MYP/3D Science Unit Planner

Marietta City Schools

Grade & Course: 9th/10th Grade Biology	**Topic:** Ecology-Stability and Change in Ecosystems	**Duration:** 5.5 weeks
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Georgia Standards and Content:

SB5. Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment.

a. Plan and carry out investigations and analyze data to support explanations about factors affecting biodiversity and populations in ecosystems. (Clarification statement: Factors include population size, carrying capacity, response to limiting factors, and keystone species.)

b. Develop and use models to analyze the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration.

- Arranging components of a food web according to energy flow.
- Comparing the quantity of energy in the steps of an energy pyramid.
- Explaining the need for cycling of major biochemical elements (C, O, N, P, and H).

c. Construct an argument to predict the impact of environmental change on the stability of an ecosystem.

d. Design a solution to reduce the impact of a human activity on the environment. (Clarification statement: Human activities may include chemical use, natural resources consumption, introduction of non-native species, greenhouse gas production.)

e. Construct explanations that predict an organism's ability to survive within changing environmental limits (e.g., temperature, pH, drought, fire).

Narrative / Background Information

Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)

S7L4. Obtain, evaluate, and communicate information to examine the interdependence of organisms with one another and their environments.

a. Construct an explanation for the patterns of interactions observed in different ecosystems in terms of the relationships among and between organisms and abiotic components of the ecosystem. (Clarification statement: The interactions include, but are not limited to, predator-prey relationships, competition, mutualism, parasitism, and commensalism.)

b. Develop a model to describe the cycling of matter and the flow of energy among biotic and abiotic components of an ecosystem. (Clarification statement: Emphasis is on tracing movement of matter and flow of energy, not the biochemical mechanisms of photosynthesis and cellular respiration.)

c. Analyze and interpret data to provide evidence for how resource availability, disease, climate, and human activity affect individual organisms, populations, communities, and ecosystems.

d. Ask questions to gather and synthesize information from multiple sources to differentiate between Earth's major terrestrial biomes (i.e., tropical rainforest, savanna, temperate forest, desert, grassland, taiga, and tundra) and aquatic ecosystems (i.e., freshwater, estuaries, and marine).

(Clarification statement: Emphasis is on the factors that influence patterns across biomes such as the climate, availability of food and water, and location.)

Year-Long Anchoring Phenomena: (LEARNING PROCESS)

Sickle cell is a heritable genetic mutation that evolved in response to interactions in ecosystems**.**

Unit Phenomena (LEARNING PROCESS)

Human activities can cause major shifts in ecosystems.

Anchoring Phenomenon: algae blooms

MYP Inquiry Statement:

Human **interaction** within **systems** can impact **relationships** and have **consequences** and affect the **sustainability of the planet**.

MYP Global Context:
Globalization and Sustainability
Scientific & Technological Innovation

Approaches to Learning Skills: *** COMMUNICATION: Communication Skills RESEARCH: Research Skills	**Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)** Food Chains & Webs Energy Pyramids Cycles of Matter (C, O, N) Succession Foundational & Keystone Species Competition Predator/Prey Relationships Growth Curves & Limiting Factors Global Ecosystem Concerns Human Impact on Ecosystems	**Crosscutting Concepts: *** (KNOWLEDGE & SKILLS)** Cause & Effect Energy & Matter Stability & Change **MYP Key and Related Concepts: **** **Select one Key Concept:** Systems **Select one or more Related Concepts:** Stability & Change Sciences - Environment and Interaction

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)
Students should have a basic understanding of food chains and webs and how a change at any trophic level affects multiple other organisms. Misconception that a single species (keystone) could affect and essentially disrupt an entire ecosystem. Invasive species are a human-caused problem, whether it was intentional or not. Adaptations occur in populations over many generations, not in an individual.

Key Vocabulary: (KNOWLEDGE & SKILLS)
Biodiversity, limiting factors, carrying capacity, range of tolerance, adaptation, ecological succession, primary succession, secondary succession, pioneer species, climax community, population, organism, biome, community, ecosystem, ecology, biosphere, abiotic factor, biotic factor, habitat, niche, birth rate (natality), death rate (mortality), immigration, emigration, density-dependent factors, density-independent factors, invasive species, keystone species, bioaccumulation/biomagnification, eutrophication, clear-cutting, pollution, carbon cycle, phosphorus cycle, nitrogen cycle, water cycle, greenhouse gasses, natural resources, renewable resources, nonrenewable resources, autotroph, heterotroph, trophic levels, trophic cascade, herbivore, carnivore, omnivore, 10% rule, predation, parasitism, mutualism, commensalism, symbiosis

Inquiry Questions:

Factual: What are trophic levels? What is biomass? What is an autotroph/heterotroph? How is energy transferred from one trophic level to the next? What is the ultimate source of energy for all ecosystems? What is the order of the levels of organization from smallest to largest? What is a habitat? What is a niche? What are the pioneer species in secondary succession? What do the arrows in a food chain or food web indicate? How much energy is transferred to the next trophic level? What is a keystone species?

