

10

Food and Agricultural Issues

Chapter Overview

Specific Expectations

In this chapter, students will:

- describe the interdependence of ecology and economics
- explain how point of view influences an individual's perceptions of a place
- identify the social, economic, cultural, political, or ecological components of selected geographic issues
- compare the economic and political aspirations of selected regional or cultural groups within different countries
- explain how human-induced changes in natural systems can diminish their capacity for supporting human activity
- analyze the impact on natural and human systems of past and current trends in agriculture
- evaluate the economic, social, and ecological impact of current practices used in harvesting or extracting a selected resource
- evaluate the short-term and long-term economic, social, and environmental effects of efforts to increase the productivity of a selected natural environment
- evaluate the effectiveness of various policies and practices that are used to promote sustainable development in selected places and regions of the world
- evaluate the short-term and long-term economic, social, and environmental effects of efforts to increase the productivity of a selected natural environment

In Unit 2, students learned the basics of demography and population history, and examined a number of population problems that threaten sustainability. Unit 3 considers some of the world's major economic issues and the effects of these issues as they relate to the development of the global economy.

The chapter opens with some definitions of familiar words that pertain to the nature of hunger. The definitions are essential because most people use hunger-related vocabulary in an imprecise way. This introductory section will help students avoid confusion when using words such as famine, malnutrition, and chronic hunger. A short Working It Out activity on the causes and diseases of chronic hunger follows.

Your students are probably unable to articulate exactly where hunger problems exist in the world. A map of the Global Hunger Index (GHI) is the focus of the next short section "The Geography of Hunger"; this map demonstrates the severity of hunger in the Near Core and Far Periphery. It ranks countries according to their GHI by using three equally weighted indicators: the proportion of people who are food-energy deficient, the prevalence of underweight children under the age of five, and the under-five mortality rate.

If your students are urban, they may not have a clear grasp of the means of food production. In the next section, they will consider the nature of agriculture in order to broaden their knowledge. The section examines deficiencies in the natural environment that limit the success of agriculture as well as practices that farmers undertake to counteract these deficiencies. The section also examines four distinct types of agriculture, but closes with the caveat that most farming actually takes a form that comprises something from each type.

The central part of the chapter consists of an examination of some of the major food and agricultural issues of the past 70 years: the Green Revolution (accompanied by a case study about a new green revolution for Africa); biotechnology and the resultant loss of genetic diversity; land reform and its effect on food supply; the beneficial role of women in food production; governmental policies that protect a country's agricultural economy; the disadvantages of

monoculture; and the corporatization of food production through factory farming and vertical integration.

One of this book's major themes, sustainability, is now introduced as it relates to agricultural issues. Organic farming and the concept of food miles are presented as possibilities in the search for sustainable agriculture. A case

study on a Canadian example of sustainable agriculture, "The 100-Mile Diet," opens by asking students if they could live only on food that was produced within a 160-kilometre radius of where they live.

The book's second theme, globalization, is introduced in the final section by means of five pertinent questions—all relating to the way that food is

produced and then sold in the world market. These questions will elicit discussion on the energy component of agriculture, the production of biofuels, the effect of climate change on food prices, and the effect of agricultural policies on farmers in developing countries.

Specific Expectations (cont'd)

- explain how economies and environments in some places can be affected by decisions made in other places
- describe the contributions of individuals who have been influential in addressing global issues and evaluate the impact of their work
- analyze problems of hunger and poverty in selected countries and explain how certain practices may aggravate the problems
- explain the relevance to their own lives of the work on poverty, disease, and the environment done by governmental and non-governmental organizations

- explain how new technology affects employment and resource management
- analyze trends related to the consumption of selected resources to determine the sustainability of the resources
- evaluate the role played by non-governmental organizations and local community initiatives in different parts of the world in promoting sustainable development and responsible resource management
- use different kinds of maps and images to identify, interpret, and analyze geographic relationships, including those that involve the consequences of human activities or environmental phenomena

- explain why it is difficult to make accurate predictions relating to human use of the earth and its resources, and why some predictions are more (or less) accurate than others

Prior Learning Required

Students should have at least a general sense of the world's population growth over the last hundred years so that they will better understand the need for improved agricultural production—see Chapter 4.

Working It Out: Chronic Hunger

(p. 149)

Question 1 Explain how each input affects "Food Shortages" and "Access to Food."

Food Shortages:

- environmental damage: drought, flooding, acid rain, insect pests, soil degraded by deforestation and toxins from industry reduce crop and animal yields
- rural to urban migration: the poor remaining in rural areas may not supply enough manpower to raise enough crops and animals; poor people

who migrate to cities have no access to land to grow food or raise animals

- armed conflict: war disrupts agricultural production and the transportation of products to market; lack of labour when workers leave their agricultural jobs and become conscripts; government spending focuses on arms rather than on food for the vulnerable, e.g., women and children
- lack of knowledge/poor farming practices: both factors prevent farmers from raising the highest

possible yields of crops or animals; raising the crop or animal best suited to the area; knowing about different varieties of crops so that if one fails, another may succeed; knowing about proper pesticide and herbicide use

Access to Food:

- poverty: when people are poor, they do not have the means (land, money, tools) to grow or purchase food
- discrimination: people who are subjected to racial, gender, or ethnic discrimination often lack access to education, credit, and employment—leading to the lack of access to food or food production
- food distribution system: despite the global abundance of food, those in developing countries have difficulty obtaining food due

to a lack of, or an inadequate, transportation infrastructure within the country

- lack of power: people who lack power—e.g., children, women, and the elderly—do not have the ability to protect their own interests, which include access to food

Question 2 List the diseases associated with undernourishment.

