THE DAILY HERALD

SPECIAL EDITION DECEMBER 14

Study Forecasts Future Food Shortage

A new study published in the *Journal of World Agriculture* raises concerns that in the future there will not be enough food for the world's growing population. The study was carried out by an international group of scientists with support from the Earth Food Bank. According to the study, the population of the world is increasing by about 80 million people each year.

To feed the growing population, crop yields will need to increase significantly. The researchers listed many factors that limit food production but singled out two for special consideration. First, the amount of freshwater available for farming is projected to limit food production. Second, higher temperatures around the world are already causing large losses in grain yields among the world's major producers. The study concluded by recommending that the Earth Food Bank sponsor a program dedicated to setting priorities and establishing policies that will enable all of the world's people to be fed.

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SPECIAL EDITION MARCH 17

Earth Food Bank to Hold Meeting on Food Production

In response to a recent international study on population and food production, the secretary general of the Earth Food Bank has announced that it will sponsor a series of two-weeklong conferences next summer to address world hunger. Attendees at each conference will discuss a different aspect of the problem and make recommendations for meeting the world's food needs. According to the study, the four major aspects of the problem are

- reducing carbon emissions that contribute to increasing Earth's temperature,
- stabilizing population growth,
- making better use of our water resources, and
- increasing the crop yields on farms.

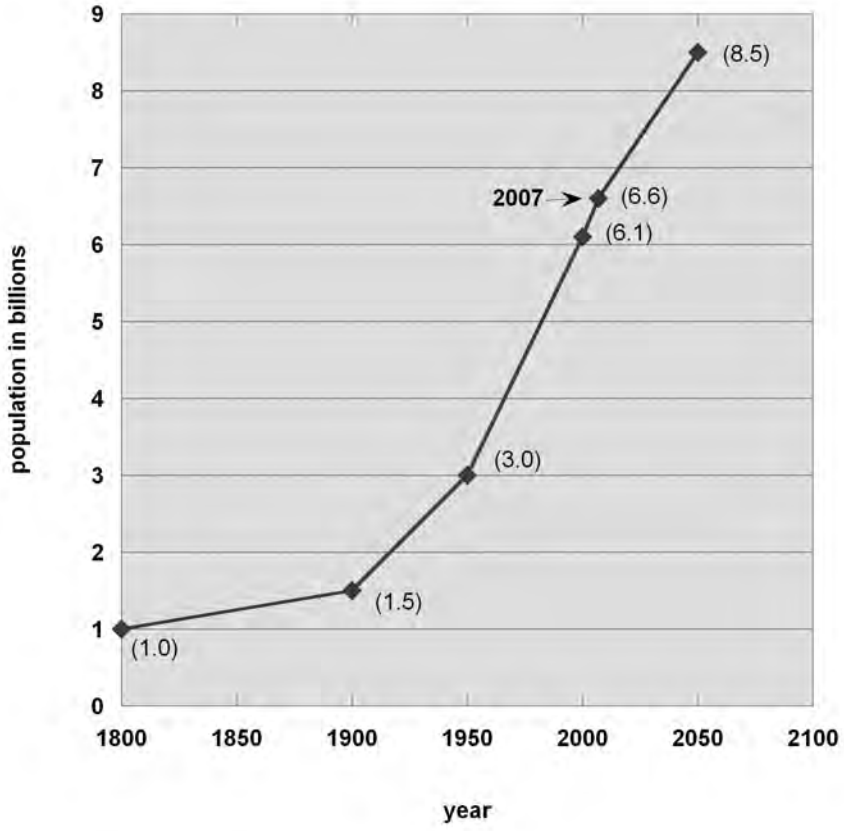
An international group of experts will attend each conference. The experts will submit a report to the secretary general that describes their recommendations. Scientists from Humanity Against Hunger will organize the conference on increasing crop yields. These scientists have experience applying modern agricultural practices in developing countries.

