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| Subject: Science | Grade: 7 | Unit ID:  |
| Unit 1: Ecosystems: Structure, Function and Human Impact | Length: 12 weeks |
| Stage 1: Desired Results |
| Standards:**Content Standards:****7.MS-LS2-1.****Pearson Grade 7 Textbook: Ch: 8 Population and Communities** Analyze and interpret data to provide evidence for the effects of periods of abundant and scarce resources on the growth of organisms and the size of populations in an ecosystem. **7.MS-LS2-2.****Pearson Grade 7 Textbook: Ch: 8 Population and Communities** Describe how relationships among and between organisms in an ecosystem can be competitive, predatory, parasitic, and mutually beneficial and that these interactions are found across multiple ecosystems. Clarification Statement: • Emphasis is on describing consistent patterns of interactions in different ecosystems in terms of relationships among and between organisms.**7.MS-LS2-3.****Pearson Grade 7 Textbook: Ch: 9 Ecosystems and Biomes** Develop a model to describe that matter and energy are transferred among living and nonliving parts of an ecosystem and that both matter and energy are conserved through these processes. Clarification Statements: • Cycling of matter should include the role of photosynthesis, cellular respiration, and decomposition, as well as transfer among producers, consumers (primary, secondary, and tertiary), and decomposers. • Models may include food webs and food chains. State Assessment Boundary: • Cycling of specific atoms (such as carbon or oxygen), or the biochemical steps of photosynthesis, cellular respiration, and decomposition are not expected in state assessment**7.MS-LS1-4.** Construct an explanation, based on evidence for how characteristic animal behaviors and specialized plant structures increase the probability of successful reproduction of animals and plants. [Clarification Statement: Examples of animal behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds; and, creating conditions for seed germination and growth. Examples of plant structures that affect the probability of plant reproduction could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.] [Assessment Boundary: Assessment does not include natural selection.]**7.MS-LS2-4.****Pearson Grade 7 Textbook: Ch: 10 Balance Within Ecosystems** Analyze data to provide evidence that disruptions (natural or human-made) to any physical or biological component of an ecosystem can lead to shifts in all its populations. Clarification Statement: • Focus should be on ecosystem characteristics varying over time, including disruptions such as hurricanes, floods, wildfires, oil spills, and construction. **7.MS-LS2-6(MA).****Pearson Grade 7 Textbook: Ch: 10 Balance Within Ecosystems** Explain how changes to the biodiversity of an ecosystem—the variety of species found in the ecosystem—may limit the availability of resources humans use. Clarification Statement: Examples of resources can include food, energy, medicine, and clean water.**7.MS-LS2-5.****Pearson Grade 7 Textbook: Ch: 6 Land, Air, and Water Resources and Ch: 9 Ecosystems and Biomes**  Evaluate competing design solutions for protecting an ecosystem. Discuss benefits and limitations of each design.\* Clarification Statements: • Examples of design solutions could include water, land, and species protection and the prevention of soil erosion. • Examples of design solution constraints could include scientific, economic, and social considerations**7.MS-ESS3-4.** **Pearson Grade 7 Textbook: Ch 5: Water and Ch: 6 Land, Air, and Water Resources** Construct an argument supported by evidence that human activities and technologies can mitigate the impact of increases in human population and per capita consumption of natural resources on the environment. Clarification Statements: • Arguments should be based on examining historical data such as population graphs, natural resource distribution maps, and water quality studies over time. • Examples of negative impacts can include changes to the amount and quality of natural resources such as water, mineral, and energy supplies.