North Dakota Agriculture Education

FOOD PRODUCTS AND PROCESSING SYSTEMS

Use analytical procedures and instruments to manage environmental service systems.

1 **Analyze and interpret laboratory and field samples in environmental sustainability systems.** 6.1

1 Identify sample types (e.g., air, water, soil, organism populations, etc.) and sampling techniques used to collect laboratory and field data. 6.1.1

2 Identify methods of statistical analysis commonly used in research (e.g., mean, standard deviation, standard error, error bars, etc.). 6.1.2

3 Determine the appropriate sampling techniques needed to generate data. 6.1.3

4 Summarize the purpose of statistical analysis methods commonly used in environmental service systems research and explain examples of their use in practice. 6.1.4

5 Prepare sample measurements using appropriate data collection techniques. 6.1.5

6 Utilize data analysis to identify trends in a data sample and assess the confidence that can be drawn from those conclusions. 6.1.6

2 **Properly utilize scientific instruments in environmental monitoring situations (e.g., laboratory equipment, environmental monitoring instruments, etc.).** 6.2

1 Identify basic laboratory equipment and explain their uses. 6.2.1

2 Explain the uses of basic environmental monitoring instruments. 6.2.2

3 Demonstrate the proper use and maintenance of basic laboratory equipment. 6.2.3

4 Demonstrate the proper use and maintenance of environmental monitoring instruments. 6.2.4

5 Calibrate and use laboratory equipment according to standard operating procedures. 6.2.5

6 Calibrate and use environmental monitoring instruments according to standard operating procedures. 6.2.6

Evaluate the impact of public policies and regulations on environmental service system operations.

3 **Interpret and evaluate the impact of laws, agencies, policies, practices, and consumer preferences affecting environmental service systems.** 6.3

1 Identify Types of laws associated with environmental sustainability systems. 6.3.1

2 Identify different types of government agencies (e.g., county planning commission, soil and water conservation districts, relevant state agencies, US Forest Service, USDA, etc.)) associated with environmental sustainability systems. 6.3.2

3 Identify different types of Non Government Organizations (NGOs) (e.g., The Nature Conservancy, World Wildlife Fund, Ducks Unlimited, etc.) associated with environmental sustainability systems. 6.3.3

4 Research policies, practices and initiatives common in business and advocacy groups associated with environmental sustainability systems (e.g., zero-waste, LEED-certified, locally-grown, etc.). 6.3.4

5 Analyze how laws associated with environmental sustainability systems are developed for local (e.g., wellhead protection, littering, etc.), tribal, state (e.g., endangered species, etc.), and federal (e.g., Clean Air Clean Water, etc.) governments. 6.3.5

6 Analyze the specific purpose of government agencies associated with environmental sustainability systems. 6.3.6

7 Analyze the specific purpose of Non Government Organizations associated with environmental sustainability systems. 6.3.7

8 Assess the intent, feasibility, and effectiveness of policies, practices, and initiatives common in business and advocacy groups associated with environmental sustainability systems. 6.3.8

9 Evaluate the impact of laws associated with environmental sustainability systems (e.g., wildlife, people, environment, economy, etc.). 6.3.9

10 Evaluate the impact of government agencies (e.g., local, state, and federal) associated with environmental sustainability systems (e.g., regulation of consumption, prevention of damage to natural resources systems, management of ecological interactions, etc.). 6.3.10

11 Evaluate the impact of Non Government Organizations (e.g., local, state, and federal) associated with environmental sustainability systems. 6.3.11

12 Evaluate the impact of policies, practices, and initiatives common in business and advocacy groups associated with environmental sustainability systems on wildlife, people, the environment, and the economy. 6.3.12

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4 Compare and contrast the impact of current trends on regulation of environmental sustainability systems. 6.4

1 Research the purpose, implementation, and impact of greenhouse gas emission policies (e.g., cap-and-trade, emission offsetting, zero-emissions, carbon-neutrality, carbon sequestration, etc.). 6.4.1

