Unit 2: Biodiversity and Land Conservation

Content Area:	**Science**
Course(s):	
Time Period:	**Marking Period 1**
Length:	**3 weeks**
Status:	**Published**

Brief Summary of Unit

This unit explores biodiversity and ecosystem services. Students will learn about endangered and threatened species and the impacts that humans have on these plants and animals. Students will learn how the United States is helping to preserve biodiversity, and how we as humans benefit from our environment and the goods and ecosystem services our environment provides. A strong theme of sustainability, wise use and conservation underlies this unit.

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CS.9-12.8.2.12.ETW.1	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.
CS.9-12.8.2.12.ETW.2	Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment.
CS.9-12.8.2.12.ETW.3	Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution.
CS.9-12.8.2.12.ITH.3	Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture.
LA.W.11-12.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
LA.RI.11-12.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
LA.RI.11-12.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).
LA.RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.
LA.RI.11-12.10a	By the end of grade 11, read and comprehend literary nonfiction at grade level text-complexity or above with scaffolding as needed.
LA.RL.11-12.1	Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.
LA.RL.11-12.2	Determine two or more themes or central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to produce a complex account; provide an objective summary of the text.
LA.RL.11-12.4	Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including words with multiple meanings or language that is particularly fresh, engaging, or beautiful. (e.g., Shakespeare as well as other authors.)
MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step

	problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
SCI.HS-LS4-2	Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
SCI.HS-LS1-2	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
WRK.9.2.12.CAP.4	Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
TECH.9.4.2.CI.1	Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
TECH.9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
TECH.9.4.2.CT.1	Gather information about an issue, such as climate change, and collaboratively brainstorm ways to solve the problem (e.g., K-2-ETS1-1, 6.3.2.GeoGI.2).
TECH.9.4.2.CT.2	Identify possible approaches and resources to execute a plan (e.g., 1.2.2.CR1b, 8.2.2.ED.3).
TECH.9.4.2.DC.7	Describe actions peers can take to positively impact climate change (e.g., 6.3.2.CivicsPD.1).
TECH.9.4.2.GCA.1	Articulate the role of culture in everyday life by describing one’s own culture and comparing it to the cultures of other individuals (e.g., 1.5.2.C2a, 7.1.NL.IPERS.5, 7.1.NL.IPERS.6).
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	Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.
	Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not.
	The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.
	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.
	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.

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.

All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors.

Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction).

Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.

Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere.

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.

Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.

Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (★).

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.

Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment.

Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.

The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.

Modeling links classroom mathematics and statistics to everyday life, work, and decision-making. Modeling is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions. Quantities and their relationships in physical, economic, public policy, social, and everyday situations can be modeled using mathematical and statistical methods. When making mathematical models, technology is valuable for varying assumptions, exploring consequences, and comparing predictions with data.

A model can be very simple, such as writing total cost as a product of unit price and number bought, or using a geometric shape to describe a physical object like a coin. Even such simple models involve making choices. It is up to us whether to model a coin as a three-dimensional cylinder, or whether a two-dimensional disk works well enough for our purposes. Other situations—modeling a delivery route, a production schedule, or a comparison of loan amortizations—need more elaborate models that use other tools from the mathematical sciences. Real-world situations are not organized and labeled for analysis; formulating tractable models, representing such models, and analyzing them is appropriately a creative process. Like every such process, this depends on acquired expertise as well as creativity.

Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.

Use a model based on evidence to illustrate the relationships between systems or between components of a system.

Emphasis is on testing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.

Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.

Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives.

Development and modification of any technological system needs to take into account how the operation of the system will affect natural resources and ecosystems. Impacts of technological systems on the environment need to be monitored and must inform decision-making. Many technologies have been designed to have a positive impact on the environment and to monitor environmental change over time.

Young people can have a positive impact on the natural world in the fight against climate change.

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Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.

Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals.

Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

Essential Questions / Enduring Understandings

Essential Questions:

What is biodiversity, and why is it so important for the functioning of life on Earth?

What is the relationship between the growth of the human population and biodiversity?

How does human activity impact the variety of life on Earth?

What strategies are available to protect Earth's living resources?

Enduring Understandings:

Biodiversity is essential to human survival and the wellbeing of the planet, and humans have engaged in both direcnt and indirect causes of its decline.

The loss of biodiversity creates instability in isolated ecosystems and planetary processes, and the loss of biodiversity cannot be reversed on a human timescale.

Objectives

Students will know key terms including biotic pollution, bell-weather species, threatened, endangered, extinct, ecosystem services, keystone species, symbiosis, mutualism, commensalisms, parasitism, intra and interspecific competition, ecosystem services, succession, pioneer species.
Students will know the relevance of deforestation in terms of ecosystem services provided by forests.
Students will know the common characteristics of endangered and threatened species.
Students will know why biodiversity is important for ecosystem and environmental stability.
Students will be skilled at identifying the importance of specific land types, such as forests and rangelands, as well as provide reasons for their decline and disappearance.
Students will be skilled at analyzing New Jersey case studies of both overpopulated and endangered species: deer, black bear, bald eagle, peregrine falcon, osprey.

Learning Plan

Biodiversity PowerPoint to outline and identify differences in biodiversity of global regions: Costa Rican rainforest, Alaskan Tundra, Amazon River Basin.

Species in Pieces Research Project: Students choose any 10 species to learn about where they live, how their numbers have declined and the causes of their endangerment.

Analysis of 6 common characteristics of endangered species and independent research on examples of each.

PPT Notes on Direct vs Indirect human causes of endangerment. Independent research on examples of each cause and connection to specific species who have been affected by that cause.

Discussion of ecosystem services. Group brainstorm on the services provided by different types of ecosystems.

Land Resources Stations: Students will visit a station each day that consists of independent assignments, reading and case studies about the major ecosystem types: forests, rangelands and wetlands

Invasive species research and case studies: gypsy moth, water hyacinth, killer bees, kudzu

Invasive species research project

Video: NJN Presents “Deer Crossing: NJ.” - Students will watch a documentary film about the impact of white tailed deer on NJ's biodiversity. WHile watching they will answer questions on a worksheet, and at the end will provide a summary of the film as well as a detailed opinion response in which they will be required to connect the film topics to the biodiversity concepts we have discussed in class.

Evidence/Performance Tasks

Formative Assessments:

- Worksheets
- Do Nows
- Exit Tickets
- Class Discussions

Bench Marks:

Midterm and Final Exam

Alternative:

- Species in Pieces Project
- Invasive SPecies Research Project

Summative:

Unit Tests:

- Biodiversity, Endangered species, invasive species, human causes of endangerment, ecosystem services of forests, rangelands and wetlands

Quizzes:

- Biodiversity types and importance
- Common Characteristics of endangered species and human causes of endangerment

Materials

Raven & Berg Evnironment Textbooks (ISBN: 978-1-119-39341-2)

Guided note packets (teacher developed)

Technology (student & teacher laptops, SmartBoard)

PowerPoints

Workshets/notes

Youtube/Netflix

Species in Pieces Website

IUCN Red List of Threatened Species website

NJ Case Study" Piping Plovers

Video: NJN Presents "Deer Crossing: NJ"

Invasive species poster project (with rubric)

Suggested Strategies for Modification

https://docs.google.com/spreadsheets/d/1P8BzKodtBsbWi4rQ0tunGWhZkCOg52IvbNO7yy-TFJI/edit?usp=sharing