be the effect on our society when non-renewable resources are exhausted?
• What will replace the resources when they are exhausted?
• What role do renewable resources play in our energy future?

Task Number 98
Explain the global economic impact of energy use and depletion.
Definition

Explanation should include

- the effects of different forms of energy (e.g., wind, solar, fossil fuels, natural gas, geothermal) according to geographic regions
- the effect of carbon emissions on the environment
- the effect of energy conservation strategies.

Process/Skill Questions

- What are the possible consequences on the global economy if non-renewable resources are depleted?
- What challenges exist in adopting new energy technologies? What is the current breakdown for energy consumption? Non-renewable fuels vs. renewable fuels?
- What or who are the largest consumers of energy?
- How can the agriculture industry reduce its demand for energy?
- How can individuals reduce energy consumption?
- How can we as a nation reduce our consumption of energy?
- What are the implications if an energy shortage occurs?
- How can we shift our energy consumption to renewable sources?
- What is a carbon footprint and how is it calculated?
- What can an individual do to reduce their carbon footprint?

Examining Land Use

Task Number 99

Explain the effect of major land development on the environment and ecosystems.

Definition

Explanation should include how land used for agriculture, industry, and commercial development affects the environment and ecosystems in terms of sedimentation, nutrient load, air quality, plant life, wildlife, aquatic plant life, animal life, macroinvertebrates, and fisheries.

Process/Skill Questions

- What are the effects of sedimentation?
- What steps are currently being taken by land developers to limit harmful effects on the environment, and how effective are these steps?
- How have agricultural practices evolved to lessen adverse effects on the environment?
- What types of development are most detrimental to the environment and ecosystems?
- What methods can be used to mitigate adverse impacts caused by land development?

Task Number 100

Explain zoning classifications and the effects of zoning.

Definition

Explanation should include the restrictions and allowances for the following classifications:

- Commercial
- Industrial
Multi-family residential
Residential commercial
Single-family residential
Agricultural
Public land

Process/Skill Questions

- How do the zoning classifications differ?
- Why does each zoning classification have restrictions?
- What is the purpose of each zoning classification?
- What are the processes for zoning reclassifications?
- How does zoning affect your life?

Task Number 101
Design a community to minimize adverse effects on the environment.

Definition
Design should include clean, efficient, and sustainable uses of water, energy, buildings, roadways, waste disposal, and buffer and riparian zones to keep environmental impact to a minimum.

Teacher resources:
- What is LEEDS Certification?
- What is LEED?

Process/Skill Questions

- What are the limitations of the land (e.g., water, topography, distance from major cities)?
- What technologies can be used to aid in designing a community that will have a minimum impact on the environment?
- What are some examples of environmentally friendly development?
- How can best management practices (direct and indirect) in urban areas be implemented to decrease stormwater runoff and increase groundwater recharge?
- What techniques can be used to decrease the amount of energy used, and what alternative development methods can be employed?
- What is the rationale of keeping environmental impacts to a minimum?

Task Number 102
Interpret land-use maps.

Definition
Interpretation should include

- identifying the scale and measuring distances
- determining resolution
- recognizing topographic features
- identifying different types of soil
- identifying different types of land cover
- identifying other distinguishing features, such as bodies of water.
Process/Skill Questions

- Why are scale, resolution, and coordinate systems important? What do they tell the viewer?
- Why are topography, soil type, and land cover important on land-use maps? What do they tell the viewer?

Exploring Government Policies, Agencies, and Regulations

Task Number 103

Analyze a comprehensive plan for a community.

Definition

Analysis should include reading a plan to determine the goals for the community in regard to

- agricultural land
- town/city area
- open spaces
- water resources
- historic preservation and conservation easements
- capital improvements
- transportation.

Process/Skill Questions

- What does the comprehensive plan outline?
- How will the plan affect the environment in terms of growth, regulations, and available resources?
- What could be done to improve the comprehensive plan?
- How often is the comprehensive plan updated? Does this correspond with the community’s long-term planning goals?

Task Number 104

Describe current environmental policies/regulations.