2 Identify environmental sustainability systems regulations on international trade (e.g., Clean Air Act, EISA, Clean Water Act, Superfund, etc.). 6.4.2

3 Summarize the impact that population growth has on environmental sustainability systems. 6.4.3

4 Identify a current regional policy or topic related to environmental sustainability systems. 6.4.4

5 Assess the impact of greenhouse gas emissions policies. 6.4.5

6 Examine the impact of environmental sustainability systems regulations on international trade. 6.4.6

7 Analyze the correlation between increased population size and the need for regulation of environmental sustainability systems. 6.4.7

8 Assess the impact of a current policy or topic on the region's environmental sustainability systems. 6.4.8

9 Devise a plan for educating others about greenhouse gas emissions and the impact on the supply chain. 6.4.9

10 Evaluate the impact of specific environmental sustainability regulation policies (e.g., Clean Air Act, EISA, Clean Water Act, Superfund, etc.) on international trade. 6.4.10

11 Predict the impact of future population growth on the regulation of environmental sustainability systems. 6.4.11

12 Develop an action plan to address a current policy or topic to advance the region's environmental sustainability systems. 6.4.12

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5 Examine and summarize the impact of public perceptions and social movements on the regulation of environmental sustainability systems. 6.5

1 Summarize how the perception and regulation of environmental sustainability systems has changed over time. 6.5.1

2 Examine how social changes (e.g., zero-waste philosophy, carbon footprints, recycling, etc.) have affected the implementation of new environmental sustainability systems. 6.5.2

3 Analyze specific changes to perceptions and regulations of environmental sustainability systems and their impact on reducing the ecological, economical, and sociological impact. 6.5.3

4 Assess the effectiveness of specific social changes related to regulation of environmental sustainability systems. 6.5.4

5 Evaluate the impact of specific historical figures, or organizations, on the perception and regulation of environmental sustainability systems. 6.5.5

6 Devise strategies for engaging the public to address a current AFNR issue brought on by social change. 6.5.6

Develop proposed solutions to environmental issues, problems and applications using scientific principles of meteorology, soil science, hydrology, microbiology, chemistry, and ecology.

6 Apply meteorology principles to environmental sustainability systems. 6.6

1 Label the different components and structural layers of the earth's atmosphere. 6.6.1

2 Explain how meteorological conditions influence air quality. 6.6.2

3 Describe how climate change impacts regional environmental sustainability systems. 6.6.3

4 Identify factors (e.g., water cycle, carbon cycle, life cycle, etc.) that affect the earth's balance of energy. 6.6.4

5 Examine how components of the atmosphere (e.g., weather systems and patterns, structure of the atmosphere, etc.) affect environmental sustainability systems. 6.6.5

6 Compare the relationships between meteorological conditions, air quality, and air pollutants. 6.6.6

7 Assess the potential environmental, economic, and social consequences of climate change. 6.6.7

8 Analyze how the greenhouse effect may alter the earth's balance of energy. 6.6.8

9 Evaluate the impact of atmospheric conditions on environmental sustainability systems using meteorological data. 6.6.9

10 Interpret data measuring air pollution, its threat on human populations, and ecological interactions. 6.6.10

11 Evaluate the potential impacts of global climate change on environmental sustainability systems. 6.6.11

12 Create an action plan to mitigate the impact of climate change on environmental sustainability systems. 6.6.12

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7 Apply soil science and hydrology principles to environmental sustainability systems. 6.7

1 Define land uses, capability factors, and land capability classes. 6.7.1

2 Describe the process of soil formation through weathering. 6.7.2

3 Explain how the physical qualities of soil influence the infiltration and percolation of water. 6.7.3

4 Define groundwater and its importance on environmental sustainability systems. 6.7.4

5 Describe the hydrogeology process. 6.7.5

6 Describe how groundwater and surface water interactions affect the existence of wetlands. 6.7.6

7 Determine the land capability classes for a parcel of land using a soil survey. 6.7.7

8 Analyze the chemical composition and mineral matter in the soil based on the rock type and parent material. 6.7.8

9 Assess the physical qualities of the soil that determine its potential for filtration of groundwater supplies and likelihood for flooding. 6.7.9

