North Dakota Agriculture Education

NATURAL RESOURCES SYSTEMS

Plan and conduct natural resource management activities that apply logical, reasoned and scientifically based solutions to natural resource issues and goals.

1 **Examine natural resource availability and ecosystem function in a particular region.** 8.1

1 Describe the process for classifying the different kinds of natural resources using common classification schemes (e.g., abiotic/biotic, renewable versus nonrenewable, native versus introduced, etc.). 8.1.1

2 Summarize the components that comprise types of ecosystems (e.g., marine systems, desert systems, forest systems, etc.). 8.1.2

3 Explain the importance of biodiversity to ecosystem function and availability of natural resources. 8.1.3

4 Use dichotomous key to classify organisms. 8.1.4

5 Analyze the interdependence of organisms within an ecosystem (e.g., food webs, niches, impact of keystone species, etc.). 8.1.5

6 Analyze how species evolve, are naturally selected, and adapt. 8.1.6

7 Devise strategies for the management (e.g., preservation, conservation, exploitation, etc.) of natural resources. 8.1.7

8 Evaluate the interdependence of biotic and abiotic components (climate, geography, energy flow, nutrient cycling, etc.) in an ecosystem. 8.1.8

9 Evaluate biodiversity in ecosystems and devise strategies to enhance the function of an ecosystem and the availability of natural resources by increasing the level of biodiversity. 8.1.9

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2 **Classify different types of natural resources in order to enable protection, conservation, enhancement, and management in a particular geographical region.** 8.2

1 Define the characteristics used to identify trees and woody plants. 8.2.1

2 Define the characteristics used to identify herbaceous plants. 8.2.2

3 Define the characteristics used to identify wildlife and insects. 8.2.3

4 Define the characteristics used to identify aquatic species. 8.2.4

5 Define the characteristics used to identify abiotic resources (e.g., soil types, climate, geography, etc.). 8.2.5

6 Identify the purpose and value of resource inventories and population studies. 8.2.6

7 Apply identification techniques to determine the species of a tree or woody plant. 8.2.7

8 Apply identification techniques to determine the species of an herbaceous plant. 8.2.8

9 Apply identification techniques to determine the species of wildlife or insect. 8.2.9

10 Apply identification techniques to determine the species of an aquatic organism. 8.2.10

11 Apply identification techniques to determine the types of abiotic resources in an area. 8.2.11

12 Apply procedures for conducting resource inventories and population studies. 8.2.12

13 Evaluate the species of trees present to assess the status of an ecosystem (e.g., presence of native versus invasive species, biodiversity, etc.). 8.2.13

14 Evaluate the species of herbaceous plants present to assess the status of an ecosystem (e.g., presence of native versus invasive plants, biodiversity, etc.). 8.2.14

15 Evaluate the species of wildlife and insects present to assess the status of an ecosystem. 8.2.15

16 Evaluate the aquatic species present to assess the status of an ecosystem. 8.2.16

17 Evaluate the abiotic resources present in an area to determine the best practices for improving, enhancing, and protecting an ecosystem. 8.2.17

18 Interpret resource inventories and population studies in a given area over time. 8.2.18

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3 Apply ecological concepts and principles (e.g., weather, air quality, UV protection, atmospheric pressure, etc.) to the interaction of atmospheric and natural resource systems. 8.3

1 Classify different kinds of biogeochemical cycles (e.g., carbon, nitrogen, water cycles, etc.) and the role they play in natural resources systems. 8.3.1

2 Explain how climate factors influence natural resource systems. 8.3.2

3 Assess the role that the atmosphere plays in the regulation of biogeochemical cycles. 8.3.3

4 Analyze the impact that climate has on natural resources and how this impact has changed due to human activity. 8.3.4

5 Make recommendations to lessen the impact of human activity on the ability of the atmosphere to regulate biogeochemical cycles. 8.3.5

6 Design strategies to address the primary causes of climate change and their impact on natural resource systems. 8.3.6

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4 Apply ecological concepts and principles to aquatic natural resource systems. 8.4

