Unit 08: Ecology

Content Area: **Science**
Course(s):
Time Period: **Marking Period 4**
Length: **4-6 weeks**
Status: **Published**

Summary

The main focus of this unit is ecology. The unit will cover each level of biological organization. Students will begin this unit learning about how matter and energy are cycled within the biosphere. Students will investigate energy transformations between trophic levels and how matter is transformed in biogeochemical cycles. The carbon cycle will be connected to human use of fossil fuels. Students will then move on to the biosphere level and learn about how each biosphere has its own unique biotic and abiotic factors. For ecosystems, students will explore how living organisms interact with and are dependent on the living and nonliving components of their environment. Students will learn about population dynamics, including factors that influence population size, limiting factors on population growth and types of population dispersal. Math skills will be applied to calculate the population density, population growth, and carrying capacity of a specific population. Student understanding of population dynamics will be applied to human population growth. Students will gain an understanding of how humans are a part of ecosystems and how human activity impacts the planet. Students will learn about biodiversity and its importance to foster an appreciation for generating environmental solutions. Students will evaluate how climate change is impacting biodiversity and develop a solution to an environmental issue in order to protect biodiversity.

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	There are actions an individual can take to help make this world a better place.
9.1.2.CR.1	Recognize ways to volunteer in the classroom, school and community.
9.4.2.CT	Critical Thinking and Problem-solving
	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.
9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
9.2.12.CAP.10	Identify strategies for reducing overall costs of postsecondary education (e.g., tuition assistance, loans, grants, scholarships, and student loans).
9.4.2.DC.6	Identify respectful and responsible ways to communicate in digital environments.
	Young people can have a positive impact on the natural world in the fight against climate change.
	Individuals from different cultures may have different points of view and experiences.
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).
LA.RI.9-10.8	Describe and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning.
LA.RI.9-10.9	Analyze and reflect on (e.g., practical knowledge, historical/cultural context, and background knowledge) documents of historical and literary significance, (e.g.,

	Washington’s Farewell Address the Gettysburg Address, Roosevelt’s Four Freedoms speech, King’s “Letter from Birmingham Jail”, Declaration of the Rights of Man and Citizen, U.N. Universal Declaration of Human Rights, etc.), including how they relate in terms of themes and significant concepts.
LA.W.9-10.2	Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
HS-LS2	Ecosystems: Interactions, Energy, and Dynamics
HS-LS2-2	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
	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.
	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.
HS-LS2-4	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
	Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.
	Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved.
LS2.B	Cycles of Matter and Energy Transfer in Ecosystems
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.
	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.
LS2.C	Ecosystem Dynamics, Functioning, and Resilience
HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
	Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction).

	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.
HS-LS4	Biological Evolution: Unity and Diversity
HS-LS4-6	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
LS4.D	Biodiversity and Humans
	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.
HS-ESS3	Earth and Human Activity
HS-ESS3-3	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
ESS3.C	Human Impacts on Earth Systems
	The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.

Essential Questions/ Enduring Understanding

Essential Questions:

How is matter and energy cycled within an ecosystem?
What are the characteristics of each biome and how do organisms interact with each other and their environments?
How are all living things connected and interdependent on each other?
How do symbiotic relationships impact how species interact with each other?
What is the importance of biodiversity and why should humans conserve the environment?
What impact do human actions have on the ecosystem?
What are possible solutions to environmental issues such as climate change?

Enduring Understanding:

The biosphere composed of all ecosystems
An ecosystem is a biological community of interacting organisms and their physical environment.
Energy passes to the next trophic level in the food web and food pyramid.
There are various factors that influence population growth.
The carrying capacity of an ecosystem is affected by factors such as environmental factors, food and water supply availability.
Environmental Conservation prevents the earth from collapsing as a result of human activities.

Objectives

Students will know key vocabulary: ecosystem, habitat, niche, community, population, ecology, biosphere, biotic, abiotic, biome, autotroph, heterotroph, producer, consumer, biodiversity.
Students will know each level of biological organization.
Students will know how energy moves through an ecosystem.
Students will know how matter cycles within an ecosystem in various biogeochemical cycles.
Students will know how burning fossil fuels connects to the carbon cycle.
Students will know the various types of symbiotic relationships.
Students will know the characteristics of earth's biomes.
Students will know each type of population dispersion pattern.
Students will know the factors that limit populations from growing exponentially.
Students will know the characteristics of the two types of reproductive strategies a species can have.
Students will know rates of change in a population size; birth, mortality, immigration, emigration.
Students will know how the human population is growing.
Students will know how humans are impacting the planet both directly and indirectly.

