

UNIT FIVE

AGRICULTURE: PRIMARY ECONOMIC ACTIVITIES

As we have seen in the previous units, the human imprint on the geographical landscape includes cultural activities, such as religion and language, as well as political configurations of the land. Another crucial influence on the organization of the earth's surface is the way that people make a living. Economic activities range from the simple to the complex and encompass human life from ancient to modern times. We may organize economic activities by dividing them into three types:

- **The primary sector (agriculture)** is the part of the economy that draws raw materials from the natural environment. The primary sector – agriculture, raising animals, fishing, forestry, and mining – is largest in low-income, pre-industrial nations.
- **The secondary sector (industry)** is the part of the economy that transforms raw materials into manufactured goods. This sector grows quickly as societies industrialize, and includes such operations as refining petroleum into gasoline and turning metals into tools and automobiles.
- **The tertiary sector (services)** is the part of the economy that involves services rather than goods. The tertiary sector grows with industrialization and comes to dominate **post-industrial societies**, or countries where most people are no longer employed in industry. Examples of tertiary jobs include construction, trade, finance, real estate, private services, government, and transportation. **The quaternary sector** is often seen as a subset of the tertiary sector. It includes service jobs concerned with research and development, management and administration, and processing and disseminating information.

Because the sectors represent necessary economic activities, most countries today have some people employed in all three. However, the percentages vary widely. Consider the examples on the chart below:

COMPARATIVE ECONOMIC SECTORS
(as percentage of labor force by occupation)

Country	Primary (Agriculture)	Secondary (Industry)	Tertiary (Services)
China	43%	25%	32%
Iran	25%	31%	45%
Mexico	18%	24%	58%
Nigeria	70%	10%	20%
Russia	10.8%	28.8%	60.5%
United Kingdom	1.4%	18.2%	80.4%
United States	.6%	22.6%	76.8%

Source: *CIA World Factbook*

By comparing economic sectors, the United Kingdom is one example of a post-industrial society, with only 1.4% of its population engaged in agriculture, and 80.4% in services. The U.S. is another post-industrial society, with .6% in agriculture, and 76.8% in services. Russia appears to have moved into post-industrialism as well. Likewise, Mexico has moved away from agriculture (18%) toward services (58%), as has Iran to a lesser extent. Despite its recent economic boom, 43% of China's population is still employed in agriculture, and Nigeria has the largest percentage of its people (70%) employed in the primary sector.

In this unit we will explore agricultural activities, which belong to the primary sector. For thousands of years agriculture was the main economic activity of most people on earth, until the Industrial Revolution transformed economies first in Europe and North America, and eventually influenced most countries in the world.

THE ORIGIN AND SPREAD OF AGRICULTURE

Agriculture is the deliberate tending of crops and livestock in order to produce food and fiber. As is evident in the chart on the previous page, many countries today have relatively smaller percentages of their populations in agriculture. Yet total agricultural production in the world is at an all-time high, mainly because the nature of farming has changed with mechanization and farm consolidation, particularly in industrial and post-industrial countries. In all countries, the processes that produce, distribute, and determine the consumption of food form a fundamental part of every culture. The ways that land is distributed to individuals and used for food production are determined by culture, as are the functions of livestock, and the consumption of food from crops and animals. For example, Hindus do not eat beef, and Muslims do not eat pork, and so the two religions greatly impact the nature of agriculture in lands where they have many adherents.

HUNTERS AND GATHERERS

The first humans probably emerged in eastern Africa, due to a happy confluence of availability of food, domesticable animals, and favorable climate. For thousands of years humans sustained themselves as **hunters and gatherers**, and as a result they were quite dependent on the abundance of food. Hunters gained skills in capturing and killing animals, and gatherers learned which plants and fruits were edible and nutritious. Technological inventions generally supported the fulfillment of these basic activities. Stones (and eventually metals) were shaped as tools and weapons, and techniques were developed for efficient gathering and storage of food.

The groups traveled frequently, establishing new home bases or camps. Their migrations depended on the movement of game and the seasonal growth of plants. Often they moved in a pattern over the same extent of land year after year, but as environments changed, sometimes the migrations were permanent. By 8000 B.C.E., humans had migrated to many other areas, probably following the herds and other available food sources. In general, hunters and gatherers left little imprint on the land. Major migrations include:

- Early Africa to Australia, the Middle East, Europe, and Asia
- Asia across the land bridge to the Americas

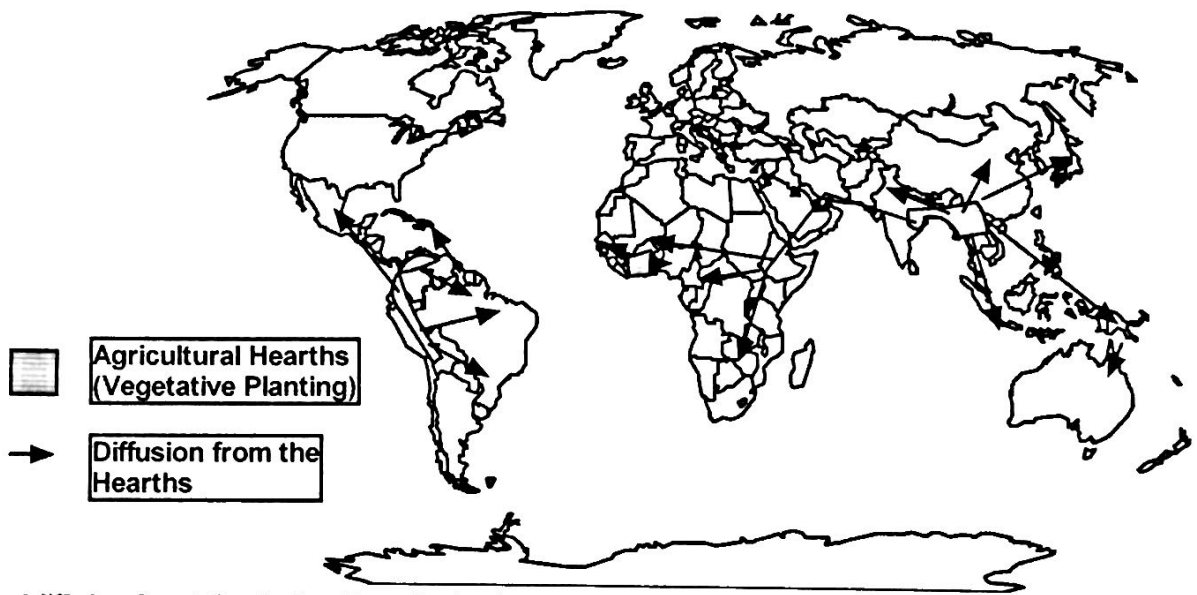
THE NEOLITHIC REVOLUTION

When, how, and why did people give up their wandering and settle to live in one place? First of all, it happened in different parts of the world at different times, but settled communities had developed in many places by 8000 B.C.E. The ability to settle was based almost entirely on successful cultivation of crops and domestication of animals. These drastic changes in human life are known collectively as the **Neolithic Revolution** that almost certainly happened independently in different places over a large span of time (independent invention). From these **agricultural hearths** farming practices diffused across the surface of the earth. For example, the people settling along the major rivers in China did not learn to farm because they were in contact with the people in the Indus River area. Instead, people in both areas probably figured out the advantages of settled life on their own, and both served as agricultural hearths. Although the Neolithic Revolution was one of the most significant marker events in world history, it occurred gradually and probably by trial and error.

The changes that resulted include:

- **Increase in reliable food supplies** – Agricultural skills allowed people to control food production, and domesticate animals. Both helped to make agricultural production more efficient and increased the availability of food.
- **Rapid increase in total human population** – Reliable food supplies meant that people were less likely to starve to death. Once people settled down, they were able to store their food for times of scarcity. With increasing life spans came increasing reproduction, and more children meant that there were more people to tend the land and animals.
- **Job specialization** – Other occupations than farming developed, since fewer people were needed to produce food. Some early, specialized jobs include priests, traders, and builders.
- **Widening of gender differences** – Status distinctions between men and women increased, as men took over most agricultural cultivation and domestication of animals. Women were responsible for raising children, cooking food, and keeping the house, but in virtually all of the early civilizations men became dominant. Since men controlled agricultural production, **patriarchal systems** commonly developed, with men holding power in the family, the economy, and the government.
- **Development of distinction between settled people and nomads** (people who continued to move from place to place) – Many people did not settle into communities but remained as hunters and gatherers. As more settled communities developed, the distinction between agriculturalists and hunters and gatherers grew, with settled people generally considering their way of life to be superior.

According to cultural geographer Carl Sauer, the earliest form of plant cultivation was **vegetative planting**, in which new plants are produced by direct cloning from existing plants, such as cutting stems and dividing roots. People first learned to farm by deliberately dividing and transplanting plants already growing wild. **Seed agriculture**, or the production of plants through annual planting of seeds, came later. Most farmers today practice seed agriculture.