1 Summarize the roles and properties of watersheds. 8.4.1

2 Describe the importance of groundwater and surface water to natural resources. 8.4.2

3 Explain the role of riparian zones and riparian buffers in enhancing water quality. 8.4.3

4 Explain methods and structures to control or reduce stream bank erosion. 8.4.4

5 Assess the function of watersheds and their effect on natural resources. 8.4.5

6 Analyze how different classifications of ground and surface water affect ecosystem function. 8.4.6

7 Compare and contrast techniques used in the creation, enhancement, and management of riparian zones and riparian buffers. 8.4.7

8 Model techniques used in the creation, enhancement, and management of structures used to control or reduce stream bank erosion. 8.4.8

9 Evaluate the importance of watersheds to ecosystem function. 8.4.9

10 Evaluate strategies to manage, protect, enhance, or improve sources of groundwater or surface water based on its properties. 8.4.10

11 Evaluate strategies for the creation, enhancement, and management of riparian zones and riparian buffers. 8.4.11

12 Evaluate strategies for the creation, enhancement, and management of stream bank erosion. 8.4.12

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5 **Apply ecological concepts and principles to terrestrial natural resource systems.** 8.5

1 Describe the stages of ecological succession. 8.5.1

2 Compare and contrast the impact of habitat disturbances and habitat resilience. 8.5.2

3 Compare and contrast techniques associated with sustainable forestry (e.g., timber stand improvement, diversity improvement, reforestation, etc.). 8.5.3

4 Compare and contrast techniques associated with soil management (e.g., soil survey and interpretation, erosion control, etc.). 8.5.4

5 Analyze examples of stages of succession. 8.5.5

6 Analyze examples of habitat disturbances and habitat resilience. 8.5.6

7 Analyze a forest in order to determine which forestry techniques would improve that habitat. 8.5.7

8 Analyze a plot of land in order to determine which soil management techniques would be most applicable. 8.5.8

9 Predict which species will become more prevalent through future stages of succession in an ecosystem. 8.5.9

10 Interpret signs of habitat disturbances and resilience in an ecosystem to assess the health of an ecosystem. 8.5.10

11 Devise a forest management plan that improves the habitat while optimizing the amount or quality of timber that can be harvested. 8.5.11

12 Devise a soil management plan to minimize erosion and maximize biodiversity, plant productivity, and the formation of topsoil. 8.5.12

6 **Apply ecological concepts and principles to biotic organisms in natural resource systems.** 8.6

1 Describe the importance of population ecology, population density, and population dispersion to natural resource systems. 8.6.1

2 Identify examples of invasive species. 8.6.2

3 Analyze the factors that influence population density and population dispersion in natural resource systems. 8.6.3

4 Analyze factors that influence the establishment and spread of invasive species. 8.6.4

5 Create a management plan for a population of a species in an ecosystem given its population ecology, population density, and population dispersion in natural resource systems. 8.6.5

6 Devise a plan to manage, prevent, control, or eliminate invasive species in a given area. 8.6.6

Analyze the interrelationships between natural resources and humans.

7 **Examine and interpret the purpose, enforcement, impact, and effectiveness of laws, agencies, and private and public organizations related to natural resource management, protection, enhancement, and improvement (e.g., water regulations, game laws, environmental policy, local, state, and national conservation organizations, agricultural extension service, etc.).** 8.7

1 List the types of laws associated with natural resource systems. 8.7.1

2 Describe the types of agencies and organizations associated with natural resources systems. 8.7.2

3 Analyze laws associated with natural resources systems. 8.7.3

4 Analyze the relationships between public and private agencies and organizations associated with natural resources systems. 8.7.4

5 Evaluate the impact of laws and treaties associated with natural resources systems (e.g., mitigation, water regulations, carbon emissions, game limits, invasive species, etc.). 8.7.5

6 Evaluate the impact and effectiveness of agencies and organizations associated with natural resources systems (e.g., regulation of consumption, prevention of damage to natural resources systems, management of ecological interactions, etc.). 8.7.6

8 **Assess the impact of human activities on the availability of natural resources.** 8.8