10 Assess the effectiveness of precautions taken to prevent or reduce contamination of groundwater. 6.7.10

11 Analyze how interactions between groundwater and surface water affect flow and availability of water. 6.7.11

12 Analyze the importance of the roles played by wetlands in regards to water availability, prevention of flooding, and other factors. 6.7.12

13 Design a master land-use management plan for a given area that utilizes land capability classes to minimize erosion and flooding, maximize development, and preserve topsoil. 6.7.13

14 Evaluate the soil composition to determine changes needed in the environmental sustainability system. 6.7.14

15 Evaluate different types of soil to determine their potential for filtration of groundwater supplies and likelihood for flooding. 6.7.15

16 Evaluate the methods used in a given example to protect groundwater. 6.7.16

17 Develop a plan to address water resources based on availability and human activity. 6.7.17

18 Recommend strategies for wetlands preservation and restoration that maximize services provided by wetlands while taking human concerns into consideration. 6.7.18

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8 Apply chemistry principles to environmental sustainability systems. 6.8

1 Explain how chemistry affects soil structure and function (e.g., pH, cation-exchange capacity, filtration capability, flooding likelihood, etc.). 6.8.1

2 Explain how chemistry affects water quality and function (e.g., oxygen saturation, pH, biomagnification, etc.). 6.8.2

3 Explain how chemistry affects air quality and function (e.g., heat retention, formation of smog and acid rain, etc.). 6.8.3

4 Describe the relationship between water and soil chemistry and the formation of different kinds of wet-lands (e.g., fens, peat bogs, potholes, etc.). 6.8.4

5 Analyze the soil chemistry of a sample. 6.8.5

6 Analyze the water chemistry of a sample. 6.8.6

7 Analyze how components of atmospheric chemistry (e.g., air chemical components, heat, moisture, etc.) affect air quality. 6.8.7

8 Assess how different kinds of wetlands are formed based on the different types of soil and water chemistry present in each case. 6.8.8

9 Determine how a sample's soil chemistry may impact considerations in environmental sustainability systems. 6.8.9

10 Determine how a sample's water chemistry may impact considerations in environmental sustainability systems. 6.8.10

11 Assess the impact of atmospheric chemistry on operational decisions in environmental sustainability systems. 6.8.11

12 Evaluate the services provided by different types of wetlands. 6.8.12

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9 Apply microbiology principles to environmental sustainability systems. 6.9

1 Summarize the contribution of microbial biodiversity to the physical and chemical characteristics of soil. 6.9.1

2 Describe how microbial populations in an ecosystem affect carbon cycling. 6.9.2

3 Explain the role that microbes play in wastewater treatment. 6.9.3

4 Describe potential applications of bioassay tests for environmental sustainability systems. 6.9.4

5 Examine how the activities of microorganisms in soil affect environmental sustainability systems and ecosystem biodiversity. 6.9.5

6 Analyze the microbial populations present in an area and their impact on carbon cycling. 6.9.6

7 Examine the impact of wastewater treatment on environmental service systems. 6.9.7

8 Conduct bioassay tests related to environmental sustainability systems. 6.9.8

9 Evaluate how soil microorganisms in environmental sustainability systems can be used to minimize waste, maximize nutrient cycling, and increase ecosystem biodiversity. 6.9.9

10 Develop strategies for negating air pollutants based on soil microbial populations (e.g., carbon sequestration and rates of decomposition). 6.9.10

11 Recommend strategies to further reduce the environmental, economic, and social impact of wastewater treatment. 6.9.11

12 Interpret the results of bioassay tests related to environmental sustainability systems. 6.9.12

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10 Apply ecology principles to environmental sustainability systems. 6.10

1 Describe the role that biodiversity plays in environmental sustainability systems and how biodiversity can be measured. 6.10.1