(Note: List them in the boxes “Undernourishment” and “Diseases.” LM 10–1.)

Line Masters/Assessment Masters

- LM 10–1 Causes of Hunger

See Figure 10–2 (reproduced below) for a list of some of the more important diseases associated with undernourishment.

Table 1		Some Diseases Resulting From Undernutrition	
Name of Disease	Caused by Deficiency of	Characteristics of Disease	
Kwashiorkor	Protein	<ul style="list-style-type: none"> ■ Loss of muscle mass ■ Damaged immune system ■ Edema (swelling), particularly of belly 	
Scurvy	Vitamin C	<ul style="list-style-type: none"> ■ Anemia ■ Weakness ■ Gum disease ■ Bleeding skin sores 	
Pellagra	Niacin and tryptophan (an amino acid)	<ul style="list-style-type: none"> ■ Scaly skin sores ■ Diarrhea ■ Mental illness 	
Anemia	Iron	<ul style="list-style-type: none"> ■ Lack of energy ■ Weakened immune system 	
Keratomalacia	Vitamin A	<ul style="list-style-type: none"> ■ Blindness 	
Beriberi	Vitamin B ₁	<ul style="list-style-type: none"> ■ Damage to heart and nervous system 	
Marasmus	Calories and protein	<ul style="list-style-type: none"> ■ Starvation 	

Table 1 Answer key for page 149, question 2.

Case Study: Alliance for a Green Revolution in Africa

(p. 154)

After students have examined the pros and cons of the Green Revolution, they will learn how a new green revolution is evolving in Africa.

Question 1 a) What organizations founded the Alliance for a Green Revolution in Africa (AGRA)?

The Bill and Melinda Gates Foundation and the Rockefeller Foundation founded the Alliance for a Green Revolution in Africa in 2006 with an initial investment of \$100 million and \$50 million respectively.

Question 1 b) What is AGRA's main goal?

The Alliance aims to increase the productivity of small African farms dramatically.

Question 1 c) What steps is it taking to achieve this goal?

To alleviate low agricultural productivity, the Alliance is going to develop new seeds and techniques that will be given to millions of small-scale farmers—the majority of them women working on farms smaller than one hectare. The Alliance is supporting the Program for Africa's Seed Systems (PASS) that will improve the

availability and variety of seeds that produce higher yields in sub-Saharan Africa.

Question 2 Do you think the five-point program of PASS is an effective way of improving the availability and variety of seeds in sub-Saharan Africa? Explain.

Students may indicate that the program will be successful because

- of the financial and managerial expertise of the two foundations that have started the program
- appropriate technology for small-scale African farmers will be used rather than bringing in technology from developed countries
- former UN Secretary-General Kofi Annan can mobilize support from leaders throughout Africa

Students may state that the program will not be successful because

- it will take years for new seeds, distribution infrastructures, and training programs to be developed—too little, too late
- since the HIV/AIDS epidemic is decimating the farmers of Africa, there is no point in training scientists and farmers without first dealing with their health problems

Case Study: The 100-Mile Diet

(p. 162)

Question 1 Why is the diet in which food travels 2400 km (1500 miles) from farm to table called the "SUV diet"?

Just as SUVs use large amounts of fossil fuel and emit large quantities of greenhouse gases, so do transport trucks, airplanes, and trains that transport food from farm to table over long distances. The negative connotation applied to SUVs is applied to foods that are not locally produced.

Question 2 Buying food locally may mean fresher food, but it doesn't necessarily mean you are creating a smaller environmental impact. Explain.

The 100-mile diet takes only one factor into consideration—the amount of fuel burned and the resulting emissions produced in order to transport food over long distances. Critics say the amount of energy used in the food's production should also be considered. For example, food grown in a Near Core or Far Periphery country may use less

energy in its production and transportation than food produced locally in an Old Core country.

Question 3 Would you like to live on the 100-mile diet? Explain.

After discussing this question, ask students to follow the 100-mile diet for one day. When they return to class, have them share their experiences.

Chapter Questions: Notes and Answers (p. 164)

Knowledge and Understanding

Question 1 Explain the differences and similarities in meaning of the following terms: famine, starvation, malnutrition, undernutrition, and chronic hunger.

Students should be encouraged to use these frequently misused terms with care.

- *Famine* is a severe short-term shortage of food caused by a temporary failure of food production or food distribution that leads to starvation. Famines may result from natural causes such as drought or from human causes such as civil war.
- *Starvation* is extreme hunger that occurs over an extended period of time. The body wastes away as tissues are broken down to provide energy and protein.
- *Malnutrition* is a condition of poor health caused by a diet that includes too much, or too little, of one or more essential nutrients. Generally, malnutrition refers to diets that lack nutrients. The term can refer, however, to conditions of obesity or high blood pressure caused by excesses in diet.
- *Undernutrition* is a form of malnutrition caused by a lack of nutrients. More than 850 million people around the world are undernourished and are unable to lead healthy lives.
- *Chronic hunger* results from an insecure supply of food. People who suffer from chronic hunger lack the opportunity or ability to earn enough money to grow or buy food consistently. Some effects of chronic hunger include
 - high infant-mortality rates

- poor physical and mental development of children
- poor economic growth of society
- increased vulnerability to common illnesses

Question 2 Examine Figure 10–4 that shows the Global Hunger Index (GHI).

Question 2 a) What three indicators are used to create the GHI?

The three equally weighted indicators are:

- the proportion of people who are food-energy deficient
- the prevalence of underweight children under the age of five
- the under-five mortality rate

Question 2 b) What parts of the world have the greatest hunger problems?