Definition

Description should include the following:

- Clean Water Act
- Safe Water Drinking Act
- Water Quality Act
- Chesapeake Bay Total Maximum Daily Load (TMDL)
- Agricultural Stewardship Act
- National Environmental Policy Act
- Virginia Erosion and Sediment Control law
- Other local and state regulations that apply (will vary by area)
Process/Skill Questions

- What is the difference between a law and a regulation?
- What led to the creation of each policy/regulation?
- How was the environment affected prior to the creation of each policy/regulation?
- What is the main purpose of each policy/regulation (including any amendments)?
- How has each policy/regulation improved water quality?
- How has each policy/regulation affected (positively and negatively) land uses (e.g., agriculture, industry, residential)?
- What agency (or agencies) are responsible for administering and enforcing each policy/regulation?
- What are the penalties for violating each policy/regulation?
- What Virginia policy/regulations are enforced in your area?
- What are the penalties for violating each policy/regulation?
- What Virginia policy/regulations are enforced in your area?
- How do these policy/regulations affect agricultural production, natural resources management, and forest harvesting?
- Why is enforcing these policy/regulations important to agriculture?
- How has each policy/regulation improved air quality?
- How has each policy/regulation affected soil conservation efforts?

Task Number 105

Identify local, state, and federal conservation, natural resource, and environmental regulatory agencies and programs.

Definition

Identification should include the main programs offered by the following local, state, and federal conservation agencies:

- Soil and Water Conservation Districts
- Virginia Department of Conservation and Recreation
- Virginia Department of Forestry
- Virginia Department of Wildlife Resources
- Virginia Department of Agricultural and Consumer Services
- Virginia Department of Environmental Quality
- Virginia Marine Resources Commission
- U.S. Fish and Wildlife Service
- U.S. Environmental Protection Agency (EPA)
- U.S. Department of Agriculture (USDA)
- Natural Resources Conservation Services (NRCS)

Process/Skill Questions

- What is the primary purpose of the agencies mentioned?
- How does each agency function?
- What role does each organization play?
- What major programs are offered by soil and water conservation districts, and how do these programs improve natural resources?
- How do local, state, and federal agencies manage wildlife and wildlife-harvesting activities?
- What are the purposes of state and national parks and forests?
- How do local, state, and federal conservation agencies work together to improve the environment?
- How can private landowners contribute to conservation efforts?
- How can agricultural producers contribute to conservation efforts?
How can the general citizenry contribute to conservation efforts, especially on public lands?

Developing Mechanical Skills Related to the Natural Resources Systems Pathway

Task Number 106
Describe water-use planning and water rights policies.

**Definition**
Description should include
- a definition of water-use planning
- examining water rights legislation
- examples of situations in which a water-use plan would be used
- guidelines for developing a water-use plan.

**Teacher resource:**

**Process/Skill Questions**
- What is the purpose of a water-use plan?
- How can a community become involved in a water-use plan?
- What is the difference between a riparian right and an appropriative right?
- How does inland water-use planning differ from coastal water-use planning?
- Where can guidelines for water-use planning for different types of development be found?
- What are riparian buffers and what is their purpose?
- What are some strategies for the creation, enhancement, and management of riparian zones and buffers?

Task Number 107
Explain the need for safety in Natural Resources Systems Pathway.

**Definition**
Explanation should include the need for
- safety rules for the use of tools and equipment
- fire safety
- lab safety
- chemical safety
- electrical safety
- weather safety
  - heatstroke
  - heat exhaustion
  - heat cramps
  - frostbite
• hypothermia
• safe lifting techniques
• PPE
  • eye
  • hearing
  • respiratory
  • clothing and shoe
• first aid.

Process/Skill Questions
• What problems might occur if safety rules are not followed?
• What guidelines help prevent accidents?
• What chemicals might one come into contact within this class?
• What are some examples of PPE and the proper use of each?
• What are some possible hazards in a laboratory environment?
• What do the colors in the safety color system represent?

Task Number 108
Demonstrate safe use of tools, materials, and equipment for use in natural resources.

Definition
Demonstration must include
• passing written tests with 100% accuracy on
• general lab/workshop safety
• safety and operating procedures for all tools, equipment, and machinery
• the major parts of all tools, equipment, and machinery
  • passing a proficiency/performance test with 100% accuracy for all tools, equipment, and machinery
  • following manufacturer’s instructions and reviewing safety manuals, when applicable
  • following all safety guidelines and procedures when using tools, equipment, and machinery in the agricultural mechanics lab/workshop and land lab
  • selecting appropriate PPE for the operation of concern
  • following the safety standards and regulations of the EPA, Occupational Safety and Health Administration (OSHA), the Equipment and Engine Training Council (EETC) Education Committee, and safety data sheets (SDS)
  • using the appropriate PPE for the task
  • using language, symbols, and procedures related to the operation of tools and equipment
• operating approved equipment using all safety procedures and protocols.

