

CHAPTER 14

Challenges and Consequences of Agricultural Practices

Topics 5.10–5.12

Topic 5.10 Consequences of Agricultural Practices

Learning Objective: Explain how agricultural practices have environmental and societal consequences. (IMP-5.A)

Topic 5.11 Challenges of Contemporary Agriculture

Learning Objective: Explain challenges and debates related to the changing nature of contemporary agriculture and food-production practices. (IMP-5.B)

Topic 5.12 Women in Agriculture

Learning Objective: Explain geographic variations in female roles in food production and consumption. (IMP-5.C)

For hunger is a direct affront not only to the physical integrity but also to the very dignity of the human person. Hunger is an insult to the fundamental values of the international community.

—UN Secretary-General, Boutros Boutros-Ghali,
World Food Summit, 1996



Source: Alamy

In Malawi, Africa, women receive training on farm equipment, such as this hand tractor, which allows them to be more productive farmers. (See Topic 5.12 for more on the changing role of women in food production.)

Consequences of Agricultural Practices

Essential Question: What are the environmental and societal consequences of agricultural practices?

In the modern era, commercial agriculture has almost completely replaced subsistence farming. Many farming operations evolved from small enterprises owned by a single family into large-scale, capital-intensive businesses. This shift has put more stress on the environment than ever before.

In addition to dealing with the environmental consequences, agricultural challenges now include, developing new farmland, growing more food, and managing agriculture at a different scale. It is not simply changing subsistence farmers into commercial farmers, but how all farmers alter their practices to accommodate the changing needs and desires of the population.

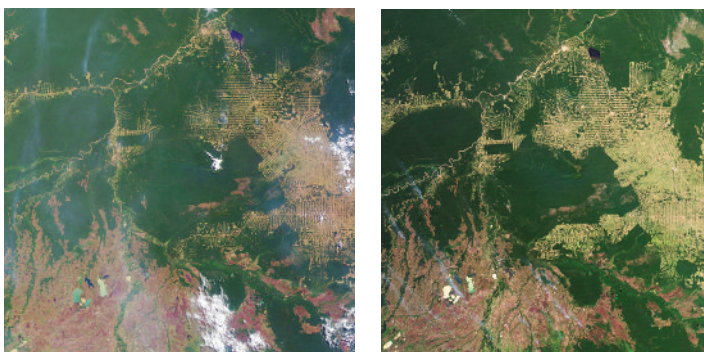
Women have always played a crucial role in food production, and in recent years, their contributions have become even more important. Women are often the leaders in finding methods to improve the productivity of farms, in spite of the obstacles of gender inequality.

Environmental Effects of Modern Food Production

Although there are tremendous differences in the efficiency of farming practices throughout the world, most practices have evolved to effectively use the soil quality and climate in various locations. Technological innovations have allowed for massive increases in food production, but at a cost. It is usually modern and intensive forms of farming that have the greatest environmental impact. Regardless of the type of farming practiced, humans have an impact on the environment when they alter natural ecosystems.

Land Cover Change

Changes in land use occur as the world's population grows, due to increased pressure to grow more food and develop more land for homes. **Land cover change** is the study of how land is used and the impact of changing land use. Geographers are particularly interested in loss of natural land areas to agriculture and the loss of agricultural land to the expansion of urban areas. (See Topics 5.11 and 6.11.) Geographers use data and satellite images to map and analyze changes in land use.



Images taken from space show parts of western Brazil in 2000 (left) and 2012 (right). Deforestation and agriculture have impacted the rainforests of this region. The dark areas are forest and the light areas are farmland. Describe the changes of land use from 2000 to 2012.

Pollution

Pollution is often associated with industrial processes, but farming also contributes to air, water, and soil pollution. The most intensive forms of agriculture are usually responsible for the worst agricultural pollution. Farmers' use of chemical fertilizers, insecticides, pesticides, and herbicides has increased tremendously over the past several decades, and resulted in polluted air, water, and land. Their use has also resulted in health issues for those exposed to the chemicals. To ensure minimal damage to the environment and people, many governments have regulated the amount and types of chemicals that can be used, in addition to how and when they can be applied.

Desertification

Alteration of the natural vegetation in arid areas causes fertile land to become infertile, or **desertification**. For example, desertification is caused by the removal of forests or overgrazing livestock which can allow for increased wind erosion and result in the loss of the topsoil. Even common farming practices, such as plowing or irrigation, done irresponsibly can expose the soil to excessive erosion.

Soil Salinization

Improper use of irrigation or water high in salt content can cause salinization of the soil. **Salinization** occurs when salts from water used by plants remain in the soil. Salinization decreases a plant's ability to uptake water and nutrients, which results in lower yields and may render soil useless. Evaporation also leaves salts behind in the soil, so if there is excess water, either in the soil or on the surface, salinization rates increase.

Protecting Natural Ecosystems and Conservation Efforts

Economic benefits of agriculture conflict with conservation and environmental efforts in many regions. In response, an increasing number of individuals, non-government organizations, and government agencies are becoming involved

with conservation efforts. Their goal is to counter the damaging effects of destroying the natural landscape, and the various flora and fauna that inhabit it, through the expansion and development of farmland.

National and local governments have instituted regulations on the use of agricultural chemicals, development and possible destruction of fragile natural environments, and preservation of valuable farmland. Governments have also educated farmers and the general public on the environmental effects of farming.

Individual farmers effect change by pursuing more environmentally friendly practices, such as reducing the use of agricultural chemicals, using more natural pest control solutions, monitoring irrigation usage, and growing crops organically. Individual consumers show support for farmers who use more sustainable practices by purchasing their products, even at higher prices.

Another practice to defend the environment is to create protected zones, forests, or preserves where development is not allowed. Some countries set aside land that has biodiversity or endangered species in order to preserve and protect the land, plants, and animals. Debates about how much protection is warranted and what types of activities should be allowed in protected areas occur on a local, national, and global scale.

An example of environmental protection at a global scale occurred in the 1980s. People from many nations joined the “Save the Rainforest” movement that supported farming and logging practices that did not damage the Brazilian rainforest.

Humans Altering the Landscape for Agriculture

Ever since the first humans began to farm, they altered the landscape to their advantage. Things that people now consider natural—building earthworks, redirecting streams, or removing natural obstacles—were at one time innovations. Far from natural, these undertakings were fresh, creative solutions to challenges faced by the earliest agriculturalists.

Terracing

One of the earliest human alterations of the landscape was **terrace farming**, in which farmers build a series of steps into the side of a hill. This creates flat surfaces, which have several benefits over steeply graded hillsides:

- The amount of arable land increases in areas with steep hillsides.
- The land collects rainfall that sustains the crops, rather than allowing it to run down a sloped hillside.
- The reduction in water running down the hillside limits soil erosion.

However, if terraces are not carefully maintained, a heavy rainfall can cause disastrous and deadly mudslides.

Terrace farming has long been used throughout the world. In East Asia, terrace farming is often used to grow rice. In South America, potatoes and

maize (corn) are the main crops. In northern Africa, people often grow fruit and olive trees on terraced land.

Managing Water

The process of applying controlled amounts of water to crops using dams, canals, pipes, sprinkler systems, or other manufactured devices rather than relying on just rainfall, is called **irrigation**. Humans have used irrigation to increase food production and increase their standard of living for thousands of years. In modern times, the successful use of large-scale irrigation contributed greatly to feeding the rapidly growing population of the world. Irrigation systems can turn deserts and semi-arid regions into productive farmland. An example is California, particularly the dry central and southern regions of the state.

Types of Irrigation Systems Dams turn streams or rivers into reservoirs that are used to maintain large quantities of water throughout the year. While beneficial to preserve and distribute water, dams destroy river ecosystems and people are often displaced from their land when the reservoirs are created.