- almost every country in sub-Saharan Africa has a Global Hunger Index ranging from serious to extremely alarming. The exceptions are South Africa and Gabon
- India, Pakistan, Nepal, and Bangladesh are in the alarming category
- Southeastern Asia (countries south of China and east of India) has many countries in the serious category, two in the alarming (Laos, North Korea), and one in the extremely alarming (Cambodia) category

Question 3 Successful agriculture depends on the interactions among a number of natural systems (see Figure 10–5).

Question 3 a) What are these systems?

climate system, soil system, topographic system, and biological system

Question 3 b) Give two factors in each system that can affect the success of agriculture.

Climate

- solar input: insufficient solar input can limit crop yields
- precipitation: insufficient precipitation can limit crop yields

Soil

- too little moisture results in insufficient humus
- too much moisture results in the loss of nutrients through leaching

Topographic

- hilly land can suffer from serious erosion
- flat land with a high water table can become waterlogged

Biological

- destructive insect pests and weeds lower crop yields
- beneficial organisms, such as bees and ladybugs, pollinate crops and control insect pests

Question 4 Why are herbicide-resistant crops so popular?

Herbicide-resistant crops (GMOs) are popular because only one application of a broad-spectrum herbicide is needed to kill just about every kind of weed. This is less expensive than multiple applications and adds fewer toxic chemicals to the environment.

With regular crops, only one herbicide can be used at a specific time during the growing cycle to kill a particular weed. Multiple applications of herbicides are expensive and cause an increased risk of damage to the environment and to people's health.

Question 5 a) What is meant by "terminator technology"?

Terminator technology refers to plants that are genetically modified to produce sterile seeds. The result is that farmers have to buy new seeds every year.

Question 5 b) What danger is associated with this technology?

Critics say that there is danger in introducing genetic material that is programmed not to reproduce into the environment. They fear that the terminator gene could escape into the gene pool with potentially catastrophic results.

Question 6 Why is it important to maintain genetic diversity?

The maintenance of the largest possible genetic stock is important for the ongoing success of selective breeding programs and genetic engineering initiatives. Both rely on the widest possible range of characteristics from which the most desirable may be selected when breeding or genetic engineering takes place. Some varieties of the same crop are susceptible to weed and insect damage, while others are not. If one or two varieties fail as a result of disease or pest invasion, the many other varieties that survive will provide the food that is needed.

If disease strikes a particular variety of crop, mass starvation could occur as it did in Ireland during the potato famine (1845–1852).

Question 7 "The history of food is one of globalization." Explain.

You may want to refer students to Figure 4–5 that shows where various foods originally developed. Trade in food has existed since humans began to travel beyond their own horizon. In the first century BCE, trade between China and the Middle East along the Silk Road saw the exchange of noodles for wine. Potatoes from South America returned to Europe with returning explorers. Food that moved from one part of the world to another was a globalized commodity in the past, as it is today.

Question 8 Research an area of the world currently suffering from a food shortage or famine. Examine

Question 8 a) causes

Question 8 b) impacts

Question 8 c) actions taken by

- local governments/agencies
- international governments/agencies

Question 8 d) success or failure of these actions

Students could be assigned events in specific countries or regions of the world. This activity can be evaluated using AR 3 Internet Search/Use in the Assessment Rubrics Section of this Teacher Resource.

Line Masters/Assessment Masters

- AR 3 Internet Search/Use

Thinking

Question 9 In 1996, the Food and Agriculture Organization (FAO) called on world leaders to halve the number of hungry people in the world by 2015. In that year there were some 800 million people who were hungry. By 2003, that number had risen to over 850 million. Why do you think the number has risen despite the pledge of world leaders to address this problem?

Students may suggest a number of possibilities:

- world leaders who pledged to address this problem did not do so because there are no penalties for not complying
- the development of food programs has not been able to keep pace with the rapid growth of population in countries where food supply is a problem
- food programs may be reduced or restricted because money is needed elsewhere, i.e., HIV/AIDS programs, the war on terror, etc.
- even if pledges are being met, environmental degradation is creating more hungry people than can be accommodated

Question 10 a) Consider the dietary deficiency diseases listed in Figure 10–2. How are these avoided (for the most part) in countries like Canada?

Diets in Canada tend to be varied in composition and rich in nutrients. People who eat a typical Canadian diet are likely to meet most, if not all, of their dietary needs. Many Canadians take dietary supplements, ranging from a simple multivitamin each day to the many products available from health food stores.

Question 10 b) Why are these solutions not practical in most developing countries?

These two solutions are not possible for people who are very poor and whose diets are often limited to what they can grow.

Question 11 Make a diagram like Figure 10–7 in your notebook. On this graph, locate each of the following types of farming operations with a small “x.” Label each point.

- a) a 1000-hectare cattle ranch in Alberta
- b) nomadic goat and sheep herding in North Africa
- c) a 0.2-hectare family farm in Bangladesh
- d) a vineyard in southern France
- e) a 75-hectare dairy farm in southern Ontario
- f) a 300-hectare corn and soybean farm in Iowa

Students may check their answers against Line Master 10–2 Continuum of World Agriculture.

Line Masters/Assessment Masters

- LM 10–2 Continuum of World Agriculture

Question 12 a) What are the characteristics of the high-yield varieties of wheat (and rice) that were developed during the Green Revolution?

- increased growth rate
- increased percentage of usable plant parts
- increased resistance to crop diseases
- smaller than regular crops because they focus more of their energy on growing seeds as opposed to stems, which are useless as food
- respond better to the use of farming inputs of fertilizer, pesticides, and irrigation
- grow faster so that more than one crop can be grown per year in suitable areas

Question 12 b) What successes did the Green Revolution have?

