Chariho Regional School District - Science Curriculum
September, 2016

WILDLIFE MANAGEMENT CURRICULUM

Unit 1: History of Wildlife Management in the United States

OVERVIEW

Summary

Students will be introduced to the history of wildlife management in the United States. This encompasses describing historic legislation and its modern impact, determining characteristics of successful wildlife conservationists, and describing general management practices that help conserve wildlife (wildlife refuges, national parks, etc). Students will be able to describe how the impact of humans lead to the era of exploitation in the United States. Students will outline and discuss the impacts of legislation created to reverse the effects of the era of exploitation. Lastly, students will discuss wildlife as a natural resource and looking forward, will describe how to protect it in the future.

Content to Be Learned

- Development of wildlife management in the United States.
- Specific actions that led to the development of the field of wildlife management.
- The role that wildlife has played in the development of America.
- The era of exploitation of America's wildlife.
- The importance of natural resources.
- The role of a variety of wildlife conservationists and the common characteristics that successful wildlife managers have.
- The general management practices that are in place today to conserve wildlife.
- Explain the primary sources of funding for wildlife habitat enhancement in the United States.

Practices

- Asking questions about how modern wildlife management came to be where it is today and research the history of wildlife management in the United States including human impact and exploitation of natural resources.
- Obtaining, evaluating, and communicating the characteristics of influential wildlife conservationists (historical and present).
- Obtaining, evaluating, and communicating information regarding the management practices set in place to conserve wildlife in the United States.

Crosscutting Concepts

- Cause and effect.
- Stability and change.

Essential Questions

- What impact have humans had on wildlife and what can be learned from this impact?
- In a world where preservation of natural resources is critical, how can the common characteristics of successful wildlife managers be applied to successful advocates for the protection of natural resources?

Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards

- NRS.02.05. Performance Indicator: Interpret laws related to natural resource management and protection.
    - NRS.02.05.01.a. Identify laws associated with natural resource systems.
    - NRS.02.05.01.b. Identify the purposes of laws associated with natural resource systems.

Unit 2: Characteristics of Animals

OVERVIEW

Summary

With a wide variety of wildlife on the Earth, it is necessary to know how to classify them. Students will learn to differentiate scientifically between major categories of animals (mammals, reptiles, birds, fish, and amphibians). They will be able to describe the characteristics that make each category of animal unique and classify the world's wildlife into these categories. Students will specialize in one category of animal and present what they have learned from research.

Content to Be Learned

- Hierarchy of classification of living things.
- The unique characteristics that differentiate birds, mammals, fish, reptiles and amphibians.

Practices

- Obtaining, evaluating, and communicating information on a particular category of animal.
- Constructing and revising an explanation as to why mammals, reptiles, and amphibians evolved to have different breathing strategies.

Crosscutting Concepts

- System and system models.
- Structure and function.

Essential Questions

- Why have the five major categories of animals evolved to have some similarities but also have evolved to have unique characteristics?

AFNR Career Cluster Content Standards

- NRS.01.02. Performance Indicator: Classify natural resources.

- NRS.01.02.03.a. Describe morphological characteristics used to identify wildlife species

Next Generation Science Standards

Students who demonstrate understanding can:

HS-LS4-5. **Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.** [Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Engaging in Argument from Evidence Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current or historical episodes in science. • Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments.	**LS4.C: Adaptation** • Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. • Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost.	**Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Connections to other DCIs in this grade-band:
HS.LS2.A ; **HS.LS2.D** ; **HS.LS3.B** ; **HS.ESS2.E** ; **HS.ESS3.A**

Articulation of DCIs across grade-bands:
MS.LS2.A ; **MS.LS2.C** ; **MS.LS4.C** ; **HS.ESS3.C**

Common Core State Standards Connections:
ELA/Literacy -
RST-11.12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS4-5)
WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS4-5)
Mathematics -
MP.2 Reason abstractly and quantitatively. *(HS-LS4-5)*

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

Unit 3: Ecosystems, Habitats, and Energy Transfer

OVERVIEW

Summary

Ecosystems are critically important to wildlife as they provide the biotic and abiotic factors necessary for life. Students will be able to define and give examples of biotic and abiotic factors in an ecosystem. They will also be able to describe the interactions between these factors and how wildlife benefits. With this information, students will be able to describe the importance of the five basic habitat requirements and apply them to a variety of wildlife species. Lastly, students will describe how both the positive and negative actions of humans have impacted wildlife habitat. Energy flows in an ecosystem. In this unit, students will label and describe each trophic level (autotroph, primary heterotroph, secondary heterotroph, tertiary heterotroph, decomposer), give examples of organisms that occupy each level, and compare the amount of energy available at each trophic level (energy pyramid). In addition to energy flow, students will examine biogeochemical cycles and describe nutrient cycling.