2 Explain the role played by habitats on environmental sustainability systems. 6.10.2

3 Explain how carrying capacities relate to environmental sustainability systems (e.g., waste processing, rate or production of pollution, disease, etc.). 6.10.3

4 Describe how ecological interactions can be used to assess environmental sustainability systems (e.g., macro invertebrates and/or amphibians as bioindicators). 6.10.4

5 Calculate the amount of biodiversity in a given area using an appropriate method (e.g., quadrant assessment, transect measurements, etc.). 6.10.5

6 Analyze the impact of the current rate of habitat loss on environmental sustainability systems 6.10.6

7 Analyze the impact of a population exceeding its carrying capacity on environmental sustainability systems. 6.10.7

8 Compare the benefits and drawbacks of using bioindicator species in environmental sustainability systems. 6.10.8

9 Predict how changing the levels of biodiversity of an area will impact environmental sustainability systems. 6.10.9

10 Devise strategies to minimize the future loss of habitats in environmental sustainability systems. 6.10.10

11 Devise a strategy for monitoring and supporting environmental sustainability systems through management of a species' carrying capacity. 6.10.11

12 Determine the pollutants in a given area using evidence from bioindicator species. 6.10.12

Demonstrate the operation of environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management and energy conservation).

11 Develop systems of sustainability management for all categories of solid waste in environmental sustainability systems. 6.11

1 Describe different types of pollution including point source and nonpoint source pollution. 6.11.1

2 List ways in which pollution can be managed and prevented. 6.11.2

3 Describe the conditions necessary for waste to be labeled as hazardous to the local environment 6.11.3

4 Examine how industrial and nonindustrial pollution has damaged the environment. 6.11.4

5 Conduct tests to determine the presence and extent of pollution. 6.11.5

6 Classify examples of pollution as hazardous or nonhazardous to the local environment. 6.11.6

7 Evaluate evidence for a given area for industrial and nonindustrial pollution. 6.11.7

8 Create a plan for pollution remediation, management, or prevention for a given area. 6.11.8

9 Construct a plan for handling hazardous waste in the local environment. 6.11.9

12 Sustainably manage solid waste in environmental service systems. 6.12

1 Compare and contrast different types of solid waste and options for treating solid waste. 6.12.1

2 Describe the components found entering sanitary landfills. 6.12.2

3 Summarize the benefits and processes of composting. 6.12.3

4 Describe the importance and potential impact of recycling. 6.12.4

5 Analyze environmental hazards created by different types of solid waste, solid waste accumulation, and solid waste management. 6.12.5

6 Analyze basic sanitary landfill operating procedures and design. 6.12.6

7 Apply scientific principles to explain the benefits and processes of composting. 6.12.7

8 Analyze different recycling methods. 6.12.8

9 Develop a plan for solid waste management for a given situation that considers the environmental hazards, economic realities, and social concerns associated with this task. 6.12.9

10 Evaluate sanitary landfill procedures for environmental, economic, and social sustainability. 6.12.10

11 Evaluate the appropriateness of composting methods in different situations. 6.12.11

12 Evaluate recycling programs and procedures. 6.12.12

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13 Apply techniques to ensure a safe supply of drinking water and adequate treatment of wastewater according to applicable rules and regulations. 6.13

1 Classify the chemical and physical properties of drinking water. 6.13.1

2 Describe methods commonly used to treat wastewater and septic waste. 6.13.2

3 Analyze all steps in the public drinking water treatment process according to applicable standards. 6.13.3

4 Examine the steps necessary to ensure wastewater and septic waste can be safely released into the environment. 6.13.4

5 Evaluate samples of water and the processes necessary to verify that the samples are safe for consumption according to applicable standards. 6.13.5

6 Evaluate examples of wastewater and/or septic waste for its potential to cause environmental, economic, and/or social problems. 6.13.6

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14 Compare and contrast the impact of conventional and alternative energy sources on the environment and operation of environmental sustainability systems. 6.14

1 List conventional energy sources and conservation measures to reduce the impact on environmental sustainability systems. 6.14.1