Origin and diffusion of vegetative planting. The earliest hearth was probably Southeast Asia, with other early hearths in West Africa and South America.

Vegetative Planting

Carl Sauer believes that vegetative planting probably originated in the diverse climates and topography of Southeast Asia, where a wide variety of plants existed that were suitable for dividing and transplanting. Also, the people did more fishing than hunting, so they were probably more settled, and so more likely to experiment with plants. The first plants domesticated in Southeast Asia included roots such as the taro and yam, and tree crops such as the banana and palm. Vegetative planting diffused from the Southeast Asian hearth northward and eastward to China and Japan, and westward through India, Southwest Asia, tropical Africa, and the area around the Mediterranean Sea. The first domesticated animals were probably dogs, pigs, and chickens.

Other early hearths were probably in West Africa and northwestern South America. In West Africa plantings were possibly palm trees and yams, and in South America, manioc, sweet potatoes, and arrowroot. The practice diffused from South America to Central America and eastern areas of South America.

Seed Agriculture

Carl Sauer identified three hearths for seed agriculture in the Eastern Hemisphere: western India, northern China, and Ethiopia. From western India it diffused to Southwest Asia, where people first domesticated wheat and barley, two grains that later fed Europeans and Americans. In Southwest Asia the inhabitants also domesticated herd animals such as cattle, sheep, and goats. Cattle were used to plow the land before planting seeds, and were fed part of the harvested crop. Animals also provided milk, meat, and skins.

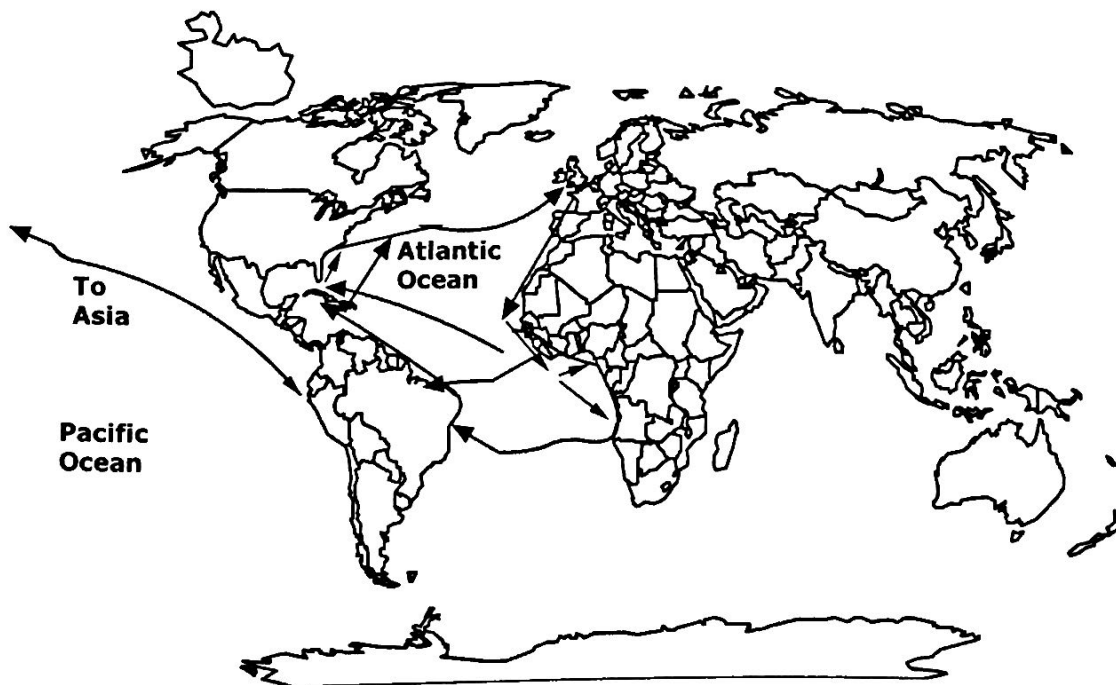
Seed agriculture diffused from Southwest Asia across Europe and through North Africa, with barley and cattle becoming more important farther north, as they thrived in cooler and moister climates. Seed agriculture also diffused eastward to northwestern India and the Indus River valley. From the northern

China hearth, millet diffused to South Asia and Southeast Asia. The cultural hearth of rice is unknown, but it probably was Southeast Asia. Millet and sorghum were domesticated in the third independent hearth in Ethiopia, which today is ironically an area with widespread starvation.

Two independent seed agriculture hearths originated in the Western Hemisphere: southern Mexico and northern Peru. Southern Mexico was the point of origin for squash and maize (corn), with beans, cotton, and squash domesticated in Peru. Agriculture diffused to other areas, although it was not widespread over the hemisphere until the arrival of Europeans in the late 15th century. Only then were wheat, oats, and barley introduced to the Western Hemisphere, and maize and beans to the Eastern Hemisphere.

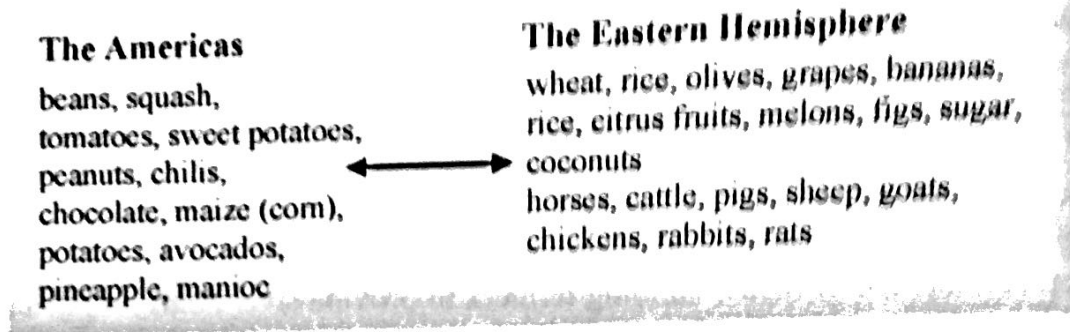
Over the years many innovations increased the chances of success for seed agricultural practices. Some early innovations were **irrigation** (the channeling of water to fields), plowing to loosen and turn the soil, fencing to keep animals out of fields, building terraces to provide level fields on hillsides, fertilizing with plant and animal waste, and weeding.

The diffusion of both vegetative planting and seed agriculture from their multiple hearths created a wide variety of food raised and consumed around the world. For example, rice became the mainstay of diets in southern China and much of Southeast Asia, while grains were basic to farming in northern China. Through increased trade and other types of interactions, people in both areas were able to share diets, but variations in climate and topography continued to reinforce the original crops and diets. Food in the Western and Eastern Hemispheres was almost completely different until the **Columbian Exchange** began in the late 15th and 16th centuries, when products were carried both ways across the Atlantic and Pacific Oceans. In some cases a crop grown in one area, like the potato that originated in the Andes Mountain areas of South America, became a mainstay in another area (Ireland). However, beans, squash, and corn are still more commonly consumed in the Americas, and rice is still more basic to Asian cultures than to other areas of the world.



The Columbian Exchange. The European exploration and conquest of the Western Hemisphere in the late 15th and 16th centuries led to the exchange of products between Western and Eastern Hemispheres, with new trade routes across the Pacific and Atlantic Oceans connecting to established trade routes. For the first time in world history, trade routes encircled the globe.

NEW EXCHANGES IN THE COLUMBIAN EXCHANGE



SECOND AGRICULTURAL REVOLUTION

A **second agricultural revolution** began in Western Europe in the 1600s, which intensified agriculture by promoting higher yields per acre and per farmer. This agricultural revolution preceded the Industrial Revolution, making it possible to feed the rapidly growing cities. Some innovations included increased use of fertilizers and improved collars for draft animals to pull heavier plows.

Beginning in the early 1700s, wealthy landowners in England began to enlarge their farms through **enclosure**, or fencing or hedging large blocks of land (including "common" areas previously shared by all) for experiments with new techniques of farming. These scientific farmers improved **crop rotation** methods, which carefully controlled nutrients in the soil. They bred better livestock, and invented new machines, such as Jethro Tull's seed **drill** that more effectively planted seeds. The larger the farms and the better the production the fewer farmers were needed. Farmers pushed out of their jobs by enclosure either became tenant farmers or they moved to cities. Better nutrition boosted England's population, creating the first necessary component for the Industrial Revolution: labor.

Once the Industrial Revolution began, farming methods became much more efficient with the use of tractors for plowing soil, reapers for cutting crops, threshers for separating grain from stalks, and motors for pumping water to do the work of people and animals. Transportation for and storage of crops also improved dramatically, especially with the invention of refrigerated railroad cars and ships. Industrially-produced chemicals for fertilizers, weed killers, and pesticides were also introduced in the 20th century.