- The Green Revolution prevented massive famines predicted by experts as a result of exploding populations.
- It reduced food-supply problems in many developing countries.

- It allowed developing countries to spend more of their limited resources on social and economic programs because they had enough food.
- It helped some countries work through demographic transition. Because of the abundance of food, more money was spent on family-planning education and better healthcare systems. These programs allowed countries to take control of their burgeoning populations.
- It caused an increase in global grain production of 170 percent between 1950 and 1999 on the same amount of land.
- It saved millions of hectares of forest and grassland that might otherwise have been destroyed if conventional farming techniques had been employed to produce the same amount of grain.
- It caused a decline of 70 percent in prices of wheat and rice, thus helping poor people afford better diets.

Question 12 c) What are the concerns about the Green Revolution?

- The Green Revolution used a modern Western model of agriculture that involved costly inputs, such as chemical fertilizers, pesticides, and irrigation that many poor farmers on small plots could not afford.
- It benefited wealthy farmers as opposed to poor ones because they could afford the costs of production.
- It led to a dramatic loss of genetic diversity because HYVs displaced traditional crop varieties.
- It contributed to the loss of genetic diversity, which puts the global food supply in jeopardy. A disease or pest invasion can wipe out a crop for which there is no disease- or pest-resistant substitute.
- It promoted only a few highly developed varieties of wheat, rice, and corn, and these came to replace the hundreds of native varieties that had been previously grown in developing countries.
- Its system of agriculture is not as environmentally sustainable as the traditional system of agriculture. Although traditional mixed cropping provided relatively stable yields for centuries, yields from HYV crops declined significantly in only a few decades.
- HYVs cause a decline in soil fertility that cannot be made up entirely by the addition of chemical fertilizers.
- Some critics suggest that the creation of Western-style agriculture, at the expense of traditional agriculture, was done out of self-interest rather than for the good of poor countries. Western-style agriculture opened huge new markets for the makers of fertilizers, pesticides, and farm equipment, most of which come from developed countries.
- It did not benefit those who live in arid and semi-arid regions because it focused on research related to farming in areas with the most fertile soils and reliable rainfall.
- It did not benefit the poor who relied on staple diets of millet, sorghum, cassava, and yams. It focused on developing varieties of wheat, rice, and maize.
- It reduced the number of agricultural jobs in developing countries because it promoted mechanization.
- It was detrimental to women farmers who grow most of the food in developing countries. Women do not have access to financing that allows the purchase of equipment and seeds.

Question 12 d) How would you respond to each of the concerns about the Green Revolution? Give reasons for your responses.

Although students may see some concerns as more significant than others, they should be able to support their viewpoint with a valid argument. Some responses are shown in Table 2 below.

Table 2 Possible Responses to Concerns About the Green Revolution	
Concern	Justification
The Western agricultural model on which the Green Revolution was based disadvantaged the poorest farmers who could not afford to buy the pesticides, fertilizers, seed, and equipment that it demanded.	There is considerable truth to this statement, but this model was unavoidable since all items were an essential part of the growth of high-yield varieties. The plant varieties were made available free to farmers so that costs were minimized.
The Green Revolution focused on areas that were well suited for farming due to adequate rainfall and good soils. It also focused on farming that took place on large-scale operations.	This focus made sense, since these were the areas with the largest populations and therefore the most people at risk. Research to meet the needs of those living elsewhere came later. Large-scale farming operations were targeted because they were seen as the fastest way to improve production.
The Green Revolution led to a serious decline in genetic diversity.	This has proven to be a significant problem, but is largely unavoidable since the whole idea of the Green Revolution was to limit agriculture to a few highly productive varieties. The problem is no different from what happens in agriculture in developed countries.
Some poor people did not benefit from the Green Revolution because their staples are not wheat and rice.	Wheat and rice were selected for development because of the large number of people in the world who rely on these two crops.
The Green Revolution has proven to be non-sustainable; yields have declined greatly in recent years.	The Green Revolution was an accelerated introduction of modern agriculture into traditional environments to save lives in countries with exploding populations. There was no time to develop a more ecologically sound system of agriculture.

Table 2 Answer key for page 164, question 12 d).

Question 12 e) Do you feel the Green Revolution was successful or unsuccessful? Explain.

To a large extent, the way students feel about the Green Revolution may be determined by how they viewed the concerns they raised and examined in parts c) and d). Regardless of the position they take, stress the need for weighing the evidence. You may want to use the analogy of a courtroom lawyer presenting a case with arguments for a particular point of view that is supported by factual evidence.

Question 12 f) Dr. Borlaug did not see the Green Revolution as the solution to the world's food problems. Rather, he saw it as providing breathing space to allow the world's population growth to be controlled. What do you think of his assessment? Explain.

Some students will agree with Dr. Borlaug because rapidly expanding populations in developing countries is the real problem. If

population growth can be slowed in these countries, then there will be more food for fewer people. Population control is essential since the amount of land suitable for growing food is finite. Those who disagree with Dr. Borlaug may say that there is already enough food in the world and that the real problem is getting it distributed to countries where it is needed. The focus should be on solving the problem of lack of transportation infrastructure in developing countries. Another focus should be on persuading developed countries to give more money to develop programs that send surplus food to developing countries.

Some students may argue that since the increased food supply kept many people from dying, it may actually have led to increasing birthrates. Unless governments re-aligned their spending during the "breathing space" toward developing health education and birth control programs, the "breathing space" could be considered a period of time when people who

were saved from starvation were able to have children.

Question 13 a) How are transgenic crops and animals created?