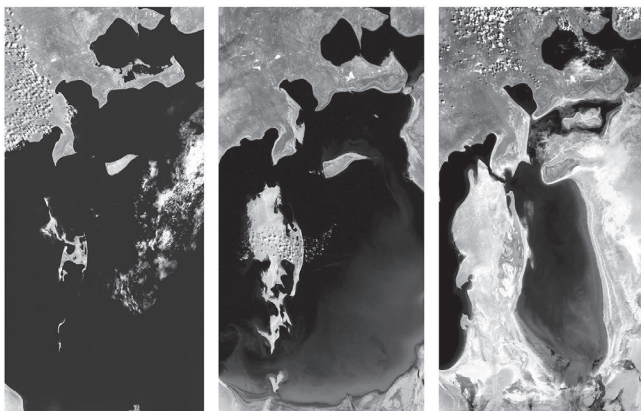
Aquifers are underground reserves of fresh groundwater which can be used to water crops. Wells must be built to access the water and then it is piped to the fields. Overuse of aquifers is a concern because the supply of water is often limited.

A system developed in the mid-20th century is **center-pivot irrigation**, in which watering equipment rotates around a pivot and delivers specific amounts of water, fertilizer, or pesticides to the field. These systems create large circular patterns in fields, which are visible from the sky. (See image on page 270.) This capital-intensive system is common with large-scale commercial farming because of its efficiency.

Problems From Irrigation When misused, irrigation can cause severe problems. It can disrupt the natural drainage of water and reduce the normal regeneration of soils caused by natural flooding. Irrigation can reduce the amount of surface water in rivers and lakes. Overwatering leads to water contaminated with chemicals seeping into rivers and underground water systems.

In the 1960s, the Soviet Union tried to divert water from rivers that flowed into the Aral Sea to increase cotton production in the region. The Aral Sea, once the fourth-largest lake in the world, was reduced to 10 percent of its former size by 1997. The project was poorly done and much of the water went to waste. The water that remained was extremely saline, which destroyed a flourishing fishing industry and caused economic hardship for the population that lived near the lake. Some of the former lakebed is now classified as a desert and cannot be farmed.

In recent years, the government of Kazakhstan has been successful in revitalizing one small part of the lake. The destruction of the lake has provided a lesson regarding the consequences of manipulating the natural environment.



The Aral Sea evolved into four smaller lakes as it dried up over several decades. As the process continued, the lakes became progressively smaller and the easternmost lake completely disappeared.

Draining Wetlands

Low-lying areas that contain a significant amount of water at or near the surface are **wetlands**. Many people viewed wetlands as not serving any useful role. Therefore, when developers looked for land, the fertile soil of wetlands is seen as a viable option to be converted into other land use, especially for farmland.

When wetlands are converted to agricultural or other land use, numerous benefits are lost. There are many positive impacts of wetlands:

- providing a significant biodiversity in both plants and animals
- acting as natural filters that protect surface water and groundwater quality
- trapping sediment and protect against shoreline and stream bank erosion
- averting flood damage during periods of potential flooding by holding and then slowly releasing water
- buffering the local water supply by holding water during periods of drought
- reducing greenhouse gases by building and storing soil carbon

Clearing Trees and Other Vegetation

The removal of large tracts of forest, or **deforestation**, has occurred throughout human history as a common solution to the need for additional farmland. Northern and central Europe were once heavily forested. Now, the region is mostly farmland and urban areas. Deforestation today occurs mostly in Southeast Asia, parts of Africa, and, most notably, in the rainforests of South America.

Cutting down trees can result in local problems, such as soil erosion, decreased rainfall, warmer temperatures, and desertification. In addition, it can cause devastating global environmental damage. In particular, the rainforests

absorb so much carbon dioxide that shrinking them leads to an increase in atmospheric carbon dioxide, which contributes to worldwide climate change.

Shifting Cultivation

Slash-and-burn agriculture, an early agricultural practice and type of shifting cultivation (see Topic 5.1), takes place when all vegetation in an area of forest is cut down and burned in place. The ash provides nutrients to the soil, and the land can be farmed for a few years before the soil becomes depleted and the plot is abandoned. The plot then returns to a natural, if somewhat altered state, while the farmers move on to burn and plant in a new space. Because slash-and-burn agriculture requires people to move regularly, it is classified as shifting cultivation. On a small scale, this system is beneficial to humans, but the environment recovers slowly. However, as population pressure increases, slash-and-burn agriculture on a large scale does not allow the ecosystem to recover, causing permanent damage.

One such environmental damage from shifting cultivation is soil erosion. Farmers usually remove vegetation by burning it, cutting it down, pulling it out, or killing it with herbicides. On the Great Plains and prairies of the United States, farmers removed the tall prairie grasses in order to plant wheat and other grains. These new crops lacked the extensive root systems of prairie grass. Without the anchor of strong roots and with dry conditions, valuable topsoil simply blew away. During this period, known as the Dust Bowl, it is estimated that nearly 35 million acres of arable land became useless. This era was one of the worst ecological disasters in U.S. history.

Pastoral Nomadism

Nomadic herding (see Topic 5.1) is an extensive agricultural activity that involves groups of people moving often and raising animals as their main means of survival. A herder's willingness to move frequently allows for a much larger number of animals to be kept, which reduces danger of the loss of a few animals. With pastoral nomadism, the farmer will keep the animals in one area only until the supply of food reaches the point that further grazing will do permanent damage to the land. If the livestock are not moved at that point, then overgrazing can lead to desertification since the animals will have eaten much of the grass, and even pulled up the roots. This makes the soil susceptible to wind erosion. This type of environmental pressure is occurring in the Sahel region of Africa.

It may appear as if pastoral nomadism is an undesirable and inefficient type of agriculture. In reality, if practiced in an environmentally sensitive way, it is an extremely efficient way to use poor quality land. The families that depend on this practice use the livestock in numerous ways. They use hides for clothing and shelters, consume meat and milk for nutrition, and trade animals when other necessities are required.

Similar to slash-and-burn agriculture, pastoral nomadism is not as common as it once was. Individuals involved in both do not usually own the

land they use but rely on customary systems of communal land usage. Since governments rarely recognize these systems, maintaining these lifestyles has been difficult.

Societal Effects of Agricultural Practices

The development of agriculture has altered landscapes and resulted in environmental challenges that have had a substantial impact on society. It has influenced the size of the world's population, dietary practices, the role of women in society, economic development, and globalization.

Changing Diets

A challenge of the global food supply is the changing dietary preferences of people, especially in semiperiphery countries. As the citizens of these countries enjoy improved standards of living, they seek a more western-style diet involving meat, dairy products, and processed and convenience foods. The demand for and the use of these products can lead to significant problems.

Animals are inefficient food converters since they consume more calories than they produce. Farmers feed approximately 35 percent of the world's crops to livestock so these animals, which are used to produce meat and dairy products, will grow larger in size and number. This means fewer crops are available for human consumption.

Livestock production also puts much more demand on the environment than crop production does. Two environmental issues with raising livestock are the large amount of fresh water required by the animals and disposal of the waste they produce.

As processed food is prepared, it can be cooked, canned, frozen, packaged, or modified with preservatives. Some foods are minimally processed such as canned vegetables, while others are heavily processed such as frozen pizzas. Large agricultural food companies efficiently process food in the field or factory. These companies then advertise the convenience and cost effectiveness of ready to eat foods. Processed foods have changed peoples' diets in many communities. Agriculture continues to change to address growing concerns about the effects of diets heavy in processed foods, such as high blood pressure, elevated cholesterol, and obesity.

Role of Women in Agricultural Production

Women play an important role in agriculture throughout the world, especially in periphery and semiperiphery countries. Traditionally, women helped men in the fields and in processing and storing the harvest. Also, women performed the task of selecting the best seeds to plant the following year.

