

Biology Curriculum Map Unit 7: Ecology

Problem Based Learning: How can you reduce the impact of an invasive species on your local ecosystem?

- As students begin the unit, the video prepares them to construct explanations of invasive species and the impact they can have on ecosystems. During the launch of the unit problem, students conduct research and evaluate evidence as they consider invasive species in their own neighborhood or local ecosystem. In Chapter 4, as students learn about the ecosystems and communities, they evaluate how invasive species affect food webs. Students investigate the growth of python populations in the Everglades as they learn about population growth in Chapter 5. In Chapters 5 and 6, students also analyze data on specific examples of invasive species and efforts undertaken to control them. Next, as students evaluate the role of humans in the biosphere in Chapter 7, they learn about and help design a plan to eliminate this invasive species from the wildlife refuge so that the native leopard frog can be reintroduced. Upon concluding the unit, students acquire the scientific knowledge and data to design, test, and evaluate a solution to the problem of invasive species in their ecosystem. They present their results to the class.

Overall Standards Covered:

- BIO1.LS2.1** Analyze mathematical and/or computational representations of population data that support explanations of factors that affect population size and carrying capacities of populations within an ecosystem. Examine a representative ecosystem and, based on interdependent relationships present, predict population size effects due to a given disturbance
- BIO1.LS2.2** Create a model tracking carbon atoms between inorganic and organic molecules in an ecosystem. Explain human impacts on climate based on this model
- BIO1.LS2.3** Analyze through research the cycling of matter in our biosphere and explain how biogeochemical cycles are critical for ecosystem function
- BIO1.LS2.5** Analyze examples of ecological succession, identifying and explaining the order of events responsible for the formation of a new ecosystem in response to extreme fluctuations in environmental conditions or catastrophic events
- BIO1.LS4.3** Identify ecosystem services and assess the role of biodiversity in support of these services. Analyze the role human activities have on disruption of these services.

Key Questions:

- Chapter 3.1** Why is ecology important? What methods are used in ecological studies? What are biotic and abiotic factors? How can we model global systems?
- Chapter 4.3** How does matter flow between trophic levels and among ecosystems? How does water cycle globally? What is the importance of the main nutrient cycles? How does nutrient availability affect primary productivity?
- Chapter 5.1** How do ecologists study populations? What factors affect population growth? What happens during exponential growth? What happens during logistic growth?
- Chapter 5.2** What factors determine carrying capacity? What limiting factors depend on population density? What limiting factors do not typically depend on population density? What is the relationship between limiting factors and extinction?
- Chapter 6.1** What factors determine and describe habitats and niches? How does competition shape communities? How does herbivory shape communities? How do keystone species shape communities? What are the three primary ways that organisms depend on each other?
- Chapter 6.2** How do communities change overtime? How do communities recover after a disturbance?

- **Chapter 7** How to ecological footprints of typical Americans compared to the global average? What is the Anthropocene? How do human activities change the atmosphere in climate? How do changes in the atmosphere drive climate change and other changes in global systems? How do the ways we use land drive change in global systems? What kinds of pollutants are drivers of global change? What criteria can be used to evaluate whether development is sustainable? Why are innovation and resilience important?

<u>Learning Objectives:</u>	<u>Vocabulary</u>
<ul style="list-style-type: none"> • List the levels of organization recognized by ecology • Explain the difference between logistic and exponential growth patterns • Cite specific examples of each type of limiting factor and how they contribute to the carrying capacity of populations • Classify limiting factors as density dependent, density independent, biotic, or abiotic • Describe the specific stages in each biogeochemical cycle (water, carbon, and nitrogen) • List where living organisms play a role in each biogeochemical cycle • Explain the process of ecological succession and what kinds of conditions give rise to primary vs. secondary succession • Explain how humans impact the process of ecological succession • Describe the role of pioneer species in beginning the process of primary succession, as well as a climax community at the end of both primary and secondary succession • Explain how the relationship between predators and prey generates stability over time • Explain how both organisms are affected in each type of ecological relationship and list specific examples of each type of relationship • Classify a relationship as predation, competition, or symbiosis (mutualism, commensalism, or parasitism) based on a description or illustration 	Biosphere Ecology Species Population Community Ecosystem Biotic Factor Abiotic Factor Atmosphere Hydrosphere Geosphere Biogeochemical Cycles Nutrient Nitrogen Fixation Denitrification Limiting Nutrient Population Density Population Distribution Age Structure Immigration Emigration Exponential Growth Logistic Growth Carrying Capacity Limiting Factor Density-Dependent Factor Density-Independent Factor Habitat Tolerance Niche Resource Competitive Exclusion Principle Keystone Species Symbiosis Mutualism Parasitism Ecological Succession Primary Succession Pioneer Species Secondary Succession Ecological Footprint Anthrome Climate Change Global Warming Deforestation Monoculture Invasive Species Pollutant Ozone Layer Smog Biological Magnification Sustainable Development Renewable Resource Nonrenewable Resource Resilience

Curricular Connections to Standards (expanded):

