05 Land and Water Use

Content Area: **Science**
Course(s): **AP Environment**
Time Period: **Semester 1**
Length: **2 weeks**
Status: **Published**

Standards

CCC.2	Cause and effect: Mechanism and explanation.
CCC.6	Structure and function.
CCC.7	Stability and change.
SEP.3	Planning and Carrying Out Investigations
SEP.4	Analyzing and Interpreting Data
SEP.6	Constructing Explanations and Designing Solutions
SCI.HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
SCI.HS-ESS3-3	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
SCI.HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
SCI.HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Essential Questions

How does the use of natural resources on our planet impact the environment?

Enduring Understandings

When humans use natural resources, they alter natural systems.

Human survival depends on developing practices that will achieve sustainable systems.

Humans depend on all of the planet's systems for a variety of resources, some of which are renewable or replaceable and some which are not.

A suitable combination of conservation and development is required to achieve sustainable systems.

Management of common resources is essential.

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

Knowledge and Skills

Unit 5

5.1 The Tragedy of the Commons

Knowledge

- The tragedy of the commons suggests that individuals will use shared resources in their own self-interest rather than in keeping with the common good, thereby depleting the resources.

Skills

- Explain environmental concepts and processes.

5.2 Clearcutting

Knowledge

- Clearcutting can be economically advantageous but leads to soil erosion, increased soil and stream temperatures, and flooding.
- Forests contain trees that absorb pollutants and store carbon dioxide. The cutting and burning of trees releases carbon dioxide and contributes to climate change.

Skills

- Describe environmental concepts and processes

5.3 The Green Revolution

Knowledge

- 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.
- Mechanization of farming can increase profits and efficiency for farms. It can also increase reliance on fossil fuels.

Skills

- Describe the author’s perspective and assumptions.

5.4 Impacts of Agricultural Practices

Knowledge

- Agricultural practices that can cause environmental damage include tilling, slash and-burn farming, and the use of fertilizers

Skills

- Describe environmental concepts and processes.

5.5 Irrigation Methods

Knowledge

- The largest human use of freshwater is for irrigation (70%).
- Types of irrigation include drip irrigation, flood irrigation, furrow irrigation, drip irrigation, and spray irrigation.
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- Types of irrigation include drip irrigation, flood irrigation, furrow irrigation, drip irrigation, and spray irrigation.
- 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.
- 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.
- Salinization occurs when the salts in groundwater remain in the soil after the water evaporates. Over time, salinization can make soil toxic to plants.
- Aquifers can be severely depleted if overused for agricultural irrigation, as has happened to the Ogallala Aquifer in the central United States.

Skills

- Describe disadvantages, advantages, or unintended consequences for potential solutions

5.6 Pest Control Methods

Knowledge

- 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.
- 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

Skills

- Make a claim that proposes a solution to an environmental problem in an applied context

5.7 Meat Production Methods

Knowledge

- Methods of meat production include concentrated animal feeding operations (CAFOs), also called feedlots, and free-range grazing.
- 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.
- 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.
- 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.
- Overgrazing occurs when too many animals feed on a particular area of land. Overgrazing causes loss of vegetation, which leads to soil erosion.
- Overgrazing can cause desertification. Desertification is the degradation of low precipitation regions toward being increasingly arid until they become deserts.
- Less consumption of meat could reduce CO_2, methane, and N_2O emissions; conserve water; reduce the use of antibiotics and growth hormones; and improve topsoil.

Skills

- Explain what the data implies or illustrates about environmental issues.

5.8 Impacts of Overfishing

Knowledge

- Overfishing has led to the extreme scarcity of some fish species, which can lessen biodiversity in aquatic systems and harm people who depend on fishing for food and commerce

Skills

- Describe potential responses or approaches to environmental problems

5.9 Impacts of Mining

Knowledge

- As the more accessible ores are mined to depletion, mining operations are forced to access lower grade ores. Accessing these ores requires increased use of resources that can cause increased waste and pollution.
- Surface mining is the removal of large portions of soil and rock, called overburden, in order to access the ore underneath. An example is strip mining, which removes the vegetation from an area, making the area more susceptible to erosion.
- Mining wastes include the soil and rocks that are moved to gain access to the ore and the waste, called slag and tailings that remain when the minerals have been removed from the ore. Mining helps to provide low cost energy and material necessary to make products. The mining of coal can destroy habitats, contaminate ground water, and release dust particles and methane.
- As coal reserves get smaller, due to a lack of easily accessible reserves, it becomes necessary to access coal through subsurface mining, which is very expensive.

Skills

- Make a claim that proposes a solution to an environmental problem in an applied context.

5.10 Impacts of Urbanization

Knowledge

- Urbanization can lead to depletion of resources and saltwater intrusion in the hydrologic cycle.
- Urbanization, through the burning of fossil fuels and landfills, affects the carbon cycle by increasing the amount of carbon dioxide in the atmosphere.
- Impervious surfaces are human-made structures—such as roads, buildings, sidewalks, and parking lots—that do not allow water to reach the soil, leading to flooding.
- Urban sprawl is the change in population distribution from high population density areas to low density suburbs that spread into rural lands, l

Skills

- Describe disadvantages, advantages, or unintended consequences for potential solutions.