Recent economic development in periphery and semiperiphery countries has resulted in jobs in different sectors of the economy. Men are more likely to leave the farm and accept these jobs in urban centers. If the centers are close enough to commute to on a daily basis, then men might continue to be

involved in the family farm. If the jobs are in centers that require men to leave their homes, then women take on much larger roles in running and managing family farms.

This feminization of agriculture has led international aid agencies to recognize that agricultural education and training, and more financial assistance, should be extended to women. The International Assessment of Agricultural Knowledge, Science, and Technology for Development (IAASTD), an initiative of the World Bank, found that women tend to be more cautious than men in making economic decisions and are less likely to accept high-risk ventures. Therefore, women are unlikely to invest in capital-intensive, large-scale commercial operations to compete in international markets.

Even if female farm owners were willing to purchase the inputs for a larger-scale operation, it is unlikely that banks or lending institutions would provide loans to them. The IAASTD has suggested that if women had equal access to production resources as men, productivity would likely rise by 20 to 30 percent.

In core countries, women usually have more opportunities to work in nonagricultural jobs than in non-core countries. There is a large number of women in rural areas of the United States who have found employment off the farm. As large agribusinesses become more common, there is an increasing number of agriculture-related jobs in management, research and development, operation of sophisticated machinery, processing, distribution, and marketing. Many of these jobs are filled by women. As agricultural changes, so do the related jobs and the mixture of people who do them.

Economic Purpose

Agriculture is an important part of most countries' economies. Agricultural products are used as food, fiber, fuel, and raw materials. Each use adds to the economic value of agricultural goods. For example, the fibers of cotton are used to manufacture clothing and other textiles, trees for building materials, corn and sugar for ethanol, and other plants are used to make medicines. Some of these products are at a local scale, near where they are grown. However, most are produced for national- and global-scale trade economies.

Agriculture contributes to the Gross Domestic Product (GDP) of countries, or the dollar amount of all final goods and services produced within a country in one year. (See Topic 7.3.) As seen in the table on the following page, agriculture is responsible for a small percentage of U.S. and Canadian GDPs. Yet, this is a small percentage of two very large GDPs (over \$22 trillion in 2019), so the actual value of agriculture is over \$200 billion. The Afghani and Ghanaian GDPs are so much smaller (\$85 billion together), that even a large percentage of those countries' GDPs equals a smaller total value of agricultural goods compared to the United States and Canada.

| AGRICULTURAL DATA, 2017 (from selected countries) | | |
|---|------------------------------------|--|
| Country | Percentage of GDP from Agriculture | Percentage of Labor Force in Agriculture |
| United States | 0.9 | 1.3 |
| Canada | 1.6 | 2.0 |
| Afghanistan | 23.0 | 44.3 |
| Ghana | 18.3 | 44.7 |

Source: CIA World Factbook

Agriculture in the United States and Canada makes up a tiny percentage of the GDP, yet in Afghanistan and Ghana it is a much larger percentage. A similar situation exists for the percentage of the labor force working in agriculture among the four countries. What does this mean about the importance of agriculture in Afghanistan and Ghana?

In both the United States and Canada, food producers do a significant amount of processing to food, which adds to the total value of agriculture. In Ghana and Afghanistan, very little value is added to the agricultural products through manufacturing.

In terms of the percentage of the labor force, the low numbers in the United States and Canada reflect the significant amount of mechanization used on farms, so the labor force required is very small. In Afghanistan and Ghana, farms use much less mechanization and there are far fewer job opportunities in other sectors of the economy, so the percentage of people involved in agriculture is very high.

REFLECT ON THE ESSENTIAL QUESTION

Essential Question: *What are the environmental and societal consequences of agricultural practices?*

| Agricultural Practices | Impact on Environment or Society |
|------------------------|----------------------------------|
| | |

KEY TERMS

land cover change

desertification

salinization

terrace farming

irrigation

center-pivot irrigation

wetlands

deforestation

slash-and-burn agriculture

Challenges of Contemporary Agriculture

Essential Question: What are the challenges and debates related to the changing nature of contemporary agriculture and food-production practices?

Many different patterns of agricultural production and consumption have developed across the globe as a result of how farmers respond to various factors. For each of the different factors, farmers decide how to take advantages of opportunities and how to overcome challenges to be successful.

Perhaps the most obvious factor influencing the patterns of production and consumption is the physical environment. How a farmer uses a flat piece of land with good soil and favorable weather will obviously be different from a rugged landscape with poor soil and unfavorable weather. Other factors that can influence the patterns of production and consumption include government policies, transportation linkages within the region and beyond, the level of economic well-being of the citizens of the region, social and cultural traditions and expectations, access to the results of agricultural research, and the proximity to large markets.

Agricultural Innovations

During the Third Agricultural Revolution, scientists researched ways to increase yields to feed growing populations, improve foods' nutritional value, and increase the profitability of farming. While agricultural innovations often accomplish at least one of these three goals, people disagree if negative consequences are outweighed by the benefits. As noted in Topic 5.5, the Green Revolution was both successful and controversial. Similarly, other innovations often raise concerns.

Biotechnology and Genetically Modified Organisms

Biotechnology is a recent controversial innovation that is used to improve the quality and health of plants and animals. Biotech includes the development of **genetically modified organisms** (GMOs), which are plants or animals that scientists have modified by extracting genes of one species and inserting them into the DNA of another species. Compared to traditional foods, GMOs can be more nutritious, resistant to weather and pest-related damage, and

less susceptible to spoilage. The use of GMO seeds usually results in farmers drastically reducing chemical usage to control disease, weeds, and pests.

While the term genetic modification is commonly used, the terms genetic engineering and genetic improvement are also used. Biotechnology can also involve other sophisticated practices that advances peoples' health, such as molecular markers, molecular diagnostics, vaccines, and tissue culture.

GMO crops were first produced in the 1970s and started becoming widely used in the 1990s. The majority of scientists have found these processes safe for humans. Today, most corn, soybeans, and cotton grown in the United States, are GMO varieties. However, only a few other countries, such as Brazil and Argentina, produce large amounts of GMO crops. Many countries, particularly in Europe, have restricted the use of GMOs due to concerns:

- GMO seeds are too expensive for poor farmers to use, in part because they are often sterile, so new seeds must be purchased each year.
- GMO seeds that are resistant to pests and herbicides might lead to the development of superpests or superweeds.
- GMOs might have potential long-term risks to consumers, such as organ problems or reduced immunity to diseases, that have yet to be identified and studied.

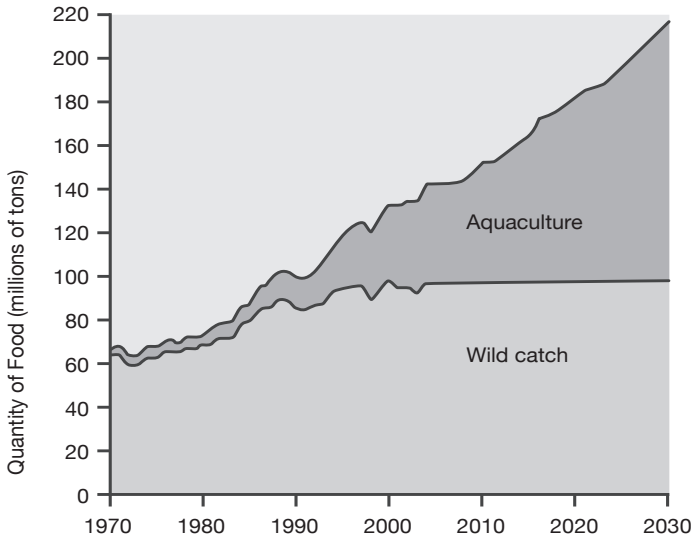
Aquaculture

Population growth has increased the demand for food which has led to overfishing, or the depletion of fish in oceans and lakes. In response, **aquaculture**, or **aquafarming**, the practice of raising and harvesting fish and other forms of food that live in water, has become more common. People in China and Southeast Asia have practiced aquaculture for thousands of years, but it is newer in the rest of the world. Often referred to as the **Blue Revolution**, the practice is now the fastest growing form of food production on the planet and responsible for approximately 50 percent of the world's seafood.