Activity/Lab	Science & Engineering Practices	Crosscutting Concepts
Case Study: The Mysterious Disappearance of Sea Otters	Analyze and interpret data Engage in argument from evidence Obtain, evaluate, and communicate information	Cause and effect Stability and change
Lab: Population Sampling	Develop and use models Plan and carry out investigations Analyze and interpret data Use mathematics and computational thinking	Patterns Scale, proportion, and quantity Cause and effect Stability and change
Activity: Population Trends	Plan and carry out investigations Develop and use models Analyze and interpret data Engage in argument from evidence	Patterns Stability and change
Activity: A BEAR-y Good Habitat	Develop and use models Analyze and interpret data Obtain, evaluate, and communicate information	Patterns Scale, proportion, and quantity Cause and effect Stability and change
Activity: A Journey through the Carbon Cycle	Obtain, evaluate, and communicate information	Patterns Systems and system models Energy and matter
Lab: Predation	Develop and use models Use mathematics and computational thinking	Patterns Cause and effect Stability and change
Activity: What's Your Ecological Footprint?	Use mathematics and computational thinking Engage in argument from evidence Obtain, evaluate, and communicate information	Patterns Systems and system models Energy and matter Stability and change

Timeline	Learning Objectives/Activities	Assessments	Pearson Alignment	Standards
2 days	Introduction to Ecology -Introduction to ecology lesson w/ notes -Is your bellybutton an ecosystem? CER -Ecosystem scavenger hunt	-Informal questioning and discussion -Ecosystem CER	Chapter 3.1 (p 78-84)	BIO1.LS2.1
1-2 days	Introduction to Population Ecology -Anchoring Phenomena: The mysterious disappearance of the sea otters research assignment -Population ecology lesson -Feeding relationships in the Northwest Pacific activity	-Informal questioning and discussion	Chapter 5.1 (p 144-151) Chapter 5.2 (p 152-157)	BIO1.LS2.1
1-2 days	Population Ecology -Population ecology lesson w/ notes -Field investigation: Population sampling lab	-Informal questioning and discussion -Lab: Population Sampling	Chapter 5.1 (p 144-151) Chapter 5.2 (p 152-157)	BIO1.LS2.1
1 day	Population Ecology (cont.) -Population ecology practice packet	-Informal questioning and discussion -Lab: Antibiotic Resistance -Natural Selection Quiz	Chapter 5.1 (p 144-151) Chapter 5.2 (p 152-157)	BIO1.LS2.1
1 day	Population Ecology (cont.) -Graphing and analyzing population trends- group collaboration	-Informal questioning and discussion -Activity: Population Trends	Chapter 5.1 (p 144-151) Chapter 5.2 (p 152-157)	BIO1.LS2.1
1 day	Population Ecology (cont.) -A BEAR-y good habitat- carrying capacity and limiting factors game/simulation -Population ecology video clip (exit ticket)	-Informal questioning and discussion	Chapter 5.1 (p 144-151) Chapter 5.2 (p 152-157)	BIO1.LS2.1
1 day	Population Ecology (cont.) -Cracking the case: Solving the mystery of the missing sea otters (article reading/questions) -HHMI Video: Some animals are more equal than others	-Informal questioning and discussion	Chapter 5.1 (p 144-151) Chapter 5.2 (p 152-157)	BIO1.LS2.1
1 day	Population Ecology (cont.) -Population ecology kahoot review -Population ecology quiz	-Informal questioning and discussion -Population Ecology Quiz	Chapter 5.1 (p 144-151) Chapter 5.2 (p 152-157)	BIO1.LS2.1
3 days	Biogeochemical Cycles -Biogeochemical cycles webquest -Biogeochemical cycles lesson w/ notes -Nitrogen cycle- Old McDonald had a farm -A journey through the carbon cycle activity -Biogeochemical cycles quiz	-Informal questioning and discussion -Biogeochemical Cycles Quiz	Chapter 4.3 (p 123-131)	BIO1.LS2.2 BIO1.LS2.3
1 day	Ecological Succession -Primary and secondary succession interactivity - Ecological succession lesson w/ notes	-Informal questioning and discussion -Lab: Candy Cladograms	Chapter 6.2 (p 182-185)	BIO1.LS2.5
2-3 days	Species Interactions (Symbiosis) -Species interactions stations activity -Predator-prey relationship lab investigation	-Informal questioning and discussion -Lab: Predation	Chapter 6.1 (p 174-181)	BIO1.LS2.1

	-Symbiosis and ecological succession quiz	-Symbiosis & Ecological Succession Quiz		
2 days	Real World Case Study -The biggest little farm documentary w/ guided questions	-Evolution Unit Assessment	Chapter 6.1 (p 174-181)	BIO1.LS2.1
2 days	Human Impact -Introductory Phenomena -Human impact lesson w/ notes -What's your ecological footprint activity	-Informal questioning and discussion -Human Impact Project	Chapter 7 (p 202-225)	BIO1.LS4.3 BIO1.LS2.2
2-3 days	Unit Review -Ecology study guide -Ecology escape room -Ecology review game	-Informal questioning and discussion -Ecology Study Guide	Chapter 3 SG Chapter 4 SG Chapter 5 SG Chapter 6 SG Chapter 7 SG	BIO1.LS2.1 BIO1.LS2.2 BIO1.LS2.3 BIO1.LS2.5 BIO1.LS4.3
1 day	Unit Assessment -Ecology Unit Assessment <i>-Bonus: A life on our planet documentary viewing guide</i>	-Ecology Unit Assessment	Chapter 3 Assessment Chapter 4 Assessment Chapter 5 Assessment Chapter 6 Assessment Chapter 7 Assessment	BIO1.LS2.1 BIO1.LS2.2 BIO1.LS2.3 BIO1.LS2.5 BIO1.LS4.3