***Note***: *If the teacher elects to tie in the above standards with the Engineering and Technology Standard (ETS) for Massachusetts, the following additional standards will be covered. Moving forward all orange text in this document will correspond to MA ETS. The focus will be on designing a solution for human impact.***7.MS-ETS1-2.****Pearson Grade 7 Textbook: STC Skills Handbook: Part 1 and 2** Evaluate competing solutions to a given design problem using a decision matrix to determine how well each meets the criteria and constraints of the problem. Use a model of each solution to evaluate how variations in one or more design features, including size, shape, weight, or cost, may affect the function or effectiveness of the solution.\* **7.MS-ETS1-4.** **Pearson Grade 7 Textbook: STC Skills Handbook: Part 1 and 2** Generate and analyze data from iterative testing and modification of a proposed object, tool, or process to optimize the object, tool, or process for its intended purpose.\* **7.MS-ETS1-7(MA).****Pearson Grade 7 Textbook: STC Skills Handbook: Part 1 and 2**  Construct a prototype of a solution to a given design problem.\***Practice Standards/Concepts & Skills:**1. Asking questions (for science) and defining problems (for engineering). 2. Developing and using models. 3. Planning and carrying out investigations. 4. Analyzing and interpreting data. 5. Using mathematics and computational thinking. 6. Constructing explanations (for science) and designing solutions (for engineering). 7. Engaging in argument from evidence. 8. Obtaining, evaluating, and communicating information |
| Overview:Students will develop a deeper understanding of ecosystem structure and function and causal patterns. With the understanding that human activities can positively and negatively impact ecosystems, students will assess ways to mitigate the negative effects. **FOCUS LANGUAGE GOALS:*** Students will be able to *write an explanation* of how humans can positively or negatively impact an ecosystem overtime
* Students will be able to *organize data and observations* to explain the growth and/or decline in organisms and populations over time.
* Students will be able to *develop a model* to explain how matter and energy cycle within an ecosystem
* Students will be able to give *evidence to support their claims* in final product
* Students will be able to *discuss ideas* with others to plan and *carry out investigations*
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| Understandings* The organisms in an ecosystem are interdependent/interconnected.
* Population growth is limited by access to resources.
* Disruptions to any physical or biological components of an ecosystem can lead to shifts in all its populations.
* Human activity impacts ecosystems they inhabit and indirectly affects all ecosystems globally.
 | Essential QuestionsHow do organisms interact with the environment and each other?Students will continue to consider….* How does energy and matter cycle within an ecosystem?
* How do ecosystems respond to change?
* How does human activity impact ecosystems?
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| **Knowledge:** **Content:*****Students will know…**** trophic levels within an ecosystem
* factors such as birth, death, and migration impact the population size of a species
* competitive, predatory, parasitic, and mutually beneficial relationships
* the difference between abiotic and biotic factors
* nutrient cycling through photosynthesis, cellular respiration, and decomposition
* food webs and food chains