Conceptual: How do algae blooms occur? What are the major differences between primary and secondary succession? Why does primary succession take longer? How do density-dependent factors affect a population? If birth rate and immigration are larger than death rate plus emigration, what happens to the population size? If two organisms share the same niche, how are those two populations affected? Why are there fewer organisms in higher trophic levels? Why does bioaccumulation affect the top of the food chain more than the bottom? What happens to most of the energy as it moves up the energy pyramid? Why is a pyramid a good shape to use to show the amount of energy, biomass, or numbers of organisms in each trophic levels? How do invasive species affect an ecosystem? How does the removal of a keystone species cause a trophic cascade?

Debatable: On what biogeochemical cycle to humans have the greatest impact?

Georgia Standards of Excellence
Achievement Level Descriptors **and** GaDOE Clarification Statements

→ **Unit Disciplinary Core Idea:** Interdependence of organisms and their environment
→ **Unit Focus Crosscutting Concepts:** Stability & Change, Cause & Effect, Energy & Matter

→ **Unit Focus Science & Engineering Practices:** Plan & Carry Out Investigations; Analyze & Interpret Data, Develop & Use Models, Construct Explanations, Design Solutions, Engage in Argument from Evidence

A student at proficiency level can: **SB5. Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment:**

- ★ **SB5a.** plan and carry out investigations and analyze data to support explanations about factors **affecting** biodiversity and populations in ecosystems; *(clarification statement:* factors include population size, carrying capacity, response to limiting factors, and keystone species.)
- ★ **SB5b** develop and use models to analyze the **cycling of matter and flow of energy** within ecosystems through the processes of photosynthesis and respiration; (arranging components of a food web according to energy flow, comparing the quantity of energy in the steps of an energy pyramid, and explaining the need for cycling of major biochemical elements (C, O, N, P, and H).
- ★ **SB5c.** construct an argument to predict the **impact** of environmental change on the stability of an ecosystem; (*clarification statement:* human activities may include chemical use, natural resources consumption, introduction of non-native species, greenhouse gas production.)
- ★ **SB5d.** design a solution to reduce the **impact** of a human activity on the environment;
- ★ **SB5e.** construct explanations that predicts an organism's ability to survive within changing environmental limits (e.g., temperature, pH, drought, fire)

Student-Friendly Learning Targets

SB5a

- I can recognize the hierarchical organization of ecology: organism-population-community-ecosystem-biome-biosphere
- I can differentiate between a habitat and a niche, and give examples of each
- I can differentiate between biotic and abiotic factors that affect biodiversity and populations in ecosystems, and give examples of each
- I can provide examples and explain the impacts of competition on a population
- I can identify predator-prey relationships
- I can explain the impact of the three types of symbiotic relationships (mutualism, commensalism, and parasitism) on populations
- I can differentiate between exponential growth and logistic growth
- I can define carrying capacity - and identify it on a growth curve
- I can draw, label, and explain exponential growth and logistic growth curves
- I can differentiate between density-dependent and density-independent limiting factors, and give examples of each
- I can recognize and explain the importance of keystone species in ecosystems, provide relevant examples of keystone species, and discuss the impact of removal of keystone species from ecosystems
- I can draw, label, and interpret a predator-prey graph
- I can differentiate between primary and secondary succession, and state causes and examples of each
- I can explain the impact of biomagnification on ecosystems
- I can plan and carry out investigations and analyze data to support explanations about factors affecting biodiversity and populations in ecosystems
- I can refine investigations to support explanations about factors that affect biodiversity and populations in ecosystems

SB5b

- I can describe the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration ***SPIRAL TOPIC
- I can identify models that can be used to analyze the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration ***SPIRAL TOPIC
- I can develop and use models to analyze the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration ***SPIRAL TOPIC

- I can explain the importance of bacteria in the nitrogen cycle (NOTE - students do not need to explain the details of nitrogen fixation, but must understand the role of bacteria in the cycle)
- I can refine a model used to analyze the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and cellular respiration

SB5c

- I can identify current threats to biodiversity, such as invasive species
- I can identify a possible impact of an environmental change on the stability of an ecosystem, and can predict the impact of different types of environmental changes on the stability of an ecosystem (acid rain, global warming, greenhouse gas production, biomagnification, etc.)
- I can recognize the importance of biodiversity hotspots (rainforests, estuaries, etc.)

SB5d

- I can identify ways that human activity impacts the environment
- I can identify a solution that could be used to reduce the impact of a human activity on the environment
- I can design a solution to reduce the impact of a human activity on the environment
- I can refine solutions to reduce the impact of human activity on the environment

SB5e

- I can recognize that organisms are limited in their ability to survive within changing environmental limits (e.g., temperature, pH, drought, fire)
- I can construct explanations that predicts an organism's ability to survive within changing environmental limits (e.g., temperature, pH, drought, fire)
- I can analyze explanations used to predict an organism's ability to survive within changing environmental limits

MYP Objectives: Design

Assessments: Formative & Summative

- Common Formative Assessment
- MYP Essay
- Common Summative Assessment
- Exploration - MYP B & C: Design and experiment to examine the effect of human impact on biodiversity

Relationship between summative assessment task(s) and statement of inquiry: The summative exploration serves to assess student knowledge of living systems in terms of how organisms affect one another in ecosystems.