MAJOR AGRICULTURAL PRODUCTION REGIONS

Agricultural practices vary widely across the globe, but the most basic distinctions may be made between agriculture in less developed countries (LDCs) and more developed countries. Farmers in LDCs usually produce food through subsistence agriculture, and farmers in more developed countries usually practice commercial agriculture. Agricultural regions, then, may be divided broadly into these two types of agriculture, and then subdivided according to varying practices, types of crops, and climates.

Subsistence agriculture, most prevalent in LDCs, is the production of only enough food to feed the farmer's family, with no surpluses to sell. Some surplus may be sold to the government or to companies, but the surplus is not the farmer's primary purpose. **Commercial agriculture** is the production of food surpluses, with most crops destined for sale to people outside the farmer's family. Practiced mainly in more developed countries, farmers in commercial agriculture generally do not sell produce directly to consumers but to food-processing companies. Big companies sign contracts with commercial farmers to buy their grain, cattle, pigs, chickens, and other products that they in turn package to sell through food outlets (such as grocery stores) to consumers. The system of commercial farming found in more developed countries is called **agribusiness**, because farming is integrated into a large food-production industry.

Subsistence and commercial agriculture may be compared in several ways:

- **Percentage of farmers in the labor force** – Logically, in countries that practice subsistence farming a high percentage of people are engaged in farming. With no surplus to sell, all people must produce their own food in order to survive. In contrast, well-developed commercial agriculture allows people to pursue other activities, so a smaller percentage of people are farmers. For example, less than 2% of all workers in the United States and Canada (countries with a great deal of commercial agriculture) are farmers. In contrast, many countries in Africa have more than 60% of their citizens engaged in agriculture.
- **Use of machinery** – A key to successful development of commercial agriculture is the use of machinery to replace work done with hand tools and animal power. In more developed countries, tractors, combines, planters, and other farm machines have largely replaced manual labor. Transportation is also important to commercial farmers, who rely on railroads, highways, and rapid sea and air travel to facilitate their ability to get goods to consumers. Commercial farmers also have scientific advances – such as fertilizers, herbicides, and new breeds of plants and animals – that boost their crop yields and the health of their animals.
- **Farm size** – Because commercial farmers have machinery and scientific advances, they can efficiently farm far larger amounts of land than subsistence farmers can. Today commercial agriculture is increasingly dominated by a handful of large farms that can afford the expensive machinery needed to efficiently produce crops. Despite the fact that very few people are farmers, the amount of land devoted to agriculture is still quite significant in most developed countries.

SUBSISTENCE FARMING: SUBREGIONS

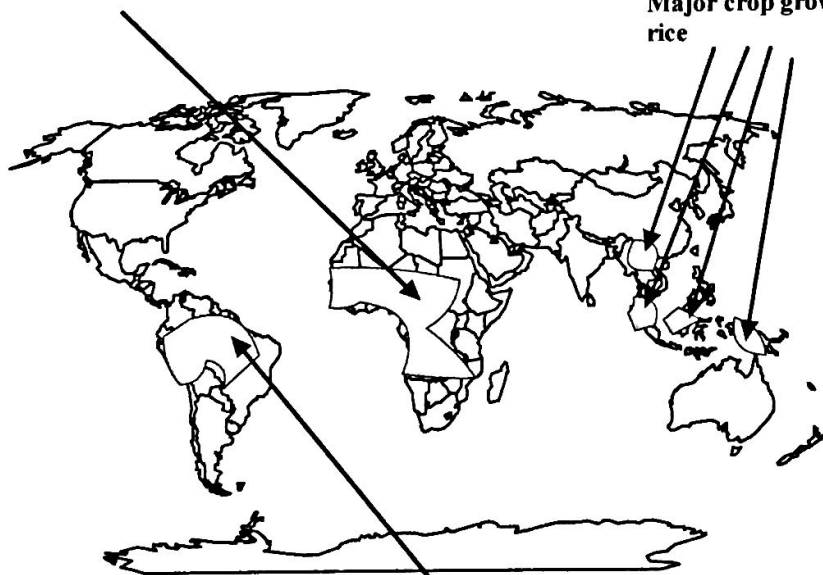
Subsistence farming varies according to adaptations to varying climates. Subregions for subsistence farming include:

- 1) **Intensive subsistence** – This type of agriculture yields a large amount of output per acre through concentrated farming, but still only provides a subsistence living for farmers. Sometimes they may sell a little to others, but usually they raise crops for their own consumption. Intensive subsistence farming is found in the large population concentrations of East and South Asia, with **wet, or low-**

land, rice dominant in many areas. Wet rice is planted on dry land in a nursery and then moved as seedlings to a flooded field to promote growth. The crop requires a great deal of time and attention, but under ideal conditions it can provide large amounts of food per unit of land. Other products include wheat (grown in northern China), maize, millet, peas, and beans. A little less than half of the people of the world are engaged in this type of farming. This **labor intensive agriculture** employs large numbers of people and requires relatively little capital to produce food. Most work is done by hand, and although the crops the farmers raise form the basis of their diets, they often link to other regions for specialized products. Today production of food for sale in rapidly growing urban markets is increasingly important, a trend that is leading these areas away from strict “subsistence” farming.

- 2) **Shifting cultivation** – Often referred to as “slash and burn” or swidden agriculture, this farming method exists primarily in rain forest zones of Central and South America, West Africa, eastern and central Asia, and much of southern China and Southeast Asia. The obvious destruction to the environment is worsened by the frequency of the farmers’ movements. As an extensive type of subsistence farming, by its very nature shifting cultivation agriculture still consumes a large percentage of arable land on the planet. At first, the soil in the burnt areas is very fertile, but when soil nutrients are depleted, farmers move on to slash and burn another piece of jungle. People who practice shifting cultivation generally live in small villages and grow food on the surrounding land, which the village controls. **Intertillage** – or the growing of various types of crops – is common. The village chief or council assigns a plot of land to each family and allows them to keep what they raise. Farming is done almost exclusively by hand, and plows and animals are not generally used. The main fertilizer is potash from burning the debris when the site is cleared. When the nutrients are depleted after a few years, the villagers identify another site and begin clearing it. They allow the old site to return to its natural vegetation, although they don’t entirely abandon it because they will return after a few years to resume their farming.

Major crops grown:
millet and sorghum



Major crop grown:
rice

Major crops grown:
manioc, sweet potatoes,
yams, beans

Major regions of shifting cultivation. Shifting cultivation is best suited to rain forest regions, where farmers fertilize the relatively infertile rain forest soils by burning the undergrowth and using the ash to allow cultivation of crops.

3) **Pastoral nomadism** – This alternative to sedentary agriculture is characterized by following the herds, just as the earlier hunters and gatherers did. A great deal of the earth's surface today is still devoted to pastoral nomadism. However, the herds are domesticated, and consists of sheep, goats, cows, reindeer, camels, and/or horses. **Nomadism**, or the practice of moving frequently from one place to the other, is dictated by the need for pasture for the animals. This life style first developed across the grassy plains of central Eurasia and nearby desert areas of the Arabian Peninsula and the Sudan, and formerly included reindeer herding in northernmost Scandinavia and along the Arctic fringe of Russia, where it is still sometimes practiced. The animals involved must be hardy and mobile, most commonly including sheep, goats, and camels, and sometimes cattle, horses, and yaks. For the herders, the animals provide their primary subsistence with milk, cheese, and meat for food, and hair, wool, and skins for clothing and shelter. Extended stays in one location are neither desirable nor possible because the herds follow seasonal availability of pasture.

Both shifting cultivation and pastoral nomadism are referred to as **extensive subsistence agriculture** because they involve large areas of land and minimal labor per land unit. Both product per land unit and population densities are low. In contrast, **intensive subsistence agriculture** involves the cultivation of small land plots through use of great amounts of labor, and yields per unit and area and populations densities are both high. A major issue for subsistence farmers today is the need to intensify farming because of rapidly growing populations. According to economist Ester Boserup, subsistence farmers intensify production by leaving land fallow for shorter periods and adopting new farming methods. In order to farm land more efficiently, plows must be used, more weeding must take place, and more ditches for irrigation must be dug. The increase in population provides more people for weeding and digging ditches, so yield per acre increases, and land may be left fallow for shorter periods of time.

