4

Worldwide Systems of Agricultural Production

Key Terms

Agricultural systems
Barter
Cash crop
Commercial livestock finishing
Commercial plantation
Developed agriculture
Drylot
Extensive agriculture
Intensive agriculture
Market gardening
Pastoralism
Primitive agriculture
Rudimentary sedentary tillage
Savanna
Self-sufficient
Shifting cultivation
Slash-and-burn agriculture
Steppes
Subsistence agriculture
Transhumance
Urban agriculture

Learning Objectives

After you have studied this chapter, you should be able to:

- Identify the broad types of agricultural production systems found worldwide.
- Describe the use of animals within each agricultural type.
- Compare and contrast the livestock industries of developed and developing countries.
- Differentiate between commercial systems of agriculture and subsistence systems and their goals.

INTRODUCTION

This chapter describes the systems of agricultural production that have developed in response to the complex set of environmental, cultural, and economic conditions of the world.

The types of livestock systems found in an area are primarily determined by the principal agricultural system of that area. In turn, the agricultural system is determined by a number of factors, including climate; topography; soil type; and socioeconomic issues, such as level of economic development, demand for products, political systems, and religions. Although all of the influences are important, climate (particularly rainfall and temperature) and level of economic development are the most critical. Climate determines, to a large degree, what can be grown and, therefore, the basic type of agriculture practiced. Within climate constraints, the level of economic (and agricultural) development determines the specific system. Economic development also determines demand for products.

There are a number of classifications of agricultural systems, one of the most widely accepted being that of Whittlesey (Table 4–1). The worldwide distribution of land-based systems is shown in Figure 4–1. Figure 4–2 summarizes the relationship of these systems to rainfall amounts and temperatures.

Table 4–1
AGRICULTURAL SYSTEMS FOUND IN AREAS WITH PRIMITIVE, SUBSISTENCE, AND DEVELOPED AGRICULTURES

Agriculture	Goal	Agricultural Systems
Primitive	Subsistence, but usually agriculture is supplemented with nonagricultural food sources (hunting, gathering, stealing)	1. Nomadic herding, transhumance 2. Shifting cultivation 3. Rudimentary sedentary tillage 4. Aquaculture
Subsistence	Subsistence	1. Subsistence crop and livestock farming 2. Paddy rice farming (Intensive subsistence tillage with paddy rice) 3. Peasant grain, tuber, and livestock farming (Intensive subsistence tillage without paddy rice) 4. Urban agriculture 5. Aquaculture
Developed	To make money with the agriculture	1. Ranching 2. Commercial grain farming 3. Commercial livestock and crop farming 4. Commercial livestock finishing 5. Commercial dairy farming 6. Commercial plantation 7. Specialized horticulture 8. Mediterranean agriculture 9. Market gardening 10. Aquaculture

Note: This listing of the systems proposed by Whittlesey has been modified by grouping the systems according to the level of agricultural development in which they are found. It has been further modified to reflect changes in agriculture since 1936.

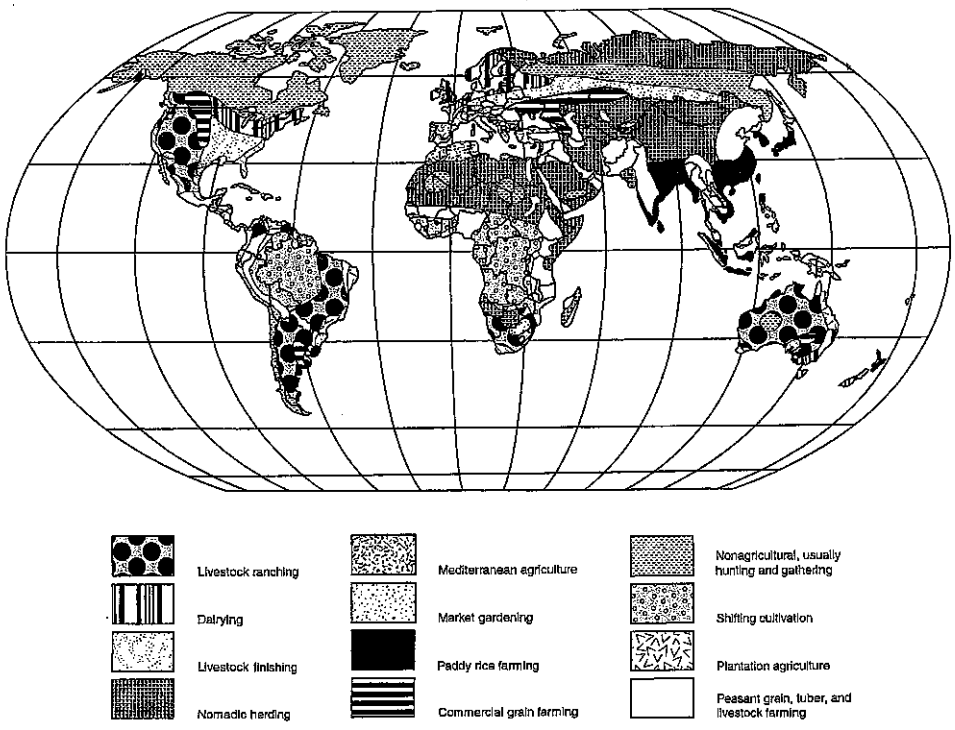


Figure 4–1
Distribution of world agricultural systems. (Source: Adapted from Whittlesey, 1936; modifications according to Jordan-Bychkov et al., 2008.)