Scientists remove a gene with a desirable characteristic from one organism and introduce it into an organism that lacks the desirable characteristic. For example, a gene that helps a fish survive in cold water has been transplanted into a tomato to make the tomato resistant to frost. This procedure can be done only after the genes of both organisms have been “mapped,” that is, when the functions of the genes in each organism have been fully understood.

Question 13 b) Create a summary of the advantages of and concerns about GMOs by completing Figure 10–19.

See Table 3 for some of the advantages and concerns expressed by students.

Question 13 c) On balance, do you personally feel comfortable eating GMO products? Do you think you have enough information to make an informed choice? Explain.

Most Canadians feel that they would like to have the choice of purchasing GMO foods. Surveys have indicated that they want labelling laws like those in Europe indicating that a product contains or might contain GM ingredients. Producers say this is impossible, since GM and non-GM products are mixed in the transportation and processing stages. GM critics say the real reason to avoid labelling is that consumers would balk at buying transgenic crops. Some of your students may express concern about ingesting a gene in a GMO that came from a food that is proscribed by their religion. Vegetarians may object to the fact that they might be ingesting an animal gene in a GM vegetable.

Some students may reject biotechnology that transplants genes from one organism to another, and yet accept traditional crossbreeding between two plant or animal varieties that hopes to pass desirable genes from parent to offspring.

Table 3 Advantages of and Concerns About the GMO Revolution	
Advantages of GMOs	Concerns about GMOs
Can create more nutritionally rich plants, e.g., rice that is rich in iron or vitamin A	The effectiveness of these products has been overstated.
GM plants do not require as much herbicide and insecticide; this saves the farmer money and reduces the toxic impact on the environment	Superbugs (and superweeds) that are resistant to all insecticides and herbicides can develop.
The Green Revolution gave its discoveries free to farmers	In contrast to the Green Revolution that gave its discoveries free to farmers, all GM technology is controlled by profit-driven private companies.
Terminator technology is a safety feature designed to ensure that genetically modified plants cannot escape into the natural gene pool	<ul style="list-style-type: none"> ■ Terminator technology forces farmers to buy new seeds every year, drastically increasing the cost of farming. ■ There are concerns that insufficient research has been done to prove the safety of GMOs. ■ Opponents feel that, at a minimum, products containing GMOs should be clearly labelled in North America, as they are in Europe. ■ Some people feel that the entire idea of transferring genes is unethical.

Table 3 Answer key for page 164, question 13 b).

Question 14 Some forms of factory farming raise questions about the ethical treatment of animals.

Question 14 a) Give some examples of how animals are mistreated.

- Hundreds of thousands of animals are raised indoors in extremely overcrowded conditions.
- Animals are fed and watered with quantities exactly measured to produce the greatest weight gain in the shortest time as opposed to letting them develop naturally.
- Chickens are genetically altered to produce more meat in a shorter period of time.
- To prevent chickens from fighting and injuring one another, their beaks and toes are cut off or they are raised in the dark.
- Pigs are raised in pens that are so small their movements are severely restricted.
- Some species, like hogs and veal calves, may be caged alone without any social contact.
- The crowded conditions create breeding grounds for stress and infectious disease.
- Animals are hung upside down by their feet at the slaughterhouse and attached to a moving rail while still conscious.

Question 14 b) What steps should be taken to eliminate this maltreatment?

Students may suggest the following:

- passing laws on the humane treatment of animals with strong penalties for non-compliance would be a start (as of 2001 such a law exists in Japan)
- supporting organizations that promote the ethical treatment of animals
- lobbying governments to pass laws for the ethical treatment of farm animals
- as consumers, purchasing organic free-range chickens and eggs and purchase products from producers who provide sufficient space and shelter, and use gentle handling techniques

Question 14 c) Do you think the “commando tactics,” such as breaking into labs to free animals or blowing up labs, adopted by some animal-rights groups are justified? Explain.

Students may argue either position:

They are justified:

- The ends justify the means because the welfare of animals is at stake—our treatment of animals is a reflection of our humanity.
- Violent forms of protest get media attention and focus people’s attention on the issues of animal welfare; simple protests do not get results.

They are not justified:

- Workers can be injured or killed when violent actions are taken.
- Extreme forms of protest can backfire when people who might support the cause refuse to do so because they are upset with the violence of the protest.

Question 15 Some people argue that organic farming is detrimental to the world’s rainforest. Because organic-farming methods rely on less intensive agriculture, more land is required to produce the same amount of food that more intensive methods of farming produce. The argument goes, “If we switch to organic farming, there wouldn’t be much room left for the rainforest.” What do you think about the accuracy of this idea?

Students may argue either position:

This argument is accurate:

- more land will have to be put under cultivation to grow enough food because organic yields from current farmland will not be great enough to feed growing populations in the developing world
- since marginal lands in non-rainforest regions cannot produce enough organic produce to meet the demand, the rainforest lands will have to be put under cultivation

This argument is not accurate:

- organic farming is already a standard practice on the small farms in most of the world and is not the main reason for food shortages
- what is needed is population control rather than expanding farming into the rainforests

Question 16 The countries of the Old Core are major suppliers of food to the rest of the world. What do you think will happen as more

and more food crops are used to produce biofuels in the Old Core countries?

Students may suggest:

- the price of food will rise around the world—as it did in 2008
- people who cannot afford the rising prices will go hungry, and more chronic hunger will occur in more places
- there will be food riots and demonstrations against rising prices—as happened in 2008
- a greater percentage of household income will be used for food rather than for other consumer goods
- the cost of producing meat will increase because of the rising cost of corn and other types of livestock feed; these feed grains are in demand for use in biofuel production

What do you think should be done about this situation?