Teacher resource:
• Laboratory Safety Resources, Virginia Tech

Process/Skill Questions
• Why is it important to have every student achieve 100 percent on the state/local safety test?
• What are some examples of basic housekeeping standards?
• What are the different categories of tools?
• What are the various safety hazards associated with each tool group?
• What are some common safety rules with power equipment?
• How are symbols used for the operation of equipment?
• Where can you find the safety rules for using the equipment at your school?

Task Number 109
Utilize tools in managing natural resources.

Definition
Utilization of tools should include using the following tools, following all safety procedures and protocols:

• GPS Unit
• Diameter tape
• Telemetry unit
• Seines
• Aquatic net
• Water meter
• Animal tag or band
• Biltmore stick
• Secchi disk
• Analog refractometer
• Hygrometer

Process/Skill Questions
• What are some tools used in natural resources jobs and what are they used for?
• What is a Biltmore stick and how is it used?
• Why would a forester need a GPS unit?

Task Number 110
Identify marked safety areas.

Definition
Identification should include describing and translating signage and special markings (e.g., floor paint) that identify work and caution areas.

Process/Skill Questions
• What are the different types of work zones?
• How can one determine whether additional safety equipment or clothing is needed to enter a safety area?
• How are walkways identified in the lab/workshop area?

Task Number 111
Identify the location and use of eyewash stations.

Definition
Identification should include describing the signage and operating procedures for the unit.
Process/Skill Questions

- What is the color of the sign that signifies an eyewash station?
- When should one use an eyewash station?
- What safety equipment provides additional eye protection?

Task Number 112

Identify the location of the posted evacuation routes.

Definition

Identification should include

- events that could trigger an evacuation
- the location and interpretation of the posted evacuation route
- the destination and procedures for evacuation.

Process/Skill Questions

- What route should be followed in the event of an evacuation?
- Where is the evacuation route posted?
- Why is it important to establish a meeting place in the case of an evacuation?

Task Number 113

Demonstrate knowledge of SDS.

Definition

Demonstration should include identifying

- the location of the sheets within the agricultural mechanics lab/workshop and the purpose they serve
- the administration’s (ownership’s) responsibility for workers’ health and safety
- laws/regulations and practices affecting workers’ health and safety
- health and safety hazards
- health and safety programs and the responsibility for environmental stewardship
- environmental laws, regulations, and practices
- sustainability initiatives.

Process/Skill Questions

- What environmental concerns should an industry address?
- What methods can be used to motivate employees to become involved in effective health, safety, and environmental practices?

Task Number 114

Demonstrate the use of protective clothing and equipment.

Definition

Demonstration should include using the types of protective clothing and equipment needed (e.g., protection of the eyes, respiratory system, auditory functions, feet, hands, and body) and grooming/hygiene (e.g., precautions related to hair length; loose clothing/jewelry; greasy hands, shoes, or clothing; dirty or scratched eye protection).
Demonstration should include the correct use, the hazards, and the precautions associated with each, in accordance with manufacturer’s instructions and government regulations concerning hazardous material and lab safety.

**Process/Skill Questions**

- What hazards exist due to loose-fitting clothing or long hair?
- When is it advisable to use goggles in the lab/workshop?
- Why are closed-toe shoes required in the lab/workshop?

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**Task Number 115**

**Demonstrate standard measurement techniques used in natural resource systems.**

**Definition**

Demonstration may include

- accurately reading a ruler with graduations in standard and metric units
- calculating volume and area
- using conversion factors (e.g., fractions to decimals, pints to quarts, feet to meters)
- using calculations of basic decimals and fractions.

**Process/Skill Questions**

- What measurement techniques are frequently used in natural resources?
- Why is it important to be able to use conversion factors?

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**Task Number 116**

**Demonstrate cartographic skills, tools, and technologies to aid in developing, implementing, and evaluating natural resource management plans.**

**Definition**

Demonstration may include

- summarizing how to use maps and technologies to identify directions land features, calculate actual distance, and determine elevation points
- applying cartographic skills and tools and technologies (e.g., land surveys, geographic coordinate systems) to locate natural resources
- identifying components of a topographical map to include, contour, lines, wetlands, buildings, compass, and scale
- analyzing an area’s resources using GIS technologies,
- evaluating the availability of and threats to natural resources using cartographic skills, tools, and technologies (e.g., spread of invasive species, movement of wildlife populations, changes to biodiversity of edge of habitat versus interior, etc.)
- plotting a hike using a topographical map making note of total miles, elevation change, and other geographic features
- using GIS data for a given area to devise a management plan for the management, conservation, improvement, and enhancement of its natural resources.
Process/Skill Questions

- How are cartographic skills and tools used in developing natural resource management plans?
- Why is it important to understand how to use topographical maps?
- How can one use GIS data to devise a management plan for the conservation, improvement, or enhancement of natural resources?