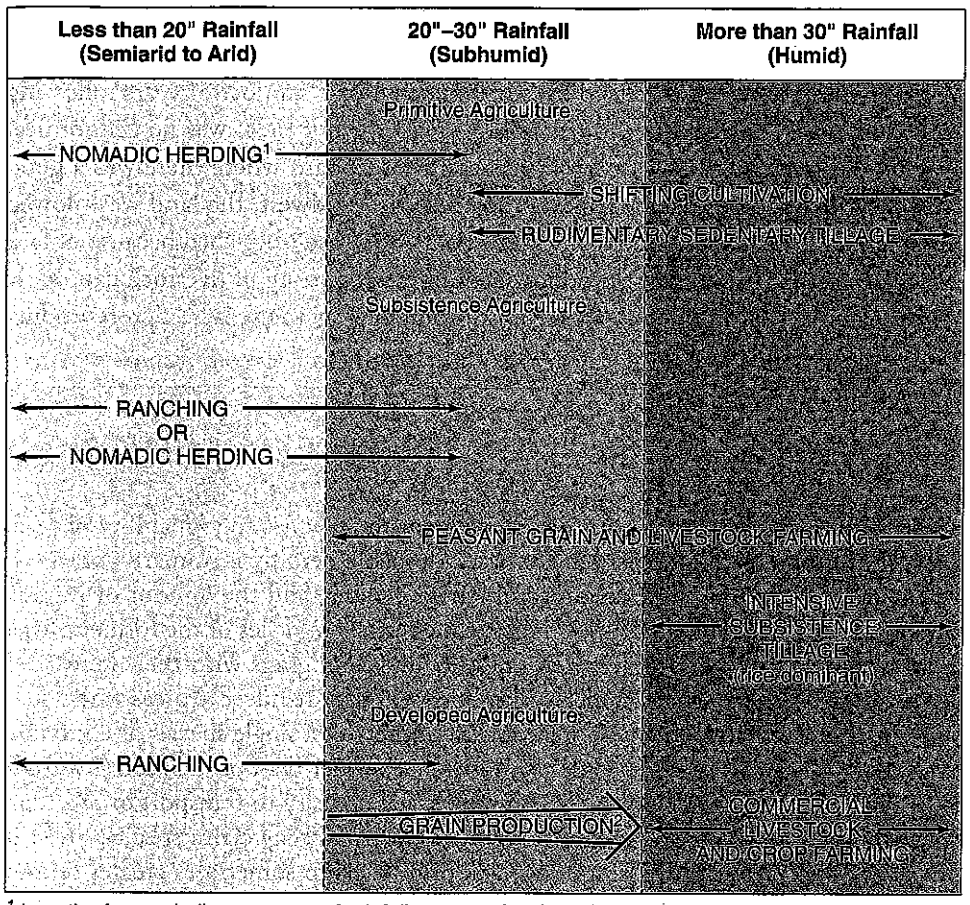


Figure 4–2
Influence of amount of rainfall on agricultural systems in each of the levels of agricultural development. (Source: Adapted from Turman, 1986.)

[1] Length of arrow indicates range of rainfall amounts in which the system is generally practiced.
[2] Width of arrow indicates extent to which the system is practiced in an area with a given amount of rainfall.

The most common reason for devoting an area to grazing livestock rather than cultivation is that it is too dry, but three other reasons for this usage are that these areas are (1) too rough to cultivate, (2) located at high elevations where the growing season is too short, or (3) so far removed from good markets that the cost of shipping the products to market would be unprofitable (Figure 4–3). In the latter

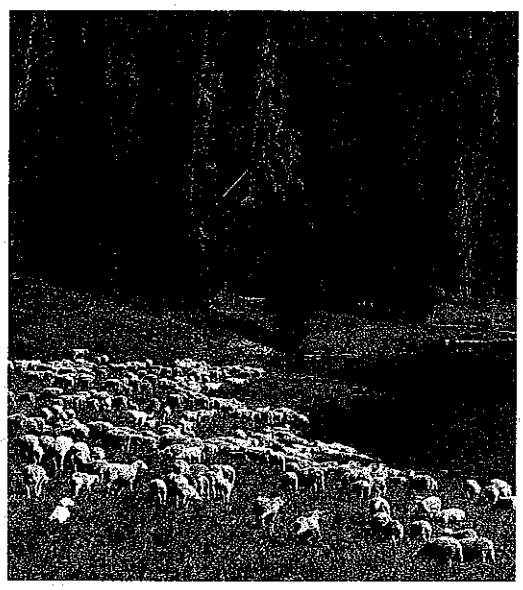


Figure 4–3
Livestock are used to graze land when it is too dry or too rough to cultivate, when high elevations cause a short growing season, or when the land is too far from good markets to make crop production profitable such as this land in the Centennial Mountains of southwestern Montana. (Photo by Scott Bauer. Courtesy USDA-Agricultural Research Service.)

case, grazing is usually only a temporary use of the land and is discontinued once transportation facilities are built. For example, much of the Corn Belt region of the United States was devoted to livestock grazing for a number of years following the Civil War. Farmers knew they could grow corn, but there was no economical way to ship vast amounts of corn to the eastern seaboard where there was a good market. Once the railroads were extended into the Midwest, the land was plowed and planted in corn. Even today, much of South America is ranched because of lack of infrastructure to transport products. Commercial grazing of livestock can rarely compete with crop production as the most profitable way to use land if crop production is possible.

NOMADISM AND TRANSHUMANCE

Steppes Short grass vegetation zones.

Savanna Tall grass vegetation belts in the hot areas of the world.

Nomadism is irregular, opportunistic movement in response to availability of feed, usually of people without a permanent base. Nomadic herding is primarily practiced in the deserts, **steppes**, and **savannas** of Africa, Arabia, and the interior of Eurasia and in the very cold areas north of the tree line in the countries of the former Soviet Union. Nomadic people move their families and belongings with their herds and flocks of cattle, sheep, goats, camels, yaks, horses, and/or reindeer to areas where feed and water are available. The herd may consist entirely of a single species or a mixture of species. The goal of these peoples is subsistence, rather than profits from livestock sale. Nomads live in tents, yurts, or snow huts that are easy to transport or abandon and replace. They own no land, although certain tribes may claim specific areas as their lands and resist trespassing. This lack of ownership sometimes creates serious problems when arbitrary political boundaries are constructed that divide traditional grazing areas into two different countries. Seldom, if ever, is any type of farming practiced. Nomadism has been greatly affected by droughts, wars, and urbanization of the world's peoples and is a declining, and probably dying, way of life (Figure 4–4). This is unfortunate because nomadic herding is a rational, sustainable way to use arid lands.