Master 5.2, *Population and Land Use Graphs*

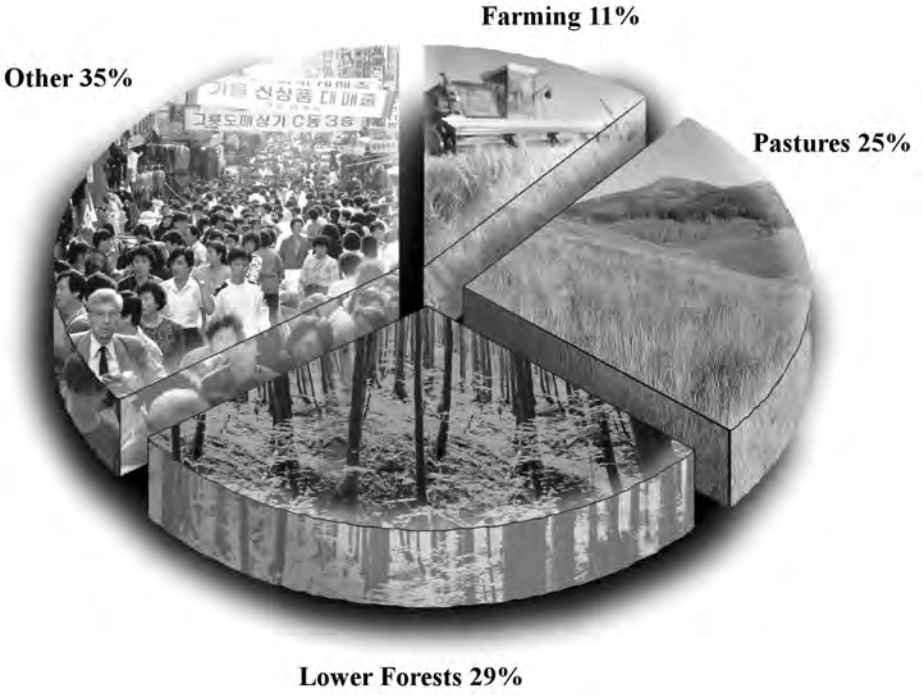
Name

Date

World Population Growth



World Land Use



Name _____

Date _____

Part A: How much farmland is used to feed each person today?

Step 1. Use the *World Population Growth* graph on Master 5.2, *Population and Land Use Graphs* to estimate Earth's population right now: _____ billion people.

Step 2. The 11 percent of land devoted to farming corresponds to 33 billion acres of farmland.

Step 3. Divide the 33 billion acres of farmland by the population (from Step 1) to get the number of acres of farmland per person:

33 billion acres farmland ÷ _____ billion people = _____ acres per person

Part B: How many acres of farmland per person will be available in 2050?

Step 1. *Use the World Population Growth* graph on Master 5.2, *Population and Land Use Graphs* to estimate Earth's population in the year 2050: _____ billion people.

Step 2. Divide the 33 billion acres of farmland by the population (from Step 1) to get the number of acres of farmland per person:

33 billion acres farmland ÷ _____ billion people = _____ acres per person

Part C. Assuming that c rop yields stay the same, how much extra land will be needed for farming in 2050?

Step 1. Calculate the estimated population increase factor from now to 2050:

population in 2050 (from Part B) ÷ population now (from Part A) = _____

Step 2. Multiply the 33 billion acres of farmland times the population increase factor (from Step 1):

33 billion acres farmland x *population increase factor* = _____ billion acres farmland needed in 2050

Step 3. To find out how much extra farmland will be needed in 2050, subtract the 33 billion acres (today's farmland) from the number of acres needed in 2050 (from Step 2):

_____ billion acres needed in 2050 - 33 billion acres = _____ billion extra acres of farmland needed

Farmers that fertilize their crops can use either organic or commercial fertilizers, or a combination of the two. As the name suggests, organic fertilizer comes from once living material such as plants or animal waste. Organic fertilizers that come from plants versus animals behave differently in the environment, so a distinction is made between the two. Manure-based fertilizer is the type used by most farms.

Commercial fertilizers are produced through industrial processes and contain nutrients in forms that crop plants can use immediately, without the action of decomposing microbes. The amount of each nutrient contained in commercial fertilizers is known precisely. This means that farmers know the exact amounts of nutrients applied to plants. A bag of commercial fertilizers is labeled with three numbers that describe the amounts of nitrogen, phosphorus, and potassium that it contains. For example, a bag labeled 15-5-10 contains 15 percent nitrogen, 5 percent phosphorus, and 10 percent potassium. In general, commercial fertilizers allow the farmer more control over plant nutrition than organic fertilizers because when using commercial fertilizers, the amounts of nutrients are precisely known and they are released in a more predictable way.

Organic fertilizers of all types contain little or no synthetic materials, which is increasingly attractive to consumers. They encourage the use of local natural resources and the recycling of farm wastes. Organic fertilizers are generally less expensive than commercial fertilizers, although they also tend to produce lower crop yields.

