Botkin & Keller- ***Earth as a Living Planet:*** 8th Edition
Guided Reading Assignment
Chapter #11- Agriculture, Aquaculture and the Environment
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Case Study: Biofuels and Banana Chips: Food Crops vs. Fuel Crops
1: Why do pig farmers have to feed their pigs *"junk-food"*?
-Because of the agricultural industry's competition vs the bioethanol industry, which leaves less crops for pig food

Agroecosystems:
2: Explain how agroecosystems halt ecological succession.
-Agroecosystems halt succession by focusing on one species of plant and artificial disturbance that keeps plants growing in one stage of succession.
3: What is the problem with growing *"monocultures"*?
-The single entire crop is more vulnerable to attack by a single disease or environmental change
4: *Why* does growing plants in neat rows and fields make it easier for pests?
-Because growing in rows and fields makes access open and easy to access for pests
5: How does plowing fields over and over damage the soils? **Explain**.
-It exposes the soil to erosion and damages its structure, leading to decline in organic matter and a loss of chemical elements
6: What are the other 2 ways that agrocultures are harmful to ecosystems?
-It can reduce soil fertility due to repeated planting of the same species, and it can also waste space and reduce biodiversity in the area used for agroculture

The Plow Puzzle
7: How much of the top soil in the U.S. has been lost since European settlement?
-1/3rd of the topsoil

Can We Feed the World?
8: What percentage of the world's land area is used for agriculture?
-38%

How We Starve
9: What is the difference between *undernourishment and malnourishment*?
-Undernourishment is a lack of calories in ones diet, and malnourishment is a lack of chemical elements in a diet, such as vitamins, proteins, and minerals
10: Why does providing food aid to countries in need actually work against increased availability of locally grown food?
-Farmers can't compete with free food being offered as aid, and agriculture dies out

What We Grow on the Land

11: Most of the world's food is produced by only 14 species. List them below in order of importance:

-Wheat, rice, maize, potatoes, sweet potatoes, manioc, sugarcane, sugar beet, common beans, soybeans, barley, sorghum, coconuts, and bananas

12: What is a *forage* crop?

-Crops grown for use as feed for domestic animals

13: Define the following:

Rangeland: An area of land that provides food for grazing and browsing animals without plowing and planting

Pasture: Plowed, planted and harvested land to provide forage for animals

14: *What impact* does the number of livestock around the world have on rangeland and pasturelands?

-Large numbers of livestock overgraze existing rangelands, which causes more pasture development

15: Why are **feedlots** considered to be a big source of local pollution?

-Feedlots produce substantial amounts of manure which pollute local streams

16: What is a benefit of farming animals rather than crops?

-Land that is too poor for crop growth (but edible) can be excellent rangeland

Soils

17: How does rainwater affect the soil horizon? **Explain.**

-Rainwater affects the soil horizon because it is slightly acidic due to carbon dioxide. When rainwater travels down, nutritionally important elements are leached from the upper horizons to the lower horizons.

18: What is ***soil fertility***? How it is determined?

-The capacity of a soil to supply nutrients necessary for plant growth; determined by location of soil, and environmental factors such as climate and age

19: Why are soils in humid and tropical areas considered to be poor? *What happens to them after deforestation?*

-Due to heavy rainfall; deforestation is often almost irreversible due to reforestation being difficult

20: What is the problem with soils in *semi-arid regions*?

-Soil may shrink when dried and swell when wet, which could crack roads and walls

21: Why are *coarse-grained soils* more susceptible to erosion that soils that contain more clay?

-Course soil has more space separating grains, so water and air can move more easily between grains and erode them. Clay can retain water and retard water movement .

22: **Soil Horizons**: *Define each of the soil horizons*
Horizon O: Mostly organic material such as twigs and leaves; brown/black
Horizon A: Mineral and organic materials; black/brown, leaching occurs and carries earth materials to the B horizon
Horizon E: Light colored materials from leaching, makes up zone of leaching along with A
Horizon B: Enriched with clay, iron oxides, silica, carbonate, etc., zone of accumulation
Horizon C: Altered parent material, rock, stained red gravels
Horizon R: Unweathered parent material

Restoring Our Soils
23: What is the difference between organic and inorganic (artificial) fertilizers?
-Organic fertilizers are derived from animal feces, inorganic fertilizers are mined (phosphorus) and made from nitrogen gas
24: *Define the following:*
Macronutrient: A chemical element required by all living things in relatively large amounts
Micronutrient: A chemical element required in small or moderate amounts by all forms of life
Limiting Factor: A factor that inhibits growth of anything

Controlling Pests
25: In the U.S, how much of the potential harvest is lost to pests?
-1/3rd of potential harvest
26: What is the definition of a *weed*?
-Plants that compete with crops

Pesticides
27: What are the differences between *inorganic and organic pesticides*?
-Organic pesticides are natural substances from organisms used to combat pests, Inorganic pesticides are created in a lab and synthesized
28: What are some of the reasons why pesticides are considered to be ineffective?
-Pesticides often kill other organisms unintentionally as well through air travel
29: Define **Integrated Pest Management (IPM)** AND *explain* HOW it works:
-IPM is a method of controlling pests rather than complete elimination by biological control, pesticides, and crop planting methods. These methods ensure minimal damage to other factors.
30: What is the use of **biological control** and *give an example*:
-Biological control is using one species that is a natural enemy of another; lizards and rodents
31: What was the *"green revolution"*?
-Post WWII programs that have led to the development of new strains of crops with higher yields, better disease resistances, or better ability to grow under poor conditions

Genetically Modified Food: Biotechnology, Farming and Environment

32: What are the *3 practices* of genetic engineering?