1 Summarize the relationship between natural resources, ecosystems, and human activity. 8.8.1

2 Categorize the primary causes of extinction of living species due to human activity (e.g., overharvesting, habitat loss, invasive species, pollution, etc.). 8.8.2

3 Describe the manner in which consumer decisions are related to the depletion of natural resources. 8.8.3

4 Assess how different kinds of human activity (e.g., agriculture, infrastructure development, transportation, etc.) affect the use and availability of natural resources. 8.8.4

5 Assess causes of extinction and how those causes related to loss of biodiversity. 8.8.5

6 Analyze possible solutions to reduce the depletion of natural resources. 8.8.6

7 Evaluate how the availability of natural resources can be improved through changes to human activity. 8.8.7

8 Devise a strategy for preventing the loss of species and biodiversity that takes into account the primary causes of species extinction from human activity. 8.8.8

9 Design a solution to reduce the depletion of natural resources affected by consumer decisions. 8.8.9

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9 Analyze how social perceptions of natural resource management, protection, enhancement, and improvement change and develop over time. 8.9

1 Summarize the different social perceptions of natural resources (e.g., public versus private land ownership, laws and regulations, economics, green technology, traditional ecological knowledge, etc.). 8.9.1

2 Illustrate how historical figures and social movements played a prominent role in shaping how natural resources are viewed and used today (e.g., Tribal and traditional ecological knowledge, Aldo Leopold, Teddy Roosevelt, John Muir, Rachel Carson, Gaylord Nelson, etc.). 8.9.2

3 Describe how technology has affected the use and views of natural resources. 8.9.3

4 Analyze how social perceptions can affect the use and sustainability of natural resources. 8.9.4

5 Examine the relationship between current trends in natural resource systems and historical figures and movements that played a prominent role in shaping how natural resources are viewed and used today. 8.9.5

6 Analyze how some technological advancements changed how natural resources were used and viewed (e.g., Industrial Revolution, fossil fuels, green technology, etc.). 8.9.6

7 Develop predictions for how the management, protection, enhancement, and improvement of natural resources will evolve through social perceptions (e.g., establishment of national parks, public opinion, reduction of waste and energy consumption, partnership with tribal communities, etc.). 8.9.7

8 Predict how society's views and use of natural resources will continue to change as a result of historical figures and trends in modern society. 8.9.8

9 Predict how future technological advancements may affect the use and views of natural resources. 8.9.9

10 Examine and explain how economics affects the use of natural resources. 8.10

1. Compare and contrast how the economic value of a natural resource affects its availability. 8.10.1
2. Describe the impact of the use of natural resources on local, tribal, state, and national economies (e.g., outdoor recreation, energy production, preservation, etc.). 8.10.2
3. Compare and contrast the economic impact of green technology and alternative energy. 8.10.3
4. Assess whether economic value increases or decreases the conservation, protection, improvement, and enhancement of natural resources. 8.10.4
5. Assess the importance of the use of natural resources on local, tribal, state, and national economies. 8.10.5
6. Analyze how the adoption of green technology and/or alternative energy affected a local, tribal, state, or national economy. 8.10.6
7. Devise a plan to improve the conservation, protection, improvement, and enhancement of natural resources based on economic value and practices. 8.10.7
8. Predict how changes to the availability of natural resources because of human activity may impact a local, tribal, state, and national economy. 8.10.8
9. Predict the economic impact of green technology and alternative energy. 8.10.9

11 Communicate information to the public regarding topics related to the management, protection, enhancement, and improvement of natural resources. 8.11