Pastoralism Herding grazing animals.

Transhumance Seasonal moving of animals from a permanent base to more abundant feed and water and then returning to the permanent base.

Transhumance is a method of **pastoralism** related to nomadism. In **transhumance**, pastoralists move seasonally to take advantage of shifting water and grazing conditions. Transhumants have a permanent base of residence where cultivation may be practiced. In some transhumanant systems, the entire family may move with the

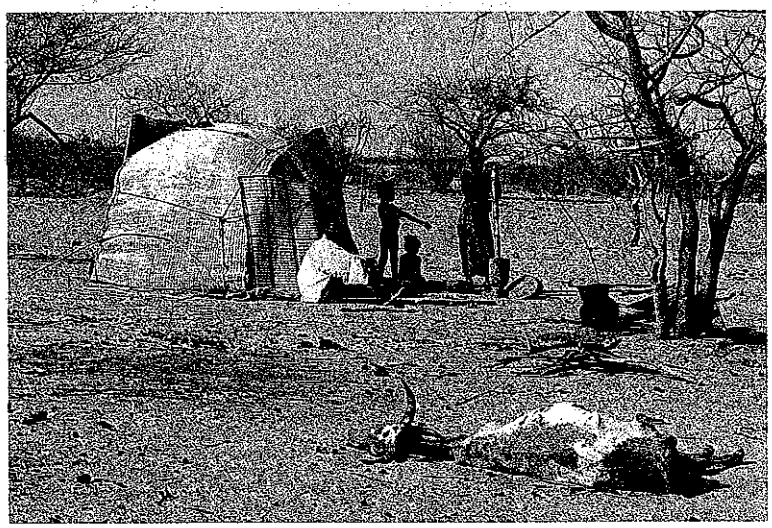


Figure 4–4
Many of the world's nomads are disappearing. Young people are abandoning the traditional way of life, and political conflicts and natural disasters take a huge toll. These destitute nomads came from drought-stricken Mali to northern Upper Volta in search of pasture but found a wasteland. (FAO photo 6715/F. Botts. Used with permission by the Food and Agriculture Organization of the United Nations.)

livestock to a seasonal settlement and then return to the permanent settlement at the appropriate time. In others, only a few members of the family travel. In mountain regions, animals are moved to higher elevations in the summer to escape heat and insects and to find grazing, and then they are returned to lower elevations for the winter. In Africa, livestock may be moved south in the dry season, but then back north in the wet season to avoid the tsetse fly. Transhumance is practiced in the Mediterranean region, the Alps and other mountain areas of Europe, the Himalayas, the western United States, dry portions of Asia, and in other geographic regions as well. In the past, in the United States and Australia, cattle were often released into mountain pastures in the spring and rounded up in the fall, with little herding in between. Today, there is more supervision and management of grazing.

SHIFTING CULTIVATION AND RUDIMENTARY SEDENTARY TILLAGE

Shifting cultivation occurs when farmers clear small plots of land, farm them for a few years until the land's fertility declines, then abandon that plot and clear another. This practice is often called **slash-and-burn agriculture** because the forest is cut and then burned as a means of clearing (Figure 4–5). The ash provides nutrients for the crops. The farmers may move to a new spot or remain in the same place. Eventually, the abandoned plots grow up in brush, trees, and other plants that help to renew soil fertility; such renewed plots are later cleared, and the cycle is repeated. In its best form, this is a good system of land rotation. The land should have 10 to 20 years to rejuvenate. Shifting cultivation is practiced in the remote tropical areas of South America, Africa, Southeast Asia, and Indonesia. The goal of shifting cultivation is subsistence. However, nonagricultural sources such as hunting, fishing, and gathering usually supplement the diet.

Slash-and-burn agriculture The practice of clearing a plot of land from the forest by cutting the trees and shrubs and then burning them. The ash from the burning fertilizes the soil.

Many areas previously devoted to shifting cultivation have been converted to rudimentary sedentary tillage. Rudimentary sedentary tillage differs from shifting cultivation in that the farmers remain in one place. This system requires land that is basically more fertile. However, the farming methods and crops produced are usually similar to those of shifting cultivation and are very primitive, involving mainly hand labor and very crude tools. With increasing human population, the cycles of production become ever shorter and the recovery of fertility less complete, which can lead to breakdown of the system. In addition, lands have been cleared in areas where rejuvenation of the cover does not occur readily, and these plots often erode and become unusable.

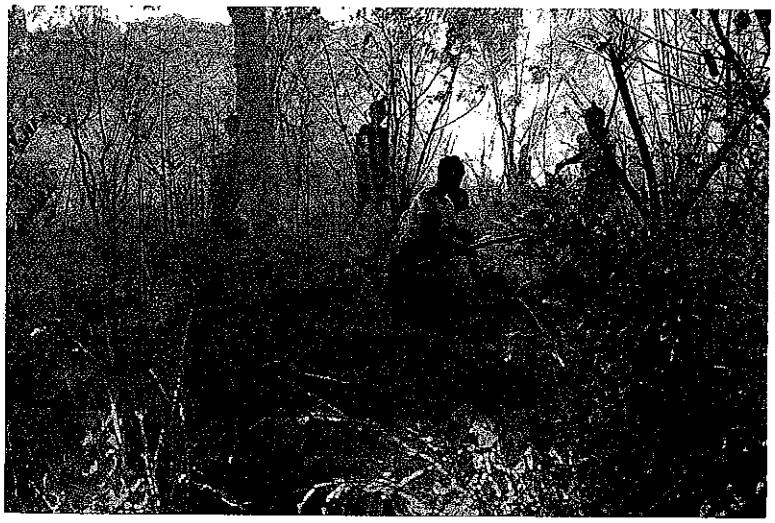


Figure 4–5
Slash-and-burn method of clearing a field. Large trees were usually killed by ringing them. The smaller trees, underbrush, and cover plants were burned to clear the land for planting. (FAO photo/14185/R. Faidutti. Used with permission by the Food and Agriculture Organization of the United Nations.)