Task Number 117

Demonstrate the use of hand tools, portable power tools, and equipment.

Definition

Demonstration could include using various types of tools, equipment, and machinery used in the field, ensuring the correct use, recognizing the hazards and the precautions associated with each, in accordance with manufacturer’s specifications and instructor’s guidelines.

- portable power tools (e.g., power drills, jigsaws, circular saws, routers, grinders, sanders)
- arc welding equipment and plasma cutters
- gas welding equipment
- stationary power tools and equipment (e.g., table saws, band saws, miter saws, radial arm saws, grinders, drill press, lathes, planers, jointers)
- pneumatic equipment (e.g., tire machine, pneumatic jack)
- hydraulic equipment (e.g., floor jack, lift rack, hydraulic press, engine hoist)
- electrical equipment (e.g., bench grinder, drill press, battery testers and chargers).

Process/Skill Questions

- What are unsafe uses of air compressors in the agricultural lab/workshop?
- What is the safest way to hold a part in a vise?
- When is the cleaning tank used?

Task Number 118

Demonstrate the use of chemicals.

Definition

Demonstration should include the different types of solvents, soaps, cleaning solutions, fuel, oils, greases, specialty additives, and gases.

Demonstration should also emphasize the correct use, the hazards, and the precautions associated with each, in accordance with manufacturers’ instructions and government regulations.

Process/Skill Questions

- Why is it important to read the manufacturer's directions when using chemicals?
- What may be the effects of using chemicals incorrectly?
- Where should chemicals be stored within the lab/workshop?

Task Number 119

Demonstrate metalworking operations as they relate to the Natural Resources Systems pathway.
Definition

Demonstration should include

- following all safety procedures and protocols
- identifying metals by physical properties
- identifying metalworking tools, equipment, and supplies
- identifying the processes involved in changing the physical property of metals
- identifying and selecting tools, equipment, and supplies for tool fitting
- reconditioning a tool
- identifying arc and gas welding tools, equipment, and supplies
- using the arc and gas welding equipment properly
- explaining the procedures for down-hand welding
- estimating a bill of materials
- constructing an approved metalworking project
- preparing and properly applying finish.

Process/Skill Questions

- How is metalworking used in natural resources?
- What safety measures must be taken when working with metals?
- What steps are involved in changing the physical property of metals?
- What are the appropriate procedures for each application of tool fitting?
- What are the steps involved in reconditioning a tool?
- Why is tool reconditioning important?
- What safety precautions should be taken when arc welding?
- What steps should be followed when arc welding?
- What safety precautions should be taken when gas welding?
- What is the procedure for correctly performing down-hand welding?
- What steps are involved in constructing a metalworking project?

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Task Number 120

Demonstrate woodworking operations as they relate to the Natural Resources Systems pathway.

Definition

Demonstration should include

- following all safety procedures and protocols
- identifying and using hand tools/hand-power tools, woodworking tools, and supplies
- selecting and using wood fasteners
- estimating a bill of materials
- constructing an agricultural woodworking project, using hand tools/hand-power tools
- preparing and properly applying finishes.

Process/Skill Questions

- What safety precautions apply to the use of hand tools/hand-power tools? Woodworking tools?
- What types of wood fasteners are available?
- What are the steps in estimating a bill of materials?
- What is the purpose of a bill of materials in a project plan?
- What are the steps in constructing a woodworking project?
Task Number 121
Demonstrate electrical operations as they relate to the Natural Resources Systems pathway.

Definition
Demonstration should include

- following all safety procedures and protocols
- explaining the principles, language, and symbols of electricity
- using tools and equipment related to electricity
- using calculations related to electricity
- constructing an approved electrical project.

Process/Skill Questions

- What are the tools used in electrical work?
- What electricity projects would relate to the natural resources industry?
- How are watts, volts, and amperes calculated?
- What is Ohm’s law?
- How does Ohm’s law apply to electricity?
- What is the proper depth to bury underground wiring?
- What class of wire or cable should be used for underground use?
- Why is contacting Miss Utility Virginia essential before excavating?

