Environmental Science Unit 2 – Ecology

Unit Overview: This unit is composed of four chapters - *The Organization of Life, How Ecosystems Work, Biomes,* and *Aquatic Ecosystems.* This unit introduces the study of ecology. It focuses on ecosystems and the interrelationships between populations and their abiotic environment. Students will explore how molecules necessary for life, such as carbon, nitrogen and phosphorus are constantly being cycled through ecosystems. Students will analyze how energy flows through an ecosystem. They will learn how to read and create models that show the flow of energy in an ecosystem. Students will develop an understanding of ecological systems including characteristics of major global and terrestrial ecosystems (biomes).

Essential Questions:

Chapter 4- The Organization of Life

- Can you explain the difference between abiotic and biotic factors in an ecosystem?
- List 4 examples of adaptations that aid in survival of a specific species.
- How does the process of natural selection occur?

Chapter 5- How Ecosystems Work

- How do food chains and food webs model the direction of energy flow in an ecosystem?
- Describe how energy is transferred from the sun to producers and then to consumers.
- Can you explain why an energy pyramid is a representation of trophic levels?
- Describe one way that humans are affecting the Carbon cycle.

Chapter 6- Biomes

- How does latitude and longitude affect which plants grow in an area?
- How does temperature and precipitation determine which plants grow in an area?
- Can you list the various types of Biomes and describe their characteristics?
- Can you describe an adaptation that assists in the survival of a species of animal in each biome?

Chapter 7- Aquatic Ecosystems

- What factors determine where an organism lives in an aquatic ecosystem?
- What are two environmental functions of wetlands?
- Describe two threats to ocean ecosystems. Can you describe the effects of these threats?
- Describe one threat to river ecosystems. Can you describe the effects of this threat?

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Living Environment Core Curriculum- MST Standards

Key Idea 1: Living things are both similar to and different from each other and from nonliving things.

1.1 Explain how diversity of population within ecosystem relates to the stability of the ecosystem

Key Idea 6: Plants and animals depend on each other and their physical environment.

6.1 Explain factors that limit growth of individuals and populations.

6.2 Explain the importance of preserving diversity of species and habitats.

6.3Explain how the living and nonliving environments change over time and respond to disturbances

Key Idea 7: Human decisions and activities have had a profound impact on the physical and living environment.

7.1- Describe the range of interrelationships of humans with the living and nonliving environment

Earth Science Core Curriculum- MST Standards

Key Idea 2: Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.

2.2 Explain how incoming solar radiation, ocean currents, and land masses affect weather and climate

New York State Science Learning Standards Performance Expectations

HS-LS2-1. Use mathematical and/or computational representations to support explanations of biotic and abiotic factors that affect carrying capacity of ecosystems at different scales.

HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in ecosystems.

HS-LS2-5. Develop a model to illustrate the role of various processes in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

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.