Farmers in both of these types of primitive farming usually also own some animals. Generally, all animals owned by the people of a village graze together on common grazing grounds near the village. One of the jobs assigned to the young and old of the village is herding the grazing animals. Usually, the animals are brought into the village compound at night for protection from predators—human as well as wild animals. In addition, milk, urine, and manure can be collected. The animals are not generally used for draft purposes and are infrequently used for meat. Most meat comes from fishing and hunting.

PADDY RICE FARMING

Paddy rice production (Figure 4–6) is concentrated in South and East Asia. Large acreages are found in India, China, Japan, and the Philippines. Rice is grown if the necessary water is available because it will outyield any other grain. This system is very labor intensive, both for human and animal labor. Vast numbers of work animals, primarily cattle and buffalos, are needed. The animals may also be used for food, but their primary use is for draft purposes. Pigs and poultry are kept as scavengers and are used as food by the human population (Figure 4–7). A few cattle or goats may also be kept to graze dry land nearby and are generally a prized source of milk. Water buffalo cows also provide milk.

Figure 4–6
Rice is very high yielding and grown in paddies in most of the densely populated areas of Asia. This system is very labor intensive, requiring much hand labor and draft animal power. Here an Indonesian farmer and his work animals return home across the rice terraces after a day in the paddy. (FAO Photo/17343/R. Faidutti. Used with permission by the Food and Agriculture Organization of the United Nations.)

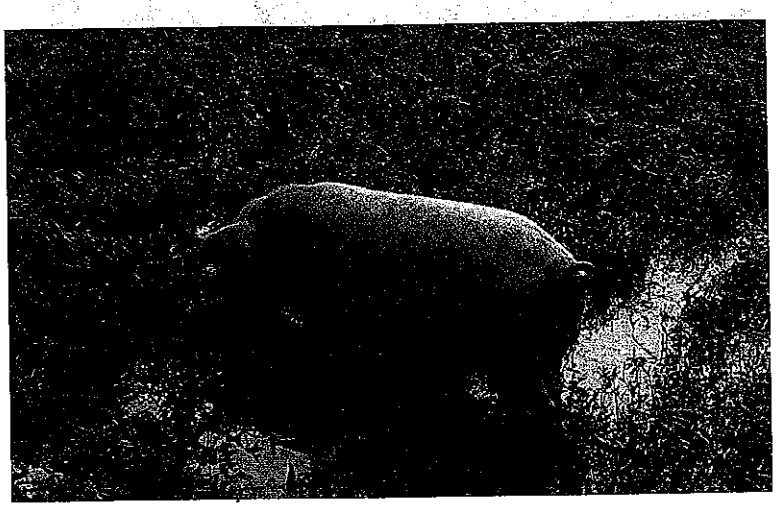


Figure 4–7
In many primitive and subsistence agricultural systems, pigs are kept as scavengers and for dung, which is used as fertilizer. (FAO Photo/20914/K. Pratt. Used with permission by the Food and Agriculture Organization of the United Nations.)

Figure 4–8
In intensive paddy rice farming, much needed protein comes from fish taken from the irrigation reservoirs and canals. Here, one man fishes, while the other weeds the rice field. (FAO Photo/22575/J. Van Acker. Used with permission by the Food and Agriculture Organization of the United Nations.)

Fish are taken from the irrigation reservoirs and canals, and some aquaculture is practiced in some areas (Figure 4–8). It is common for paddy rice farmers to raise a cash crop such as tea, jute or sugarcane for direct human consumption, or mulberry bushes for silkworm production. Paddy rice farming has been and continues to be one of the world's most successful and sustainable subsistence systems of agriculture.

PEASANT GRAIN, TUBER, AND LIVESTOCK FARMING

Peasant grain, tuber, and livestock farming, also called subsistence crop and livestock farming, is also a highly successful subsistence agriculture and involves small farms, each with a few head of livestock. It is practiced primarily in the poorer regions of Europe and in the colder, drier parts of Asia, the river valleys of the Middle East, throughout Africa, and in Latin America. Most of the produce of the land and animals is used by the farmer, with only small amounts available for sale or **barter. Self-sufficiency** rather than profit is the objective of farmers engaged in this system of agriculture. The dominant crops are wheat, barley, millet, oats, corn, sorghum, soybeans, and potatoes. Multiple-purpose animals (for work, food, and fiber) are used (Figure 4–9). Milk is a more important food than meat. Cattle, pigs, and sheep are the large animals usually raised. Their manure is commonly used to improve soil for the field crops. Poultry are often kept. In South America, llamas and alpacas are raised. A **cash crop** such as cotton, flax, hemp, or tobacco may be raised to generate a meager income to purchase items the farmers cannot grow.

Barter Trading services or commodities for each other.

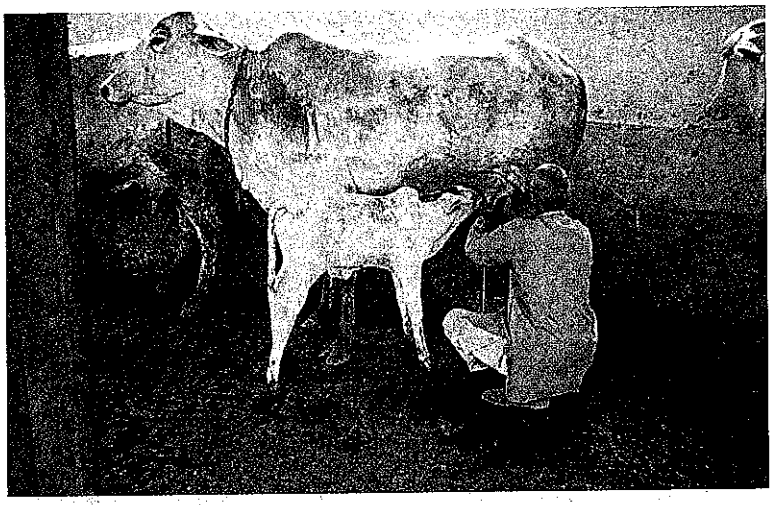
Self-sufficiency Providing for one's own needs.