As with other forms of food production, there are environmental concerns related to aquaculture. Critics of open-pen systems—in which a cage or net is moored to the seafloor and the fish are able to interact with the wild surroundings to some extent—point out numerous problems:

- High fish density in enclosures means diseases and parasites thrive and spread easily.
- Parasites and diseases can easily spread from fish in the enclosures to the nearby wild stock.
- Chemicals and antibiotics used to counter parasites and diseases can damage the ecosystem around the enclosures.
- Fish can escape pens and may breed or compete with native stocks of fish.
- Excess feed and the concentration of fish waste can produce dangerously high levels of organic matter in local bodies of water.

THE GROWTH OF AQUACULTURE



Source: futuretimeline.net

Describe the trend of both aquaculture and wild caught seafood since 1970.

There are also social concerns regarding aquaculture. The installation of fish farms can challenge traditional fishing and lead to conflicts between the two groups of fishers, disrupting the local way of life. Another concern is that owners of the aquaculture operations may unethically exploit the local labor and local environment. Some people are concerned that fish from fish farms contain high levels of pesticides that could harm humans.

Debates continue on issues of sustainability of both wild seafood and aquaculture. Without aquaculture, demand for wild caught fish increases stress on ocean and sea ecosystems. Quotas, regulated fishing seasons, and zones have helped wild seafood stock to rebound, but challenges remain. As the world's demand for seafood increases, striking a balance between the two systems will be critical to maintain a sustainable system.

Environmental Issues Related to Agriculture

Modern agriculture has dramatically modified the natural landscape. Some of these changes constitute significant environmental damage.

Agricultural Chemicals and Fossil Fuels

Much of the environmental impact of farming comes from the use of chemicals. Farmers have long used fertilizers to replace nutrients in the soil. Traditionally, the fertilizer was human or animal waste. When used properly, these products provided the soil with nutrients and disposed of wastes. While some farmers still use waste as fertilizer, most rely more on chemical fertilizers. If too much is applied, the excess contaminates nearby water supplies, causing significant

environmental damage, including growth of toxic algae that uses the oxygen in the water, which kills fish and other organisms.

A second group of potentially harmful chemicals includes those designed to kill unwanted insects or plants. Pesticides, insecticides, and herbicides destroy parts of the natural ecosystem. When used or disposed of incorrectly, they can cause significant damage to other life forms, including humans.

Another group of powerful chemicals are those given to livestock, such as antibiotics to prevent disease and hormones to promote growth. Many consumers fear the consequences of consuming meat from animals given these chemicals. The primary concern is that the practice can lead to the development of antibiotic resistant bacteria, or superbugs, that could be transferred to humans and lead to serious illnesses. There is not agreement within the scientific community on the associated risks.

Modern farming machines, such as combines and tractors, run on fossil fuel. The use of these machines results in air pollution from the exhaust, depletion of fossil fuel reserves, and leaks or spills of various petroleum products that can contaminate soil and water.

Depletion of Water Supplies

The misuse of water by farmers can also damage the environment. On a worldwide scale, approximately 70 percent of all accessible fresh water is used for agriculture. Some of this water is wasted through inefficient irrigation. At times, farmers are wasteful with water by using more for crops than needed, using irrigation systems with pipes that leak, or growing crops in arid places that require excessive amounts of water. Poor irrigation can cause several problems including salinization and water depletion. (See Topic 5.10.)

Loss of Biodiversity

Changes in agriculture often reduce biodiversity. As improved varieties of crops are developed, farmers often abandon older varieties. In addition, farmers grow fewer varieties of crops than ever before. Specializing in one crop, which is known as monocropping, or monoculture, then reduces the diversity of the insects, animals, and other organisms that depend on other varieties of plants. Biodiversity also decreases as land cover uses change from wild ecosystems to agriculture or urban uses. (See Topic 5.10.)

Soil Degradation and Erosion

Many people believe grazing animals has very little impact on the natural landscape. In a large open area, the animals will simply wander from area to area seeking grass and allow the grazed areas time to recover. In restricted areas, farmers move their herds between enclosures to allow for the recovery of the grasslands.

However, if the density of animals is greater than even expansive grasslands can support, animals will **overgraze** in the search for food. This damages the grasslands to the extent that the vegetation will not refresh itself even after the

animals leave. Overgrazing most often occurs when farmers or herders have too many animals, they control too little land, or climatic conditions worsen and there is less pasture available than usual. With the right combination of overgrazing and environmental circumstances, soil erosion become a danger. The Sahel region of Africa is an example of where this pressure is occurring.

Overgrazing is increasing in pastoral nomadism as the amount of land available to herders and their families has shrunk in recent decades. Since there is less land available for the migratory herders, they have to remain longer in fewer locations, significantly increasing the risk of overgrazing. Several changes have decreased the availability of pastureland, which makes overgrazing more likely:

- Governments have become more protective of their borders, which makes it difficult for some herders to follow their traditional migratory routes that often cross international borders.
- Some former pastureland is now irrigated and used for growing crops and housing permanent residents.
- Areas of former pastureland are now used for mining and petroleum operations.

Once overgrazing occurs, the grasses will not recover as quickly, if at all. Similar results occur when soil is overtilled, or poor plowing techniques are used. When farmers drain the soil of nutrients from practices such as overuse, lack of crop rotation, or failure to replace nutrients, the soil loses its ability to support plant growth. All of these practices can result in soil being susceptible to erosion by wind and water.

Sustainability and Agriculture

Farmers today face many challenges to operate in ways that are sustainable in the long term. Maintaining soil fertility without degrading the soil is possible, but it takes careful planning. Sustainable grazing and tilling practices help to minimize soil erosion. Managing chemical levels and sedimentation in bodies of water, conserving water, employing renewable energy resources, and preserving biodiversity are all part of an environmentally sustainable perspective. Farmers have to constantly analyze their decisions in order to strike a balance between immediate profitability and long-term sustainability.

Farmers face many challenges as they maintain sustainable agriculture. Today, they use GIS software to manage chemical application, reduce the impact of plowing techniques on soil, and slow runoff and soil erosion.

Changes in Food Production and Consumption

The broad trends in agriculture over the past century have been toward larger farms, corporate ownership, intensive use of machinery and chemicals, and higher output. However, smaller trends are also evident, such as the increase in fair trade, organic farming and value-added crops.

Fair Trade

Some consumers support the fair trade movement. The goal of this movement is to get more money into the hands of the small farmers in poor countries, rather than supporting large transnational corporations that manage trade in agricultural products. The most widely sold fair-trade products are bananas, chocolate, coffee, and tea. (See Topic 5.9 for more on the fair-trade movement.)

Organic Foods

In the United States, people spent more than \$50 billion for organic food in 2020—an increase of almost 5 percent from the previous year. In order to be classified as an **organic food**, crops must be non-GMO, produced without pesticides or synthetic fertilizers, and use sustainable growing practices. According to the USDA, animals must be fed 100 percent organic feed and ranchers cannot administer antibiotics or hormones to the animals.

Many consumers believe that organic is healthier for them and safer for the environment. Since organic farming tends to be more labor-intensive than other forms of agriculture, it creates more jobs, but the food produced is more expensive.

Organic agriculture has possible drawbacks. One potential environmental cost is the need for more land to produce the same quantity of food. Also, some organic production of commodities, such as milk, cereal, and pork, create more greenhouse gases than conventional farming techniques. And while organic farming regulations prohibit the use of synthetic pesticides, they do allow farmers to use naturally occurring chemicals that can also be harmful to humans and other life forms.