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Environmental Science Content	NYSSLS Disciplinary Core Ideas	Additional Resources	Project Based Resources and Activities - Version 1 Scaffolded with Supports	Project Based Resources and Activities - Version 2
Chapter 4- The Organization of Life **Section 1- Ecosystems- Everything is Connected** ● Distinguish between the biotic and abiotic factors in an ecosystem ● Describe how a population differs from a species ● Explain how habitats are important to organisms **Section 3- The Diversity of Living Things** ● Name the 6 kingdoms of organisms and identify two characteristics of each ● Explain the importance of bacteria and fungi in the environment ● Describe the importance of protists in the environment ● Explain why insects are such successful animals	● 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. ● Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. 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. ● Carrying capacity results from the availability of biotic and abiotic factors and from challenges such as predation, competition, and disease. ● Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. ● The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual coevolution of Earth's surface and the life that exists on it.	**Text Resource** ***Environmental Science* – Holt** **Chapter 4 - pp. 93-96; pp.102-107** **Student Resources** NYS Department **of** Environmental Conservation (DEC) – Information and links concerning animals, plants, and aquatic life in New York State. NYS Department of Environmental Conservation Nature Explorer – DEC search engine contains information on birds, reptiles, amphibians, rate animals and plants, and significant natural communities. **Teacher Resources** Project Wild Activity Resources – Access to Project Wild resources including Step with STEM, WILD work, student pages, and additional resources.	**Environmental News Summary** Students research and summarize a current event article. Environmental News Summary Student Resource Unit 2	**Environmental News Summary** Students research and summarize two current event articles. Environmental News Summary Student Resource Unit 2
Chapter 5 - How Ecosystems Work **Section 1- Energy Flow in Ecosystems** ● Describe how energy is transferred from the Sun to producers and then to consumers ● Describe one way in which consumers depend on producers ● List two types of consumers	● Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. ● The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. ● 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	**Text Resource** ***Environmental Science* – Holt** **Chapter 5 - pp. 117-133** **Student Resources** Food Webs and Energy Pyramids An Amoeba Sisters video exploring food webs, energy pyramids, and biodiversity.	**WNY Ecosystem Project** Students create their own ecosystem based on organisms and abiotic components native to WNY. Student projects include an illustration of their ecosystem and a food web. Analysis questions are a separate	**WNY Ecosystem Project** Students create their own ecosystem based on organisms and abiotic components native to WNY. Student projects include an illustration of their ecosystem and a food web. Analysis questions are embedded in the project. WNY Ecosystem Project

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• Explain how energy transfer in a food web is more complex than energy transfer in a food chain • Explain why an energy pyramid is a representation of trophic levels **Section 2- The Cycling of Materials** • Describe one way that humans are affecting the carbon cycle • List the three stages of the nitrogen cycle • Describe the role that nitrogen-fixing bacteria play in the nitrogen cycle • Explain how the excess use of fertilizer can affect the nitrogen and phosphorus cycles **Section 3- How Ecosystems Change** • List two types of ecological succession • Explain how a pioneer species contributes to ecological succession • Describe how lichens contribute to primary succession	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. 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. • Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, hydrosphere, and geosphere through chemical, physical, geological, and biological processes. • 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. • Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.	Ecology Simulation Lab – Producers & Food Webs Ecosystems are complex and delicate. In this lab students build their own ecosystem and explore the effects of interrelationships. Carbon and Nitrogen Cycles An Amoeba Sisters video that explores the cycling of carbon and nitrogen. Students will discover the importance of nitrogen. **Teacher Resources** Food Webs and Energy Pyramids – Amoeba Sisters Video Recap – Resource document allows for student review and response to Amoeba Sisters video. Carbon and Nitrogen Cycles – Amoeba Sisters Video Recap – Resource document allows for student review and response to Amoeba Sisters video. The Theft from the Sun (Blackfoot Lodge Tales) * This Native American folktale recounts the tale of an Old Man who tries to steel from the Sun but fails to escape. **NEED -** Greenhouse in a Beaker Students explore how the addition of carbon dioxide to the air affects air temperature during the day and during the night. **NEED -** Greenhouse in a Beaker **Video** NEED curriculum and Training Associate demonstrates the activity Greenhouse in a Beaker **NEED – Carbon Cycle Simulation** This activity assists students to visualize how carbon naturally cycles in the carbon cycle and how the carbon cycle is affected with	document for teachers to use as appropriate for their students. WNY Ecosystem Project WNY Ecosystem Project Rubric WNY Ecosystem Project Analysis Questions WNY Biodiversity List BNRiverkeeper Native Plant Guide Biogeochemical Poster Project Students will create a visual project of the 3 main biogeochemical cycles (carbon, nitrogen, and water).	WNY Ecosystem Project Rubric WNY Biodiversity List BNRiverkeeper Native Plant Guide Biogeochemical Poster Project Students will create a visual project of the 4 main biogeochemical cycles (carbon, nitrogen, water, and phosphorus).