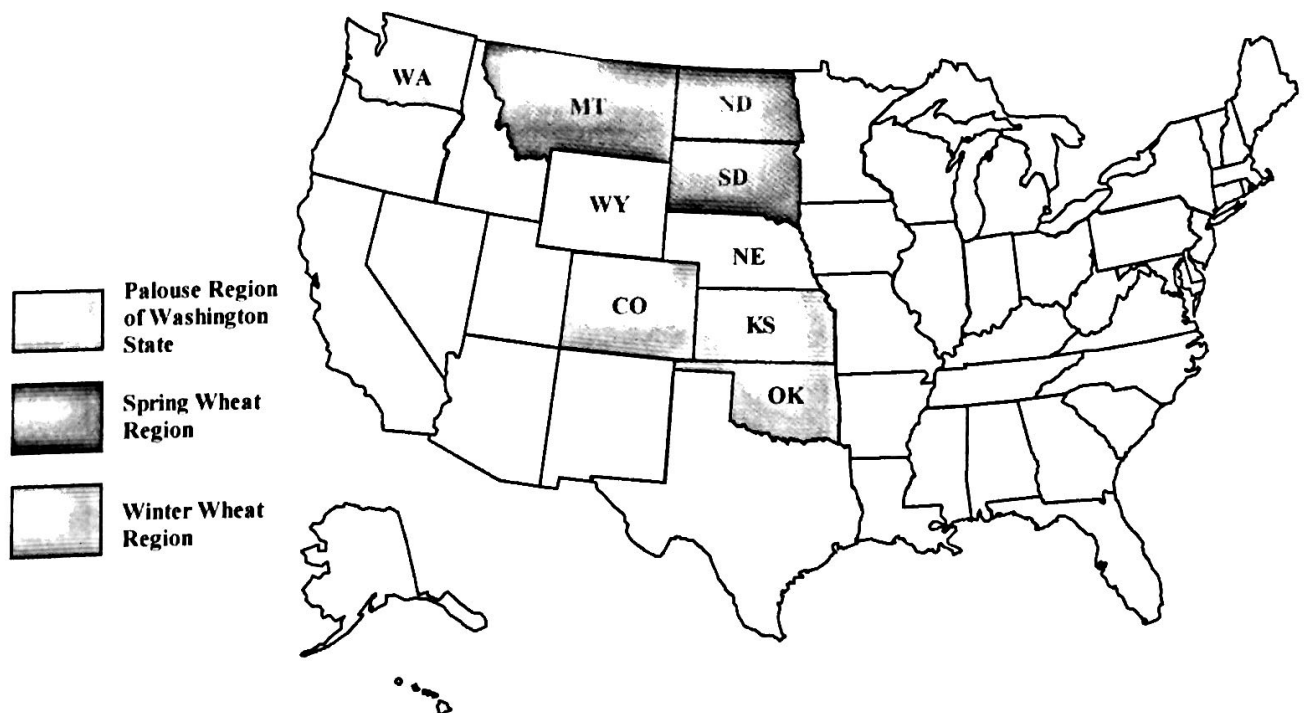
COMMERCIAL AGRICULTURE: SUBREGIONS

In pure **commercial agriculture**, farmers and ranchers sell all of their output for money and buy their families' food at stores. Commercial farmers are part of a large, complex economy in which they are only one element in an integrated commodity chain that includes industrial and service sectors as well. Commercial agriculture generally is dominant in more developed countries, and may be divided into intensive types (dairy farming and truck farming) and extensive types (large grain farms and livestock farms). The seven types of commercial agriculture listed below may be categorized as intensive, extensive, or a combination of the two.

1. **Mixed crop and livestock farming** – This is the most common form of commercial agriculture in the United States west of the Appalachian Mountains and in much of Europe from France to Russia. As the name implies, farmers grow crops and raise livestock on the same land spread, with most of the crops fed to animals rather than to people. Most income comes from the sale of animal products, such as beef, milk, and eggs. Mixed crop and livestock farming permits farmers to distribute the workload more evenly through the year, with fields requiring attention in the spring when crops are planted, and in the fall, when they are harvested. Livestock require year-long attention, but unlike crop produce, livestock produce can be sold in the wintertime, too. Most farmers practice **crop rotation**, where each field is planted on a planned cycle. Different crops take different nutrients from the soil, but commercial farmers make more intensive use of their soil than shifting agriculturalists do, with the latter leaving fields fallow for long intervals. At any given time, commercial agriculturalists will have almost all of their fields planted, but with different crops

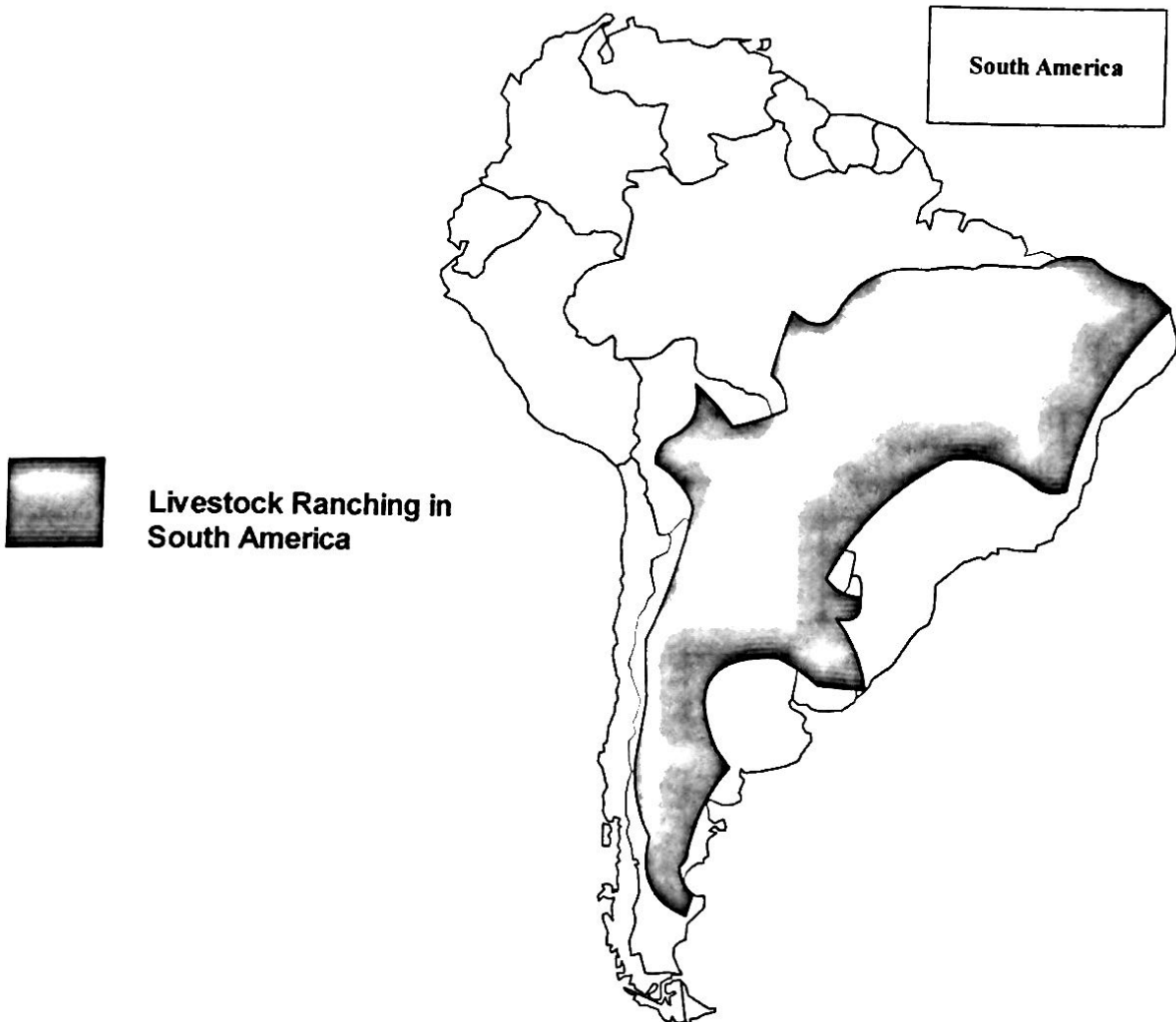
from those of previous years. For example, one cycle might focus on **cereal grains**, such as oats, wheat, rye, or barley; a second cycle might feature a root crop, such as turnips; a third cycle would be a “rest” crop, such as clover, that helps to restore the field, but may be eaten by cattle. Then the farmer can start over with a cereal grain. In the United States today corn is most commonly raised, with soybeans (used as an ingredient in processed food) the second most important crop in mixed commercial farming regions.

