UNIT 7 ACTIVITIES

Step 1. Read Chapter 7 in your textbook (*Principles of Environmental Science* by Cunningham and Cunningham) and answer the questions in these worksheets. For hints, or to double-check your answers, go to the Biology 105 website.

Step 2. For 12 assignment points, do the "Remote Sensing Internet Activity." This is a web-based activity that can be completed at home. The instructions for the activity are on the Biology 105 website. You can submit your answers online or turn in a hardcopy. Your instructor will grade your assignment and return it to you in a few days to a week after it is due.

Step 3. For 12 assignment points, do the "Remote Sensing of Vegetation—Internet Activity." This is a web-based activity that can be completed at home. The instructions for the activity are on the Biology 105 website. You can submit your answers online or turn in a hardcopy. Your instructor will grade your assignment and return it to you in a few days to a week after it is due.

Step 4. For 12 assignment points, do the "Remote Sensing Case Studies" activity. This is a web-based activity that can be completed at home. The instructions for the activity are on the Biology 105 website. You can submit your answers online or turn in a hardcopy. Your instructor will grade your assignment and return it to you in a few days to a week after it is due.

Step 5. Read the optional news about Food and Agriculture on the class website.

Step 6. Prepare for the Unit 7 Exam. Study your completed worksheets, and take the online multiple-choice self test (on the Biology 105 website).

Step 7. Come in to the Biology Learning Center to take your Unit 7 Exam. The exam will consist of 40 multiple-choice questions.

STEP 1: TEXTBOOK WORKSHEETS

Read Chapter 7 in your textbook, and answer the following questions. For hints, or to double-check your answers, go to the Biology 105 website. [NOTE: Read the textbook to learn and understand the subject, but be sure to focus on the UNIT 7 LEARNING OBJECTIVES.]
GLOBAL TRENDS IN FOOD AND NUTRITION
1. There are five factors that have allowed food production to increase globally by 2.2% in the past 40 years:
   1. new cropland and more efficient use of existing cropland
   2. increased use of irrigation
   3. improved crop varieties
   4. more readily available fertilizers
   5. better distribution networks for transportation of food globally from areas of surplus to those in need of food products

GLOBAL TRENDS IN FOOD AND NUTRITION: FOOD SECURITY IS UNEVENTLY DISTRIBUTED
2. An estimated 900 million people are chronically undernourished, meaning they routinely receive less than 90% of the minimum caloric intake needed for normal growth and development and a healthy productive life. About 1 in 8 people (about 13%) are chronically undernourished.

3. Describe the area of the world with the highest risk of persistent hunger and explain why this occurs.

4. Define food security.

GLOBAL TRENDS IN FOOD AND NUTRITION: FAMINES HAVE POLITICAL AND SOCIAL ROOTS
5. Define the term famine. Describe the causes of famine.

6. The aid policies of rich countries may help feed people in the immediate crisis (and serve to make us feel good), but the aid policies do nothing to help solve the political and economic problems that caused the famine. In fact, herding people into refugee camps (= feeding camps) subjects the starving people to poor sanitation and epidemic diseases and promotes further social and economic disorder.
HOW MUCH FOOD DO WE NEED?
7. The FAO estimates that nearly 50% of the world’s population suffers from malnutrition. Malnutrition leads to a number of physiological problems, especially in children, including devastating illnesses, death, reduced mental capacity, developmental abnormalities, and stunted growth.

HOW MUCH FOOD DO WE NEED?: A HEALTHY DIET INCLUDES THE RIGHT NUTRIENTS
8. Define malnourishment.

9. Describe the following nutritional deficiencies.
   a. kwashiorkor
   b. marasmus
   c. folic acid deficiency
   d. vitamin A deficiency
   e. iodine deficiency
   f. anemia: low hemoglobin levels in the blood, often caused by iron deficiency. (There are many other possible causes of anemia, but nutritional causes are the most common.)

HOW MUCH FOOD DO WE NEED?: OVEREATING IS A GROWING WORLD PROBLEM
10. Sixty-four percent of all adult Americans are overweight. What problems are caused by being overweight?