Task Number 122
Demonstrate small-engine operations as they relate to the Natural Resources Systems pathway.

Definition
Demonstration should include

- following all safety procedures and protocols
- explaining the principles, language, and theory of small engines
- explaining the safety measures that should be followed and the PPE that should be used when repairing small engines
- using tools and equipment related to small engines
- completing an approved small-engine project (e.g., troubleshooting, maintaining, servicing).

Process/Skill Questions

- What are the symbols used in small-engine work?
- What are the tools used in small-engine work?
- What small-engine projects would relate to the Natural Resources Systems pathway?
- Why is an annual engine maintenance program important?

Task Number 123
Demonstrate plumbing operations as they relate to the Natural Resources Systems pathway.
Definition

Demonstration should include

- following all safety procedures and protocols
- explaining the principles, language, and symbols of plumbing
- explaining the safety measures that should be followed when conducting plumbing operations
- using tools and equipment related to plumbing
- using calculations related to plumbing
- completing an approved plumbing project.

Process/Skill Questions

- What are the tools used in plumbing work?
- What plumbing projects would relate to the Natural Resources Systems pathway?

SOL by Correlations

<p>| Identify the role of supervised agricultural experiences (SAEs) in agricultural education. | English: 9.1, 9.3, 9.5, 9.8, 10.1, 10.3, 10.5, 10.8 |
| History and Social Sciences: Govt 15 |
| Participate in an SAE. | English: 9.1, 9.6, 9.8, 10.1, 10.6, 10.8 |
| Identify the benefits and responsibilities of FFA membership. | English: 9.5, 9.8, 10.5, 10.8 |
| Describe leadership characteristics and opportunities as they relate to agriculture and FFA. | English: 9.5, 10.5 |
| History and Social Sciences: Govt 2 |
| Apply for an FFA degree and/or an agricultural proficiency award. | English: 9.5, 10.5 |
| Define terms and key concepts related to natural resources, ecology, and environmental sciences. | English: 9.3, 9.5, 10.3, 10.5 |
| Science: BIO.7, BIO.8, ES.11, ES.12, ES.6, ES.4, |
| Identify the different types of natural resources. | English: 9.5, 10.5 |
| Research historical figures who played a prominent role in shaping how natural resources are viewed and used today. |
| Explain principles and processes of ecological succession in different vegetation communities. | English: 9.5, 10.5 |
| Science: BIO.8 |
| Explain the concept of tragedy of the commons. | English: 9.3, 9.5, 10.3, 10.5 |
| History and Social Sciences: WG 16, WHII 14, VUS 14 |
| Science: BIO.8 |
| Describe the principles, threats to, and benefits of biodiversity. | English: 9.3, 9.5, 10.3, 10.5 |
| History and Social Sciences: WG 16, WHII 14, VUS 14 |
| Science: BIO.8 |
| Analyze how the level of biodiversity in an ecosystem influences the availability of natural resources. | English: 9.5, 10.5 |
| Science: BIO.8 |</p>
<table>
<thead>
<tr>
<th><strong>Analyze programs of supporting organizations and partners that play a role in natural resource management.</strong> English: 9.5, 10.5</th>
<th><strong>History and Social Sciences: WG 16, WHII 14, VUS 14, Govt 7, 8, 9</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Explain common ecological cycles as they relate to the environment.</strong> Science: BIO.8</td>
<td><strong>Explain the safety procedures and programs associated with the outdoors.</strong> English: 9.5, 10.5</td>
</tr>
<tr>
<td><strong>Describe the composition of the atmosphere.</strong> English: 9.5, 10.5</td>
<td><strong>Science: ES.11</strong></td>
</tr>
<tr>
<td><strong>Identify ecological concepts and principles related to atmospheric natural resource systems.</strong> English: 9.5, 10.5 Science: ES.11</td>
<td><strong>Identify air pollutants, their sources, and their effects on the environment.</strong> English: 9.5, 10.5 Science: ES.11, ES.12</td>