- Dairy farming** – Dairy farms abound in the areas outlying large urban areas, where their products feed populations in cities across the United States (most frequently in the Northeast), Western Europe, and Southeast Canada. Dairy farms must be closer to their market than other products because milk spoils quickly, so a ring of milk production called a **milkshed** surrounds a major city. Today refrigerated rail cars and trucks have extended the reach of the milksheds, so that nearly every farm in the U.S. Northeast and Northwest Europe is within the milkshed of at least one urban area. Dairy farms also produce butter and cheese, with many specializing in one product or another. Since cheese and butter keep fresh longer than milk does, farms further away from urban centers tend to favor these products over milk. For example, New Zealand is the world’s largest producer of dairy products, but they only devote a small share of their attention to liquid milk because it is too far away from North America and Western Europe to hold the milk market in those areas. Dairy farmers, like other commercial agriculturalists, usually do not sell their products directly to consumers, but to wholesalers or to butter and cheese manufacturers. A disadvantage of dairy farming is the expense of feeding cows in the winter. In contrast to mixed crop and livestock farmers, dairy farmers must purchase all feed, making it less likely that they will make a profit. Dairy farming is also labor intensive, since in addition to managing the care of their animals, cows must be milked regularly twice a day. The number of dairy farms have declined significantly since 1980, with departing farmers citing long work hours and too little profit as reasons. However, despite the decrease in numbers of farms, overall dairy production rose, indicating that the farms that still exist are producing more.



Major grain-producing region of the United States. States like Wyoming and Nebraska that lie between regions often are able to produce both winter and spring wheat.

3. **Grain farming** – The most important grain-producing areas in the world are in the United States in three regions: the **winter wheat area** in Kansas, Colorado, and Oklahoma, where the crop is planted in the autumn, survives the winter, and ripens the following summer; the **spring wheat area** of the Dakotas and Montana, where winters are too severe for winter wheat; and the Palouse region of Washington State. Other grain-producing countries are Canada, Australia, Argentina, France, and the United Kingdom. Large-scale grain production, like other forms of commercial agriculture, is heavily mechanized on large farms. The labor required for grain farming is concentrated during planting and harvesting seasons, although some farmers (depending on their locations) may combine companies that eventually sell to consumers within the country, much wheat finds its way into the international market, where it serves as the world's leading export crop. As a result, the prairies of North America are often referred to as the “world's breadbasket.”



4. **Livestock ranching** – Ranching is the commercial grazing of livestock over an extensive area, and is often practiced in arid or semi-arid regions where climate conditions make crop production impractical. Cattle ranching extends over much of the western United States, where the patterns of life associated with it have shaped the popular image of the West through stories of cowboys, round-ups, and trail-herding. In the early days, cattle roamed freely across vast extents of land, and were rounded up in the spring and then driven across land to railroad termini, such as Kansas City and St. Louis. However, by the late 19th century, cattle claimed more western lands. Today most and more railroads covered the landscape and farmers claimed more western lands. Today most

cattle grazing is on land leased from the U.S. government. Although much land in the U.S. has been converted from ranching to crop production today, large ranches still exist, although some are now owned by meat-processing companies. In South America, large portion of the **pampas** (prairie) of Argentina, southern Brazil, and Uruguay are devoted to grazing cattle and sheep. Ranches in Australia, New Zealand, the Middle East, and South Africa are more likely to raise sheep than cattle. In all of these areas, as in the United States, irrigation has allowed conversion of ranch land to crops, with the remaining ranches experimenting with new methods of breeding, feeding, and watering in order to stay profitable. While livestock raised in the U.S. is sold primarily in the domestic market, livestock raised in other areas is more likely to be exported to high consumption developed countries.

5. **Mediterranean agriculture** – This type of agriculture exists not only in the lands that border the Mediterranean Sea, but also in California, central Chile, the southwestern part of South Africa, and southwestern Australia. These areas share a similar physical environment: they border seas, and are on the west coasts of continents, with moisture provided by prevailing sea winds and moderate winter temperatures. Summers are hot and dry, with hilly lands and mountains that plunge directly to the sea, leaving narrow strips of flat land along the coast. Some livestock is raised, but most effort is put into crop production for human consumption rather than for animal feed. **Horticulture** – the growing of fruits, vegetables, and flowers – and tree crops form the commercial base of Mediterranean farming. Major crop are olives, grapes, fruits, and vegetables. The hilly landscape encourages farmers to plant a variety of crops within one farming area. In the areas around the Mediterranean Sea, the most important cash crops are olives and grapes, with two-thirds of the world’s wine produced there. Olives are an important source of cooking oil. California also produces grapes (and wine), and provides much of the citrus fruits and tree nuts for the United States market. California produces a wider variety of crops than other Mediterranean climate areas because of the extensive use of irrigation. During the winter months, many fruits and vegetables consumed in the United States are imported from Chile.
6. **Commercial gardening and fruit farming** – This type of agriculture predominates in the U.S. Southeast, a region with a long growing season and humid climate and accessibility to the large markets of the Northeast. It is often referred to as **truck farming**, because “truck” originally meant “bartering” in the English language. Products include apples, asparagus, cherries, lettuce, mushrooms, and tomatoes, with some sold fresh to consumers, but most sold to large processors for canning or freezing. Truck farms usually rely heavily on machinery and fertilizers, and labor costs are controlled by hiring migrant farm workers who work for very low wages.
7. **Plantation farming** – A **plantation** is a large farm that specializes in one or two crops, and is found today in Latin America, Africa, and Asia. Almost all crops are raised for export to high-consumption developed countries, and are called **cash crops** because they are raised to make money for their owners. Plantations are colonial legacies that persist in poorer, primarily tropical, countries along with subsistence farming. Cotton, sugarcane, coffee, rubber, and tobacco are usually grown on plantations in sparsely settled locations where they often import workers and provide them with food and housing. Until the 19th century, slave labor was employed, but today the workers are paid, although their room and board constitutes a large part of their salaries. Plantation agriculture predominated in the Southeastern United States until slavery was outlawed in the 1860s, when the land was subdivided and either sold to individual farmers or worked by tenant farmers. Today many plantations in former colonies are still owned by Western individuals or corporations.

RURAL LAND USE AND SETTLEMENT PATTERNS

As the variety of agricultural regions reflects, rural land may be put to many uses, including both subsistence and commercial farming. For subsistence farmers, the land and climate largely determine what crops may be grown as well as how they are cultivated. For commercial farmers rural land use is also influenced by access to markets, competition from other farmers, and government regulations and subsidies.

VON THÜNEN'S MODEL

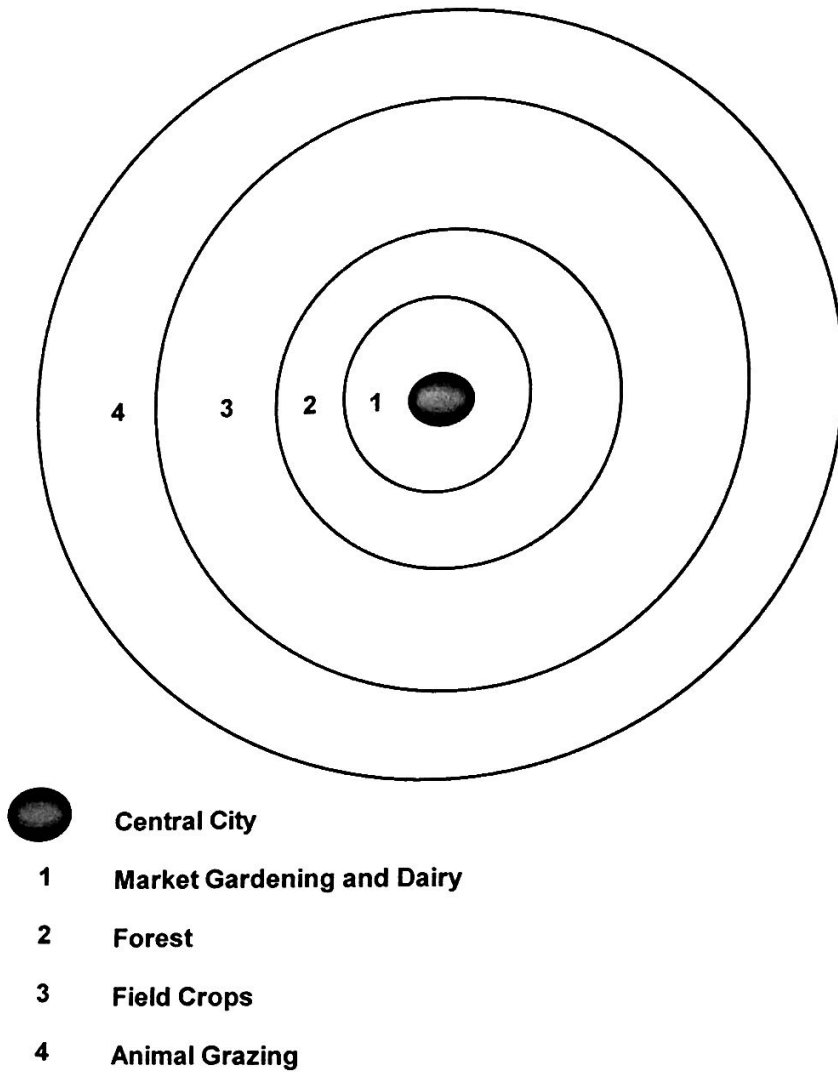
A German farmer, Johann Heinrich von Thünen, developed a famous model for rural land use in the early 19th century. Von Thünen studied the spatial layout of farming around the town of Rostock in northeast Germany, where he noticed that within the landscape one crop gave way to another without any visible change in the soil, climate, or terrain. As he mapped this pattern, he discovered that each town was a market center surrounded by a set of roughly concentric rings that featured different crops.