5.11 Ecological Footprints

Knowledge

- Ecological footprints compare resource demands and waste production required for an individual or a society

Skills

- Explain what the data implies or illustrates about environmental issues.

5.12 Introduction to Sustainability

Knowledge

- Sustainability refers to humans living on Earth and their use of resources without depletion of the resources for future generations. Environmental indicators that can guide humans to sustainability include biological diversity, food production, average global surface temperatures and CO2 concentrations, human population, and resource depletion.
- Sustainable yield is the amount of a renewable resource that can be taken without reducing the available supply.

Skills

- Explain what the data implies or illustrates about environmental issues.

5.13 Methods to Reduce Urban Runoff

Knowledge

- Methods to increase water infiltration include replacing traditional pavement with permeable pavement, planting trees, increased use of public transportation, and building up, not out.

Skills

- Identify a research method, design, and/or measure used

5.14 Integrated Pest Management

Knowledge

- 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.
- The use of integrated pest management (IPM) reduces the risk that pesticides pose to wildlife, water supplies, and human health.
- Integrated pest management (IPM) minimizes disruptions to the environment and threats to human

health but can be complex and expensive.

Skills

- Use data and evidence to support a potential solution.

5.15 Sustainable Agriculture

Knowledge

- 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.
- Strategies to improve soil fertility include crop rotation and the addition of green manure and limestone.
- Rotational grazing is the regular rotation of livestock between different pastures in order to avoid overgrazing in a particular area.

Skills

- Make a claim that proposes a solution to an environmental problem in an applied context.

5.16 Aquaculture

Knowledge

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

Skills

- Describe disadvantages, advantages, or unintended consequences for potential solutions.

5.17 Sustainable Forestry

Knowledge

- Some of the methods for mitigating deforestation include reforestation, using and buying wood harvested by ecologically sustainable forestry techniques, and reusing wood.
- Methods to protect forests from pathogens and insects include integrated pest management (IPM) and the removal of affected trees.
- Prescribed burn is a method by which forests are set on fire under controlled conditions in order to

reduce the occurrence of natural fires

Skills

- Justify a proposed solution, by explaining potential advantages.

Make connections to other units by considering:

Earth's systems interact, resulting in a state of balance over time. Most of the Earth's atmosphere and its characteristics are due to energy from the sun.

Key vocabulary you need to know

Plate tectonics

Albedo

Troposphere

Stratosphere

Mesosphere

Tsunami

Plate boundary

Transform fault

Boundaries: convergent and divergent

Volcano

Atmosphere

El Nino/ ENSO

La Nina

Thermosphere

Exosphere

Trade Winds

Coriolis Effect

Gyre

Soil

Leaching

Weathering

Soil Horizons: O, A,E, B, C, Bedrock

Permeability

Porosity

Rain Shadow

Headwaters

Ocean Current

Ocean Conveyor Belt

Climate

Weather

Earthquake

Soil texture: sand, silt, clay

Salinization

Desertification

Desiccation

Conservation Reserve Program

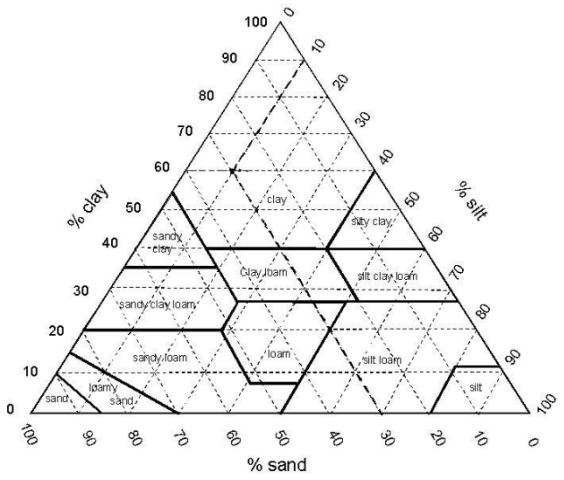
Watershed

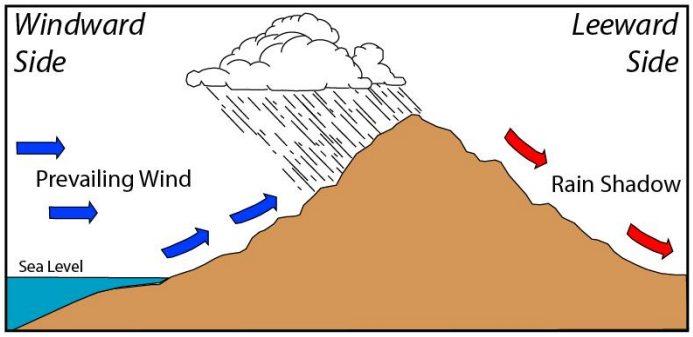
Solar Radiation/ Solar Insolation

Tributary

Floodplain

Figures/ Equations to know





Transfer Goals

Relate human activities to the availability of limited resources like water and soil.

Explain how agricultural practices impact the quality of the environment.

Explain the tragedy of the commons.

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit?usp=sharing

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit?usp=shar

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