Value-Added Specialty Crops

Increasing revenue and profits is a goal of all businesses. Farmers' and ranchers' profit margins have been in decline, so they have tried new approaches, such as raising value-added specialty crops or practicing value-added farming. **Value-added crops** are those for which consumers are willing to pay more because of special qualities or because they are difficult to acquire:

- organically grown crops and meats
- rare subtropical plants, such as passion fruit, cherimoya, longan, and star fruit
- grass-fed beef and free-range chickens and eggs

Value-added farming occurs when farmers process their crops into high-value products, rather than simply selling it as it comes from the field. The tremendous growth in grape production and the development of small wineries is a good example. Turning strawberries and other fruits into jams and jellies or using tomatoes and peppers to produce salsa, are also examples. Dairy producers create added value by making and selling their own cheese or ice cream.

Local-Food Movement

Another trend among some consumers is a **local-food movement**, or seeking out food produced nearby. Advocates, sometimes called “locavores,” have pointed out that this supports local farmers and reduces the use of fossil fuel used to transport products. Starting in the 1990s, farmers markets, where consumers can purchase fruits, vegetables, and other food items directly from farmers, became more popular. Many farmers cater to local consumers by producing specialty crops, such as herbs, mushrooms, and eggs from free-range chickens, in small quantities but at relatively high prices.

Urban Farming

Urban farming refers to the production of farm goods within an urban area with the goal of providing locally grown food. It may be practiced in different forms, but all assume a level of commerce—meaning the products will be sold and not used for personal consumption. The greatly reduced distances between producer and consumer allow consumers to enjoy fresh products. Farms may be owned by a traditional farmer but could follow a nontraditional ownership model, such as a few friends, a nonprofit group, or a neighborhood group. The food produced could be sold locally at grocery stores, restaurants, or farmers’ markets. Additionally, the food could be used at a local soup kitchen, church, or shelter. Cities like Detroit, Michigan, have large urban farming communities.

An increasingly popular variation of the urban farming model is **community gardens**. People use community gardens to share agricultural products with family, friends, and perhaps those in need rather than as a business. These garden plots allow people to grow and harvest their own fresh food, grown organically, if they wish. They also allow economically disadvantaged citizens to acquire high-quality food that otherwise they would have unlikely been able to access. These plots of farmland may be found in many different areas in the city such as parks, abandoned lots, or even on top of buildings.

A new type of urban farming is called vertical farming. **Vertical farms** grow crops inside in stackable trays, using greenhouses, artificial lights, and hydroponics. **Hydroponics** allows crops to grow without soil using mineral-enriched solutions. These processes use less water and less land since trays can be stacked vertically. One criticism is the substantial amount of energy needed to power the lights to grow the crops.



Source: Wikimedia Commons

Much less space is needed to grow crops using vertical farms.

Community-Supported Agriculture

One strategy used within the local-food movement is **community-supported agriculture (CSA)** that brings producers and consumers into a type of partnership. Consumers buy a share, or subscribe to a certain quantity of crops for a season. The food is made available to the consumer throughout the growing season. This ensures the consumers a local supply of fresh products and the farmer receives revenue throughout the season, rather than only at the end. It also allows for a connection between consumers and producers because consumers can often participate in the process of growing and harvesting the food. Consumers usually develop an appreciation of the challenges of production, while producers develop a better understanding of consumer wants.

Challenges of Feeding a Global Population

The development of agriculture of all types has resulted in the availability of massive amounts of food. There is enough food for everyone in the world, yet almost 1 billion people do not get sufficient food. Factors causing the food shortages include food distribution networks and the cost of the food. A distribution network is challenged by transportation difficulties, storage problems, political unrest or conflicts, or when large amounts of food are diverted to feed animals. Also, much of the food produced in developing countries is exported to wealthy countries. When food is available, people in the greatest need often cannot afford to purchase sufficient food or it can be denied because of local conflict or government corruption.

Food Insecurity

When households lack access to adequate food because of limited money or other resources, they experience **food insecurity**. People who experience food insecurity often have to make the choice between purchasing food or other necessities. Children are particularly vulnerable to food insecurity since it hinders their ability to learn and negatively affects growth.

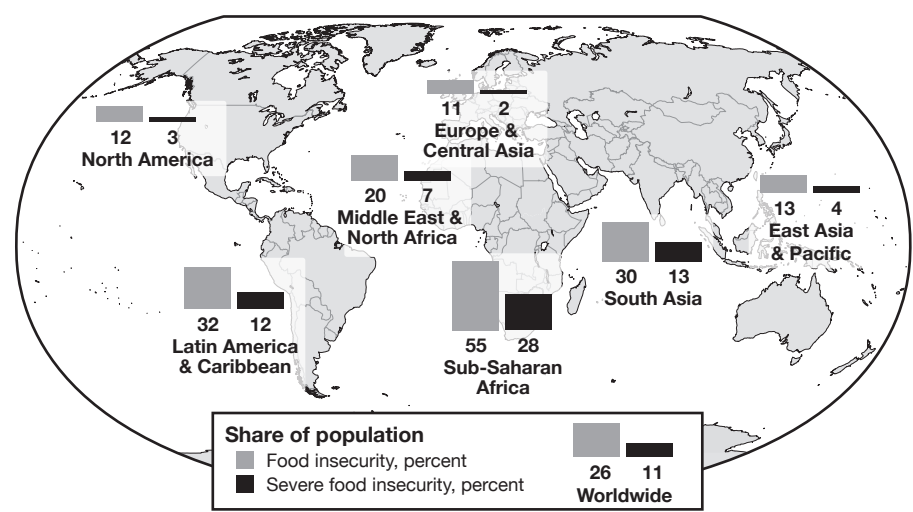
This problem does not exist in only periphery and semiperiphery countries. The United States is one of the richest countries in the world, yet it is estimated that over 50 million people, or more than 14 percent of the population, suffer from some level of food insecurity. In the periphery and semiperiphery regions of the world, the rate of food insecurity is approximately 30 percent. In sub-Saharan Africa, 55 percent of the people experience food insecurity. As a result of the COVID-19 pandemic, food insecurity numbers increased dramatically around the world.

The underlying causes of food insecurity in the United States—poverty, unemployment, and under-employment—are interconnected. Poverty and employment situations are also causing food insecurity in periphery and semiperiphery countries. Additional problems in non-core countries, such as high population growth, political instability, and environmental challenges, intensify food insecurity.

Food insecurity rarely exists to the same degree throughout an entire country. In the United States, it is most prevalent in poor neighborhoods and among the homeless of both major cities and rural areas. It is least noticeable in suburban areas and smaller cities.

In poorer countries, the landless poor and female-headed households in both urban and rural settings are most vulnerable. When people move from farms to find a job, they can no longer grow the foods to support their family, and often lack the financial resources to afford food. Additionally, assistance programs in the periphery often lack the resources to combat food insecurity.

FOOD INSECURITY AND SEVERE FOOD INSECURITY, 2017



There is a tremendous variation in the levels of food insecurity between the core, the periphery, and the semiperiphery. Countries at war or dealing with high levels of poverty are particularly vulnerable.

Food Deserts

A neighborhood where residents have little to no access to healthy and affordable food is a **food desert**. The USDA definition involves two elements. The first is the area has low income and high poverty. The second element is an urban area with 33 percent of the population located more than 1 mile from a grocery store, or more than 10 miles away in a rural area.

These neighborhoods are usually home to racial and ethnic minorities or large percentages of elderly or disabled people. Due to economic and physical constraints, the residents often do not have the means to travel to grocery stores outside of their area of the city. Car ownership may be rare and city buses may be too expensive or not readily available. As a result, the residents are forced to shop in their own neighborhoods. Often, grocery chains have eliminated stores in these neighborhoods due to lower than acceptable levels

of profits. What usually remains are small independently-owned grocery stores and convenience stores. It is challenging for these small stores to maintain selections of healthful food at affordable prices. Consequently, many of the residents suffer from poor diets and the ensuing health issues.