Von Thünen identified these four rings that surrounded market centers:

- **Market gardening and dairy** – Nearest the town, farmers raised perishable products, such as garden vegetables and milk. These products are expensive to deliver and must reach the market quickly because they spoil rather quickly, so it makes sense that these farmers needed to choose locations close to town.
- **Forest** – In von Thünen's day, towns were still surrounded by belts of forest that provided wood for fuel and construction. Closeness to market is important because trees are bulky and heavy to transport.
- **Field crops** – The next ring was used for crops that were less perishable, such as wheat and other grains. Usually the crops were rotated from one year to the next.
- **Animal grazing** – The outermost ring was devoted to livestock grazing, which required lots of space. Beyond this ring, it generally became unprofitable to farm commercially because the transportation costs became too high.

The pattern of rings reflects the need to apply **intensive agriculture** methods for high-value and perishable crops in the first ring, where land is subdivided into relatively small units. Land far from markets, in rings three and four, may be farmed **extensively** and in larger units. Intensive vs. extensive agricultural techniques determine settlement patterns, with dairy and truck farmers seeking smaller plots of relatively expensive land relatively close to cities, and grain farmers and ranchers settling on larger, less expensive land farther away from urban areas.

Von Thünen's model assumed a flat terrain with uniform soils and no significant barriers to transportation to market. He did acknowledge that the spatial arrangement could vary according to topography. For example, towns located on rivers or on hilly terrain had to arrange their rings accordingly. Von Thünen published his model in 1826 in a book called *The Isolated State*, the first effort to analyze the spatial character of economic activity. Despite the fact that soil quality, terrain, and climate changes may alter the model significantly, von Thünen identified the interplay of transportation costs and value of the products on rural land use, a formula that is still at the heart of **location theory**, the general but logical attempt to explain how an economic activity is related to the land space where goods are produced.



Von Thünen's Model. According to this model, different types of farming are conducted at different distances from a city, or market center, depending on the cost of transportation and the value of the product.

GLOBAL PATTERNS OF RURAL LAND USE

Von Thünen applied his model to the relatively small land space around 19th century German towns, but his basic concern with the interplay of market location, transportation costs, and land use may be applied on different scales. Even with fast transportation available, many foods need to reach market within a short amount of time, especially with the growth in popularity of organic foods. Without added preservatives, organic products have a shorter freshness span, so von Thünen's model comes in to play in assessing rural land use for organic foods. For example, on a regional level, fresh organic chicken served in a New York City restaurant would most likely have a more limited area of profitability than chicken that is non-organic.

On a global scale, von Thünen's model is useful for understanding broad patterns of rural land use. Farmers in areas far away from the major markets of Western Europe and North America are less likely to grow highly perishable products or crops that are bulky and expensive to transport. However, other factors that affect rural land use include varying climate and soil conditions, farming methods, technology,

and even historical influences. For example, many poor countries today still grow commercial crops, such as coffee and bananas, on soil that otherwise might be used for food for their own consumption. The historical roots of this practice are in colonialism, where entrepreneurs from powerful European countries and/or the United States established plantations for commercial agriculture.

PATTERNS OF SETTLEMENT

Clearly, the intensity of crop cultivation affects the density of housing in rural areas. Areas of extensive agricultural practices demonstrate a **dispersed settlement pattern**, with individual farmhouses lying quite far apart. Dispersed settlement patterns may also exist in areas where machinery makes intensive cultivation over large areas possible. For example, most farms across the Midwestern U.S. are large, houses are spaced far apart, and land is farmed fairly intensively by machines. In contrast, many rural areas in Indonesia are characterized by a **nucleated settlement pattern**, with villages located quite close together with relatively small surrounding fields. Land use is intense, but people and animals do the work. Nucleated settlement is the most common worldwide pattern of agricultural settlement. Houses are grouped together in **hamlets**, or small clusters of buildings, or in slightly larger settlements called **villages**. These arrangements reflect the historical need to band together for protection, but even though this need has changed in modern day, the patterns were established long ago and still persist.

Housing Styles and Geography

Geography has always influenced the types of houses that people build for shelter. For example, people in flood-prone areas learned how to build houses on stilts, and people in areas with lots of snow learned to build steep-sided roofs. Lifestyles also determine housing styles, such as the light-weight, transportable materials used by nomadic people for shelter. Until relatively recently, people were limited by their physical environments in their building materials for housing. For example, early settlers in the Midwestern United States build sod houses because trees were not readily available. Today migrations have carried housing styles far away from their origins, and building materials are shipped for long distances, so many areas have mixed housing styles.

Housing styles in rural areas tend to be more traditional than those in urban areas, especially if the areas are remote from or resistant to outside influences. Villages all over the world have mixtures of traditional and modified housing, with traditional styles ranging from sod-covered roofs in Scandinavia, to hand-cut stone houses in the Andes Mountains, to mud-walled houses in China.

Different building materials include:

- **Wood** – The use of wood in houses is still linked to the distribution of forests, but wood is now shipped to most corners of the globe. The log house probably originated in northern Europe where forests were plentiful, and its use spread to North America when Europeans first settled there. In those areas today wood is not usually the primary building material, but still is used for framing and trimming. Houses made primarily of wood are still found in a zone that extends eastward from Scandinavia through Russia to the Pacific coast.
- **Brick** – Although builders in the U.S. define brick as oven-baked blocks of cement, brick in other areas of the world are made from different materials. Wet mud mixed with straw is used in the

Middle East, northern China, the southwestern United States, and Mexico. This mixture is sun-dried rather than oven-baked. Today brick is a major element of modern construction across the world.

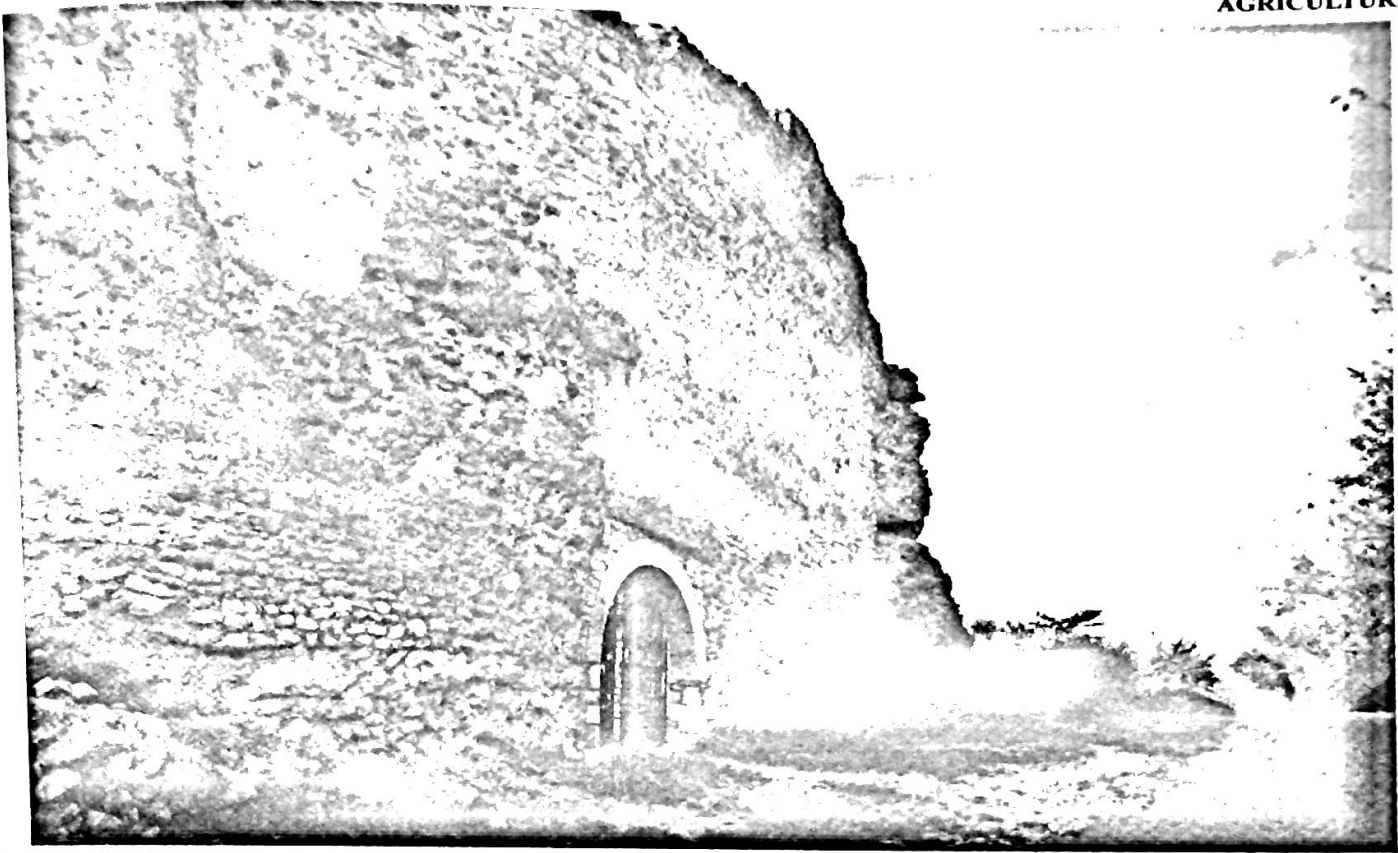
- **Stone** – Natural stone has long been used in home construction. A distinctive feature of buildings in the Andes Mountains is that many have no mortar, but are stacked in puzzle-like pieces that have stood in some cases for centuries. More typically, houses of natural stone are built with cement mortar, usually in areas where building stone is plentiful.
- **Wattle** – The term **wattle** refers to poles and sticks woven tightly together and then covered with mud. Many African houses are constructed with wattle and a thick thatched roof. Other regions where wattle building is common also have plenty of bamboo, sticks, bark, and leaves for building, such as Southeast Asia and the Amazonian River Basin.