**Language:**Students will become familiar with a variety of different text types in the four skills (reading, writing, listening and speaking) for such purposes as:* Describing relationships that exist within ecosystems
* Classifying the different components of the matter and energy cycling
* Cause and effect of population change overtime

Vocabulary: [(see definition of CCSS tiered vocabulary)](https://drive.google.com/open?id=0B1oO5U3iU008Q1ZGaEpFeFpLVnc)

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| **Tier 1** | **Tier 3** |
| EcosystemPredatorPreyOrganismSpeciesHabitatProducerConsumerHerbivoreCarnivoreOmnivoreFood chainFood webDecomposer**Tier 2**CommunityPopulationEcosystemMatterBirth rateDeath rateImmigrationEmigrationdecomposition | Limiting factorCarrying capacityCompetitionMutualismSymbiosisParasitismCommenulasimPhotosynthesisRespirationAbiotic factorBiotic factorAtomMoleculeNicheNitrogen fixationbiodiversity |

 | **Skills**: **Content:*****Students will be skilled at…*** * collecting, graphing, and analyzing data on population changes in an ecosystem
* analyzing and developing a model of a food web that shows the flow of energy and cycling of matter through an ecosystem and how it conserved
* synthesizing information and predicting the outcome to explain overall impact of a disruption

**Language:*** I can develop a model to show how a food web that shows the flow of energy and cycling of matter through an ecosystem and how it conserved
* I can identify and analyze evidence that supports that populations within communities have changed over time and communicate my findings using technical language
* I can argue with evidence to explain how a disruption impacts an ecosystem
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| Stage 2: Assessments |
| Assessments administered in this unitAssessments administered in this unit* Traditional computer based or paper and pencil teacher generated assessment
* Common district assessment questions (pending)
* Common district Pearson Quick Lab: Pearson Quick Lab: [Technology and the Environment](https://drive.google.com/drive/folders/1NTCdBDrJA_IYeHhebOoJQ729cEV4TW1m) (link to folder in Middle School Science Team Drive)
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| Stage 3: Learning Plan |
| Summary of Key Learning Events and Instructions:**NGSS created a unit that addresses the LS2, ESS3, and the ETS standards called “*Ecosystem Disruptions*”**This middle school unit was designed to support the middle school NGSS related to Ecosystems: Interactions, Energy, and Dynamics integrated with elements of related Earth science NGSS (Human Impact). The unit includes five chapters, each focused on a specific phenomenon related to ecosystem disruption, including questions around the reintroduction of wolves into Yellowstone and the invasion of zebra mussels in the Great Lakes and the Hudson River.The unit can download from NGSS.org at [Middle School: Disruptions in Ecosystems](https://www.nextgenscience.org/resources/middle-school-disruptions-ecosystems)**OR****Overview of ecosystem abiotic and biotic factors (7.MS-LS2-1)**Discuss a familiar local environment. Have students share their ideas aboutthe living and non-living parts of the environment and any interactions that they may haveobserved or be aware of.Possible Helpful Resources for lesson:* + - * Pearson Textbook: Ch 8: Lessons 1-2

**Transfer of Energy & Cycling of matter** **(7.MS-LS2-3)**Possible Helpful Resources for lesson:* Highlight Vocab - Producer, Consumer, Decomposer, Herbivores, Carnivores, Omnivores, and Decomposers

Suggestions:* + Energy Flow
		- * Pearson Textbook: Ch 9: Lessons 1-3
			* <https://www.sascurriculumpathways.com/portal/Launch?id=1278> This link is a 5 minute video that depicts “energy flow through an ecosystem”. It contains important vocabulary and good graphics: (trophic levels, food chain/webs, respiration) and has a quiz to follow. (MS-LS2-7)
	+ Photosynthesis Lab- Suggest using this lab, using aquatic plants and bromothymol blue to show carbon dioxide consumption (MS-LS2-3):
		- * [NSTA Photosynthesis Lab](http://serc.carleton.edu/sp/mnstep/activities/35653.html)
			* OpenSciEd activities (Cameron)
	+ Cycling of Matter-Water cycle interactives:
		- * Pearson Textbook: Ch 9: Ecosystems and Biomes, Lesson 2
			* <http://techalive.mtu.edu/meec/module01/title.htm>
			* <https://water.usgs.gov/edu/watercycle-kids-int.html>

**Use engaging lessons and activities with students to highlight that organisms in an ecosystem are interdependent and interconnected and that populations are stabilised by limiting factors unless disruptions occur.** **(7.MS-LS2-1, 7.MS-LS2-2, 7.MS-LS2-4)*** Food Webs **(7.MS-LS2-2) (7.MS-LS2-3)**
	+ Pearson Textbook: Chapter 8, Lesson 3 (7.MS-LS2-2)
	+ Pearson Textbook: Chapter 9, Lessons 1-3 (7.MS-LS2-3)
	+ Highlight Vocab - Primary, Secondary, & Tertiary Consumers
	+ Develop food chains. Suggestion is for an environment relevant to the school setting
	+ Use food chains to develop food webs for specific ecosystems
	+ Have discussions/debates surrounding the roles that different types of consumers have in the ecosystem
	+ Have students identify the impact on a food web if one component was removed.

Possible Helpful Resources for lesson:* + - <http://ed.ted.com/lessons/dead-stuff-the-secret-ingredient-in-our-food-chain-john-c-moore>
		- [Trophic cascade](https://ed.ted.com/lessons/from-the-top-of-the-food-chain-down-rewilding-our-world-george-monbiot#review)
		- <http://ecomuve.gse.harvard.edu/foodweb/>
* Relationships between organisms **(7.MS-LS2-2)**
	+ Pearson Textbook: Chapter 8, Lesson 3
	+ Highlight Vocab - Predatory, competitive, mutualistic, and parasitic relationships
	+ Identify different relationships between organisms in various ecosystems (i.e. predatory, competitive, mutualistic, and parasitic)
	+ Compare and contrast different types of relationships and how they impact the organisms involved
	+ Have students identify examples of these types of relationships across various ecosystems

