CHAPTER 9 FOOD AND HUNGER

Chapter Overview

This chapter explains the significance of hunger in the developing world and food production. Famine that afflicts the developing world results in undernourishment and malnourishment as well as iron deficiency (anemia) and protein deficiency (kwashiorkor). Three crops have been instrumental for nutrition and food supply. Wheat, rice, and maize (corn) are the staples throughout the world. The green revolution and genetically modified organisms (GMOs) are important contributors to food production worldwide.

Topics and Key Concepts

Population

- Relate various malnutrition and undernutrition diseases with the lack of specific nutrients.
- Describe patterns of world hunger.
- Discuss how national policy can affect food resources.
- Explain the green revolution and the increased production of food for the human population.

Land and Water Use

- Cite the nutritional needs of human beings, including needed macro- and micronutrients.
- Relate the production of a transgenic or genetically modified organism.
- Appraise the ethics, politics, and economics of producing GMOs.

Pollution

- Identify key plant and animal food sources.
- Summarize environmental, societal and health impacts associated with production and consumption of meat.

Key Terms

anemia
aquaculture
chronically undernourished
concentrated animal feeding operation (CAFO)
famines
food security
genetically modified organism (GMOs)
green revolution
kwashiorkor
locavore
malnourishment
marasmus
obese

Pacing Guide

Spend 4-5 days on this chapter. Other important concepts on agriculture will be covered in the next chapter. More extensive time should be spent on Chapter 10.

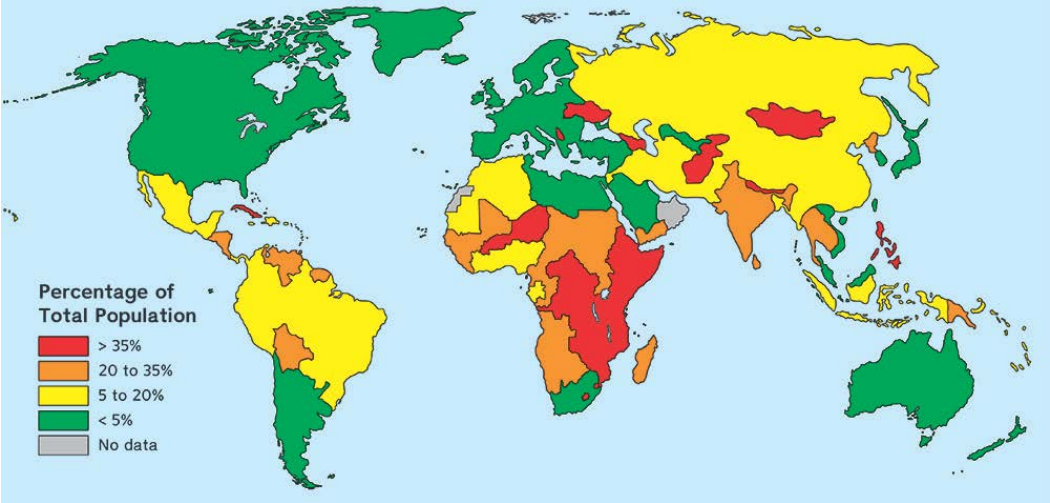
Approach and Tips

The food pyramid has changed recently to reflect a change in the understanding about nutritional requirements. Have students examine their own diets and compare the suggested dietary requirements to their own. There has been much discussion on the Mediterranean diet and its health benefits, as well as a variety of others (South Beach, Asian-inspired, and Californian). Discuss what makes these types of diets "healthier" than others. Conversely, many Native American peoples that have adopted Western diets have seen an increase in diabetes and heart disease. Discuss possible metabolic reasons for the rise in disease.

In order to thrive and survive, people need carbohydrates, lipids, and proteins, as well as vitamins, and trace minerals. Students should know that anemia is an iron deficiency and kwashiorkor is a protein deficiency. Students should also be able to identify scurvy and marasmus. Stress that famines are often triggered by environmental conditions, such as hurricanes, tsunamis, and insect infestation.

Have students differentiate between undernourished and malnourished states. Being malnourished is different from being undernourished. Malnourishment can be the result of poor choices and not just the lack of availability of some food types. Undernourishment is often the result of poverty and is unavoidable. Ask them to explain how malnourishment can affect how well a person is able to perform everyday tasks and operations. Emphasize that malnourishment results from a lack of specific nutrients, and that a person can be malnourished even if their caloric intake remains sufficient. If time permits, have students watch the film *Supersize Me*.

Refer students to Figure 9.3 (p. 180) in the textbook and discuss why sub-Saharan Africa and Southeast Asia are experiencing food shortages and what is being done about the problem.



The majority of people throughout the world depend on three food crops for nourishment, rice, wheat, and maize (corn). Farmers are paid subsidies by the government to grow (or not grow) a particular crop. Subsidies can distort the agricultural market, particularly corn, rice, wheat, and soybeans. Subsidies can make food grown in one area cheaper than it could be grown locally, destroying the local farmers' livelihoods. Students should understand how subsidies affect the price and production of agricultural crops.