Villages

The definition of **village** varies across the world, but it usually describes a small number of people who live in a cluster of houses in a rural area. Other structures, such as places for religious gatherings, barns, markets, and government buildings, are commonly found in villages. How large may a village be? In Canada, the official definition limits a village to 1000 people; in the United States villages may have up to 2500 people. The numbers go way up in densely-populated areas, such as Japan and India. Another way to define a village is by the occupations of its inhabitants. In a village, most people work in the primary economic sector as farmers, herders, or fishers, and relatively few people have narrow, specialized jobs. Some villagers provide services to those who farm, herd, or fish, but the social organization is relatively simple.

Village forms include:

- **Round villages** – This most traditional style is found in East Africa and parts of Europe, and it features houses that circle around a central corral for animals, with fields extending outside the ring of houses. Clearly, the style was developed to protect domesticated animals, such as cattle.
- **Walled villages** – This type of village developed in ancient days in order to protect villagers from attack. In Europe the villages were often surrounded by moats as well. Today remnants of these walls still exist, and in some cases walls are still intact.
- **Grid villages** – These more modern villages are laid out in straight street patterns that run in parallel and perpendicular lines. Grids are also used in cities, and work best in areas with flat land.
- **Linear villages** – These modern settlements follow major roads, often one single thoroughfare lined with houses, businesses, and public buildings.
- **Cluster villages** – These settlements may have more than one major road that they build along, and they also may have housing that clusters around large public buildings, such as churches, temples, mosques, livestock corrals, or grain bins.



Remains of a village wall. The photo above shows the remains of the wall and an old city gate that led to the city of Die in France. The wall provided protection from attack, and the gate was heavily fortified.

The Influence of Land Ownership and Survey Techniques

One of the most important influences on land settlement patterns is land ownership. Parcels of land are divided by lines that clearly separate one person's land from another's. Rules about property inheritance often determine land distribution. For example, in areas where **primogeniture** is practiced, all land passes to the eldest son, resulting in land parcels that are large and tended individually. This form of property distribution is found in northern Europe, the Americas, South Africa, Australia, and New Zealand. In other areas, such as much of Asia, Africa, and southern Europe, land is divided among heirs, resulting in smaller plots of land with scattered ownership.

Survey methods were first used in areas where settlement was regulated by law, such as European surveying of the Americas as settlers moved westward from the eastern coastline. For example, the U.S. government used the **rectangular survey system** to encourage settlers to disperse evenly across interior farmlands. The section lines were drawn in grids, often without reference to the terrain, that determined where people settled. The straight section lines often became the places where roads were built, shaping the landscape into familiar grid-like patterns still found across the U.S. today.

Other survey systems that have shaped the rural landscape are the **metes and bounds** approach where natural features are used to mark irregular parcels of land. This approach has been used along the eastern seaboard of the United States. The **long-lot survey system** divides land into narrow parcels that extend from rivers, roads, or canals. This approach gives more people access to transportation, and has been used in the Canadian Maritimes, Quebec, Louisiana, and Texas.

MODERN COMMERCIAL AGRICULTURE

Modern commercial agriculture has its roots in the commercial revolutions started in the 18th century by European powers. The economic system of **mercantilism** was developed most effectively by the British and the Dutch, with private companies under charter from the governments carrying out the trade. Mercantilism's main goal was to benefit the mother country by trading goods to accumulate precious metals, and thus enriching the country. Major products included cotton grown in Egypt, Sudan, India; tobacco and cotton in the American colonies; and sugar from plantations in the Caribbean and Brazil. These goods were marketed mainly in Europe, but sometimes they were manufactured in European factories and sold back to the colonists.

Although much has changed since colonial times, modern global agricultural patterns still follow colonial patterns. Poor countries still produce raw materials, including food, for consumption by people in the richer countries. For example, Colombians still produce a great deal of coffee, and Guatemala's economy is supported by banana sales. The production of cash crops in poor countries is perpetuated because many of them must repay loans from international organizations, such as the World Trade Organization, the International Monetary Fund, and the World Bank.

DIFFUSION OF INDUSTRIAL AGRICULTURE

Today **industrial agriculture** is the current stage of commercial agriculture resulting from the shift of the farm as the center of production to a position as just one step in a multiphase industrial process that begins on the farms and ends on the consumer's table. Commercial agriculture has spread to virtually all areas of the world through global trade and exchange markets, and almost all economies have adjusted to it in one way or another. Farmers produce not for their own subsistence but for a market that is part of a complex system that includes mining, manufacturing, processing, and service activities. They must act within the constraints of the market that set prices based on supplies and demands of the global economy, and not on their own immediate needs.

Agriculture now is characterized by **specialization**, or the growing of specialized crops because they seem to be the most profitable. Farmers must weigh in costs of production – such as machinery, fuel, fertilizer, and labor – and deal with unpredictable weather and/or disease. Also, market conditions may change by the time the crops are harvested, contributing to the risks. To minimize their risks, farmers in the 1950s in the United States began signing agreements with buyer-processors, who specified exact times and weights of products to be delivered, including chickens, cattle, wheat, potatoes, and other basic foods.

This **agribusiness** is now spreading to developing countries where small-size farmers are linking with foreign sources for advice, seeds, fertilizers, machinery, and profitable markets at stable prices. Contract farming in poorer countries has been criticized as exploitative of small farmers who receive too little money for their products. Farmers in wealthier countries are also concerned that competition from farmers in less developed countries will drive down market prices. As a result, some governments have placed controversial tariffs on foreign produce in order to protect their own farmers.

THE THIRD AGRICULTURAL REVOLUTION

The First Agricultural (Neolithic) Revolution began about 10,000 years ago when people changed from hunting and gathering to farming in several different areas of the world. The Second Agricultural Revolution occurred in the late 18th century as improved equipment and better farming methods greatly increased the productivity of European farms. The **Third Agricultural Revolution** began in the mid-20th century and is still going on today in the form of **industrial agriculture**, modern farming that refers to the industrialized production of livestock, poultry, fish, and crops. Methods of industrial agriculture include innovation in agricultural machinery and methods, genetic technology, techniques for achieving economies of scale in production, the creation of new markets for consumption, and global trade. These methods are widespread in developed nations and increasingly prevalent worldwide. Most of the meat, dairy, eggs, fruits, and vegetables available in supermarkets are produced using these methods of industrial agriculture. It is based on new, higher-yielding varieties of crops developed in laboratories and plant nurseries through **biotechnology**, the use of genetically altered crops in agriculture and DNA manipulation in livestock in order to increase production. The experiments began with hybrid rice initiatives in the U.S. Midwest in the 1930s, eventually leading to the development of “IR8,” a cross developed in the Philippines between a dwarf Chinese variety of rice and an Indonesian variety. This led to other hybrids, so that by the 1980s “IR36” was developed, with the qualities of larger grains, a shorter growing cycle, and more resistance to pests. By the early 1990s IR36 was the most widely grown crop on earth. Meanwhile, a “miracle wheat seed” was developed that was shorter and stiffer, hardier, and faster-maturing than traditional varieties. More recently, scientists have developed new high-yield variations of corn.

