SMCOE Green Career Awareness
AGRISCIENCE

Solutionary Phase	Problem Cycle 1
Lesson # and title	Lesson 5: Farming Impacts on Biodiversity and Soil Health
Duration	45 minutes

Lesson Overview
In this lesson, students will begin to explore how conventional farming practices have reduced biodiversity and diminished soil health.
Learning Objectives
● Students will understand how conventional farming practices have impacted genetic diversity, species diversity, and ecosystem diversity. ● Students will learn about how spraying soil with chemicals kills off the biodiversity in soil.
Content Standard(s)
CA NGSS *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. (MS-LS2-4)* ● *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. (MS-LS2-5)*

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. (secondary to MS-LS2-5)*

CTE Agriculture

G7.1 *Plan how to effectively manage and conserve soil through conventional, minimum, conservation, and no-tillage irrigation and through drainage and tillage practices.*

College and Career Connection(s)

This lesson ties the concepts of how growers (farmers) have a direct effect on soil health through farm management. This shows students that there can be careers in both horticulture/farming and agronomy (soil science).

Equipment, Instructional Resources, and Materials

- Lesson 5 - Farming Impacts on Biodiversity and Soil Health
- Plant nutrients cards
- Nutrients in Soil Scale.docx

Suggested Student Grouping

Whole group for lecture/discussion
Small groups (~2-3) for Crop Cards Activity

Vocabulary

- Agriculture - The practice of growing plants for food, clothing, animal feed, and other resources humans need or desire. It also includes raising domesticated animals (livestock).
- Atmosphere - A thick layer of air that surrounds the Earth, supports life on Earth, and protects living things from the sun's harmful radiation.

- Biodiversity - Biological diversity is the variety of life in an area. Examples include the variety of individuals in a species, the variety of species in an ecosystem, and the variety of biomes or species on earth.
- Carbon - An element that is in all living things (e.g., humans, animals, and plants) and many nonliving things (i.e., rocks, soil, water, and our air/atmosphere). Atmospheric carbon is often attached to oxygen in the form of carbon dioxide.
- Carbon footprint - The amount of carbon dioxide and other greenhouse gases that a person or group of people puts into the atmosphere from their use of fossil fuels.
- Carbon sequestration - The process of capturing and storing carbon dioxide and other forms of carbon from the atmosphere. The natural process of sequestration stores carbon in soil and bodies of water. The human-designed processes using technology to capture and store carbon.
- Carbon release - The process of carbon being released from the soil. This happens naturally as soil organisms breathe (respire), and can be sped up through human activities such as tilling or plowing.
- Climate change - The global long-term change in temperature and weather patterns due to increases in atmospheric carbon dioxide, mostly due to use of fossil fuels.
- Conventional/degenerative agriculture - Industrial practices of farming which include large single-crop farms, intensive tilling and irrigation, and the use of synthetic fertilizers, pesticides, and herbicides. This way of farming is very productive, but requires high amounts of energy, adds toxins to the soil, and increases carbon release from the soil rather than carbon sequestration (capture).
- Decomposer - Any organism that breaks down dead or decaying organic matter such as dead animals, fallen trees, or leaf litter.
- Ecosystem - A place where all the living things (plants, animals, microorganisms) interact with each other and with nonliving parts of their environment (water, sun, temperature, rocks and soil).
- Erosion - When rocks, soil, or other landforms are gradually worn down by ice, water, or wind.
- Fertilizers - Any substance, natural or man-made, added to soil to increase the level of nutrients it contains and speed up plant growth.
- Greenhouse effect - The natural process of the Earth's atmosphere trapping heat from the sun. Human use of fossil fuels has increased the amount of carbon in the atmosphere, leading to more of the sun's heat being trapped (global warming).
- Herbicides - Chemicals used to kill unwanted plants. Also known as weedkillers
- Microorganism - A living thing such as bacteria or fungi that is too small to be seen without the use of a microscope or other magnification.
- Macro-organism - A living thing that can be seen by the naked eye.
- Monoculture - The practice of growing or producing only one crop, species, or animal in the same place at the same time.
- Pesticides - Chemicals used to kill unwanted organisms such as insects, rodents, plants, or fungi.
- Photosynthesis - The process by which plants use the sun's energy to create carbon-based sugars from carbon dioxide and water.
- Polyculture - The practice of growing or producing multiple crops, species, or animals in the same place at the same time.
- Regenerative agriculture - Farming and grazing practices that focus on restoring soil health and biodiversity, and

sequestering (capturing) carbon in the soil.
- Soil - The material on the surface of the Earth in which plants grow. It is a mixture of eroded rocks, minerals, and organic matter. It holds water and air, provides nutrients and structural support to plants, and supports a diverse ecosystem of living micro- and macro-organisms.

The Lesson

Preparation

1. Have slides ready
2. Cue up the Kiss the Ground Video to 8:11
    a. Password: school
3. Print and cut out the Plant nutrients cards (one set for each group)
4. Print Nutrients in Soil Scale.docx for each group

Lesson Procedure

Link to Lesson Slide Deck: Lesson 5 - Farming Impacts on Biodiversity and Soil Health

Activity/Task	Description	Time (min)
Warm-up	Discuss the prompt Farming affects the soil. What tools and farming techniques do you see being used in the farms around here?	5
Lecture/Discussion	• Remind students of the 3 types of biodiversity. Have them brainstorm ways they think farming might impact these types of biodiversity. • Let students know that they will be exploring a few examples of how humans have impacted biodiversity through agriculture. • Have students look at the two images of a banana on slide 4 and discuss which	15

	banana they would prefer eating and why. Discuss the information on the slide and have students try to think of examples they may have heard of. ○ Extension: If students have limited background knowledge in Selective Breeding, Cloning, and GMO, this lesson can be extended to provide more information and/or research about these methods of controlling genetics. ● Show the students “The End of Bananas?” Have them discuss the impacts of using cloning with bananas. Discuss why having less genetic biodiversity is harmful for a species. ● Have the students look at the image on slide 6 and discuss the prompts.	
Crop Cards Activity	● Break the students into groups of 2-3. ● Pass out the crop cards and the scales. ● Have the students read the information on the crop cards and place them on the scale for how well the plants replenish nutrients or deplete nutrients. ● Debrief as a class.	10
Lecture/Discussion	● Describe what a monoculture is. ● Discuss the prompts on slide 9. ● Tell students about the impacts of a monoculture on animals. ● Have students look at the image on slide 11 and discuss what they notice/wonder. ● Review the information and graphics on slide 12. ○ Extension, have students read the full article.	5
Video	Have the students watch the Kiss the Ground video from 8:11-9:26. Have the students discuss what they noticed and wondered in the video.	5
MudWatt/Plant Growth	Have the students check on the progress of the MudWatts they set up in lesson 1 and the seeds they planted in lesson 2.	5-10