MASTER 5.1
NEWSPAPER ARTICLES

NAME

DATE

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.

THE DAILY HERALD
MORNING 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-week-long 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.

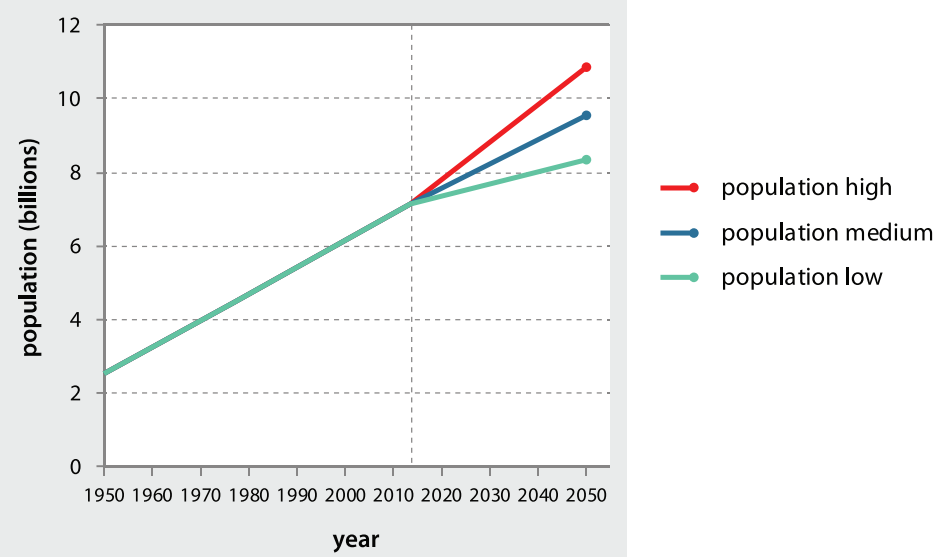
MASTER 5.2

POPULATION AND LAND USE GRAPHS

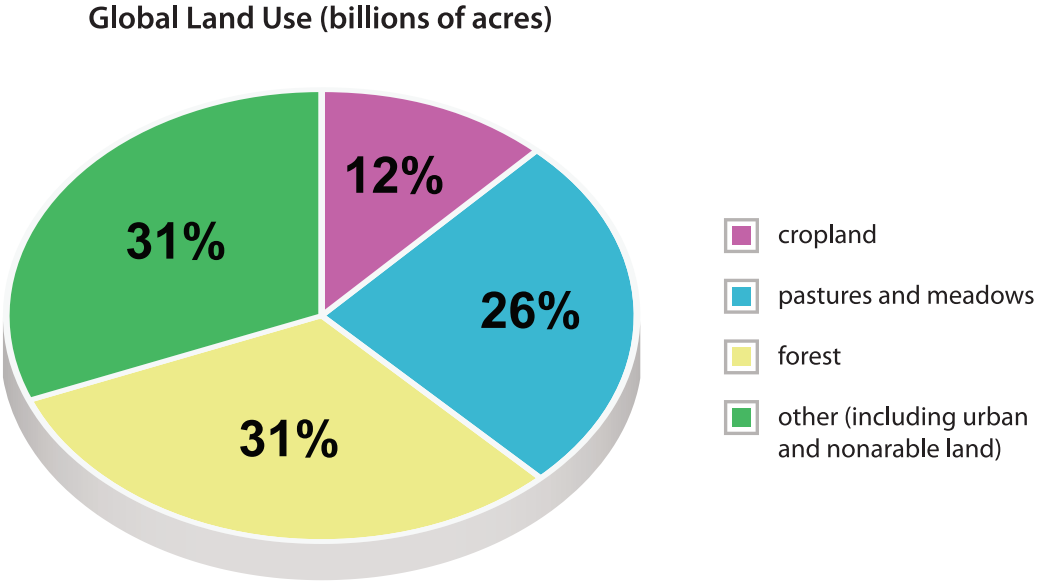
NAME

DATE

WORLD POPULATION GROWTH



Source: United Nations, Department of Economic and Social Affairs, Population Division (2013). World Population Prospects: The 2012 Revision, Volume I: Comprehensive Tables ST/ESA/SER.A/336. http://esa.un.org/unpd/wpp/index.htm



Source: Food and Agriculture Organization of the United Nations (2014). FAOSTAT. http://faostat3.fao.org/faostat-gateway/go/to/home/E

MASTER 5.3

NEEDS OF THE FUTURE

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 3.5 billion acres of farmland.