		excess carbon. All of the components required for the simulation are below. • Carbon Cycle Simulation Teacher Resource • Carbon Cycle Simulation Student Informational Text • Carbon Reservoir Comparison Graphic Organizer • Carbon Cycle Simulation Reservoir Posters • Carbon Cycle Simulation Reservoir Instruction Sheets • Carbon Cycle Simulation Carbon Tracking Sheet • Carbon and the Carbon Cycle Google Slide deck **Z Space Activities: (code)** Trophic Levels in an Energy Pyramid (A290) Students will calculate how much energy is transferred from one trophic level to another, as well as account for the energy not transferred due to its use for life-sustaining functions Teacher Resource pdf Student Resource pdf Chemical Impacts: Ecological Interactions (A045) Investigate connections between chemicals from biotic and abiotic factors, View the chemical structures of ibuprofen and benzene, Understand the functions of each molecule, Present impacts the chemicals have on the human body and the biosphere Teacher Resource pdf Student Resource pdf Termite Mound: Idea Sheet (AP64) Dissect the termite mound model. Analyze its structures and functions Teacher Resource pdf Student Resource pdf		

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Chapter 6- Biomes **Section 1- What is a Biome?** ● Describe why vegetation is used to describe a biome ● Explain how temperature and precipitation determine which plants grow in an area ● Explain how latitude and altitude affect which plants grow in an area **Section 2- Forest Biomes** ● List three characteristics of tropical rainforests ● Name and describe the main layers of a tropical rainforest ● Describe one plant in a temperate deciduous forest and an adaptation that helps it survive ● Describe one adaptation that may help an animal survive in a taiga ● Name two threats to the world's forest biomes **Section 3- Grassland, Desert, and Tundra Biomes** ● Describe the difference between tropical and temperate grasslands ● Describe the climate in a chaparral biome ● Describe two desert animals and the adaptations that help them survive ● Describe one threat to the tundra biome	● 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. ● Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus, the variation and distribution of traits observed depends on both genetic and environmental factors. ● 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. ● The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. ● The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual coevolution of Earth's surface and the life that exists on it.	**Text Resource** ***Environmental Science* – Holt** **Chapter 6 - pp. 143-163**	Biome Project – Using a project choice board students will research one biome. **Z Space Resource: (code)** Idea Sheet: Biomes (AP64) Explore several biomes to gather research information Teacher Resource pdf Student Resource pdf	Biome Project – Using a project choice board students will research two biomes.

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Chapter 7- Aquatic Ecosystems **Section 1- Freshwater Ecosystem** ● Describe the littoral zone and the benthic zone that make up a lake or pond ● Describe one threat against river ecosystems **Section 2- Marine Ecosystem** ● Explain why an estuary is a very productive ecosystem ● Compare salt marshes to mangrove swamps ● Describe two threats to coral reefs ● Describe two threats to ocean organisms	● 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. ● Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus, the variation and distribution of traits observed depends on both genetic and environmental factors. ● 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.	**Text Resource** ***Environmental Science* – Holt** **Chapter 7 - pp. 173-185** **Teacher Resources** Aquatic Wild Activity Resources - Access to Aquatic Wild resources including Step with STEM, WILD work, student pages and additional resources. Ocean Tracks – Getting Started – Instructions and tutorial videos to assist teachers with Ocean Tracks map interface. **NEED – Ocean Acidification** – Students will explore the relationship balance between atmospheric carbon dioxide and ocean pH. Ocean Acidification Meter Method Teacher Resource Ocean Acidification Meter Method Student Resource Ocean Acidification Indicator Method Teacher Resource Ocean Acidification Indicator Method Student Resource	**Interpreting Patterns in Ocean Tracks Data** Students will recognize how animal movement is represented in the Ocean Tracks interface while identifying, extracting, and interpreting meaningful patterns in tracking data. PowerPoint Student Resource **What's UP in the Pacific Ocean?** Students will describe ocean conditions by interpreting color maps of sea surface temperatures and chlorophyll concentrations. Students will then use data to make and support claims about relationships between ocean conditions and animal behavior. PowerPoint Student Resource **Upwelling Project** Students will read informative text on the subject of upwelling and complete a two-column graphic organizer. What is Upwelling and Why Does It Happen – Informative Text Two- Column Graphic Organizer	**Interpreting Patterns in Ocean Tracks Data** Students will recognize how animal movement is represented in the Ocean Tracks interface while identifying, extracting, and interpreting meaningful patterns in tracking data. PowerPoint Student Resource **What's UP in the Pacific Ocean?** Students will describe ocean conditions by interpreting color maps of sea surface temperatures and chlorophyll concentrations. Students will then use data to make and support claims about relationships between ocean conditions and animal behavior. Finally, students will compare three types of animals and their migratory patterns. PowerPoint Student Resource **Upwelling Project** Students will create an informational poster explaining the process of upwelling. PowerPoint Poster Project Student Resource Poster Project Rubric