Problems with Distribution Systems

A network of trade and transportation that get food from farms to consumers is a **food distribution system**. Food distribution challenges exist at multiple scales. At the local scale, both farmers and consumers are hindered by their inability to get to a market. If farmers cannot reach the market with their surplus products, the food will go to waste. If people require additional food beyond what they can grow, but cannot access the closest market, then the problems of malnutrition and hunger emerge.

At the regional and global scale, modern transportation systems and advances in food storage have vastly improved distribution, but there are still obstacles. A ship, transport truck, or train can move large quantities of food efficiently, but these systems work well only if there are suitable ports, roads, and rail lines. Often those in the greatest need of food live in remote areas without good transportation links.

Governments can affect food distribution systems. Political leaders will often use food as a weapon during times of political unrest to suppress opposition. Other times, government officials are forced to make decisions on food allocation when accessible food supplies are insufficient.

Adverse Weather

Farmers are intense weather watchers because a slight change in the weather can impact their crops and animals. In core countries, farmers often have crop insurance to provide some financial protection from weather disasters. Crop insurance is not nearly as common in non-core regions. In regions with little surplus that can be stored for future needs, the loss of crops and livestock can have a devastating impact on the population unless another region can step in and quickly deliver necessary food to the affected population.

Farmers are among those who could be most affected by global climate change. However, scientists are unsure of how this trend will express itself over the next several decades. Climate change might increase the frequency and intensity of droughts and severe storms, threatening crop yields and livestock. In areas which already have suitable weather, warmer weather could cause problems of drought and for livestock farmers heat-wave deaths, reduced milk production in dairy cattle, and reduced weight gain for beef cattle.

Global warming could have positive effects for farmers in some regions. For farmers practicing at the fringes of agricultural zones, an extended growing season due to shorter and milder winters could allow farmers to be more successful. Warmer weather could also benefit livestock farmers in these areas through lower feed costs, increased survival rates of the young animals, and reduced energy costs.

Land Use Lost to Suburbanization

Existing farmland is threatened by the expansion of cities and suburbs. Millions of acres of farmland worldwide are converted to land use for suburban housing, shopping centers, business parks, or other types of urban development. Many view the continual loss of fertile land as a significant threat to the ability to feed a growing population.

Because most cities originally developed as agricultural centers, these cities are located near fertile land. The region of Canada with the best soil and most productive farms have recently experienced growth. This growth has consequently placed tremendous pressure on the surrounding farmland. Each time a new subdivision or some other urban land use is created, hundreds, even thousands, of acres of Canada's best farmland is lost to development.

Similar problems exist in nearly all expanding towns and cities surrounded by agricultural land around the world. Land-use planners are aware of these concerns and try to control the expansion of cities, but growing populations and the associated houses, businesses, and infrastructure have to be nearby. One solution to alleviate urban expansion issues and loss of farmland is to find ways to increase the densities within the existing cities, thus containing the growing population.

Factors Affecting Food Production

The decisions farmers make are influenced by numerous factors, including the location of food processing facilities and markets, economies of scale, distribution systems, and government policies.

Location of Food Processing Facilities and Markets

The transformation of agricultural products into food or taking food items and transforming them into a different type of food is **food processing**. One example is taking wheat and milling it into flour, which then can be either sold to consumers or sold to factories for making bread. Transportation systems and relative distance from the processing location are important factors and can vary depending on the product. The von Thünen model introduced some elements of this concept. (See Topic 5.8.) Core countries have advanced infrastructure that can move agricultural products rapidly with minimal waste. In periphery countries, product loss can be substantial because of poor transportation infrastructure and lack of access to processing plants.

Traditionally, companies located food processing facilities in rural areas or small towns. By locating facilities close to where the harvest occurs, companies could work with fresh products and benefit from the lower labor and land costs in rural areas. However, improvements in roads, truck efficiencies, and storage techniques have prompted many companies to close older, smaller facilities and open new, more-efficient ones. These larger and more-modern facilities allow companies to process more product at a lower cost per unit, thus taking advantage of economies of scale.

Economies of Scale

In farming, as in any business, taking advantage of economies of scale allows producers to increase profits. This occurs at every scale, although it is often associated with larger farming operations. The key is to alter farming practices to make the operation more efficient, and reduce the cost per unit of production. On a smaller farm, the farmer might take advantage of economies of scale by increasing the level of fertilization and irrigation of a crop. By doing so, the farmer increases expenses by 10 percent, but if the harvest increases by 25 percent, then the cost per unit will decrease, and once again, profits will increase.

Distribution Systems

In commercial farming, people have to transport products from farm to market before consumers can purchase them and suppliers can make profits. That means the products have to arrive at a food processor, wholesaler, and eventually, market in a timely manner.

If the crops are perishable, such as tomatoes or strawberries, the distribution system from the farm to the market must allow for frequent pickup and delivery to the market. If this is not possible, then the farmers and the shipper must have access to a storage system that can preserve the quality of the crop for a few extra days. However, agricultural industries, like other industries, have adopted a system of *just-in-time delivery* to reduce the need for storage space. The COVID-19 pandemic illustrated that when just-in-time delivery systems were interrupted and product shortages occurred.

In the case of regional and global distribution, different markets might demand different products, and therefore, farmers have to adapt their production accordingly. The differences in the demand could relate to preparation and storage options available at the destination, eating traditions and taste preferences, and religious beliefs.

However, if bad weather, transportation breakdowns, or other problems delay a delivery to a grocery store, then the consumers will often have to do without the desired product. With food, this might be an inconvenience or a serious concern, especially in a region where the population is struggling to survive.

Government Policies

Food is vital to national security, so governments often adopt policies to protect agriculture. However, many governments let market forces determine exactly what and how much farmers produce. Government policies can influence food production and farmers in several ways:

- Regulations governing migrant workers who often work in food production industries
- Financial assistance, such as low-interest loans and transportation subsidies

- Investment in transportation and storage (grain elevators) infrastructure to increase efficiency and storage capacity
- Regulations on the amount of a product grown or sold to prevent surplus or shortages
- Taxes to discourage production and use of products considered unhealthy, such as tobacco
- Changes in environmental and health regulations influence which products farmers will grow

International politics can also lead to changes in production. A trade agreement with another country could open new markets for farmers and encourage increased production. As part of a larger trade deal, a country might have to reduce exports of a certain crop which could lead to less production. On occasion, countries will impose a **tariff** (tax on imports) or a **quota** (limit the quantity of a good imported) to protect domestically produced goods. These trade restrictions raise the price of imports and make domestic goods more competitive in price within the country in which they were produced. If these restrictions continue for an extended period, farmers alter their production of crops. Between 2018 and 2020, the United States and China both raised their tariffs on traded products. (See Topic 7.6.)

REFLECT ON THE ESSENTIAL QUESTION

Essential Question: *What are the challenges and debates related to the changing nature of contemporary agriculture and food-production practices?*

| Contemporary Agriculture and Food-Production Practices | Associated Challenges With Practices |
|--|--------------------------------------|
| | |

KEY TERMS

| | |
|---------------------------------------|---------------------------------------|
| genetically modified organisms (GMOs) | vertical farms |
| aquaculture (aquafarming) | hydroponics |
| Blue Revolution | community-supported agriculture (CSA) |
| overgraze | food insecurity |
| organic foods | food desert |
| value-added crops | food distribution system |
| value-added farming | food processing |
| local-food movement | tariff |
| urban farming | quota |
| community gardens | |

Women in Agriculture

Essential Question: What are the variations in female roles in food production and consumption?