By the 1970s the collection of new agricultural techniques was called the **Green Revolution**, which involved two important practices: the use of new higher-yield seeds and the expanded use of fertilizers. New miracle seeds diffused rapidly around the world, with many countries recording dramatic productivity increases. Biotechnologists don't just cross two varieties of plants or animals, hoping for the best. Instead, they identify the particular genes on the DNA molecules that produce the desirable characteristic and splice the gene directly into the chromosomes of the other plant or animal. During the 19th century scientists identified the critical elements in natural fertilizers (manure, bones, and ashes) as nitrogen, phosphorus, and potassium. Today these three elements form the basis for fertilizers that have boosted crop productivity even further. The Green Revolution has resulted in agricultural production outpacing population growth by the late 20th century.

THE IMPACT OF THE GREEN REVOLUTION

The Green Revolution has brought about dramatic changes in the world's food production, with consequences that have been both praised and criticized.

Whereas the Green Revolution appears to be contributing to the good health of many people around the world, it has failed to provide famine relief for people in Sub-Saharan Africa. Seriously affected countries include Somalia, Ethiopian, Sudan, Gambia, Senegal, Mali, Mauritania, Burkina Faso, Niger, and Chad. Part of the problem is lack of resources to buy seed, fertilizer, and machinery, but the situation is worsened by rapid population growth. Traditionally, this region supported limited agriculture, with pastoral nomadism prevailing. The land has now been overgrazed by animals, and soils have been exhausted from overplanting. These practices have led to an alarming rate of **desertification**, with

PRAISE AND CRITICISM OF THE GREEN REVOLUTION

PRAISE

Agricultural production now outpaces population growth, almost certainly avoiding disastrous famines that have plagued the past.

Nitrogen-based fertilizers, now widely used, have greatly increased farm productivity in many countries of the world.

Scientists continue to invent new food sources, including cultivating the oceans, developing higher-protein cereals, and improving palatability of rarely consumed foods.

Higher productivity is primarily responsible for reducing dependency on imports in Asia, including China and India. In both areas populations are balanced fairly well with food resources.

New irrigation processes have greatly increased crop yields.

Agribusiness has increased the productivity of cash crops, yielding profits for farmers and raising large amounts of basic crops to feed the world.

CRITICISMS

Poor countries cannot always afford the machinery, seeds, and fertilizers necessary to raise the new crops, leading to problems in getting the new foods to their citizens.

Farmers in poor countries cannot afford the fertilizers, increasing inequalities between rich and poor countries. Fertilizers also lead to groundwater pollution and the reduction of organic matter in the soil.

Many fishing areas are already over-fished, and populations of many breeds of fish are dwindling. Cultural preferences shape food consumption, and production of rarely eaten foods will not change eating habits.

Many people in Sub-Saharan Africa are not getting enough to eat, with millions of people facing famine. Green Revolution techniques have made too few inroads, and population is increasing faster than food production.

Irrigation has led to serious groundwater depletion, negatively impacting water supplies for urban populations.

Agribusiness often means that land is devoted to raising one type of crop, rather than the variety needed for a balanced diet, especially in poorer countries.

the Sahara Desert continuing to claim more and more land space. Soil erosion has become a problem, with the limited number of trees cut for wood and charcoal for urban cooking and heating. Government policies have traditionally favored urban populations by keeping food prices low, giving farmers little incentive to increase their productivity. In recent years international aid for agriculture has dropped drastically, while aid for health and primary education has surged. However, in its 2007 annual report, the World Bank put agriculture and the productivity of small farmers – particularly in Africa – at the heart of its global agenda to reduce poverty. The African Union and the United Nations have also



Food Supply Crisis in Africa. Production of most food crops is lower today in Africa than it was forty years ago, whereas populations are increasing. Particularly hard hit are the countries that formerly were inhabited by nomadic herders shown in gray shading on the map above. The problem has been worsened not only by increasing population, but also by desertification, as the Sahara Desert continues to grow.

advocated major investments to increase the productivity of poor farmers in Africa, although a great deal of disagreement remains regarding the role that African government should play in spurring farm productivity.

ENVIRONMENTAL IMPACTS OF MODERN AGRICULTURE

From its very beginnings, agriculture has transformed the natural landscape. Forests have been cleared for agriculture, terraces built into hillsides, and natural vegetation removed in order to make room for desirable crops. However, the industrialization and commercialization of agriculture has strengthened agriculture's impact on the environment. More land has been cleared, and the land is farmed more intensely. As a result, the mix of plants and animals on any given plot of earth is often a far cry from what existed there naturally.

Other problems, beyond clearing the land, include:

- **Erosion** – Lands cleared for agriculture almost immediately begins to erode away, usually by wind or running water. The surface material removed is transported by rivers, and changes valley contours, extending areas subject to flooding, and clogging irrigation and drainage channels.
- **Changes in the organic content of soil** – Crops take nutrients from the soil, so they change its organic content, especially if fields are not allowed to remain fallow long enough to restore the

nutrients removed, or if crops are not rotated on a regular basis. The more pressure there is on land to be farmed intensely, the more likely it becomes for soil to lose its fertility.

- **Depletion of natural vegetation** – This problem is especially acute when commercial agriculture expands into marginal environments. For example, when livestock herding moves into arid or semi-arid areas, the natural vegetation in these areas cannot always sustain the herds. This can lead to ecological damage and, in some areas, to desertification.
- **Presence of chemicals in soils and ground water** – Concern about the presence of chemicals from fertilizers and pesticides has sparked a recent trend toward **organic agriculture**. Crops are grown without fertilizers and pesticides, ensuring that the consumer will not suffer adverse health effects from them. Sales of organic food in the United States, Western Europe, and Japan have soared in recent years, benefiting farmers in those areas, but not those in other parts of the world.

Some have called the depletion of farmlands a “quiet crisis” that threatens to undermine the foundations of civilization today.

FUTURE FOOD SUPPLIES

Food supplies are a crucial component of every economy, and throughout history almost all other accomplishments have rested on the availability of food surpluses. Today several strategies are used to ensure and improve the production and distribution of adequate food products around the world:

- **Expansion of agricultural land** – This is the historical method of increasing food production – clear and plow more land for planting. When the world’s population began to increase rapidly in the late 18th and early 19th centuries, people migrated to sparsely-inhabited land in western North America, the pampas of Argentina, and central Russia to farm new land. However, this method is not as likely to increase food supplies as it once was. Only about 11 percent of the world’s land area is currently cultivated, but most of the remaining land – especially in Europe, Asia, and Africa – is not arable. In fact, some land has been lost to **desertification**, a deterioration of land to a desert-like condition by over-grazing and over-planting. Irrigation can also ruin land in dry areas because it cannot drain properly from the hard soils. Urbanization also cuts down on available land space, as farms are replaced by homes, roads, and shops.
- **Increase in land productivity** – The Green Revolution has made this alternative for increasing food supply a viable one. Land produces more crops and supports more animals as new hybrids are introduced and nutrients are added to soil through fertilizer. Farming methods also have made land more productive, and many anticipate that higher-yielding fields will be developed in the future.
- **Identification of new food sources** – Many things in the world that are edible are not chosen as food for a number of reasons. Oceans and seas have provided only a small percentage of world food supply historically, and many plants and creatures live in these waters. In recent years, fish catches have increased significantly, causing over-fishing in some areas. With improved access to ocean food away from shore, more food sources almost certainly may be found there. Many people avoid food for social reasons. Americans prefer hamburgers and hotdogs to tofu, sprouts, and other soybean products, but that preference doesn’t make the soybean products any less nutritious.

- **Improved distribution of food** – Today the top three export grains are wheat, corn, and rice, and most of those grains come from the United States. About half of global corn exports and a quarter of all wheat exports come from the United States. Other major exporters of wheat are Argentina, Australia, France, and Canada. Thailand has replaced the United States as the leading exporter of rice, and now other Asian countries, such as Vietnam, India, and China, also export rice. In countries that export, food sometimes goes to waste, either because markets are not coordinated properly or because the government subsidizes crops. Meanwhile, countries that need food cannot buy it, either from lack of resources or poor coordination of markets.

Despite increasing urbanization and globalization in today's world, farming is still the major occupation of people in less developed countries. In more developed countries, fewer people are farmers, but many are employed in the food business, including processing plants, supermarkets, restaurants, and food wholesalers. Farming continues to alter the earth's landscape, leaving the human imprint deeply ingrained on the land.

TERMS AND CONCEPTS

agribusiness
 agricultural hearths
 agriculture
 biotechnology
 cereal grains
 Columbian Exchange
 commercial agriculture
 desertification
 dispersed settlement pattern
 enclosure
 erosion
 extensive agriculture
 extensive subsistence agriculture
 Green Revolution
 hamlets, villages
 horticulture
 hunters and gathers
 industrial agriculture
 intensive agriculture
 intensive subsistence agriculture
 irrigation
 job specialization
 labor intensive agriculture
 location theory
 long-lot survey system
 Mediterranean agriculture
 mercantilism
 metes and bounds