Cash crop A crop grown specifically with the intent of marketing its product.

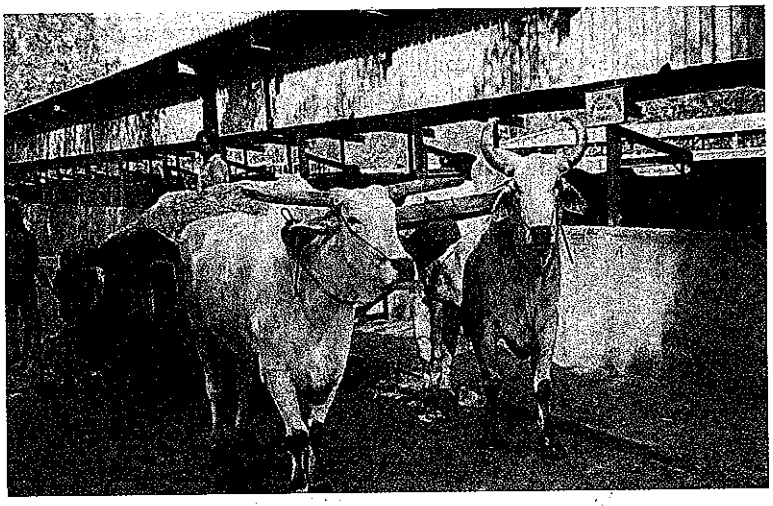
RANCHING

Ranching is the commercial use of the dry areas of the world (Figure 4–10). In very general terms, ranching is the predominant system in areas with less than 20 inches of yearly rainfall, although it is practiced in areas that receive as much as 25 inches of yearly rainfall. Livestock is the primary enterprise in ranching. Generally, ranching is based on cattle or sheep, and only occasionally are goats or other animals involved. Management is very **extensive,** which means that the animals are spread out and do not receive much individual attention. Usually, only one species is involved in a given ranching enterprise. However, mixing species often produces better use of the land. Ranching is always a for-profit enterprise even if found in a developing country. Thus, species decisions on ranches are made with a profit motive.

Extensive agriculture Agriculture systems practiced in a manner that spreads human time and attention across vast acreages and/or many animals.



(a)



(b)

Figure 4–9
The Hariana cow of India (a) is kept for her milk production and the bullocks she produces (b), which are used as draft animals. (Photos courtesy of Dr. Eric Bradford, Animal Science Department, University of California, Davis.)

Unlike nomads, ranchers are permanently located on land they either own or lease. Ranchers very definitely seek to make a profit from their livestock. Although ranchers are primarily concerned with livestock production, some farming may be practiced, if possible, to produce forage to feed in winter. Most cattle ranches are found in the United States, Canada, tropical and subtropical Latin America, and

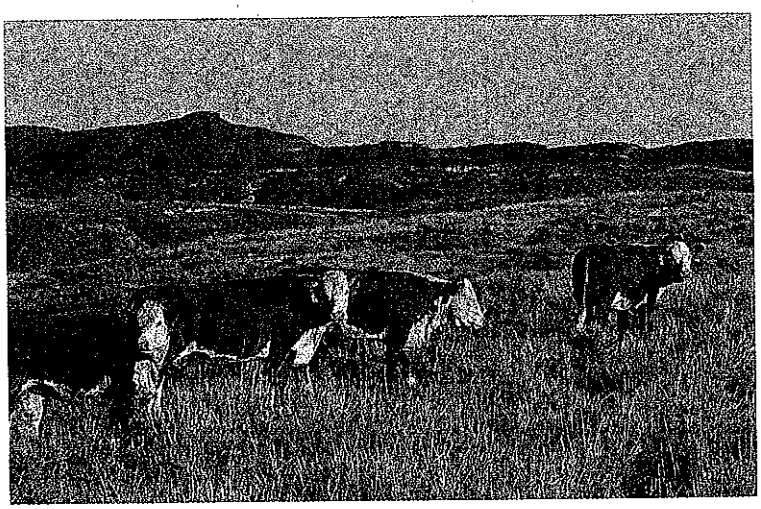


Figure 4–10
Ranching is a for-profit, extensive system of agriculture practiced in the dry areas of the world. (Photo by Keith Weller. Courtesy of USDA-Agricultural Research Service.)

the hotter parts of Australia. Most sheep ranches are located in Australia, New Zealand, South Africa, and Argentina. Ranching is practiced in some countries that are not developed. In many of these undeveloped areas, the income from ranching has helped the economic development of those nations tremendously.

COMMERCIAL CROP AND LIVESTOCK FARMING

Commercial crop and livestock farming predominates in areas with more than 30 inches of rainfall per year but is also practiced in areas that receive 25 to 30 inches of yearly rainfall. Crop production is the primary enterprise, with livestock secondary to crops. Beef cattle, sheep, dairy cattle, pigs, horses, or poultry are secondary enterprises on these farms. Often, animals are finished for slaughter in the winter when the farmer is not working the crops. Farmers may specialize in only one species or may be diversified, raising two or more species. The production is usually **intensive,** which generally means the animals are confined so that mechanization and the latest technology can be maximized and individual attention given to the animals without greatly increasing labor.

Intensive agriculture Any agriculture system in which much human attention and focus is directed to a small plot of land or to each animal.

Commercial Livestock Finishing

Commercial livestock finishing is a modification of commercial crop and livestock farming that has only been in existence since the last half of the 20th century and represents a further specialization of agriculture. Generally, these producers do not raise any crops; they buy commodities and by-products to feed their livestock. The Corn Belt, the South, and the Plains area of the United States, parts of western and central Europe, and, increasingly, Australia, South Africa, and Brazil are the major areas practicing commercial livestock finishing. The United States is the largest practitioner of this agricultural system. The cattle feedlots found in the High Plains of the United States are the classic example of this system. Large numbers of cattle are finished for market in this area by systems that are highly specialized for the purpose (Figure 4–11). With the expanding influence of vertically integrated poultry and swine operations, these species are commonly raised in this type of specialized production as well. In the case of poultry and to a lesser degree pigs, this system is becoming increasingly important around the world, including many developing countries. Because this system is so closely interspersed with commercial crop and livestock farming, Figure 4–1 does not show this region separately.