Students may suggest:

- stop making biofuels out of livestock feed grains and food crops such as corn and soybeans, and instead use non-food biomass, such as switch grass
- developed countries should increase their financial support of the UN World Food Programme to make up for the extra money it has to pay for the more expensive food it purchases
- foreign aid should be increased to developing countries that are dependent on crops used in the biofuel industry. The price of these seeds increases as the demand by the biofuel industry grows and poor farmers cannot afford to buy them.
- increase the production of biofuels from non-food sources, for example, biodiesel from fats, and biobutanol from the fermentation of sugars
- develop alternative types of fuel such as solar, wind, hydrogen

Question 17 When the Canadian International Development Agency (CIDA) and NGOs assist people in famine-ravaged areas, they try to purchase foods from local or nearby suppliers. Why don't they ship in food produced in Canada?

It makes more sense for donor countries to purchase food from nearby countries or regions because it benefits local economies, and because the food is typical of diets in the famine area. Canada has learned through bitter experience that Canadian food is frequently unsuitable since people receiving the aid do not know how to prepare it, or it is too different from their normal diet, or as in the case of powdered milk, they do not have the necessary enzymes to digest it. Sending Canadian food also distorts the local economies; farmers in nearby countries or regions can't sell their products because free food aid is available.

Question 18 Research the roles performed by the United Nations Food and Agricultural Organization.

Students can obtain information about the roles of the Food and Agricultural Organization (FAO) at its Web site www.fao.org/unfao/about/index_en.html.

The FAO's mandate is to "raise levels of nutrition, improve agricultural productivity, better the lives of rural populations, and contribute to the growth of the world economy."

The activities of the FAO cover four main areas:

- i) Putting information within reach: serves as a network to collect, analyze, and disseminate data that contribute to development
- ii) Sharing policy expertise: uses its expertise to devise agricultural policy, support agricultural planning, draft legislation, and create national strategies aimed at achieving rural development and hunger-alleviation goals
- iii) Providing a meeting place for nations: provides the setting where rich and poor nations meet to build common understanding
- iv) Bringing knowledge to the field: has thousands of field projects throughout the world

Some programs developed and funded by the FAO include:

- Special Programme for Food Security—helps governments replicate successful food-security practices on a national scale
- Assisting countries to meet the Millennium Development Goals

- Designing and managing the Farmer Field School that trains farmers in developing countries in the best practices for their areas

How successful has it been?

Students will have to weigh the positive activities against the criticisms.

The FAO has benefited many countries with advice from experts, money for agricultural projects, the collection of agricultural data, and its support of many food initiatives.

The FAO has been criticized for some questionable policies and practices in forestry, fishing, aquaculture, and pest control. In 2004, the FAO endorsed agricultural biotechnology as a new tool in the war on hunger—a position objected to by more than 600 organizations around the world. A report in 2007 criticized the FAO as being too conservative and slow to adapt to the changing needs of poor countries, and its expertise is in question because of staffing problems.

Question 19 Sometimes called the “doomsday vault,” it is in fact a repository for seeds from major agricultural crops from around the world. It received its first 100 million seeds—from 268 000 varieties of crops—in early 2008. Conduct research on the Svalbard Global Seed Vault and answer the following questions.

NOTE: THE ANSWERS ARE BASED IN INFORMATION AVAILABLE IN EARLY 2008.

Question 19 a) Where is the global seed vault located?

- It is located on the Norwegian island of Spitzbergen, one of the Svalbard Islands in the Arctic Ocean, about halfway between Norway and the North Pole.
- It is situated just outside the town of Longyearbyen.

Question 19 b) What is the purpose of the global seed vault?

- The vault is designed to safeguard the genetic diversity of the world’s food crops in case nuclear war, climate change, or other impacts wipe out key seed varieties.
- There are about 1400 collections of agricultural seeds at universities, and government and plant-breeding facilities around the world; these facilities

have about 6.5 million seeds in storage. If these facilities lose their seeds, as some have due to power outages, wars, or natural disasters, the seed vault will be able to replace the seeds.

Question 19 c) Describe the characteristics of the vault.

- The vault is an underground bomb shelter 125 m inside a sandstone mountain of permafrost.
- It has blast-proof doors at the entrance, a second door 115 metres down the tunnel and two keyed air-locked doors at the end of the tunnel.
- The keys are coded to allow access to different levels of the facility.
- The vault has three halls, each about 1500 cubic metres in size (25 m deep, 10 m wide, 6 metres height).
- It is 130 m above sea level to ensure that it will stay dry even if the icecaps melt.
- Coal mined nearby provides power for the refrigeration system that cools the inside of the vault to -20°C to -30°C .
- The vault has the capacity to conserve 4.5 million seeds.

Question 19 d) How are the seeds stored?

- The seeds are wrapped in 4-ply laminated, aluminum foil packages that are heat sealed.
- The packages are sealed inside cardboard or plastic boxes and stored on shelves inside the facility.

Question 19 e) Who paid for and maintains the storage facility?

- The Norwegian government paid the US\$9 million construction cost.
- It is managed by the Norwegian government, the Global Crop Diversity Trust, and the Nordic Gene Bank.
- The Global Crop Diversity Trust is raising \$260 million to run the facility. As of spring 2008, US\$135 million has been pledged by donors including Norway, the UK (£10 million), the US, Australia, the Gates Foundation (US\$30 million), the Rockefeller Foundation, Monsanto Corporation, and Syngenta Foundation, among others.

Question 19 f) Under what conditions will the seeds leave the facility?

- Seeds will be replaced by a fresh sample.
- Seeds will be used to reseed a crop that has been wiped off the earth.