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Unit 2 Evidence of Learning	Ticket Out • Think-Pair-Share • Formative Assessment • Weekly Quiz • Unit Test • Homework • Review Questions			
Unit 2 Materials	WNY Ecosystem Project • Construction paper, markers, colored pencils, crayons, etc. (PAPER version) • Laptop – utilize Microsoft Word or OneNote (DIGITAL version) Biogeochemical Poster Project • Poster paper, markers, colored pencils, crayons, etc. (PAPER version) • Laptop – utilize Microsoft PPT or Adobe Spark (DIGITAL version) • Poster paper, cardboard, markers, colored pencils, crayons, and possibly other materials for board game (PAPER version) • Laptop – utilize Microsoft Word, PPT, or Publisher (DIGITAL version) •			
Unit 2 Vocabulary	**Chapter 4** abiotic factor angiosperm archaebacteria biotic factor community ecosystem eubacteria fungus gymnosperm habitat invertebrate organism population protist resistance species vertebrate	**Chapter 5** carbon cycle cellular respiration climax community consumer decomposer ecological succession food chain food web nitrogen cycle nitrogen-fixing bacteria phosphorus cycle photosynthesis pioneer species primary succession producer secondary succession trophic level	**Chapter 6** altitude biome canopy chaparral climate desert emergent layer epiphyte latitude permafrost savannah taiga temperate deciduous forest temperate grassland temperate rainforest tropical rainforest tundra understory	**Chapter 7** barrier island benthic zone benthos coral reef estuary eutrophication littoral zone mangrove swamp nekton plankton salt marsh wetland