Women play a crucial role in global agriculture. This role has changed and is continuing to change as women become more important in the world's efforts to eliminate hunger. The importance of women's role in agriculture is reflected in the following suggestion made in a report by the UN's Food and Agriculture Organization, "if women farmers gain access to the same resources as their male counterparts, the entire world will eat, too."

Gender Roles in the Food System

In most cultures throughout history, males and females had distinct roles in producing and preparing food. However, some of these roles have changed as technology has changed.

Food Production Women have played a major role in agriculture since humans first started farming. Today, they make up about 40 percent of the world's agricultural labor force. In regions where subsistence farming remains common, that figure is 70 percent, and the contributions of women are changing regardless of the type of farming:

- In many areas of the developing world, men migrate to urban areas in search of employment, while women stay at home and work their farms along with children. In operations where farmers sell their products at local market, women are often the sellers.
- Where farming has modernized and machines have been introduced, women have become less involved with the field work.
- In large-scale agribusinesses, women have taken on additional roles. Besides raising crops, tending animals, and processing products, they work in management, sales, distribution, and research.

Food Preparation As people have changed where they live and work, they have changed how they prepare food. As people moved from rural areas to urban areas, they grew less food and purchased more of it. Today, women are more likely to work outside the home, so they spend less time preparing food than in previous generations.

People purchase more convenience foods than previously, from cake mixes to entire meals that simply need to be heated. The demand for these foods has grown so much that food companies are committing significant research

money to developing visually appealing, tasty, and healthful food products. In addition, men have become more involved in food preparation in the regions of the world with greater gender equality, particularly in households where both partners are working. Another result is that people eat in restaurants more than ever before. In 2015, for the first time in history, Americans spent more money eating out than they spent on groceries.

Gender Equality and Agriculture: Hope for the Future

The unequal opportunities, treatment, or rights of a person based on gender is considered **gender inequality**. It is a reality throughout all parts of the world and affects all aspects of society, such as educational and leadership opportunities, reproductive rights, employment options, and property ownership. Over the past few decades some progress toward gender equality has occurred, but not in all countries. (See Topic 7.4.)

In agriculture, the lack of gender equality has a very significant impact on productivity. Especially in periphery countries, where the majority of economically active women are employed in farming, women have assumed increased responsibilities. Increasingly, men are taking nonfarming jobs in urban areas, leaving women to run the farm and care for children. In spite of the added work and responsibility, women still often have little authority in the eyes of the government officials, businesses, society, or male farmers.

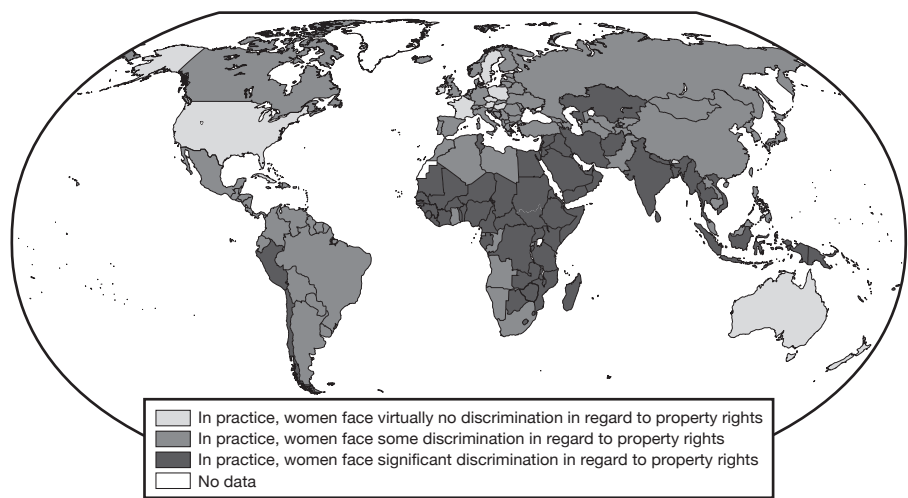
Women face **gender-specific obstacles**, or discriminatory practices that prevent female farmers from reaching their potential productivity:

- Women are denied access to finance and capital. It is much more difficult for women to secure the necessary financing for farm inputs, such as machinery and agricultural chemicals. Therefore, female farmers are often not able to modernize and increase productivity.
- Women are denied training and education. Women are often excluded from opportunities to become familiar with new and improved practices to improve productivity and safety on their farms.
- Women are denied property ownership. Female property ownership is rare throughout the world, especially in the peripheral countries.
- Women have limited mobility. In cultures where women face restrictions to their mobility, such as needing their husbands' or fathers' consent to leave their homes, it is difficult for women to either take farm products to the market to sell or trade, or to go to the market to acquire food.
- Women lack political power. When development projects are planned, women are rarely allowed leadership positions or consulted. Consequently, plans are implemented without the knowledge and ideas of the women who will play a role in shaping the plan's success or failure.

In terms of productivity, the lack of gender equality has resulted in a **crop gap** of 20 to 30 percent between male- and female-run farms. Female-run farms are much less productive because of gender-specific obstacles. The worst food insecurities in the world are found in the periphery, the same area where

the gender-specific obstacles are the most prevalent. The Food and Agricultural Organization (FAO) of the United Nations estimated that if gender equality existed, the crop gap would disappear, and that female-run farms could even exceed the productivity of male-run farms. This would result in tremendous economic growth and increase the amount of food available in the periphery.

PROPERTY RIGHTS FOR WOMEN, 2017



Source: womenstats.org

Describe the patterns of property rights of women. What is the relationship between the patterns and gender equality in agriculture?

REFLECT ON THE ESSENTIAL QUESTION

Essential Question: *What are the variations in female roles in food production and consumption?*

| Challenges Due to the Role of Females in Food Production and Consumption | Contemporary Solutions |
|--|------------------------|
| | |

KEY TERMS

gender inequality
gender-specific obstacles

crop gap



Farmers, like business owners, try to utilize their resources and attract new sources of revenue and profit. Two strategies to increase revenue are agritourism and organic farming.

Agritourism

An additional potential revenue source for farmers is the growing trend of agritourism—where tourists visit farms for recreational reasons. It has become more common for farms to provide entertainment and hospitality experiences for consumers. Agritourism is especially important to smaller family farms.

Tourists may be involved in U-pick activities or purchase fresh products from a farm stand. The farm may provide experiences such as a corn maze, a petting zoo with farm animals, or a hayride. Educational opportunities for school groups or interested individuals might be another service the farm provides. Some farms host overnight stays to allow the guests to experience a true farm lifestyle, whether it is waking up to the crowing of a rooster, gathering fresh eggs to cook for breakfast, or helping with chores.



Farmers benefit from the revenue collected from agritourism activities such as a corn maze. Agritourism is also a great way for the non-farming public to become educated about farming practices and gain an appreciation for where food comes from

Organic Trends

Organic agricultural sales have boomed over the past decade with revenue in 2019 of nearly \$50 billion in the United States. While non-organic modern agriculture produces food for the masses and is often sold globally, organic food has been largely seized upon by local-food movements. Organic farming—which is more expensive—has proven to be profitable because many people will pay more for organic foods.

The Distribution of the Organic Food Market

The location of organic food consumption can be best explained through the spatial analysis of economic factors, such as income. The concentration of organic food sales is predictably uneven. Farmers markets and supermarkets that offer organic foods are largely found in wealthier regions. Almost half

of all organic food is sold and consumed within 100 miles of its production. Moreover, most consumption and production in the United States takes place around wealthy urban areas and organic hotspots along the West Coast and in the Northeast.

1. Describe TWO ways that farmers are trying to increase revenue.
2. Describe why some farmers are choosing to grow organic crops.
3. Explain why organic farming is unlikely to work on a global scale.