Question 19 g) If Canada sends seeds to the vault, who owns the seeds?

- The seeds remain the property of Canada, and only Agriculture Canada can take the seeds out of the vault.
- In 2008, Agriculture Canada sent 6000 samples from 90 different species to the vault for storage.

Question 19 h) Some seeds cannot be stored in the vault. Explain.

- The seeds of some plants such as strawberries, raspberries, Saskatoon berries, and coconuts do not store well.
- These plants are kept in living collections, rather than in seed storage facilities.
- Some plants, such as bananas, don't have seeds and are also maintained in living collections.

Question 19 i) Not everyone agrees that the seed vault is a good idea. What criticisms have been made about this storage facility?

There are already 1500 ex situ (off-site) storage facilities around the world that are trying to preserve crop diversity. Many are failing, however, because

- the seeds weren't stored properly
- some seeds have been contaminated from improper storage
- the reliance on one conservation strategy (storage) in one large facility is seen by some as the wrong strategy; rather, farmers around the world should be encouraged to store and use a wide variety of local seeds
- methods of security adequate to protect the seeds from contamination and theft have yet to be determined

What do you think?

Students will have to weigh the pros and cons discussed in the above questions.

Communication

Note: An ArcView activity, Question 21, has been included in these questions.

Question 20 a) Most agricultural areas of the world suffer from one or more deficiencies in the natural systems that support farming. List these deficiencies (see Figure 10–6).

The main deficiencies are described in question 3. You may choose to ask your students to do either this question or question 3.

Question 20 b) Work with three or four classmates to investigate some of these deficiencies. Each of you should choose one of the deficiencies to research. In your investigation, look for examples of both traditional and modern methods of addressing the deficiency. Share your findings with the members of your group.

This is a good opportunity for students to develop their Internet research skills.

Question 21 One way to measure the adequacy of the food supply in a country is to compare the amount of food energy available to the amount needed for good health. To examine the world pattern of food adequacy, you will create and analyze either a hand-coloured or ArcView map. (Your teacher will suggest which approach you will use and provide full instructions.)

Please refer to the GIS section in this Teacher Resource for overall instructions on completing the GIS activities in the text.

Students' work may be evaluated using AR 7 Mapping in the Assessment Rubrics section of this Teacher Resource.

Line Masters/Assessment Masters

- AR 7 Mapping

Question 22 Investigate eight food production issues, using a jigsaw approach. Research one of the topics below and present your findings to other members of the class who have studied other issues and who will present their

findings to you. Your teacher will give you details about how to do this.

- a) loss of genetic diversity**
- b) land reform**
- c) role of women in agriculture**
- d) agricultural support policies (for example, subsidies)**
- e) corporate farming**
- f) organic farming**
- g) the 100-mile diet**
- h) integrated crop and pest management**

A jigsaw approach works well with this question if the number of students in your class is equal to a multiple of eight. If the number of students you have is not a multiple of eight, two students can share a topic within one group. Each group of eight is called a “home group.” The students from each home group who are studying the same topic form an “expert group” and may research the same topic cooperatively. When research is completed, the “experts” make a presentation within their home group. It is a good idea to have all experts make their presentations to their home group in the same order. Should a student be absent, two home groups may combine so that students will hear reports on all the topics.

Application

Question 23 Philanthropy still plays a role in world development. Using the Internet, investigate how one of the following very rich people has contributed to making the world a better place in which to live.

Philanthropy is the act of donating money, time, or effort to a charitable cause. The philanthropic tradition was started by the entrepreneurs of the pre–World War I period and has continued with the contemporary billionaires listed below.

Question 23 a) Ted Turner

In 1990, he created the Turner Foundation to focus his philanthropic work on environmental and population issues. In 1998, Turner donated US\$1 billion to the United Nations to develop new programs on issues of this nature. He donated the

money after realizing that his stock portfolio had increased by US\$1 billion in only a few days.

Question 23 b) George Soros

In the 1970s, Soros began his philanthropic work by providing funds for black students in apartheid South Africa. He also provided large sums of money to the countries of Eastern Europe and to countries that were formerly part of the Soviet Union. This aid helped provide for a smoother transition from communism to capitalism. In 2007, he donated \$100 million to develop the Internet infrastructure for Russian universities and \$50 million for eradicating poverty in Africa. As of 2007, he had donated more than \$6 billion!

Such generosity might seem odd given that Soros, who is a currency trader, was the person who sparked the collapse of Asian economies in the late 1990s. He did this by deciding that Thailand’s currency was grossly overvalued and promptly dumped his holdings. His action started a run on all Asian currencies.

Question 23 c) Bill Gates

Gates and his wife, Melinda, have decided that they will give away all their money over their lifetimes through the Bill and Melinda Gates Foundation (they are setting aside US\$30 million for each of their children). The Foundation, started in 2000 with \$126 million, grew to \$2 billion by 2002, and with the donation of \$10 billion by Warren Buffett (the world’s richest person in 2007), the foundation’s assets grew to about \$35 billion in 2006.

The foundation has three grant-making programs:

- Global Health Program that includes grants for eradicating polio among children and for supporting HIV research
- Global Development Program that includes grants to the Grameen Foundation that provides loans to small entrepreneurs in developing countries; to the Alliance for a Green Revolution in Africa that supports agricultural development; and for the development of public libraries throughout the world

- United States Program that includes grants to libraries for Internet access and education scholarships

Question 23 d) another very rich person of your choice

Students should be able to find a number of people who fall into this category.

Question 24 The production of most food crops depends on honey bees for pollination. However, in North America, Europe, and Asia, bees are disappearing. This sudden disappearance may be the result of Colony Collapse Disorder. Do some research on this phenomenon, and answer the following questions.