Content to Be Learned

- Biotic and abiotic factors in an ecosystem.
- The dependence of wildlife on both biotic and abiotic factors.
- Basic habitat requirements for all wildlife.
- Elements necessary for ideal wildlife habitats.
- The importance of each element in an ideal wildlife habitat is equal.
- Activities that impact wildlife habitats.
- Describe human activities that destroy or harm wildlife habitat.
- Describe things that humans do to benefit wildlife.
- Energy flow in an ecosystem that compares the energy at different trophic levels.
- Diagram the energy flow in an ecosystem that compares the energy at different trophic levels.
- Energy flow and biogeochemical cycling.

Practices

- Constructing an explanation describing the importance of biotic and abiotic factors in an ecosystem and the interactions wildlife has with them.
- Analyzing and interpreting data to show how human actions have impacted wildlife habitat (positively and negatively).
- Using models to illustrate energy flow in an ecosystem (food chain, food web, biomass pyramid, energy pyramid).
- Analyzing and interpreting data that shows how variations in population can impact the amount of energy available in a food web (Data Nugget - mud snails).
- Constructing an explanation as to what disruptions can happen in a food web and the level of intensity of these disruptions.

Crosscutting Concepts

- Cause and effect.
- Systems and system models
- Energy and matter.

Essential Questions

- Why is the existence of life dependent on ecosystems and the interactions of biotic and abiotic factors?
- What is the importance of of energy flow and nutrient cycling in living things?

AFNR Career Cluster Content Standards

- NRS.01.01. Performance Indicator: Apply knowledge of natural resource components to the management of natural resource systems.
    - NRS.01.01.02.a. Define ecosystem and related terms.
    - NRS.01.01.02.b. Describe the interdependence of organisms within an ecosystem.
    - NRS.01.01.02.c. Conduct a field study of an ecosystem, and record and document observations of species interactions.
- NRS.02.04. Performance Indicator: Demonstrate natural resource enhancement techniques.
    - NRS.02.04.03.a. Identify characteristics of a healthy wildlife habitat.
    - NRS.02.04.03.b. Identify methods of wildlife habitat improvement.

- NRS.02.06. Performance Indicator: Apply ecological concepts and principles to natural resource systems.
    - NRS.02.06.01.a. Identify biogeochemical cycles.
    - NRS.02.06.01.b. Diagram biogeochemical cycles and explain the processes.

Next Generation Science Standards

Students who demonstrate understanding can:

HS-LS2-3. **Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.** [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [*Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. ***Connections to Nature of Science*** **Scientific Knowledge is Open to Revision in Light of New Evidence** • Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence.	**LS2.B: Cycles of Matter and Energy Transfer in Ecosystems** • Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes.	**Energy and Matter** • Energy drives the cycling of matter within and between systems.

Connections to other DCIs in this grade-band:
HS.PS1.B ; **HS.PS3.B** ; **HS.PS3.D** ; **HS.ESS2.A**