STEP 3. Divide the 3.5 billion acres of farmland by the population (from Step 1) to get the number of acres of farmland per person:

3.5 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 3.5 billion acres of farmland by the population (from Step 1) to get the number of acres of farmland per person:

3.5 BILLION ACRES FARMLAND ÷ _____ BILLION PEOPLE = _____ ACRES PER PERSON

PART C. ASSUMING THAT CROP 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 3.5 billion acres of farmland times the population increase factor (from Step 1):

3.5 BILLION ACRES FARMLAND × 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 3.5 billion acres (today's farmland) from the number of acres needed in 2050 (from Step 2):

_____ BILLION ACRES NEEDED IN 2050 – 3.5 BILLION ACRES = _____ BILLION EXTRA ACRES OF FARMLAND NEEDED

MASTER 5.4
THINKING ABOUT FERTILIZERS

NAME

DATE

Farmers may choose to use conventional farming practices or organic ones. In reality, the choices facing farmers are much more complex than using this or that production system. Many farmers use elements of both approaches. Additionally, a comparison of conventional farming and organic farming is not the same thing as a comparison of organic nutrient sources and inorganic nutrient sources. Organic farming tends to minimize or eliminate the use of synthetic inputs while maximizing the use of natural resources. The descriptions below refer to organic and commercial nutrient sources, not to organic and conventional farming.

ORGANIC FERTILIZERS usually contain little or no synthetic materials. They encourage the use of local natural resources. For example, animal manure (that would otherwise have to be disposed of) is often used to fertilize crop plants. 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. Organic fertilizers contain relatively low and unpredictable amounts of nutrients as compared with commercial fertilizers. The lower amounts of nutrients in organic fertilizers mean that farmers may need to use larger amounts of organic fertilizers in order to meet the needs of the crops. The balance of nutrients in organic fertilizer is often not what the crops need. This can mean that in order to supply the needed amount of nitrogen, for example, the fertilizer may also supply too much of another nutrient such as phosphorus. On the other hand, the lower nutrient amounts in organic fertilizers may make it less likely that crop plants will be damaged through exposure to excessive amounts of nutrients. Although organic fertilizers can be less expensive than commercial fertilizers, the use of organic fertilizers may produce lower crop yields. More land may be required to grow plants used as fertilizer (green manure) or to raise the livestock that produce the animal manure.

COMMERCIAL FERTILIZERS are produced through industrial processes. Commercial fertilizer is natural in the sense that its components come from natural mineral deposits or, in the case of nitrogen, from the air. These fertilizers contain nutrients in forms that crop plants can use. The amounts of each nutrient contained in commercial fertilizers are known precisely. This means that farmers know the exact amounts of nutrients applied to plants. A bag of commercial fertilizer 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 the amounts of nutrients in commercial fertilizers are precisely known and they are released in a more predictable way. Overuse of commercial fertilizers is more likely to occur as compared to overuse of organic fertilizers. No matter what type of fertilizers farmers use, they need to follow best management practices in order 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

MASTER 5.6
NUTRITION POLLUTION

NAME

DATE

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 either too little or too much of a nutrient can harm a plant or animal. A similar situation exists with regard to our environment. 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, algae and bacteria. This rapid growth reduces the amount of sunlight available to other plants and animals. Furthermore, the metabolism of these organisms uses up the available oxygen and can cause fish and other animals to suffocate.

NONPOINT source pollution refers to polluted runoff water. When water from any source such as rain or irrigation for crops washes over land, it picks up contaminants that may include nutrients. These contaminants find their way into waterways either directly or through storm drains. So-called point sources of pollution come from a specific source such as a factory or waste-treatment plant.

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 wastewater into the ground. Farmers also contribute to the problem. Overuse of fertilizers sends excess nutrients into the environment. Today, the largest source of nutrient pollution from agriculture is nitrogen from animal wastes that leaks into surface waters.

Antipollution laws 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 two examples of each type of source.

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