Plant breeding has led to plants with higher crop yields and more desirable characteristics. Green revolution plants require optimal conditions for growth and production, as opposed to traditional varieties. Emphasize that genetic engineering manipulates the genes of an organism in a variety of ways and that genetically modified organisms (GMOs) can be developed to be disease resistant, to grow faster, and to be more nutritious. Be sure that students realize that GMOs are controversial. Critics of genetically modified plants argue that they may not be safe and want food products labeled.

Seafood is a key source of protein for humans worldwide. Seafood harvesting needs to be managed to prevent overharvesting and habitat destruction. Fish production can be increased through aquaculture, though there are environmental drawbacks to aquaculture facilities. On land, concentrated animal feeding operations (CAFOs) have increased protein production. CAFOs lead to high population densities of livestock, which increases issues with waste production and disease. Students can extrapolate this effect if they think about the wastes their own pet produces in a given amount of time. Cat owners are especially aware of the effects of increasing wastes in a finite amount of space. Have students report on their observations.

Common Mistakes and Misconceptions

Quite often students don't realize the magnitude of hunger throughout the world. Also, the students don't differentiate between malnourishment and famine. Stress the meaning and implications of subsidies. This is another area where students are unclear. Students who live in urban areas may struggle with the concept of food production. There are numerous videos available to show crop harvest and mechanized farming.

Activities

King Corn Activity

Viewing the documentary King Corn (2007) can give students a new view into the agriculture and food production business. Below is a plot synopsis from the movie's website:

> "King Corn is a feature documentary about two friends, one acre of corn, and the subsidized crop that drives our fast-food nation. In King Corn, Ian Cheney and Curt Ellis, best friends from college on the east coast, move to the heartland to learn where their food comes from. With the help of friendly neighbors, genetically modified seeds, and powerful herbicides, they plant and grow a bumper crop of America's most-productive, most-subsidized grain on one acre of Iowa soil. But when they try to follow their pile of corn into the food system, what they find raises troubling questions about how we eat-and how we farm."

Questions regarding the video are provided on a worksheet located at the end of this teacher's manual chapter.

An alternate movie is Food, Inc. (2008), which explores the ethical, economic, political, and environmental factors surrounding grain and meat production.

GMO Pamphlet Activity

Assign a GMO to each student. Have them make a tri-fold pamphlet on the GMO. Included on the pamphlet should be: picture of the GMO, how it was modified, results of the modification or description of the desirable trait, current status (Is it in use? And if so, how much is being used?), and possible controversies. Some GMOs to be considered are provided below. Others may be found on the internet:

roundup ready soybeans
Bt corn
flavr savr tomato
Bt cotton
golden rice

Questions for Review

1. What are the three main grain crops that humanity depends on worldwide?
   Rice, wheat, and maize (corn)

2. What types of food do people eat to obtain protein? What is the name of a protein deficiency?
   Seafood, meat, eggs, legumes, and nuts are high in protein. Kwashiorkor and marasmus are types of protein deficiencies.

3. What are subsidies and how do they influence market price and production?
   Subsidies are payments to farmers from governments as incentives for agricultural production. Subsidies can be used to promote agricultural production or inhibit production. If there is a large supply of crops, then the price will be lower.

4. What is a GMO? What is the controversy with GMOs?
   Genetically modified organism that has DNA from an unrelated organism, usually resulting in a desirable trait. Many argue that GMOs may create new pests, superweeds, or might pose health risks.

Practice Questions

Multiple Choice:

Directions for questions 1-5: The lettered choices below correspond to the descriptions given in questions 1-5. Select the one lettered choice that best fits each statement. Each choice may be used once, more than once, or not at all.

(A) aquaculture
(B) CAFO
(C) green revolution
(D) Bt plant
(E) GMO

1. animals housed and fed corn for rapid growth

2. provides half of the seafood eaten by humans

3. causes environmental problems when manure from feedlots run-off into local waterways

4. started in the 1950s and 1960s

5. Roundup ready soybeans

6. The controversy surrounding Bt plants is
   (A) Bt plants have lower levels of nutrients than non Bt plants
   (B) Bt plants have a lower productivity than non Bt plants
   (C) Bt plants produce a chemical that helps some insects to survive
   (D) Bt plants produce a chemical that kills monarch butterflies
   (E) Bt plants produce a chemical that kills dandelions

7. Anemia is a/an
   (A) iron deficiency caused by low hemoglobin
   (B) protein deficiency
   (C) carbohydrate deficiency
   (D) vitamin C deficiency
   (E) vitamin D deficiency

8. Which of the following organisms must intake the most kilograms of grain to produce 1 kilogram of weight gain?
   (A) pig
   (B) chicken
   (C) fish
   (D) cattle
   (E) turkey

9. All of the following are environmental costs of salmon farms except
   (A) decrease in wild fish populations
   (B) loss of habitat due to salmon eating grasses surrounding pond
   (C) release of antibiotics
   (D) spread of diseases
   (E) release of feces

10. Large scale food shortages, massive starvation, social disruption, and economic chaos are characteristics of
   (A) famines
   (B) food security
   (C) overeating
   (D) malnourishment
   (E) kwashiorkor

Free-Response Question:

Directions: Answer all parts of the following question. Where explanation or discussion is required, support your answers with relevant information and/or specific examples.