-Faster abd more efficient ways to develop new hybrids; introduction of the terminator gene; transfer of genetic properties from widely divergent kinds of life

33: What are the PROS and CONS of developing **hybrid crops**?

-Hybrid crops could perform and grow more efficiently, but people are concerned of the idea of a superhybrid that becomes more of a pest than a benefit

34: What is the **terminator gene** and *what does it do*?

-A gene that makes seeds from a crop sterile

35: What are the political and social concern with companies using seeds with terminator genes?

-It may allow companies and countries to control food industry, and countries won't be able to grow food for their citizens

36: How are ***GMO (Genetically Modified Organisms)*** helpful?

-GMOs may aid human development by providing more nutritional food

37: How can GMO's be *harmful*?

-Could adversely affect nutrition of consumer

Aquaculture

38: What is **aquaculture** and how can it be *helpful*?

-Farming wild aquatic organisms; increases availability of food

39: What is **mariculture**?

-Farming of ocean fish

40: How can aquaculture and mariculture harmful to the environment?

-More fish must be caught to nourish and feed farmed fish than the act of just catching the fish

Critical Thinking Issue: Will There Be Enough Water to Produce Food for a Growing Population?

1: How might *dietary changes* in developed countries affect water availability?

-Dietary changes such as a shift to a more carnivorous diet would require more water to make, which will lower water availability, and vice versa.

2: How might *global warming* affect estimates of the amount of water needed to grow crops in the 21st century?

-Global warming could affect estimates if bodies of water were affected by the change, such as the possibility hat the ice caps could melt and icebergs.

3: Withdrawing water from aquifers faster than the replacement rate is sometimes referred to as *"mining water"*. Why do you think this term is used?

-Because aquifers are drilled in order to acquire water stored in them, but the water is unsustainable, just like minerals that are mined normally.

4: Many countries in warm areas of the world are unable to raise enough food, such as wheat, to supply their populations. Consequently, they import wheat and other grains. *How is this equivalent to importing water?*
-Water is used to grow crops, and the cost of water is a sort of externality that is overlooked by countries that import crops. So really, countries are importing water that was already used for the growing of crops.
5: **Malthusians** are those who believe that sooner or later, unless population growth is checked, there will not be enough food for the world's people. **Anti-Malthusians** believe that technology will save the human race from a Malthusian fate. **Analyze the issue of water supply for agriculture from both points of view.**
-Malthusian: The water supply will constantly be depleted in an exponential rate as long as the population still grows according to growth trends recorded in the last decade. Since water use is already at a startling high, population growth will render most unable to provide for themselves.
Anti-Malthusian: Existing technologies and methods are already surfacing that conserve substantial amounts of water each day, and technology will only get better in the coming years. Countries wil adopt these technologies, and the combined savings may be enough to save the human race from worldwide drought.

Interactive Soil Pyramid- Understand How to Calculate the Soil Composition Type go to:
http://courses.soil.ncsu.edu/resources/physics/texture/soiltexture.swf
Understand and Using Soil Pyramids
go to: http://soils.usda.gov/technical/aids/investigations/texture/
Directions: *Using the Soil Pyramid Program- Identify the Type of Soil with the Following Percent Compositions:*
Sand: 30
Clay: 30
Silt: 40
Answer: Clay Loam

Sand: 45
Clay: 10
Silt: 45
Answer: Loam

Understand Soils in Biomes Around the World
Go to: https://php.radford.edu/~swoodwar/biomes/
Directions: Determine the Type of Soils that are Characteristics of Each Specific of These Terrestrial Biomes and List Why?
Tundra: No true soil due to permafrost and cold
Taiga (Boreal Forest): Spodosol, acidic soil due to pines
Temperate Broadleaf Deciduous: Alfisol, nutrient poor due to broadleaf trees
Mediterranean Scrub: Moist, warm soil due to climate
Temperate Grassland: Very fertile soil due to calcification and mollisols
Scrubland: Dry, salty, nutrient-poor soil due to calcium carbonate near the sruface
Tropical Rainforest: Nutrient poor due to abundance of organisms and plants,
Tropical Savannah: Dry, varies on climate and growth

Control of Soil Erosion- go to: http://www2.kenyon.edu/projects/farmschool/types/tillage.htm
Directions: *Define and describe each of the alternative methods to traditional soil tillage*
Windbreaks: Planting of trees to cut wind erosion
Cover Crops: Plant crops during erosive seasons to protect topsoil
Grassed Waterways: Planting in strips to keep soil away from diverting water erosion
Contour Cultivation: Planting in contours that are perpendicular to the slope of a field
Strip Cropping: Alternating strips of crops
Forages: Planting forage crops to cut down on erosion
Conservation Tillage: Leave crops on fields to protect soil during all seasons
No-Till: Leave all last crop's residue in the soil while planting new crops
Ridge Tillage: Form soil in ridges and plants seeds on ridges to increase soil integrity