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English Language Learners (ELL) Enhancements To access hyperlinked material, you must be logged into your BPS Google Drive	**Listening** • **Cross- Linguistic Practices:** Gives students opportunities to make connections between what they hear and their home language (For example, allow students to listen to a passage and identify cognates.) • **Build background knowledge** • **Activating Prior Knowledge** Activating prior knowledge means both eliciting from students what they already know and building initial knowledge that they need in order to access upcoming content • **Activating Prior Knowledge** • **Visuals** - GIFs, pictures- will assist students in understanding what they are listening to. Use **visual thinking strategies** to set the lens for learning. • Video to review or introduce a topic – use **closed captioning** to help students see the words and pronunciations while they listen to the content. • **Word stretching / Vowel stretching** when instructing allows student to listen closely to the pronunciation of the word • **Performance Level Descriptors** This document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of listening.	**Speaking** • **Sentence Frames** - to begin a sentence - such as *The water cycle is…* or *I think that water cycle is…* • **Academic Conversation Starters:** Have a visual of a list of academic sentence starters that students can refer to in a discussion. Examples include- I expect ____ to happen. My data shows that… This helps students have a more science focused dialogue. • **Choral Reading** - To build fluency, self-confidence and motivation with reading/speaking • Create **movement** to go with the word. Movement can be a motivating factor, as well as a kinesthetic tool for conceptualizing the rhythm and flow of fluent reading while triggering brain function for optimal learning • **Performance Level Descriptors** This document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of speaking.	**Reading** • **Supplementary Text** to help reinforce concepts. If necessarily, use lower Lexile levels to ensure comprehension. • **Visual Aids** - Pictures or models to support vocabulary words and concepts • Video to review or introduce a topic - use **closed captioning** to help students read along while they listen to the content • **4 Square / Frayer models** to help students gain a deeper understanding of vocabulary. • **Highlighting** important text to assist students in answering questions after the reading. • **Chunking**-Break reading of text into chunks or paragraphs • **Performance Level Descriptors** This document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of reading • **Vocabulary Morphology**- Morphology relates to the segmenting of words into affixes (prefixes and suffixes) and roots or base words, and the origins of words. Understanding that words connected by meaning can be connected by spelling can be critical to expanding a student's vocabulary.	**Writing** • **Sentence Frames** - to begin a sentence- such as *Biodiversity is…* or *An example of competition is….* • **Cloze passages** with word banks • **Word banks** • **Graphic Organizers** to help break down the writing process and organize thoughts • **Standards-based sentence stems** • **Performance Level Descriptors** This document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of writing.	**Instructional Accommodations (depending on the student's needs)** • **Extended time** for tests in class, projects and assignments • **Directions read.** Broken down as necessary • **Model** how to complete the activity in the lesson • **Oral simplification** of directions or questions • **Translated version** of test when available. Student may have both version English and native language version • Use of **approved bilingual glossaries** from NYS in each subject

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<table>
<tr>
<td>Special Education Modifications

Special Education students must have accommodations as per Individual Educational Plan (IEP)</td>
<td><u>Instructional</u>
• Pre-teach vocabulary
• Use picture vocabulary
• Scaffold Depth of Knowledge questions
• Provide copy of notes/notes in “cloze” form
• Use of Think, Pair, and Share strategy to help process information
• Scaffold written assignments with the use of graphic organizers
• Allow for multiple ways to respond (verbal, written, response board)
• Provide model of performance task
• Modify informational text to fit the needs of the students
• Provide a digital or paper interactive notebook
• Present complex tasks in multiple ways
• Provide mnemonic strategies for Environmental Science concepts</td>
<td><u>Technology:</u>
• Audio reading of text
• Text to type functions
• Videos to clarify/visualize Environmental Science concepts
• Record class lecture/discussions and make accessible to student
• Nearpod- interactive presentations of notes
• Playposit - show a video clip about the topic and add your own questions for them to answer as they watch
• Allow students to type answers in chat on Teams

<u>Other:</u>
• Arrange seating for maximum engagement and minimum distraction</td>
<td><u>In Class Assessments</u>

• Provide review packet or review sheet of concepts covered on the test
• Practice similar questions prior to the test
• Provide multiple options for projects
• Give a timeline of when things are due and remind them of the process often.
• Use of timer in class
• Break all complex tasks into chunks</td>
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<tr>
<td>Step Up to Writing
Step Up to Writing materials can be found in BPS Science K-12 Schoology Folder
9-12 Resources
Environmental Science
Environmental Science Curriculum Materials Step Up to Writing Materials</td>
<td colspan="3"><u>SUTW Strategies</u>

• Informal Outline
• Color-Coding – Informative/Explanatory Text
• Two-column notes
• I-V-F Topic Sentence progressing to Four Step Summary Paragraph
• CUPS – Capitalization, Usage, Punctuation, Spelling
• Transitions</td>
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<tr>
<td>Culturally and Linguistically Responsive Teaching (CLRT) in the Science Classroom</td>
<td colspan="3">• Materials, resources, and/or discussions address diverse cultural backgrounds and real-world applications
• Artifacts (posters, charts, etc.) in the science classroom are representative of the cultures of the student population
• All students are given an opportunity to engage in science discourse
• Teacher demonstrates high expectations for all students

CLRT resources which align to Science content are denoted with a *</td>
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