1. The green revolution occurred during the 1950s and 1960s.

   (a) Explain TWO outcomes of the green revolution.

   (b) Genetic engineering is at the forefront of modern agriculture.

      (i) Define the term GMO.
      (ii) Give an example of a GMO and explain the desirable characteristic of that particular GMO.
      (iii) Describe three drawbacks of GMOs.

   (c) How might a GMO affect a food chain in an ecosystem?

   (d) What might a government do to encourage farmers to grow specific crops?

Answers to Practice Questions

Multiple Choice:

1. B
2. A
3. B
4. C
5. E
6. D
7. A
8. D
9. B
10. A

Free-Response Question:

This question is based on 10 points.

1. (a) 2 points total, 1 point for each outcome. Outcomes include: increased crop yields, increase in the use of both pesticides and fertilizers.

   (b) (i) 1 point for knowing that GMO stands for genetically modified organism.

   (ii) 2 points total. 1 point for an example and 1 point for describing the characteristic of that GMO. An example would be roundup ready soybeans and the characteristic is that they are herbicide resistant.

   (iii) 3 points total. 1 point for each drawback. Drawbacks include the possibility of superweeds, the effects on non-target species, and possibility of creating new pests.

   (c) 1 point for indicating that if a non-target species is killed by a GMO that has been modified to kill insects, that this affects the food chain by possibly removing that species from the food chain. This usually results in a domino effect.

   (d) 1 point for indicating that subsidies are given to farmers to grow crops.

Answers to questions in the Student Edition:

Case Study AP Document-Based Question (page 178)

(A) Local, seasonal produce is better for the environment—local and seasonal food does not have to be transported as far so it has a smaller carbon footprint, and it does not use the resources needed to grow out of season food; eating local food encourages sustainable agriculture.

(B) One potential negative health impact of eating organic, local food could be a lack of availability depending on where you live. Many of us rely on having the fruits and vegetables we like available all year round.

(C) Food production increases by 66.7% ((100,000-60,000)/60,000*100) over a decade.

Use the Math (page 194)

In 2000, HT soybeans made up 54% of all soybean crops; HT corn made up 8% of all corn crops. In 2013, HT soybeans made up 93% of all soybean crops; HT corn made up 85% of all corn crops. The percent change in HT soybean use is a 72.2% increase ((93-54)/54*100); the percent change in HT corn use is a 962.5% ((85-8)/8*100) increase.

AP Connections Review Answers (pages 195-196)

Multiple-Choice

1. c. Vitamin A is necessary for normal eye function, thus a deficiency would cause blindness. A deficiency in iron causes anemia, and a deficiency in calcium or vitamin D will cause rickets. An iodine deficiency interferes with the function of the thyroid.

2. b. Subsidies often create surplus food: farmers sell it abroad and eventually food markets become dependent on foreign imports. Uniformity in prices is not a consequence of subsidies.

3. c. GMO foods are often created to have more nutrients like golden rice, they may be less expensive to purchase because they can grow quickly with less fertilizer, and they do not taste bad. Consumers often read or hear news articles about GMO products that can frighten them and make them less desirable to purchase.

4. d. Bottom trawling drags heavy wooden doors along the bottom of the ocean or river disturbing the benthic habitats.

5. b. diabetes is more associated with being overweight, while all others can result from malnourishment.

6. b. trawl net

Data Analysis and Free-Response Questions

1A Northern Africa has declined most dramatically. Sub-Saharan Africa has increased the most.

1B A value of 0.8 means 80 percent as many people are hungry compared with those in 1969. A value of 2.0 means twice as many people (200 percent) are hungry. A value of 1.0

means exactly as many people are hungry as in 1969. No, you cannot tell if the percentage of chronically hungry people in the population has changed, because this graph does not show the change in total population, which might have increased slightly or a great deal since 1969.

1C In 1990-1992, the Index was 0.25. This means there were approximately 62,500 chronically hungry people in 1990-1992 (250,000*0.25).

2A Environmental benefits from using GMO crops include bringing higher productivity to degraded or marginal farmland, less spraying of insecticides, and a decrease in erosion by leaving more crop residue on the land.

2B Answers will vary, but economic benefits could include increased yields and lower costs to the consumer, including of other products like meat. Economic disadvantages could include higher costs and less profit for farmers.

2C Answers will vary.

King Corn Activity Worksheet

*Student:*_____

1. Why are the life expectancies of the two stars shorter than that of their parents?

2. What are most of their bodies made out of? How did they figure out their bodies were mostly made of that substance?

3. Why do they come to the conclusion that their bodies are made of that substance (from question 2)?

4. In what part of the world was corn first grown?

1. When was high fructose corn syrup first introduced to the market? Why was this done?

2. What type of fertilizer did they use to grow their corn?

7. Did they get a subsidy from the government to grow their corn? How much money did they make on their corn crop?