2 Describe alternative energy sources and the motivations for seeking alternatives to conventional energy sources as they relate to environmental monitoring. 6.14.2

3 Describe the factors that affect energy consumption are their relation to environmental monitoring. 6.14.3

4 Explain how energy consumption and the carbon cycle relate to environmental monitoring. 6.14.4

5 Describe the purpose and applications of life cycle assessments to environmental sustainability systems. 6.14.5

6 Compare the advantages and disadvantages of conventional energy sources in regard to environmental sustainability systems. 6.14.6

7 Analyze the advantages and disadvantages of alternative energy sources as they pertain to environmental sustainability systems. 6.14.7

8 Analyze the main categories of energy consumption. 6.14.8

9 Calculate the impact of the carbon cycle imbalance (due to energy consumption). 6.14.9

10 Conduct a life cycle assessment for a given source of energy. 6.14.10

11 Evaluate the impact burning fossil fuels has on environmental sustainability systems. 6.14.11

12 Evaluate the impact alternative energy sources have on environmental conditions. 6.14.12

13 Determine the most effective course of action to reduce energy consumption based on the needs of environmental sustainability systems. 6.14.13

14 Recommend a method to reduce the imbalance in the carbon cycle through changes to energy consumption using data from environmental monitoring. 6.14.14

15 Determine the best option for energy in regard to environmental sustainability systems using data from a life cycle assessment. 6.14.15

Use tools, equipment, machinery and technology common to tasks in environmental service systems.

15 Use technological and mathematical tools to map land, facilities, and infrastructure for environmental sustainability systems. 6.15

1 Explain the importance and applications of surveying and mapping for environmental sustainability systems. 6.15.1

2 Describe the methods in which GIS can be used in environmental sustainability systems (e.g., tracing of point pollution, control of the spread of invasive species, etc.). 6.15.2

3 Apply surveying and cartographic skills to make site measurements for a situation involving environmental sustainability systems. 6.15.3

4 Apply GIS skills to a situation specific to environmental sustainability systems. 6.15.4

5 Make a recommendation to address concerns and needs within an environmental sustainability systems situation using site measurements. 6.15.5

6 Interpret GIS data to come to a conclusion about a scenario specific to environmental sustainability systems. 6.15.6

16 Perform assessments of environmental conditions using equipment, machinery, and technology. 6.16

1 Summarize methods used to determine water quality (e.g., dissolved oxygen, chemical tests, macroinvertebrates, etc.) and to determine if a source of water has been contaminated. 6.16.1

2 Summarize methods and tools used to measure soil health when determining if an area of land has been contaminated (e.g., soil probes, core monolith, soil fertility tests, etc.). 6.16.2

3 Summarize methods and tools used to determine air quality and to determine if pollution is present (e.g., CO2 probe, particulate matter sampler, etc.). 6.16.3

4 Summarize methods used to determine ecological health and to determine if an ecosystem is threatened (e.g., quadrat analysis, bioindicators, mark-re-capture, etc.). 6.16.4

5 Analyze different measurements of water quality to determine their effectiveness and limitations. 6.16.5

6 Compare different measurements of soil quality (e.g., soil horizons, soil texture, organic matter, soil respiration, etc.) to determine their effectiveness and limitations. 6.16.6

7 Compare different measurements of air quality (e.g., ozone, carbon monoxide, particulate matter, etc.) to determine their effectiveness and limitations. 6.16.7

8 Compare different measurements of assessing ecological health (e.g., quadrat biodiversity assessments, transect surveys, population counts, detection of disease and invasive species, etc.) to determine their effectiveness and limitations. 6.16.8

9 Evaluate a sample of water to determine its quality and if it has been contaminated. 6.16.9

10 Evaluate a sample of soil to determine its quality and if it has been contaminated. 6.16.10

11 Perform an evaluation of air quality to determine and assess its impact on human and ecological populations. 6.16.11

12 Evaluate a habitat to determine its ecological quality and if it is threatened. 6.16.12