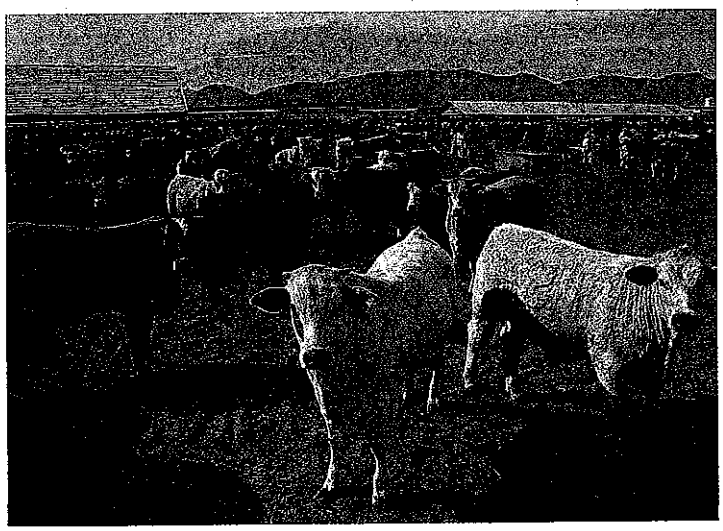


Figure 4–11
Commercial livestock finishing is a modification of commercial crop and livestock farming. The cattle feedlots in the western United States are an example. (Photo by Jeff Vanuga. Courtesy USDA-Natural Resources Conservation Service.)

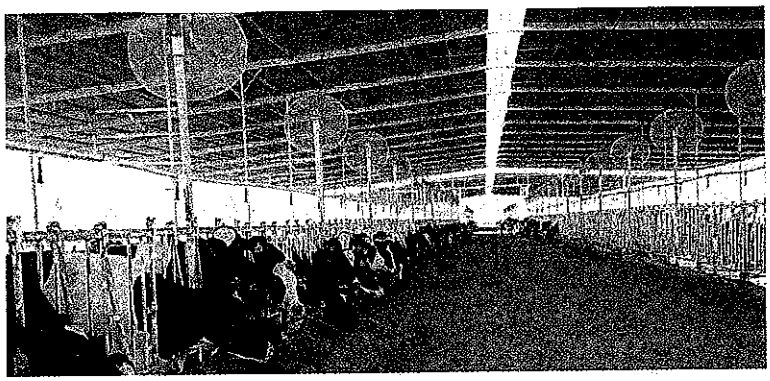


Figure 4–12
In a confinement dairy system, the feed is brought to the animals, rather than relying on the animals to graze pasture.

Commercial Dairy Farming

Commercial dairy farming is also a modern modification of commercial crop and livestock farming and has much in common with commercial livestock finishing operations including their intensive nature. It is generally intermingled with commercial crop and livestock farming. Proximity to markets dictates the primary dairy products produced in a specific region. For instance, fluid milk is perishable and expensive to transport, so it tends to be produced near human population centers. Dairies that are far removed from dense populations specialize in processed dairy foods such as butter, cheese, and condensed milk. For example, geographically remote New Zealand produces butter and other processed products that can be kept fresh and shipped to population centers. Wisconsin, a major dairy state in the United States, produces much of the cheese shipped to and consumed in other regions of the United States.

As practiced traditionally in the United States, Europe, Australia, and New Zealand, dairying has depended on maximizing the use of pastures with some crop production to produce winter feed. Confinement **drylot** (Figure 4–12) systems have replaced pasture systems in many commercial dairies. Feed is either purchased or grown, harvested, and brought to the cows who are in confinement drylot conditions.

Drylot A confined area generally equipped with feed troughs, automatic watering devices, shelter, and working facilities where animals are fed and managed.

This resembles livestock finishing in many ways, except for the products. Around the world, these dairy farms are often situated close to human population centers. In addition to feed, farmers often buy replacement females for their herd or contract with other producers to grow them. Economies of scale dictate that these be large-scale operations with thousands of cows rather than the 200 to 300 cows found on small family dairies. Clearly, these operations are in the process of further specialization.

COMMERCIAL GRAIN FARMING

Commercial grain production is practiced in areas receiving between 20 and 30 inches of yearly rainfall. Some livestock may be produced. The animals are usually stocker cattle and/or lambs brought in to graze small grain pastures in the fall and winter, or cows/calves used to clean up the crop residues. The major emphasis is on producing corn and small grains, usually wheat or rice. Australia has very large wheat belts, as do the American plains, Canada, Europe, the steppes of Russia, and the pampas of Argentina. Commercial rice farms can be found in the United States, Argentina, Australia, Egypt, India, Pakistan, Spain, Vietnam, and other countries.

Figure 4–13
Olives were once a mainstay of traditional Mediterranean agriculture. Livestock had marginal use, generally relegated to the mountainous areas. Other crops that are now important include grapes. These grapevines are being grown on terraces on the hillside above Manarola Village on the Mediterranean coast of Italy. (FAO Photo/21432/R.Messori. Used with permission by the Food and Agriculture Organization of the United Nations.)

MEDITERRANEAN AGRICULTURE

Mediterranean agriculture is very different today than it used to be. In ancient times, it was peasant subsistence agriculture based on wheat and barley for rainy winter season crops, drought-resistant trees and vines (grape, olive, and fig) for the summer, along with sheep, goats, and some pigs. Grain was often raised in alleys in the orchards, and animals were not really integrated into the land. Farmers did not raise feed, collect manure, or keep draft animals. The animals were kept in the mountains, and crops were planted in the hills and valleys below. However, irrigation has changed all of this. Today, much of the Mediterranean region is referred to as **market gardening** and is a commercial area. Some animals are still grazed in the mountains, but citrus is now a dominant crop. Grapes are also an important crop, making this area famous for its wines (Figure 4–13). Fruits, vegetables, and lavender are also substantial crops.