Plant-based fertilizers include plant compost and cover crops (also called green manure. Cover crops such as rye, alfalfa, or clover can be planted immediately after a crop harvest to hold the soil in place, preventing erosion and nutrient loss. They also represent an important type of fertilizer because they provide nutrients when they are eventually plowed into the soil. These plant-based fertilizers are used on a small scale in comparison to animal manure-based fertilizers. Plant-based organic fertilizers usually contain some nutrients that dissolve in water, but most of the nutrients are released slowly as microbes in the soil break down the organic material into forms that the plant roots can absorb. This is an advantage when fertilizers are added infrequently during the growing season.

continued

Manure-based fertilizers are by far the dominant form of organic fertilizer used on farms. The use of manure fertilizer saves money when they are used locally, and helps solve the problem of disposing of animal wastes. The nutrients in manures are released more rapidly than those in plant-based fertilizers.

The environmental problems that can be associated with fertilizers vary with the type of fertilizer. Both manure-based organic fertilizer and commercial fertilizers may runoff the land or leach into groundwater because they tend to move with water. In the case of manure-based organic fertilizers, the nitrogen component is easily lost to the air as a gas. In fact, over 50% of the nitrogen in manure-based fertilizer can be lost as ammonia gas only to eventually fall out elsewhere as nitrogen pollution. Loss of manure-based nutrients to the environment tends to occur when they are over-applied to fields near the livestock. Plant-based organic fertilizers present the fewest environmental challenges, but are not widely used. No matter what type of fertilizers are used, it is important to follow best management practices designed to raise healthy crops while, at the same time, protecting the environment.

Master 5.5, *Pros and Cons of Different Fertilizers*

Name

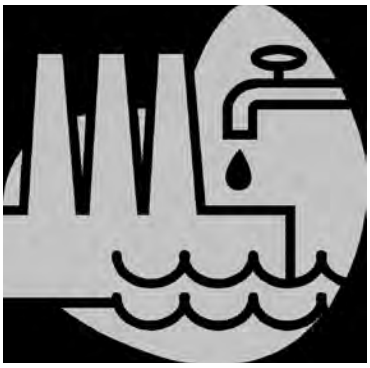
Date

Organic Fertilizers

Advantages	Disadvantages

Commercial Fertilizers

Advantages	Disadvantages



When we think of environmental pollution, we think of chemicals from industry and car exhaust fouling our air and water. Although nutrients occur naturally, they, too, can be a source of pollution. You should recall that all living things require nutrients, but too much of a nutrient can harm terrestrial and aquatic ecosystems. Excessive amounts of nutrients in our waterways are bad for the environment because they can lead to explosive growth of aquatic organisms such as phytoplankton and algae, The organisms eventually die and sink to the bottom, where they are decomposed by oxygen-consuming bacteria. These bacteria can use up the available oxygen and cause fish to suffocate. There are large areas of estuaries and coastal zones worldwide that suffer from this problem.

Excess nitrogen is also accumulating in groundwater and the air. High levels of nitrate can affect human health if it accumulates locally in groundwater. A form of nitrogen gas that is increasing in the atmosphere globally is nitrous oxide (N_2O). Nitrous oxide is a greenhouse gas and contributes about 6 percent to current global warming. Nitrous oxide is emitted from all ecosystems naturally, but it is emitted at high rates from fertilized agricultural fields, animal feed lots, and the burning of plant biomass (e.g. tropical forest fires). Management practices can reduce these losses.

Nonpoint source pollution refers to polluted runoff and ground water. When water from any source such as rain or water for crops washes over land, it picks up contaminants that include nutrients. These contaminants find their way into waterways either directly or through storm drains. In contrast to nonpoint sources are point sources of pollution. Point source pollution comes from a specific source such as a factory or waste-treatment plant.

continued

In urban areas, such point sources are often the main contributors to nutrient pollution. Urban areas also are affected by nonpoint source pollution. For example, the burning of fossil fuels by cars and industry releases nitrogen compounds into the air. These compounds fall to the surface with rain and contribute to nutrient pollution.

As suburban areas have grown, they have moved beyond the reach of city sewer systems. Homes in many areas use septic systems that release nutrients from waste-water into the ground. Also, an increase in the amount of paved area increases runoff. Farmers also can contribute to the problem. Improper application of fertilizers can send excess nutrients into the environment. Agriculture is often the major nonpoint source of nutrient pollution in rural areas, but not urban areas.

Antipollution laws and some voluntary efforts are helping reduce nutrient pollution from point sources such as factories. Nonpoint sources represent the largest pollution threat to our waters, but they are difficult to identify and control. Can you think of ways to limit nutrient pollution from nonpoint sources?

Master 5.7, *Nutrient Pollution Discussion Questions*

Name

Date

Discussion Questions

1. Why are excessive amounts of nutrients bad for the environment?

2. What is the difference between a point source and a nonpoint source of nutrient pollution? List examples of each type of source.

3. What are some ways to limit nutrient pollution from nonpoint sources?