Possible Helpful Resources for lesson:* + - <http://ed.ted.com/lessons/the-threat-of-invasive-species-jennifer-klos>
		- [Ecology Simulation](http://www.learner.org/courses/envsci/interactives/ecology/ecology.html)
* Population Changes & Disruptions **(7.MS-LS2-1) (7.MS-LS2-4)**
	+ Pearson Textbook: Chapter 8, Lesson 1 and 2 (7.MS-LS2-1)
	+ Pearson Textbook: Chapter 10, Lesson 1 -3(7.MS-LS2-4)
	+ Draw basic connections between ecosystems and
	+ Graphing and analyzing population data
	+ Positive and negative population changes due to human and natural disruptions

Possible Helpful Resources for Lesson:* [Concord Consortium: African Lions Modeling](https://learn.concord.org/resources/102/african-lions-modeling-populations)
* [**Wolf Reintroduction Changes River (Yellow Stone)**](http://www.yellowstonepark.com/wolf-reintroduction-changes-ecosystem/)
* [**http://ed.ted.com/lessons/the-threat-of-invasive-species-jennifer-klos**](http://ed.ted.com/lessons/the-threat-of-invasive-species-jennifer-klos)
* [**Population Growth and CO2 Emissions**](https://www.oercommons.org/courses/population-growth-and-co2-emissions)
* [World to Lose Two-Thirds of Wild Animals by 2020?](http://news.nationalgeographic.com/2016/10/living-planet-index-world-lose-two-thirds-animals-2020-conservation-science/)
* [The Basics of Population Dynamics](http://www.clemson.edu/extension/natural_resources/wildlife/publications/fs29_population_dynamics.html)
* [Graphing and Predicting Animal Population](http://www.nature.com/scitable/knowledge/library/an-introduction-to-population-growth-84225544)
* [Ecological Succession simulator](https://www.texasgateway.org/resource/ecological-succession)
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| Instructional Notes:**Sociocultural implications*** The tier 2 vocabulary words in this unit can be misleading and cause confusion with many students. Pre-teaching or calling attention to these words and how they may be used in everyday language vs. science class may be helpful
* Utilize the diverse community of students within the classroom to share experiences and different interactions with ecosystems from home country.

**Connections to Prior Knowledge** (Source: MA STE 2016 Frameworks, [Appendix III Disciplinary Core Idea Progression Matrix](http://www.doe.mass.edu/frameworks/scitech/2016-04/AppendixIII.pdf))**Connections to Future Knowledge*** Organisms are constantly breaking down and reorganizing matter.
* Ecosystems have carrying capacities resulting from biotic and abiotic factors.
* Photosynthesis captures energy in sunlight and stores it in chemical bonds of matter. Most organisms rely on cellular respiration to release energy in these bonds to power life processes.
* Photosynthesis, cellular respiration and decomposition are key components of the global carbon cycle.
* The ability of an ecosystem to both resist and recover from change is a measure of its overall health.

**Common Misconceptions*** Article on[Common Misconceptions about Biomes and Ecosystems](http://beyondpenguins.ehe.osu.edu/issue/tundra-life-in-the-polar-extremes/common-misconceptions-about-biomes-and-ecosystems)

**Instructional Strategies*** Actively monitor for understanding of ecosystem dynamics and disruption concepts.
* Utilize frequent check-ins/checkpoints with students to encourage good documentation in the notebook/notes. Students should be using specific content vocabulary and technical writing
* Support students in checking and refining their writing of their process. Actively encourage revision of their writing so that they develop a clear technical description of their process.
* Consider peer review. Other students should be able to read their process and be able to follow it. Not every student will have the same process as it depends on how they go about their design and testing.
* Allow students may make minor adjustments and/or retest their designs
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| Resources:**Texts:*** Pearson Textbook

**Websites:*** Next Generation Science Standards: [Middle School: Disruptions in Ecosystems](https://www.nextgenscience.org/resources/middle-school-disruptions-ecosystems)
* CDSM Curriculum Documents : [CDSM G7 U6](https://docs.google.com/document/d/1yBUzEZUe9h30q_P96yLWps_2Z2q37asTAAoEiaf5BzA/edit?usp=sharing) Ecosystems

**Anchoring Phenomenon:*** [**Wolf Reintroduction Changes River (Yellow Stone)**](http://www.yellowstonepark.com/wolf-reintroduction-changes-ecosystem/)
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