Market gardening Specialized production of fruits, vegetables, or vine crops for sale.

These areas are often mountainous and use mountain pastures through transhumance by slowly grazing livestock up the mountains during the summer. Once livestock reach the highest elevations (generally midsummer), they graze slowly back down the mountain to reach the valley before snow falls.

MARKET GARDENING

Market gardening is a specialized agriculture of developed zones, which produces and sells products to large urban centers. Another term often used to describe this agriculture is truck farming. These farms do not have any livestock, but rather produce nontropical fruit, vegetables, vine crops, and flowers in intensive tillage systems. Common products include various flowers, potatoes, tomatoes, lettuce, melons, beets, broccoli, celery, radishes, onions, cabbage, strawberries, table grapes, raisins, wine, citrus fruits, peaches, and plums. These operations tend to be labor intensive and often depend on seasonal farm laborers who move from area to area depending on the work available. Most countries have significant market gardening areas. Often, market gardening is practiced in an emerging form of agriculture called *urban agriculture*.

COMMERCIAL PLANTATION

Plantation agriculture is a form of commercial agriculture that uses large land holdings and labor-intensive practices, most often in developing countries, to produce a single crop for the commercial market. Today, most of this agriculture is found in

Figure 4–14
Sri Lankan women carry sacks of harvested tea on a plantation. Plantation agriculture is commercial agriculture that uses the cheap labor force of developing countries to produce crops for the commercial market.
(FAO Photo/17022/G. Bizzarri. Used with permission by the Food and Agriculture Organization of the United Nations.)

the tropics and subtropics and produces crops to be marketed in Europe, Japan, and the United States. Profit is the objective of this system of agriculture. Most plantations are owned by governments or large corporations. Crops include various fruits, coffee, tea, spices, sugar, fiber, cacao, rubber, vegetable-oil products, and tobacco.

Plantation agriculture is found in South America, Central America, Indonesia, the Philippines, the Caribbean, India, Sri Lanka, and West Africa (Figure 4–14). Animals have little place in plantations other than as pack animals. Most of the labor has traditionally been provided by humans. In modern times, even the human labor requirement has been reduced substantially through mechanized farming practices. The term *neo-plantation* is used to describe these modern mechanized plantations.

URBAN AGRICULTURE

The urbanization of the population of the world continues in both developed and developing countries. Many of these new city dwellers have brought farming practices with them to their urban/city homes. With this is a newly developed type of agriculture referred to as *urban agriculture*. Vegetables, fruit, herbs, ornamental plants, meat, eggs, and milk are commonly produced. Backyards are the most common location urban agriculture is practiced, but roadsides, along waterways, rooftops, and public areas are also used. Some urban farmers even practice hydroponics production.

Both intraurban and peri-urban spaces are used. A variety of animals are raised, including poultry, rabbits, goats, sheep, cattle, pigs, guinea pigs, and fish. Urban agriculture is distinguished from rural agriculture in that it is integrated into the urban economic and ecological system. The United Nations Development Program (UNDP) estimates that, worldwide, 800 million people rely on urban agriculture for food and income (Figure 4–15). Much is subsistence oriented but income is also generated, and full-fledged commercial ventures are also common. Urban agriculture is being promoted in many developing countries for its positive roles in alleviating urban poverty; promoting social inclusion; and providing for urban food security, urban waste management, and urban greening.

AQUACULTURE

Aquaculture is not a new form of agriculture. It has been practiced as a subsistence food system for centuries in coastal waters, freshwater ponds, rice paddies, and irrigation canals. However, aquaculture is becoming more important as a form of food

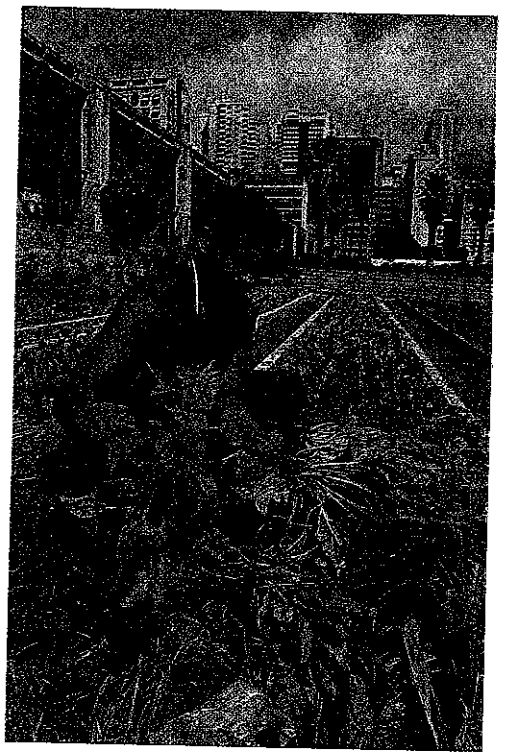


Figure 4–15
Urban agriculture has become an important part of the equation in providing food and income for the world's population. (FAO photo/DSC-037/G. Bizzarri. Used with permission by the Food and Agriculture Organization of the United Nations.)

production with the advent of large-scale commercial aquaculture production, producing over one-third of the world's supply of seafood (Figure 4–16). Asia and the Pacific Rim are the dominant practitioners of commercial aquaculture.

DEVELOPED VERSUS SUBSISTENCE AGRICULTURE

In comparison with the agriculture of the developed countries, subsistence agriculture appears to be very inefficient and unproductive. However, it is a serious error to judge all economic systems in terms of what is considered to be the best in a developed country such as the United States.

