Grade 6

STEM Learning Garden Unit: Soil

Massachusetts State Standards:

MS-LS2-3. Develop a model to describe the cycling of matter among living and nonliving parts of an ecosystem including through the process of photosynthesis and cellular respiration.

MS-LS2-7(MA). Construct a model of a food web to explain that energy is transferred among producers, primary, secondary, and tertiary consumers, and decomposers as they interact within an ecosystem

MS-LS2-5. Evaluate competing design solutions for protecting an ecosystem. Discuss benefits and limitations of each design.

Essential Questions: Why is soil quality so important?

Performance Expectation: *(What will the students know and be able to do after this unit? Matching the student task or question directly with the practices.)* The students will be able to analyze the soil in the garden to determine if it is suitable for growing. They will be able to identify the types of soil and the ratio of each in a sample. Students will create a compost bin and describe the way it breaks down matter into soil.

Science and Engineering Practices

Constructing Explanations and Designing Solutions

- Use evidence (e.g., measurements, observations, patterns) to support an explanation.

Developing and Using Models

- Develop and use a model to describe phenomena.

Standards for Mathematical Practices

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for an express regularity in repeated reasoning.

Focused Disciplinary Core Ideas

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems

- Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem.
- **Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.**

Related Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.
- Growth of organisms and population increases are limited by access to resources.
- Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.
- **LS2.C: Ecosystem Dynamics, Functioning, and Resilience**
- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.
- Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems.

	●The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. ●**LS4.D: Biodiversity and Humans** ●Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.) ●**ETS1.B: Developing Possible Solutions** ● There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.
Resources: ***Resources:*** ***Teacher: Lesson Examples:*** **http://www.doctordirt.org/teachingresources/soilfilter** **Activity - Soil layers (different horizons)** **http://www.layers-of-learning.com/soil-horizons/** **Students can take samples from the school garden to study soil layers** **http://www.cleanair.pima.gov/more/FourLayersSoil.html** **Think Garden: Soil Composition (PBS Online)** http://www.pbslearningmedia.org/resource/thnkgard.sci.ess.soilcomp/think-garden-soil-composition/ ***Online Video*** There is more to it than just dirt! https://www.brainpop.com/science/earthsystem/soil/ ***Informational Articles (NEWSELA leveled) PDF format*** Salty Soil (880L, 1100L and 1150) ***Compost Bin*** http://www.cvswmd.org/uploads/6/1/2/6/6126179/do_the_rot_thing_cvswmd1.pdf	**Math Standards** **6.RP: Understand ratio concepts and use ratio reasoning to solve problems..** **6.G Solve real-world and mathematical problems involving area, surface area, and volume.** **ELA Standards** **RST: 3** Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks **WHST: 7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration** **8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. .**
Discussion Questions: ● What are *macronutrients* and *micronutrients*? ● How do nutrients end up in the soil? ● How is the food web related to nutrients in the soil? ● Why are decomposers essential to the process of creating nutrients in the soil? ● What can happen to plants if you have too much of a certain nutrient in the soil? **Assessment:** ● Scientific Notebooks ● Soil analysis model identifying layers ● Data collected from soil testing **Group Project** ● Group Project Rubric ● Compost bin and recycling project	**Careers:** ● **UMASS: https://www.umassulearn.net/programs/summer/soil-science-certificate** ● **http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054277** ● **http://learn.org/articles/What_is_a_Soil_Engineer.html**