Students will be skilled at identifying biotic and abiotic factors.
Students will be skilled at creating food webs, food chains, and food pyramids.
Students will be skilled at calculating the amount of energy that passes to each trophic level.
Students will be skilled at calculating population density.
Students will be skilled at calculating carrying capacity.
Students will be skilled at graphing and analyzing population growth.
Students will be skilled at evaluating human environmental impact and creating possible solutions.

Learning Plan

- Ecology Prompts: throughout the unit students will respond to prompts related to ecology and the environment. For some of the prompts, students will conduct online research about possible solutions to climate change. Students will reflect on why the environment is important to them, personally, and what actions they can take to make a positive impact on the planet.
- Ecosystem Interactions: Students will be asked to define biotic and abiotic factors and to brainstorm examples of each. The class will discuss how living things interact with each other and with their environment to support ecosystem stability. Students will provide specific, real world examples of specific interacting in their environment. Lastly, students will define and provide examples of habitat and niche.
- Create a Food Web: students will choose an ecosystem for which they will create a food web. Students will use arrows to show the transfer of energy between organisms in the ecosystem.
- Energy Pyramid Activity: students will create an energy pyramid. Students will provide examples of specific organisms at each trophic level and answer questions about how the amount of energy, the biomass, and and the number of individuals changes between trophic levels.
- Biogeochemical Cycles Packet: students will read about one assigned biogeochemical cycle. They will answer questions about the cycle and draw a flowchart showing how the specific material is cycled within the biosphere. Students will then get into groups to teach each other about the cycle they learned about. Then, the whole class will discuss ways human activity impacts each cycle.

- Biome Travel Broucher: students will create a travel broucher for a chosen biome. The broucher will creatively display information that includes, biotic and abiotic factors, biome local cultural importance and global importance, a packing list, and a description of the biome. Students will produce a food web for the biome, using organisms found in that biome. The broucher should be creative, engaging, neat, and colorful. Students will present their broucher to the class.
- Symbiosis Activity: students will learn about the various types of symbiotic relationships; commensualism, parasitism, predation, and mutualism. Students will go to different stations around the classroom that have images and descriptions of how two different organisms interact with each other in their habitat. Students will identify which type of symbiotic relationship is being described and explain their answer using reasoning and understanding of ecological concepts.
- Calculating Population Size Activity: students will complete an activity that models how population density is estimated by ecologists. The worksheet will have students apply mathematical skills to calculate the population density from a small sample plot taken from the entire population.
- Population Dynamics Data Analysis Packet: Students will complete a packet with various population dynamics problems. Students will determine the four rates of change in a population and practice recalculating the population size due to these rates. Students will also calculate the carrying capacity of a population and explain the factors that limit population growth. Students will analyze graphs to answer questions about trends in population growth and make predictions about future population grow
- Human Population Growth Graph Packet: Students will graph the change in the human population throughout history. The class will discuss historical events and innovations that have enabled the human population to grow. Students will identify which type of growth pattern the human population demonstrates. Students will answer analysis questions about the human population carrying capacity and make predictions about future human population growth.
- Climate Change Impact Project: students will choose a human activity that is negatively impacting the environment to research. Students will research the causes, consequences, and contributors to the impact and collect data that demonstrates the impact. Students will then develop their own unique solution to the human impact. Students will write proposals that outline the logistics and the description of the solution and will then crate a model of the solution. Students will present their impact and the solution to the class.

Assessment

Formative:

- Do Now Questions.
- Exit Ticket Questions.
- Ecology Prompts
- Quizzes:
    - levels of biological organization
    - population dynamics
    - human impact
- Participation in class discussions
- Worksheets and classwork
- Creating a food chain, food web, and energy pyramid

Summative:

- Unit Assessment

- Formal Lab Reports:
    - Ocean Acidification Lab
    - Mark Recapture Simulation

Benchmark:

- CP Biology Final Exam

Alternative Assessments:

- Biome Travel Broucher
- Human Environmental Impact Project

Materials

- Textbook - Biology Glencoe
- SmartBoard and computers
- PowerPoint
- Guided notes
- Worksheets
- Lab materials
    - goggles
    - gloves
    - beakers
    - graduated cylindars
    - timers
    - rulers
- paper, colored pencils, markers

Modifications

See attached document.
https://docs.google.com/spreadsheets/d/1uDlwQcgdvbrOcLnMAKouOe1gQph5rWDWxM74UFeuACM/edit?usp=sharing