HOW MUCH FOOD DO WE NEED?: DO WE HAVE ENOUGH FARMLAND?
11. What characteristics make much of the world’s uncultivated lands unsuitable for farming?
12. Describe the percent of the earth’s land area that is currently in agricultural production. Describe how the amount of land per person has changed, due to population growth. Describe what could happen if additional land were to be cultivated.

13. In North America, 95% of recent agricultural growth in the last 100 years has come from improved crop varieties and increased fertilization, irrigation, and pesticide use—not from cultivation of additional land. In fact, less land in North America is being cultivated now than 100 years ago.

**What Foods Do We Eat?**

14. To understand world nutrition, you need to know the following facts about world food sources:

   a. The three most important crops worldwide are wheat, rice, and maize (maize is corn). In addition to the three above, other important food crops include:
      - potatoes, barley, oats and rye in northern Europe and northern Asian (in cool moist climates)
      - cassava and sweet potatoes in warm wet areas of the world
      - sorghum and millet in dry areas of Africa

   b. There are several crops grown for vegetable oil, with soybeans being the most important. Soybeans also are used to feed cattle. The major producers of soybeans are USA, Brazil, and China.

   c. The people of North America, Europe, and Japan make up only 20% of the world’s population, but consume 80% of the milk and meat in the world. The less-developed countries produce 60% of the animals, but only consume 20% of the animal products.

   d. 90% of the grain grown in North America is used to feed animals other than humans. (According to your textbook, if we were to eat the grain directly, we would get 21 times more calories and 8 times more protein than we get by eating the meat it produces.)

   e. In addition to the nutritional inefficiency of producing meat, there are other problems as well. Animals are crowded into feedlots, which can lead to severe air and water pollution. Use of antibiotics in animal feed has led to the rapid rise in antibiotic-resistant pathogens.

   f. Fish and other seafood are important parts of people’s diets in many coastal countries. However, many areas are overfished or face ecological destruction. Future aquaculture projects are focused on inland, and even urban, settings.

**What Foods Do We Eat?: Biohazards Arise in Industrial Production**

15. What are the three environmental risks associated with increased food production discussed in your textbook?
LIVING SOIL IS A PRECIOUS RESOURCE
16. Your textbook emphasizes the fragile nature of soil, including the rate of topsoil accumulation and loss from erosion. Topsoil accumulates at a rate of 1 mm per year (under good conditions) to 1 mm per 1000 years (under poor conditions). Erosion can remove topsoil at a rate of 2.5 cm per year.

LIVING SOIL IS A PRECIOUS RESOURCE: WHAT IS SOIL?
17. What makes up soil?

LIVING SOIL IS A PRECIOUS RESOURCE: HEALTHY SOIL FAUNA CAN DETERINE SOIL FERTILITY
18. Describe some of the organisms that help create a healthy soil ecosystem.

19. Figure 7.17 shows a soil profile with all the possible soil horizons. You should know the name, order, and description of these soil horizons. (It is important to note that not all soils contain all of these layers, and there is much variation depending on biome and location. For example, the topsoil under natural virgin prairie can be several meters thick, while many deserts have no topsoil.)

O = Surface litter:

A = Topsoil:

E = Zone of leaching:

B = Subsoil:

C = Weathered parent material: partially broken down inorganic minerals

Bedrock = the parent rock that underlies the soil
Living Soil Is a Precious Resource: Your Food Comes Mostly from the A Horizon

20. Which soil horizon is best for farming?

Living Soil Is a Precious Resource: How Do We Use and Abuse Soil?

21. Describe the relationship between agriculture and environmental degradation.

22. Name and describe the main mechanisms of soil degradation.

23. Arizona has areas of soil degradation due mostly to wind erosion and a little water erosion. Some of Arizona is severely degraded.

Living Soil Is a Precious Resource: Water Is the Leading Cause of Soil Loss

24. Define the following terms:

- Sheet erosion
- Rill erosion
- Gully erosion
- Streambank erosion

25. Desertification is the conversion of once productive land to desert due to erosion by wind and/or water, which moves soil particles that have been exposed due to agricultural or grazing activities.

Living Soil Is a Precious Resource: Wind Is a Close Second in Erosion

26. Describe the cause of erosion on croplands in the United States.
AGRICULTURAL INPUTS: ALL SUBSECTIONS
27. In addition to soil, your textbook describes four other agricultural resources. Name these four resources and describe current issues with these resources.