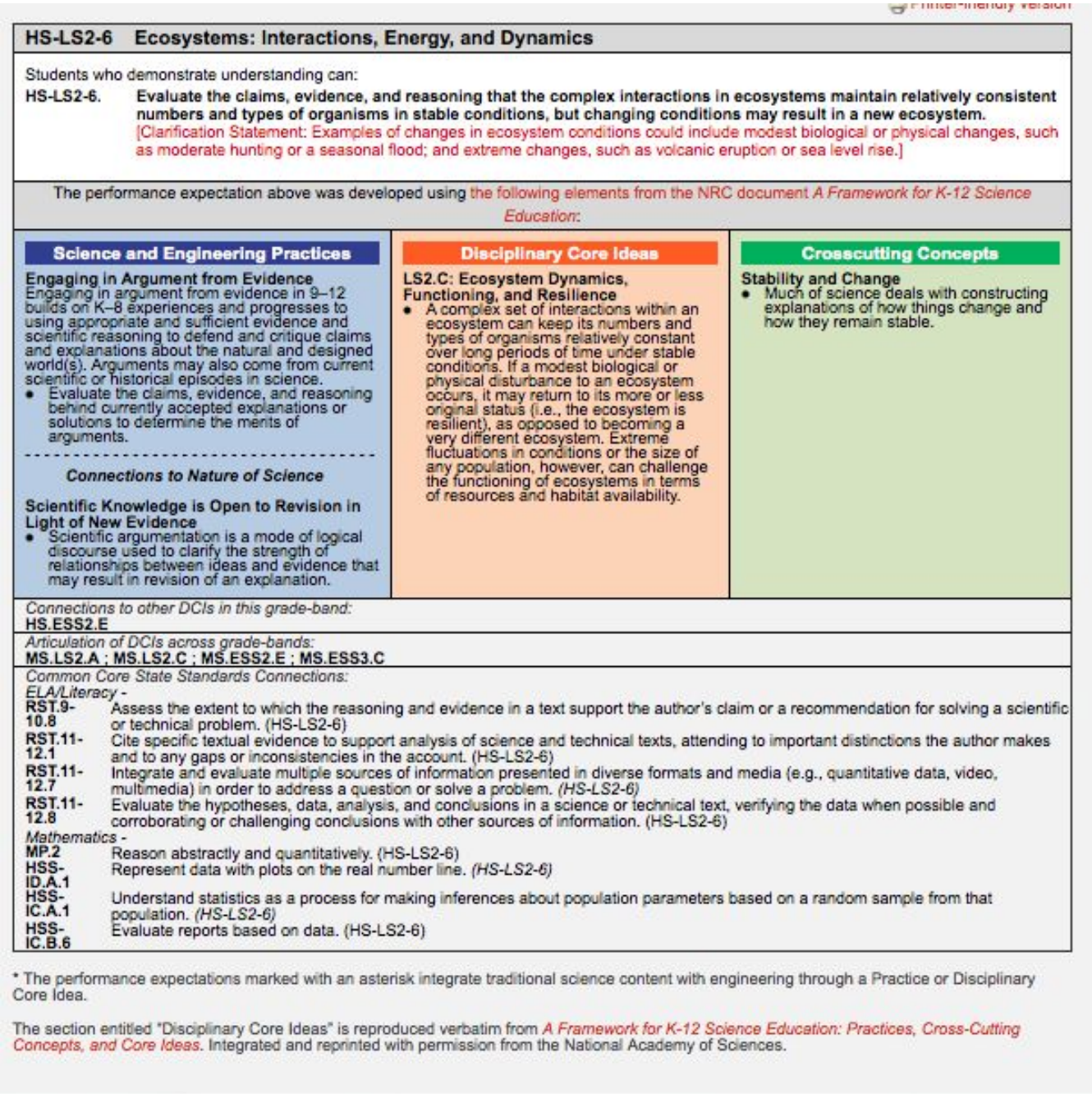
Articulation of DCIs across grade-bands:
MS.PS1.B ; **MS.PS3.D** ; **MS.LS1.C** ; **MS.LS2.B**

Common Core State Standards Connections:
ELA/Literacy -

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS2-3)

WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS2-3)

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.



HS-LS2-6 Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

HS-LS2-6. **Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.** [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Engaging in Argument from Evidence
Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.
- Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Connections to Nature of Science

Scientific Knowledge is Open to Revision in Light of New Evidence
- Scientific argumentation is a mode of logical discourse used to clarify the strength of relationships between ideas and evidence that may result in revision of an explanation.

Disciplinary Core Ideas

LS2.C: Ecosystem Dynamics, Functioning, and Resilience
- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.

Crosscutting Concepts

Stability and Change
- Much of science deals with constructing explanations of how things change and how they remain stable.

Connections to other DCIs in this grade-band:
HS.ESS2.E

Articulation of DCIs across grade-bands:
MS.LS2.A ; MS.LS2.C ; MS.ESS2.E ; MS.ESS3.C

Common Core State Standards Connections:

ELA/Literacy -

RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-6)

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS2-6)

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. *(HS-LS2-6)*

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS2-6)

Mathematics -

MP.2 Reason abstractly and quantitatively. (HS-LS2-6)

HSS-ID.A.1 Represent data with plots on the real number line. *(HS-LS2-6)*

HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. *(HS-LS2-6)*

HSS-IC.B.6 Evaluate reports based on data. (HS-LS2-6)

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

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Unit 4: Modern Wildlife Management

OVERVIEW

Summary

As time has gone on, humans have improved wildlife management techniques. In this unit, students will be able to outline modern wildlife management techniques used in the United States and globally. These

include hunting, wildlife conservation organizations, population control, etc. They will also be able to describe common laws of nature and how they can be manipulated by humans to benefit wildlife (ex: carrying capacity, biological surplus, predator/prey relationships). In addition, students will research and communicate information regarding species whose populations have increased due to proper wildlife management techniques.

Content to Be Learned

- The relationship between sport hunters and wildlife populations.
- Major private wildlife conservation organizations.
- Funding generated by sport hunters/fishermen also benefits non-game species.
- Practices used in modern wildlife management.
- Factors that limit a wildlife population.
- Species whose numbers have increased due to proper wildlife management.

Practices

- Analyzing and interpreting data to describe how modern wildlife management techniques have successfully increased wildlife populations (Turkey Trouble).
- Engaging in argument to describe the benefits of legal, monitored hunting in terms of wildlife populations.
- Obtaining, evaluating, and communicating information regarding modern wildlife management techniques used globally.