</tr>
<tr>
<td><strong>Describe current methods used to reduce air pollutants and improve air quality.</strong> History and Social Sciences: WG 16, WHII 14, VUS 14</td>
<td><strong>Describe the soil formation process and components of soil.</strong> English: 9.5, 10.5 Science: ES.8</td>
</tr>
<tr>
<td><strong>Evaluate soil texture and soil properties.</strong> English: 9.5, 10.5 Science: ES.8</td>
<td><strong>Demonstrate procedures for collecting soil samples and conducting soil tests.</strong> English: 9.5, 10.5</td>
</tr>
<tr>
<td><strong>Explain techniques associated with soil management.</strong> English: 9.5, 10.5</td>
<td><strong>Examine best management practices for improving soil health.</strong> English: 9.5, 10.5</td>
</tr>
<tr>
<td><strong>Describe erosion, its effects on the environment, and prevention methods.</strong> English: 9.5, 10.5 ES.7</td>
<td><strong>Test water percolation.</strong> English: 9.3, 9.5, 10.3, 10.5</td>
</tr>
<tr>
<td><strong>Demonstrate how to use a soil survey.</strong> English: 9.5, 9.8, 10.5, 10.8</td>
<td><strong>Describe the characteristics of water and the processes of the hydrologic cycle.</strong> English: 9.5, 10.5 Science: ES.8</td>
</tr>
<tr>
<td><strong>Explain the ecological concepts and principles of aquatic natural resources.</strong> English: 9.3, 9.5, 10.3, 10.5 Science: ES.8</td>
<td><strong>Delineate a watershed.</strong> English: 9.5, 10.5 Science: ES.8</td>
</tr>
<tr>
<td><strong>Explain the importance of wetlands to an ecosystem.</strong> English: 9.3, 9.5, 10.3, 10.5 Science: ES.8, BIO.8</td>
<td><strong>Explain the function, advantages, and disadvantages of flood-control structures and their impact on an ecosystem.</strong> English: 9.5, 10.5 History and Social Sciences: WG 16, WHII 14, VUS 14</td>
</tr>
<tr>
<td><strong>Explain the various methods of water treatment to meet national drinking water standards.</strong> English: 9.5, 10.5 History and Social Sciences: WG 16, WHII 14, VUS 14, Govt 7, 8, 9</td>
<td><strong>Analyze water quality indicators of a given body of water or aquatic habitat.</strong> English: 9.5, 10.5</td>
</tr>
<tr>
<td>Activity</td>
<td>English:</td>
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<tr>
<td>------------------------------------------------------------------------</td>
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<tr>
<td>Explain how total maximum daily load (TMDL) is calculated and its effects on watersheds.</td>
<td>9.3, 9.5, 10.3, 10.5</td>
</tr>
<tr>
<td>Examine methods of residential and municipal wastewater treatment systems.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td>Analyze an agricultural industry’s effect on its surrounding ecosystems.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td></td>
<td>History and Social Sciences: WG 16, WHII 14, VUS 14</td>
</tr>
<tr>
<td></td>
<td>Science: BIO.8, ES. 6</td>
</tr>
<tr>
<td>Compare the major types of forests in Virginia, the United States, and the world.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td></td>
<td>Science: BIO.8</td>
</tr>
<tr>
<td>Analyze basic tree structure and growth.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td></td>
<td>Science: BIO.4</td>
</tr>
<tr>
<td>Identify common trees native to Virginia.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td></td>
<td>Science: BIO.4, BIO.8</td>
</tr>
<tr>
<td>Examine the major threats to forests, including biotic, abiotic, and human-induced threats and their effect on the forest.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td></td>
<td>History and Social Sciences: WG 16, WHII 14, VUS 14</td>
</tr>
<tr>