28. What are the two most common types of pesticides? What does your textbook say about your exposure to pesticides?

29. Describe alternatives to toxic chemical pesticides.
**How Have We Managed to Feed Billions?**

30. Describe the benefits associated with using new varieties of crops as food.

Of interest: Older versions of your book mentioned Gary Nabhan and the conservation of seeds used by Native Americans. Gary lives in Flagstaff (although he lived in Tucson for a long time prior to that) and is active in Native Seeds/SEARCH, a seed conservation organization with a store on 4th Avenue.]

**How Have We Managed to Feed Billions?: The Green Revolution Has Increased Yields**

31. Describe the green revolution. Describe high responder varieties of plants, and how they do under different growing conditions.

**How Have We Managed to Feed Billions?: Genetic Engineering Could Have Benefits and Costs**

32. Define genetic engineering, and describe some of the ways that genetic engineering could help food production.

33. Your textbook in a previous edition had a Case Study about genetically modified rice. It reviewed both the pros and cons of genetically modified rice. Here is a summary of those pros and cons:

- **Pros:** The rice contains beta carotene, the precursor for vitamin A. This would enable people who eat a poor diet of only rice to avoid vitamin A deficiency.
- **Cons:** Opponents of genetically modified organisms (GMOs) had several concerns:
  - (a) farmers would become dependent on multinational seed producers,
o  (b) there might be unforeseen ecological consequences of releasing newly created plants around the world,
  o  (c) technological solutions are not the answer to poverty and malnutrition, &
  o  (d) the people that needed the rice are landless peasants who will not be able to grow the rice and will not be able to afford to buy it.

**How Have We Managed to Feed Billions?: Is Genetic Engineering Safe?**

34. Your textbook, in previous editions, had a more lengthy section that discussed some of the concerns with transgenic plants. I've summarized those points below:

- GMO plants might escape and become pests
- GMO plants might interbreed with wild but related species (If herbicide-resistant plants interbreed with wild species, it could lead to "superweeds.")
- GMO plants that produce their own pesticides could accelerate pesticide resistance in insects, or leave behind toxic residues
- pesticide-producing plants may kill non-target insects, such as bees and non-pest butterflies.
- herbicide-resistant plants allow farmers to spray more herbicides than needed, causing environmental problems.
- if only corporations have access to GMOs, then small farmers in developing countries are left out.

**Sustainable Farming Strategies: Soil Conservation is Essential, Groundcover, Reduced Tilling Protect Soils**

35. Describe how the following techniques improve soil conservation and help achieve sustainable agriculture.
   a. contour plowing
   
   b. strip-farming
   
   c. terracing
   
   d. crop residues
   
   e. cover crops

36. Here are some other techniques that used to be discussed in your textbook include:

reduced tillage systems: other types of plow blades can be used to cause less disruption to the soil, helping prevent erosion.
planning perennial species: the planting of crops that grow for more than two years. Perennial species do not have to be cultivated every year, so the soil is protected from erosion.

mulch: natural organic mulch helps protect the soil and hold water. Plastic sheets can also be used for the same purpose.

**SUSTAINABLE FARMING STRATEGIES: LOW-INPUT SUSTAINABLE AGRICULTURE CAN BENEFIT PEOPLE AND THE ENVIRONMENT**

37. Describe the advantages of low-input agriculture.

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**CONSUMERS ACTION AND FARMING**

38. What are the three ways you can reshape farming, as described by your textbook?

39. You need to be able to locate and identify the following 4 regions and countries (all of which are discussed in Chapter 7) on a map of the world for your Unit 7 test: Brazil, Argentina, the Philippines, and United Kingdom (Britain, Wales, N. Ireland). You also need to be able to identify all of the regions and countries assigned in previous units:

Galápagos Islands (part of Ecuador), Sonoran Desert (S. Arizona & N. Mexico), Lake Victoria (in Africa), Greenland, North America, Western Europe, Japan, China, India, sub-Saharan Africa, California, Amazon, Atlantic Ocean, the Gulf of Mexico, Thailand, Mexico, Russia, Bangladesh, Yellowstone National Park (Wyoming), Canada, New Zealand, and Madagascar.

There are two foldout maps at the back of your textbook to help you.