Crosscutting Concepts

- Cause and effect.
- Stability and change.

Essential Questions

- What are the commonalities among modern wildlife management techniques that are globally successful?

Agriculture, Food and Natural Resource AFNR

- NRS.03.01. Performance Indicator: Produce, harvest, process and use natural resource products.
    - NRS.03.01.03.a. Identify wildlife species that can be sustainably harvested.
    - NRS.03.01.03.b. Describe techniques used in the harvesting of wildlife.
    - NRS.03.01.04.a. Identify products obtained from wildlife species.

Next Generation Science Standards

HS-LS2-6 Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

HS-LS2-6. **Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.**
[Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Engaging in Argument from Evidence
Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Connections to Nature of Science

Scientific Knowledge is Open to Revision in Light of New Evidence

- Scientific argumentation is a mode of logical discourse used to clarify the strength of relationships between ideas and evidence that may result in revision of an explanation.

Disciplinary Core Ideas

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.

Crosscutting Concepts

Stability and Change

- Much of science deals with constructing explanations of how things change and how they remain stable.

Connections to other DCIs in this grade-band:
HS.ESS2.E

Articulation of DCIs across grade-bands:
MS.LS2.A ; MS.LS2.C ; MS.ESS2.E ; MS.ESS3.C

Common Core State Standards Connections:

ELA/Literacy -

RST.9-10.8	Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-6)
RST.11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS2-6)
RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. *(HS-LS2-6)*
RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS2-6)

Mathematics -

MP.2	Reason abstractly and quantitatively. (HS-LS2-6)
HSS-ID.A.1	Represent data with plots on the real number line. *(HS-LS2-6)*
HSS-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population. *(HS-LS2-6)*
HSS-IC.B.6	Evaluate reports based on data. (HS-LS2-6)

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

Unit 5: Endangered and Invasive Species

OVERVIEW

Summary

Both endangered and invasive species deserve equal recognition. In the unit, students will identify animals on the endangered species list. They will discuss the causation of endangered species as well as be able to list the levels of endangerment as outlined by the IUCN Red List. Additionally, students will describe and give examples of how humans have driven species to extinction in the United States as well as globally. Lastly, students will make an argument whether endangered species should be saved or not and if so, describe the method that would be best. In terms of invasive species, students will identify invasive species common to the United States. They will also describe the impact that these invasive species have and outline eradication methods to help stop the spread of invasive species.

Content to Be Learned

- Causes of endangerment.
- Management practices for endangered species.
- Human actions that have driven several species in the United States to extinction.
- Requirements for species being put on an endangered list.
- Impacts of invasive and introduced species.
- Invasive species common to New England.
- Invasive species eradication methods.

Practices

- Communicating scientific information regarding the causation of endangered species in the United States.
- Engaging in argument from evidence to persuade an audience as to which method of saving endangered species is most effective (hotspot, evolutionarily distinct, charismatic species).
- Analyzing and interpreting data that underscores the impact of invasive species in New England and the United States as a whole.
- Constructing an eradication plan for a specific invasive species.

Crosscutting Concepts

- Cause and effect.
- Stability and change.

Essential Questions

- What is the possible relationship between endangered species and invasive species?

Agriculture, Food and Natural Resource AFNR

- NRS.04.03. Performance Indicator: Manage insect infestations of natural resources.
    - NRS.04.03.01.a. Identify harmful and beneficial insects and signs of insect damage to natural resources.

Unit 6: Species Identification

OVERVIEW

Summary

In this unit, students will learn to identify common large and small mammals of North America visually and by tracks. Students will examine habitat requirements (food, water, shelter, space), behavior characteristics, and types of habitats of each of these animals. Students will then work to determine the relatedness of these animals based on similar characteristics.

Content to Be Learned

- Common large mammals and large game in the United States.
- Characteristics of common large mammals and large game in the United States.
- Type of habitat where large mammals or large game may be found.
- Major food source for each large mammal species.
- Behavior traits of each large mammal species.
- Common small mammals in the United States.
- Characteristics of common small mammals in the United States.
- Type of habitat where you may find small mammals.
- Major food source for each small mammal species.
- Behavior traits of each small mammal species

Practices

- Communicating scientific information regarding morphology of common large and small mammals in the United States.
- Obtaining, evaluating, and communicating information regarding specific species of mammal in the United States and relaying that information to classmates.

Crosscutting Concepts

- Structure and function

Essential Questions

- How can knowing the characteristics of mammals in the United States help identify and know mammals around the globe?

Agriculture, Food and Natural Resource AFNR

- NRS.01.02. Performance Indicator: Classify natural resources.
    - NRS.01.02.03.a. Describe morphological characteristics used to identify wildlife species.
    - NRS.01.02.03.b. Identify wildlife species.