Unit 5 Sustaining Agriculture

Content Area: **Science**
Course(s): **AP Environmental Science**
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Enduring Understandings

ERT-4 Earth's systems interact, resulting in a state of balance over time.

EIN-2 When humans use natural resources, they alter natural systems

STB-1 Humans can mitigate their impact on land and water resources through sustainable use.

Essential Questions

- How does your use of natural resources impact the world?
- Why are sustainable practices difficult to implement?

Standards

ERT-4.B.1 Soils are formed when parent material is weathered, transported, and deposited.

ERT-4.B.2 Soils are generally categorized by horizons based on their composition and organic material.

ERT-4.B.3 Soils can be eroded by winds or water. Protecting soils can protect water quality as soils effectively filter and clean water that moves through them.

ERT-4.C.1 Water holding capacity—the total amount of water soil can hold—varies with different soil types. Water retention contributes to land productivity and fertility of soils.

ERT-4.C.2 The particle size and composition of each soil horizon can affect the porosity, permeability, and fertility of the soil.

ERT-4.C.3 There are a variety of methods to test the chemical, physical, and biological properties of soil that can aid in a variety of decisions, such as irrigation and fertilizer requirements.

ERT-4.C.4 A soil texture triangle is a diagram that allows for the identification and comparison of soil types based on their percentage of clay, silt, and sand.

EIN-2.C.1 The Green Revolution started a shift to new agricultural strategies and practices in order to increase food production, with both positive and negative results. Some of these strategies and methods are mechanization, genetically modified organisms (GMOs), fertilization, irrigation, and the use of pesticides.

EIN-2.C.2 Mechanization of farming can increase profits and efficiency for farms. It can also increase reliance

on fossil fuels.

LOR-2.D.1 Agricultural practices that can cause environmental damage include tilling, slashand-burn farming, and the use of fertilizers.

EIN-2.E.1 The largest human use of freshwater is for irrigation (70%). EIN-2.E.2 Types of irrigation include drip irrigation, flood irrigation, furrow irrigation, drip irrigation, and spray irrigation.

EIN-2.F.1 Waterlogging occurs when too much water is left to sit in the soil, which raises the water table of groundwater and inhibits plants' ability to absorb oxygen through their roots.

EIN-2.F.2 Furrow irrigation involves cutting furrows between crop rows and filling them with water. This system is inexpensive, but about 1/3 of the water is lost to evaporation and runoff.

EIN-2.F.3 Flood irrigation involves flooding an agricultural field with water. This system sees about 20% of the water lost to evaporation and runoff. This can also lead to waterlogging of the soil.

EIN-2.F.4 Spray irrigation involves pumping ground water into spray nozzles across an agricultural field. This system is more efficient than flood and furrow irrigation, with only 1/4 or less of the water lost to evaporation or runoff. However, spray systems are more expensive than flood and furrow irrigation, and also requires energy to run.

EIN-2.F.5 Drip irrigation uses perforated hoses to release small amounts of water to plant roots. This system is the most efficient, with only about 5% of water lost to evaporation and runoff. However, this system is expensive and so is not often used.

EIN-2.F.6 Salinization occurs when the salts in groundwater remain in the soil after the water evaporates. Over time, salinization can make soil toxic to plants.

EIN-2.F.7 Aquifers can be severely depleted if overused for agricultural irrigation, as has happened to the Ogallala Aquifer in the central United States.

EIN-2.G.1 One consequence of using common pest-control methods such as pesticides, herbicides, fungicides, rodenticides, and insecticides is that organisms can become resistant to them through artificial selection. Pest control decreases crop damage by pest and increases crop yields.

EIN-2.G.2 Crops can be genetically engineered to increase their resistance to pests and diseases. However, using genetically engineered crops in planting or other ways can lead to loss of genetic diversity of that particular crop.

EIN-2.H.1 Methods of meat production include concentrated animal feeding operations (CAFOs), also called feedlots, and free-range grazing.

EIN-2.I.1 Meat production is less efficient than agriculture; it takes approximately 20 times more land to produce the same amount of calories from meat as from plants.

EIN-2.1.2 Concentrated animal feeding operation (CAFOs) are used as a way to quickly get livestock ready for slaughter. They tend to be crowded, and animals are fed grains or feed that are not as suitable as grass. Additionally, feedlots generate a large amount of organic waste, which can contaminate ground and surface water. The use of feedlots are less expensive than other methods, which can keep costs to consumers down.

EIN-2.1.3 Free range grazing allows animals to graze on grass during their entire lifecycle. Meat from free range animals tends to be free from antibiotics and other chemicals used in feedlots. Organic waste from these animals acts as fertilizer. Free range grazing requires large areas of land and the meat produced is more

expensive for consumers.

EIN-2.I.4 Overgrazing occurs when too many animals feed on a particular area of land. Overgrazing causes loss of vegetation, which leads to soil erosion.

EIN-2.I.5 Overgrazing can cause desertification. Desertification is the degradation of low precipitation regions toward being increasingly arid until they become deserts.

EIN-2.I.6 Less consumption of meat could reduce CO2, methane, and N2O emissions; conserve water; reduce the use of antibiotics and growth hormones; and improve topsoil.

STB-1.C.1 Integrated pest management (IPM) is a combination of methods used to effectively control pest species while minimizing the disruption to the environment. These methods include biological, physical, and limited chemical methods such as biocontrol, intercropping, crop rotation, and natural predators of the pests.

STB-1.D.1 The use of integrated pest management (IPM) reduces the risk that pesticides pose to wildlife, water supplies, and human health.

STB-1.D.2 Integrated pest management (IPM) minimizes disruptions to the environment and threats to human health but can be complex and expensive.

STB-1.E.1 The goal of soil conservation is to prevent soil erosion. Different methods of soil conservation include contour plowing, windbreaks, perennial crops, terracing, no-till agriculture, and strip cropping.

STB-1.E.2 Strategies to improve soil fertility include crop rotation and the addition of green manure and limestone.

STB-1.E.3 Rotational grazing is the regular rotation of livestock between different pastures in order to avoid overgrazing in a particular area.

STB-1.F.1 Aquaculture has expanded because it is highly efficient, requires only small areas of water, and requires little fuel.

STB-1.F.2 Aquaculture can contaminate wastewater, and fish that escape may compete or breed with wild fish. The density of fish in aquaculture can lead to increases in disease incidences, which can be transmitted to wild fish.

Content

Vocabulary:
Industrialized Agriculture
Traditional Subsistence Agriculture
Green Revolution
Interplanting
Malnutrition
Malnourished
Overnutrition
Fishery
Overfishing
Commercial Extinction

Aquaculture
Fish Farming
Fish Ranching
Sustainable Agriculture
Pesticides
Pesticide Treadmill
Integrated Pest Management

Resources

College Board AP Central : https://apcentral.collegeboard.org/courses/ap-environmental-science/course

College Board AP Environmental Science Course & Exam Description Manual https://apstudents.collegeboard.org/sites/default/files/2019-05/ap-environmental-science-course-and-exam-description.pdf

College Board AP Environmental Science "AP Classroom" https://apcentral.collegeboard.org/about-ap/news-changes/ap-2019?course=ap-environmental-science

AP Environmental Science Classroom Resources https://apcentral.collegeboard.org/courses/ap-environmental-science/classroom-resources

Khan Academy (Please look in AP Biology & Chemistry/Physics for all APES topics) https://www.khanacademy.org/science

Bozeman Science AP Environmental Science videos http://www.bozemanscience.com/ap-environmental-science