<td>Describe forest products, including those made from wood and other products from trees.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td>Describe non-timber forest products (NTFPs).</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td>Demonstrate various methods of measuring standing timber.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td>Determine the value and volume of a given tract of land.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td>Analyze various silvicultural practices to include techniques associated with sustainable forestry (e.g., timber stand improvement, diversity improvement, reforestation).</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td>Explain safety practices used in the forest industry.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td>Identify fire management strategies used in natural resource systems.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td>Examine classification levels within the science of taxonomy as a way to classify wildlife organisms.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td></td>
<td>Science: BIO.6</td>
</tr>
<tr>
<td>Analyze the status of wildlife populations.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td></td>
<td>Science: BIO.8</td>
</tr>
<tr>
<td>Identify types of native wildlife species and their habitat requirements.</td>
<td>9.3, 9.5, 10.3, 10.5</td>
</tr>
<tr>
<td></td>
<td>Science: BIO.8</td>
</tr>
<tr>
<td>Differentiate between population ecology, population density, and population dispersion and the importance of these concepts to natural resource systems.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td></td>
<td>Mathematics: AFDA.8</td>
</tr>
<tr>
<td>Describe the steps in establishing and managing wildlife habitats.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td>Describe fisheries in Virginia (e.g., commercial and sport fishing, farm-raised fish, hatcheries).</td>
<td>9.5, 9.8, 10.5, 10.8</td>
</tr>
<tr>
<td></td>
<td>Science: BIO.8</td>
</tr>
<tr>
<td>Describe aquatic habitats.</td>
<td>9.5, 10.5</td>
</tr>
<tr>
<td>Task</td>
<td>Subject Areas</td>
</tr>
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<td>----------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Describe common fish and aquatic species in a given area.</td>
<td>History and Social Sciences: Govt 7, 8, 9</td>
</tr>
<tr>
<td>Describe aquatic inventory/sampling methodologies.</td>
<td>History and Social Sciences: WG 16, WH II 14, VUS 14</td>
</tr>
<tr>
<td>Analyze various energy sources.</td>
<td>History and Social Sciences: WG 16, WH II 14, VUS 14</td>
</tr>
<tr>
<td>Contrast various forms of renewable and non-renewable energy sources.</td>
<td>History and Social Sciences: WG 16, WH II 14, VUS 14</td>
</tr>
<tr>
<td>Explain the global economic impact of energy use and depletion.</td>
<td>History and Social Sciences: WG 16, WH II 14, VUS 14</td>
</tr>
<tr>
<td>Explain the effect of major land development on the environment and ecosystems.</td>
<td>History and Social Sciences: WG 16, WH II 14, US 14</td>
</tr>
<tr>
<td>Explain zoning classifications and the effects of zoning.</td>
<td>History and Social Sciences: WG 16, WH II 14, VUS 14</td>
</tr>
<tr>
<td>Design a community to minimize adverse effects on the environment.</td>
<td>History and Social Sciences: WG 16, WH II 14, VUS 14</td>
</tr>
<tr>
<td>Interpret land-use maps.</td>
<td>History and Social Sciences: WG 16, WH II 14, VUS 14</td>
</tr>
<tr>
<td>Analyze a comprehensive plan for a community.</td>
<td>History and Social Sciences: WG 16, WH II 14, VUS 14</td>
</tr>
<tr>
<td>Describe current environmental policies/regulations.</td>
<td>History and Social Sciences: WG 16, WH II 14, VUS 14</td>
</tr>
<tr>
<td>Identify local, state, and federal conservation, natural resource, and environmental regulatory agencies and programs.</td>
<td>History and Social Sciences: WG 16, WH II 14, VUS 14, Govt 7, 8, 9</td>
</tr>
<tr>
<td>Describe water-use planning and water rights policies.</td>
<td>History and Social Sciences: WG 16, WH II 14, VUS 14, Govt 7, 8, 9</td>
</tr>
<tr>
<td>Explain the need for safety in Natural Resources Systems Pathway.</td>
<td>History and Social Sciences: Govt 7, 8, 9</td>
</tr>
<tr>
<td></td>
<td>Science: CH.1</td>
</tr>
<tr>
<td></td>
<td>Science: BIO.8</td>
</tr>
</tbody>
</table>
Demonstrate safe use of tools, materials, and equipment for use in natural resources.