1. Describe ways in which a message regarding natural resources may be communicated to the public through standard media sources (e.g., press, radio/podcasts, TV, public appearances, social media etc.). 8.11.1
2. Summarize how social media and the internet have changed how people perceive and utilize natural resources (e.g., greater awareness of conservation issues, calls to action, etc.). 8.11.2
3. Describe how communication can be used to influence behavior, call people to action, and instill a sense of civic behavior related to the conservation, management, enhancement, and improvement of natural resources. 8.11.3
4. Assess the effectiveness of different methods for communicating natural resource messages. 8.11.4
5. Assess how to most effectively communicate a message about the conservation, management, enhancement, and improvement of natural resources via social media and the Internet. 8.11.5
6. Analyze examples of how communication can be used to influence behavior, call people to action, and instill a sense of civic behavior related to the conservation, management, enhancement, and improvement of natural resources. 8.11.6
7. Devise a strategy for communicating a natural resources message through media. 8.11.7

8 Predict how messages about the conservation, management, enhancement, and improvement of natural resources will change because of social media and the Internet. 8.11.8

9 Create a communication plan to influence the behavior of people, call people to action, and instill a sense of civic behavior related to the conservation, management, enhancement, and improvement of natural resources. 8.11.9

Develop plans to ensure sustainable production and processing of natural resources.

12 **Sustainably produce, harvest, process, and use natural resource products (e.g., forest and rangeland products, wildlife, minerals, fossil fuels, shale oil, alternative energy, recreation, aquatic species, etc.).** 8.12

1 Compare and contrast forest harvesting methods. 8.12.1

2 Describe methods by which wildlife can be sustainably harvested (e.g., controlled harvests, hunting licenses, regulations, etc.). 8.12.2

3 Compare and contrast the costs and benefits (e.g., impacts on environment, economic, wildlife, etc.) of mineral extraction to a local, tribal, state, and/or national economy. 8.12.3

4 Compare and contrast the costs and benefits (e.g., impacts on environment, economic, wildlife, etc.) of fossil fuels to a local, tribal, state, and/or national economy. 8.12.4

5 Compare and contrast the costs and benefits (e.g., environmental impacts, etc.) of shale oil from fracking to a local, tribal, state, and/or national economy. 8.12.5

6 Compare and contrast the costs and benefits (e.g., environmental impacts, etc.) of alternative sources of energy (e.g., hydroelectric, solar, wind, biofuels, geothermal, etc.). 8.12.6

7 Summarize how recreational uses of natural resources can be changed to improve sustainability. 8.12.7

8 Categorize aquatic species used for commercial and recreational purposes. 8.12.8

9 Assess harvesting methods in regards to their economic value, environmental impact, and other factors. 8.12.9

10 Assess techniques used to harvest wildlife in regards to sustainability, practicality, and other factors. 8.12.10

11 Assess the economic impact of mineral extraction in regards to the costs and benefits to a local, tribal, state, and/or national economy. 8.12.11

12 Assess the economic impact of fossil fuel extraction in regards to the costs and benefits to a local, tribal, state, and/or national economy. 8.12.12

13 Assess the economic impact of shale oil extraction (i.e., fracking) in regards to the costs and benefits to a local, tribal, state, and/or national economy. 8.12.13

14 Assess factors that affect the economic, environmental, and social sustainability in regards to the use of alternative sources of energy. 8.12.14

15 Assess different options for improving the sustainability of outdoor recreation based on its impact on natural resources and likelihood of acceptance. 8.12.15

16 Analyze techniques used to acquire aquatic species for their environmental, economic, and social sustainability. 8.12.16

17 Develop a forest harvesting plan that ensures economic, environmental, and social sustainability. 8.12.17

18 Develop a method for the sustainable harvest of wildlife species. 8.12.18

19 Evaluate methods used to extract and process minerals for economic, environmental, and social sustainability. 8.12.19

20 Evaluate methods used to extract and process fossil fuels for economic, environmental, and social sustainability. 8.12.20

21 Evaluate methods used to extract and process shale oil for economic, environmental, and social sustainability. 8.12.21

22 Predict how the impact of alternative energy will change in the future based on trends in energy production and consumption. 8.12.22

23 Recommend how an outdoor recreation activity can be made more sustainable in a manner that is accessible and equitable to those who take part in that activity. 8.12.23

24 Develop recommendations for the sustainable harvest of aquatic species. 8.12.24

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13 Demonstrate cartographic skills, tools, and technologies to aid in developing, implementing and evaluating natural resource management plans. 8.13