Question 24 a) What is Colony Collapse Disorder?

Beginning in late 2006, US beekeepers began reporting losses of 30 to 90 percent of their hives. A report by the Apiary Inspectors of America in the spring of 2008 indicated that 34 percent of commercial hives had disappeared. The disappearances are called Colony Collapse Disorder (CCD). When a bee becomes sick, it leaves the hive in order not to infect other bees. Researchers do not know if this is happening, or if the bees are unable to find their way back to the hive because of some other disorder.

Question 24 b) Give some possible reasons for Colony Collapse Disorder.

As of early 2008, no one was sure why the disappearances were occurring. Some speculations include:

- toxic pesticides or herbicides
- an AIDS-like virus
- a form of malnutrition due to crop pollen with low nutritional value
- stress due to overcrowding
- the electromagnetic radiation from cell phones and other sources
- genetically modified crops that contain the Bt toxin that might be killing bees as well as other insects
- a parasite that lives on the bee and gradually kills it

Question 24 c) What is the current state of finding a cure for CCD?

In 2007, the Agricultural Research Service of the United States Department of Agriculture brought together experts from around the world to discuss the problem. Research is focusing on four areas: pathogens, parasites, environmental stresses, and bee management stresses such as poor nutrition. The researchers seem to think that a single factor is not the cause of CCD. Studies in 2007 indicated that only one pathogen was found in almost all the bee colonies with CCD—the Israeli acute paralysis virus (IAPV) that is transmitted by a mite. The study found a strong correlation of the appearance of IAPV and CCD, but no cause-and-effect connection was confirmed.

Question 24 d) What has been the impact of CCD on agriculture?

The impact of the loss of bees could be catastrophic. The production of most food crops depends on honey bees. Honey bees pollinate approximately 100 of our most important crops, including fruits and vegetables. Monoculture agriculture, however, has reduced the natural habitat of bees to the point that there are not enough in most locations to pollinate crops adequately. To overcome this problem, bees are trucked all over the continent to pollinate crops. One month they may be in the almond orchards of California, and the next in the blueberry fields of the east coast. Some bees are trucked over 7500 km a year.

It is estimated that bee pollination is responsible for \$15 billion in added crop value per year in the US. In California, the almond crop alone uses 1.3 million colonies of bees, approximately one half of all honey bees in the United States; this need is projected to grow to 1.5 million colonies by 2010. In 2006, the almond crop was worth \$1.5 billion. Without bees, this industry and others will be at risk. The impact on our food supply could be disastrous.

Question 25 The food in our supermarkets comes from all over the world. Work with three or four classmates to investigate where the

food you generally eat originates. Canada's Food Guide lists four main food groups:

- **vegetables and fruit**
- **grain products**
- **milk and alternatives**
- **meat and alternatives**

It also mentions

- **oils and fats**
- **beverages**

Question 25 a) Each group member is to visit a supermarket and examine the place of origin for five items in each food group.

Question 25 b) Compare your findings with those of other group members. What patterns, if any, did you find? For example, did certain types of foods come from particular countries/regions? (Note: the place of origin for some products may vary with the seasons.)

In autumn, many of the foods may come from local producers, but in the winter and spring months many fresh foods will come from California, Mexico, Florida, China, Chile and other warm-weather countries. Coffee, tea, bananas, and similar fruits will come from tropical countries.

Question 25 c) In each food group, determine which two products travelled the shortest distances and which two travelled the longest distances.

Question 25 d) Draw a diagram showing the food miles of the two products in each food group that travelled the longest distances. (Note: Refer to Figure 10–18 to see how your diagram should look.)

Question 25 e) Are there alternative places of origin or substitute foods for those products that have a high number of food miles? Explain.

It would be difficult to find alternative places of origin for some foods such as tropical fruits and fresh vegetables in winter. Import substitution, in which Canadian products are substituted for imported products can be practised. For example, instead of orange juice from Florida, apple juice from Canada can be used. In winter, frozen or

canned products grown locally can be used instead of imported fresh products.

Assign this question twice: once during local harvest time and then again during the winter in order that comparisons can be made. Since this activity takes some time to complete, it should be assigned several days before taking it up.

- The diagrams produced by students in part d) could be displayed to show the impact of food choices to students not in this course.
- A class discussion of food substitutes in part e) could focus on the use of Canadian products such as apple juice instead of imported orange juice, cabbage instead of imported lettuce, and hot house cucumber instead of imported cucumber.

Question 26 FOCUS ON GLOBALIZATION: The UN has given you the task of making recommendations to solve the following situation: The Core countries have an excess of food, and the Periphery countries have a shortage of food. What do you think can or should be done? Explain your recommendations.

Students may discuss ideas such as the following:

- The simplistic answer is that food should be shipped from the rich countries to the poor. This answer ignores the realities of the world's agricultural economic system. Food can flow from the US, Canada, the EU, and Australia (and a few other countries), but only if it is paid for. How much money are these countries willing to spend, and for how long? Shipping food from one country to another does not solve the basic problem of food shortages—it is only a stop-gap.
- If a solution is to be found to the problem of hunger, a good beginning would be to repeal subsidies. Agricultural subsidies distort the fair and efficient operation of the market and help to keep farmers in developing countries poor since they can't compete with the subsidized commodities on the world market. The subsidies make it harder for these farmers to operate effectively and provide for the people in their home countries.

- Two other related problems must be addressed. First, much of the best farmland in developing countries is used for producing cash crops such as bananas and sugar for developed countries. Second, there is a need for land reform in order that the poorest farmers in developing countries may have land to feed themselves.