Utilize tools in managing natural resources.

Identify marked safety areas.

Identify the location and use of eyewash stations.

Identify the location of the posted evacuation routes.

Demonstrate knowledge of SDS.

Demonstrate the use of protective clothing and equipment.

Demonstrate standard measurement techniques used in natural resource systems.

Demonstrate cartographic skills, tools, and technologies to aid in developing, implementing, and evaluating natural resource management plans.

Demonstrate the use of hand tools, portable power tools, and equipment.

Demonstrate the use of chemicals.

Demonstrate metalworking operations as they relate to the Natural Resources Systems pathway.

Demonstrate woodworking operations as they relate to the Natural Resources Systems pathway.

Demonstrate electrical operations as they relate to the Natural Resources Systems pathway.

Demonstrate small-engine operations as they relate to the Natural Resources Systems pathway.

Demonstrate plumbing operations as they relate to the Natural Resources Systems pathway.

### FFA Information

The National FFA is an organization dedicated to preparing members for leadership and careers in the science, business, and technology of agriculture. Local, state, and national activities and award programs provide opportunities to apply knowledge and skills acquired through agriculture education.

For additional information about the student organization, see the [National FFA website](https://www.ffa.org/) and the [Virginia FFA Association website](https://www.vaffa.org/).

The following leadership development events are available for this course:

- [Agricultural Issues](#)
- [Conduct of Chapter Meetings](#)
- [Creed Speaking](#)
- [Employment Skills](#)
- [Extemporaneous Public Speaking](#)
- [Parliamentary Procedure](#)
- [Prepared Public Speaking](#)

The following career development events are available for this course:

<table>
<thead>
<tr>
<th>Science: CH.1</th>
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<tbody>
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<tr>
<td>Utilize tools in managing natural resources.</td>
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<tr>
<td>Demonstrate knowledge of SDS.</td>
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<td>Demonstrate plumbing operations as they relate to the Natural Resources Systems pathway.</td>
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</tbody>
</table>
Entrepreneurship Infusion Units

Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked “optional.”
Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- College and Work Readiness Assessment (CWRA+)
- Customer Service Specialist (CSS) Examination
- Ecology Conservation & Management Examination
- FAA Remote Pilot Small Unmanned Aircraft Systems Certification Examination
- Forest Products and Processing Assessment
- National Career Readiness Certificate Assessment
- Natural Resources Systems Assessment
- Workplace Readiness Skills for the Commonwealth Examination

Concentration sequences: A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.

- Agricultural Business Fundamentals I (8022/36 weeks)
- Agricultural Business Management III (8026/36 weeks)
- Agricultural Business Operations II (8024/36 weeks)
- Agricultural Production Technology (8010/36 weeks)
- Applied Agricultural Concepts (8072/18 weeks)
- Applied Agricultural Concepts (8073/36 weeks)
- Biological Applications in Agriculture (8086/36 weeks)
- Biotechnology Applications in Agriculture (8087/36 weeks)
- Biotechnology Foundations in Agricultural and Environmental Science (8085/36 weeks)
- Community Forestry and Tree Management (8048/36 weeks)
- Cybersecurity in Food and Agriculture (8074/36 weeks)
- Ecology and Environmental Management (8045/18 weeks)
- Ecology and Environmental Management (8046/36 weeks)
- Fisheries and Wildlife Management (8041/36 weeks)
- Forestry Management (8042/36 weeks)
- Forestry Management, Advanced (8044/36 weeks)
- Foundations of Agriculture, Food, and Natural Resources (8006/36 weeks)
- Operating the Farm Business (8014/36 weeks)
- Outdoor Recreation, Parks, and Tourism Systems Management (8043/36 weeks)
- Sustainability and Renewable Technologies (8414/36 weeks)

Career Cluster: Agriculture, Food and Natural Resources

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Occupations</th>
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<tbody>
<tr>
<td>Environmental Service Systems</td>
<td>Agricultural Products Sales Representative</td>
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<td>Environmental Compliance Inspector</td>
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<td>Environmental Sampling and Analysis Technician</td>
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<td>Hazardous Materials Handler</td>
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<td></td>
<td>Recycling Coordinator</td>
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<td>Secondary School Teacher</td>
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<td></td>
<td>Toxicologist</td>
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<tr>
<td></td>
<td>Turf Farmer</td>
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<tr>
<td></td>
<td>Water Conservationian</td>
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<tr>
<td>Natural Resources Systems</td>
<td>Ecologist</td>
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<td></td>
<td>Fish and Game Officer</td>
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<td></td>
<td>Fisheries Technician</td>
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<tr>
<td></td>
<td>Forest Manager, Forester</td>
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<tr>
<td></td>
<td>Forest Technician</td>
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<td></td>
<td>Geological Technician</td>
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<td></td>
<td>Logging Equipment Operator</td>
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<td></td>
<td>Microbiologist</td>
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<td></td>
<td>Outdoor Recreation Guide</td>
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<td></td>
<td>Park Manager</td>
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<td></td>
<td>Park Technician</td>
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<tr>
<td>Plant Systems</td>
<td>Range Technician</td>
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</tbody>
</table>

**Career Cluster: Science, Technology, Engineering and Mathematics**

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Civil Engineer</th>
<th>Civil Engineering Technician</th>
<th>Environmental Engineer</th>
<th>Human Factors Engineer</th>
<th>Ecologist</th>
<th>Environmental Scientist</th>
<th>Geoscientist</th>
<th>Hydrologist</th>
<th>Microbiologists</th>
<th>Oceanographer</th>
<th>Plant Biologist</th>
<th>Secondary School Teacher</th>
</tr>
</thead>
</table>

| Engineering and Technology    |                 |                               |                        |                        |           |                       |              |             |                  |                 |                |                          |
| Science and Mathematics        |                 |                               |                        |                        |           |                       |              |             |                  |                 |                |                          |