1 Summarize how to use maps and technologies to identify directions and land features, calculate actual distance, and determine the elevations of points. 8.13.1

2 Summarize how GIS (e.g., GPS receivers, UAVs, etc.) can be used to manage, conserve, improve and enhance the natural resources of an area. 8.13.2

3 Apply cartographic skills and tools and technologies (e.g., land surveys, geographic coordinate systems, etc.) to locate natural resources. 8.13.3

4 Analyze an area's resources using GIS technologies. 8.13.4

5 Evaluate 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.). 8.13.5

6 Use GIS data for a given area to devise a management plan for the management, conservation, improvement, and enhancement of its natural resources. 8.13.6

Demonstrate responsible management procedures and techniques to protect, maintain, enhance, and improve natural resources.

14 Demonstrate natural resource protection, maintenance, enhancement, and improvement techniques. 8.14

1 Identify different kinds of streams. 8.14.1

2 Identify characteristics of a healthy forest. 8.14.2

3 Identify characteristics of a healthy wildlife habitat. 8.14.3

4 Describe the characteristics of a rangeland and the global importance of the biome to providing multiple ecosystem services to humanity. 8.14.4

5 Identify characteristics of natural resources that make them desirable for recreational purposes. 8.14.5

6 Identify characteristics of healthy marine and coastal natural resources. 8.14.6

7 Assess indicators of the biological health of a stream. 8.14.7

8 Assess the methods used to improve a forest stand. 8.14.8

9 Assess methods of wildlife habitat management. 8.14.9

10 Apply methods for rangeland management for multiple ecosystem services. 8.14.10

11 Assess management techniques for improving outdoor recreation opportunities. 8.14.11

12 Assess methods to improve marine and coastal natural resources. 8.14.12

13 Create an enhancement plan for a stream. 8.14.13

14 Create a timber stand improvement plan for a forest. 8.14.14

15 Devise a comprehensive improvement plan for a wildlife habitat. 8.14.15

16 Revise a rangeland management plan to support the provisioning of multiple ecosystem services. 8.14.16

17 Evaluate the impact of recreational activities on natural resources. 8.14.17

18 Create an improvement plan for marine or coastal natural resources. 8.14.18

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15 Diagnose plant and wildlife diseases and follow protocols to prevent their spread. 8.15

1 Classify causes of diseases in plants and the correct authorities to whom some diseases should be reported. 8.15.1

2 Classify causes of diseases in wildlife and aquatic species. 8.15.2

3 Analyze a plant disease based on its symptoms. 8.15.3

4 Analyze a wildlife or aquatic species disease based on its symptoms. 8.15.4

5 Create a management plan to reduce infection and the spread of plant diseases in natural resource systems. 8.15.5

6 Create a management plan to reduce infection and spread of wildlife or aquatic species diseases in natural resource systems. 8.15.6

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16 Prevent or manage introduction of ecologically harmful species in a particular region. 8.16

1 Identify ecologically harmful species common to a particular region. 8.16.1

2 Summarize strategies and benefits of preventing the introduction of ecologically harmful species to a particular region. 8.16.2

3 Analyze signs of the spread of ecologically harmful species. 8.16.3

4 Implement a plan for preventing the spread of ecologically harmful species for its effectiveness. 8.16.4

5 Create a management plan to reduce the spread of ecologically harmful species in natural resource systems. 8.16.5

6 Devise strategies to prevent ecological damage that would result from the introduction of an ecologically harmful species. 8.16.6

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17 Manage fires in natural resource systems. 8.17

1 Describe the difference between desirable and undesirable fires and the role fire plays in a healthy ecosystem. 8.17.1

2 Explain how fire management techniques have evolved. 8.17.2

3 Assess techniques used to fight wildfires, manage prescribed fires and ensure human safety. 8.17.3

4 Assess the effectiveness of techniques previously and currently used to prevent harmful fires. 8.17.4

5 Develop a prevention plan for harmful fires for a particular region. 8.17.5

6 Predict how fire management techniques will change in the future. 8.17.6