THINK AS A GEOGRAPHER: USE SCALE TO ANALYZE FAIR TRADE

| FAIR TRADE IMPORTS TO THE UNITED STATES, 1998–2015 | | | | |
|--|---------------|------------|-------------|-------------|
| Year | Coffee | Tea | Cocoa | Sugar |
| 1998 | 76,059 | no data | no data | no data |
| 2000 | 4,249,534 | no data | no data | no data |
| 2005 | 44,585,323 | 490,645 | 1,036,696 | 271,680 |
| 2010 | 105,251,476 | 1,483,666 | 4,392,674 | 18,146,124 |
| 2015 | 163,630,275 | 2,347,699 | 38,492,988 | 38,173,065 |
| Total, 1998 to 2015 | 1,359,418,892 | 16,002,044 | 129,087,925 | 151,248,397 |

Source: Fair Trade USA 2015 Almanac. Quantities measured in pounds or other units.

The concept of scale is useful to analyze how the principles of fair trade work in practice. The underlying principle of fair trade is to ensure that agricultural producers are fairly compensated for their work. Other principles of fair trade include fair pricing, poverty alleviation, mutual benefit (seller-producer), gender equity, safe working conditions, and environmental responsibility.

At the global scale, fair trade works when consumers in core countries desire fair trade products from the periphery countries of the world. The concept can also be applied at the neighborhood or family scale. (See Topic 5.9 for more on fair trade.)

Apply the concept of scale to the principle of fair trade in each question.

1. At the household scale, how does a family that grows food in a garden for their own consumption demonstrate some, but not all, of the principles of fair trade?
2. At the community scale, how does a farmers market demonstrate the principles of fair trade?
3. At the global scale, how does the data suggest that the idea of fair trade is becoming more widespread?
4. How does the practice of fair trade affect each of the following groups: producers in periphery countries, multinational companies, and consumers in highly developed countries?

CHAPTER 14 REVIEW:

Understanding the Challenges and Consequences of Agriculture

Topics 5.10–5.12

MULTIPLE-CHOICE QUESTIONS

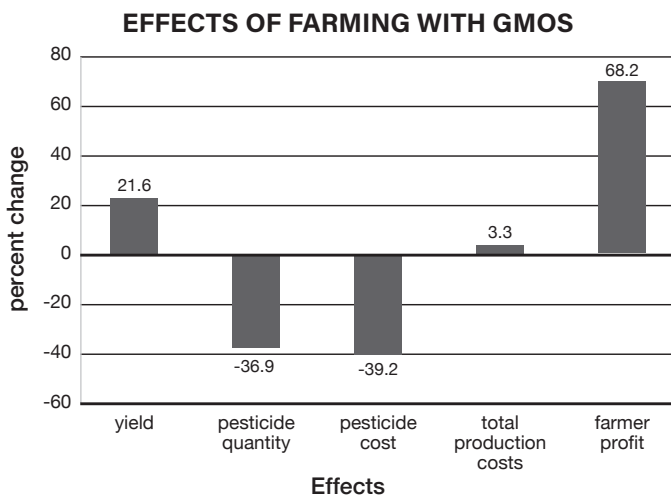
Questions 1 and 2 refer to the following image.



1. Which concept is demonstrated in the picture above?
 - (A) The results of the enclosure movement
 - (B) The impact of the Green Revolution
 - (C) The significance of carrying capacity
 - (D) The use of terrace farming
 - (E) The effects of deforestation
2. Which is a major concern related to the practice shown in the image?
 - (A) The amount of arable land is increased
 - (B) The practice decreases the efficient use of water resources
 - (C) Soil erosion increases dramatically
 - (D) Maintenance of the fields is difficult
 - (E) The use of large-scale capital-intensive machinery to grow crops

3. Deforestation has resulted in
- (A) more farmland in some places but more desertification in others
 - (B) more farmland in some places and less desertification in others
 - (C) less farmland in some places but more desertification in others
 - (D) less farmland in some places and less desertification in others
 - (E) no noticeable change in the amount of farmland or desertification
4. In which group of countries are GMOs used most widely?
- (A) United States, Brazil, and Argentina
 - (B) France, Germany, and the Netherlands
 - (C) Kenya, Tanzania, and Ethiopia
 - (D) India and Bangladesh
 - (E) Australia and New Zealand
5. Slash-and-burn agriculture is often used in areas that have
- (A) soil that lacks sufficient nitrogen to grow food crops quickly
 - (B) a climate of extremes, with very hot summers and very cold winters
 - (C) a shortage of rain throughout the year, such as an arid region
 - (D) very high elevations, such as in mountain ranges
 - (E) a combination of climate and physical features that result in crops growing very slowly
6. What is the main reason that female farmers in periphery countries are not as productive as male farmers?
- (A) Gender inequalities prevent female farmers from access to the same resources as male farmers.
 - (B) Male farmers have more farming experience and their farming knowledge is passed down from fathers to sons.
 - (C) Men have a greater natural talent (aptitude) for farming.
 - (D) Farming is a physically demanding activity and males are stronger.
 - (E) Women in periphery countries consider farming as a hobby and just practice it in their spare time.

Question 7 refers to the following graph.



Source: Science in the News

7. What does the graph indicate about the effects of farming with genetically modified crops?
- (A) The use of both pesticides and fertilizer drop significantly.
 - (B) Farm revenue goes up but production costs go up more.
 - (C) Yields increase and farm profits increase even more.
 - (D) Total production costs drop because pesticide costs decrease.
 - (E) Farm profits go up due to increased prices internationally.

FREE-RESPONSE QUESTION

There have been many changes in the production, distribution, and marketing of food over the past few decades.

- (A) Explain why farmers using GMOs often use less insecticides and pesticides than farmers growing traditional crops.
- (B) Explain why some people consider supporting the local-food movement to be more environmentally friendly than purchasing food from a large grocery chain.
- (C) In order to increase profits some farmers are relying on value-added farming. Identify an example of value-added farming.
- (D) Describe how community-supported agriculture typically works.
- (E) Describe TWO differences between a coffee plantation and a fair-trade coffee farm.
- (F) Compare the food purchasing options available to people living in a food desert and a suburban area of a city.

UNIT 5 REVIEW:

Connecting Course Skills and Content

APPLYING GEOGRAPHIC SKILLS

Applying and utilizing geographic skills is critical for success on the AP® Exam. For each skill listed, write a one-paragraph response that illustrates your understanding of that course skill. Support your response with specific examples and evidence. Refer to the Unit 1 introduction (pages 3–8) for tips on how to apply geographic skills.

- 1E** Explain strengths, weaknesses, and limitations of von Thünen’s Model.
- 2D** Explain similarities and differences of agricultural processes in the core and periphery regions of the world.
- 3B** Use one map and one data table from Unit 5 that contains quantitative data and describe two spatial patterns for each map and table.
- 4C** Choose one of the sets image in Topic 5.10 (western Brazil or the Aral Sea) and explain a pattern and change within the images. Also, explain a reason for and an impact of the pattern or change.
- 5C** Compare how large-scale global food production is different than small-scale subsistence farming. Describe one way the two systems can interact on a local scale.



WRITE AS A GEOGRAPHER: USE RELEVANT INFORMATION

One problem students face when answering a free-response question is to decide what information actually supports their claim. Students should leave out all other information that is not clearly, directly related to the question. For example, a free-response question might ask: Explain how farmers in Mexico make decisions about what crops to grow.

Which of the following statements are relevant to answering this question? For ones that are not, explain why they are not.

- 1. Most of southern Mexico has a warm, moist climate that supports growing many fruits and vegetables.
- 2. Brazil has areas of heavy rainfall that are excellent for growing sugar and rice.
- 3. Improvements in the ports in New Orleans and on the Florida coast reduced the cost of importing goods.
- 4. Concerns about the long-term effects of soil erosion and fertilizer runoff have persuaded some farmers to consider changing the crops they grow.
- 5. Von Thünen’s model can be used to study decisions by farmers.
- 6. The primary language spoken throughout Mexico is Spanish.