Unit Objectives:			
Learning Activities and Experiences	**Inquiry & Obtain: (LEARNING PROCESS)**	**Evaluate: (LEARNING PROCESS)**	**Communicate: (LEARNING PROCESS)**
Weeks 1/2: Flow of Energy & Cycling of Matter Topic 1 ● food chains/food webs ● energy pyramids Topic 2 ● carbon cycle ● nitrogen cycle	Common Openers/Closers **Inquiry Lab:** Plan and carry out investigations and analyze data to support explanations about factors affecting biodiversity and populations in ecosystems. Video: Introduction to Nutrient Cycling Making Food Webs Activity (Honors)	Ecology PPT V1 (honors) Ecology PPT V2 (on level) Understanding Feeding Relationships Activity Short Nitrogen Video to accompany the reading on the Comic Instruction Page https://www.youtube.com/watch?v=oQohpVN20FI Review of Carbon Cycling Video https://www.youtube.com/watch?v=rXzN89I4_Yk Nitrogen Cycle Comic Instructions and Rubric Nitrogen Cycle Blank Comic Pages Nitrogen Cycle Worksheet Slides to go with N Cycle Worksheet Energy Pyramid Model (Honors) Energy Flow Pyramid Model Practice (Honors) Watershed Ecosystem Nutrient Cycling (Honors)	Unit 1 Study Guide Common Formative Assessment (Topics 1 & 2)
Weeks 2/3/4: Community Ecology Topic 3: ● succession, foundational species, biotic and abiotic factors, levels of ecology, habitat, niche,	**Inquiry Lab (continued):** Plan and carry out investigations and analyze data to support explanations about factors affecting biodiversity and populations in ecosystems. **Ecology Stations:** Small Powerpoint Station 1: Levels of Ecology Kahoot review Station 2: Habitat vs Niche and biotic vs abiotic	Ecology PPT V1 (honors) Ecology PPT V2 (on level) Succession PPT Lab Activity: Lynx Hare Predator Prey Lab Lynx Hare Predator Prey Lab V2 Lynx Hare Student Cards Lynx Hare Data Sheet Lab Activity: How are Populations in Nature Controlled by the Predator/Prey Relationship?	Students will work in groups to predict what an abandoned Marietta High school would look like today, ten, fifty, and two hundred years from now. They will draw and describe applying their understanding on primary and secondary succession.

keystone species • competition, predator and prey • growth curves, limiting factors	Station 3: Competition- Complete page in packet—teacher help as needed Station 4: Relationships- video and packet page Station 5: Exponential vs logistic growth: packet page and article **Phenomenon**: Ant diversity in Gorongosa ● Video: Surveying Ant Diversity in Gorongosa National Park | HHMI BioInteractive **Phenomenon:** *Pisaster ochraceus* ● Video: Some Animals are More Equal than Others - Keystone Species & Trophic Cascades **Phenomenon:** Serengeti- Nature's Living Laboratory ● Video: ● Analyze & Interpret Data Activity **Population Growth Lab** and **Population Growth Lab (Honors)**: In this lab students will explore the effects of limiting factors on a pair of ducks. Students will then examine why the limiting factors influence the carrying capacity of a population. Students will collect data and analyze it before drawing a conclusion about limiting factors and carrying capacity.	Activity: Density Dependent & Independent Limiting Factors Activity	
Weeks 4/5.5: Global Concerns and Human Impact on Ecosystems	**Inquiry Lab (continued):** Plan and carry out investigations and analyze data to support explanations about factors affecting biodiversity and populations in ecosystems.	Ecology PPT V1 (honors) Ecology PPT V2 (on level) Exploration Topic: Invasive Species and Endangered Species A Look at Biomagnification Activity	Keystone & Invasive Species C-E-R 1 MYP - Global approach to all topics in unit 1 Common Summative Assessment

Topic 4: ● Nitrogen cycles ● pollution & acid rain ● carbon emissions, global warming ● water pollution, biomagnification, algae blooms ● invasive species ● habitat destruction & loss of biodiversity	Human Impact Article Video on Human impacts: Greenhouse Effect, Acid Rain, Deforestation, Biomagnification Video: His Epic Message Will Make You Want to Save the World | Short Film Showcase Video: The Great Pacific Garbage Patch	Article/Case Study: Alternative Fuels Case Study Article/Case Study: Global Warming: *A Heated Debate*	

Resources (hyperlink to model lessons and/or resources):
All resources are available on Schoology.

Reflection: Considering the planning, process and impact of the inquiry

Prior to teaching the unit	During teaching	After teaching the unit
Students are generally familiar with the information in this unit, however, they sometimes struggle with graphs and data.	(click here)	(click here)