Primitive and subsistence systems have proven to be substantial systems for centuries. The animals have been integrated into the systems to achieve maximal returns

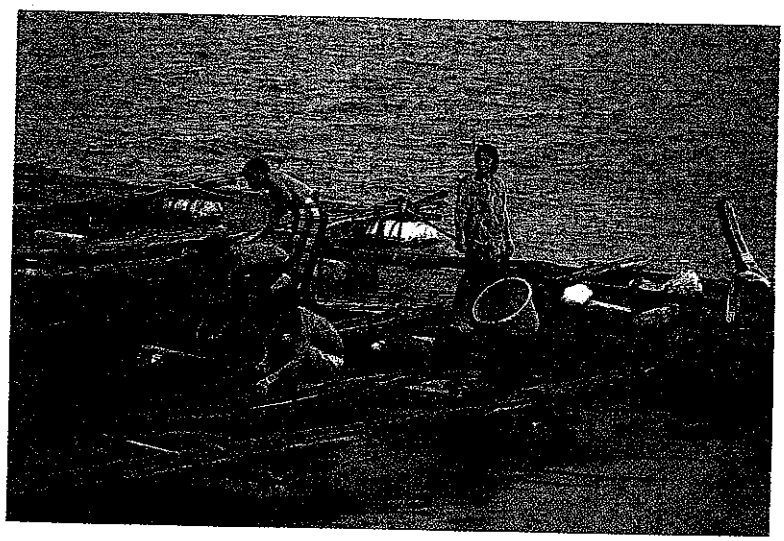


Figure 4–16
Aquaculture is becoming an increasingly important source of the world's food supply. Villagers of the picturesque Andaman island known as Panyee tend fish raised in cages. Once harvested, these fish will be sold to supply restaurants catering to tourists in nearby Phuket. (FAO photo/24553/R. Faidutti. Used with permission by the Food and Agriculture Organization of the United Nations.)

for their upkeep. There is a very low capital investment in animals and housing for the animals and farm equipment. This is vital to the systems because the majority of the farmers have a low income, so little or no money is available to finance capital improvements of any kind in the farm enterprise. Of even greater importance, when repairs are needed, they can usually be done locally using relatively inexpensive, readily available materials and with a minimum of delay.

There are several reasons why animals, rather than tractors, are the predominant source of power in subsistence agriculture. Obviously, they cost less, both initially and to replace. Animals are a renewable resource that can be produced locally, usually by the farmer. Machines require fossil fuels that are both expensive and are usually in short supply. The fuel for animals, largely consisting of plants that cannot be consumed by humans, can be produced by the farmer.

The final reason is that labor has no alternate use. Hand labor is a major contribution of agriculture to poor human populations. It provides work for a vast number of people who would otherwise be unemployed. This labor pool will continue to be used in agriculture as long as human labor is more economical than machine labor. If the time ever comes when there are nonagricultural demands for the service of such people, they will no longer be a cheaper source of labor than machines, and they will be replaced in agriculture by machines. Until such time, however, the employment of vast amounts of hand labor is a very efficient use of human hands.

COMPARISON OF THE LIVESTOCK INDUSTRY IN THE DEVELOPED AND THE DEVELOPING COUNTRIES

Table 4–2 compares the livestock industry in the developed and developing countries. The two are similar in that each has a very few units that are very large in size, but differ in that such units in the developed countries are usually much more productive. However, even though they are not managed as efficiently as are such operations in the developed countries, the very large units are usually the only livestock-producing units in the developing countries that use any modern technology or have improved breeds of livestock.

Developed and developing countries differ radically in the numbers of livestock units that are moderate to large in size. Such units make up the majority of the units in the developed countries, but they are almost totally absent in the developing countries. In the developed countries, these are the farms and ranches owned and operated by the middle class, a class almost nonexistent in the poor countries of the world.

By far, the most numerous type of livestock enterprise in the developing countries is the small unit. Small units are also common in developed countries—but for a different reason. In developed countries, small units are seldom the major source of income for the owner/operator. In sharp contrast, almost all of the small units in the developing countries are not only a major source of income, but they are usually the only source of income for their owners.

As shown in Table 4–2, the small units in both groups of countries are similar: (1) they cover a limited land area, (2) they are operated almost entirely by the labor of the family, and (3) cash returns are low. The most important reason for low cash returns is the small size of the operation. However, returns per animal unit are usually less than for larger units. One of the main reasons for this low return in developed countries is that small producers do a poor job of marketing their animals even though good markets are available. In developing countries, low returns are the result of the combined effect of the unavailability of good markets and a general low level

Table 4–2
COMPARISON OF THE LIVESTOCK INDUSTRY IN DEVELOPED AND DEVELOPING COUNTRIES

	Characteristics of the Livestock Industry	
Size of Unit	**Developed Countries**	**Developing Countries**
Very large	Very few	Very few
Moderate to large	The majority	Almost none
Small	Fairly numerous	By far the most numerous type of livestock enterprise
	Usually not the major source of income for the owner/operator	The major source of income for the owner/operator
	1. Use limited land area 2. Operated almost entirely by family labor 3. Cash returns to livestock enterprise are low as a result of:	
	a. Small size b. Inefficient marketing	a. Small size b. Poor markets available c. Low level of animal productivity 1. Genetically poor animals 2. Low nutritional levels 3. Diseases and parasites
	Little or no desire to expand 1. Livestock usually more of a hobby than a business	Little opportunity to expand 1. Total income needed for subsistence; none available for expansion 2. Little or no collateral for loans (if loans are available)

Source: Adapted from Turman, 1986.

of animal productivity. Usually, the only cash market available to the producers in a developing country is from traders who offer a very low price; hence, the producer has no choice because the traders are the only buyers.

The small units in both groups of countries are likely to remain small, but for different reasons. In the developed countries, small units are usually a sideline—many are a hobby rather than a business. The operator has a job in town but lives on a few acres in the country. He keeps a few animals because he has the space to do so and enjoys working with animals, but he has no desire to expand. In contrast, most small farmers in the developing countries would like to expand but have little or no opportunity to do so.

Two additional points are relevant about the livestock industry in the developing counties: (1) livestock are kept for many reasons other than to produce food, and (2) animal performance is usually submaximal from a biological standpoint, so there is room for improvement while staying within the system that has developed.

SUMMARY AND CONCLUSION

Agriculture in the United States is almost exclusively a developed system. However, understanding the various agricultural systems throughout the world gives us better knowledge of our own systems by providing a frame of reference. It also helps us gain perspective on where we have been, and it assists us in knowing how to help others achieve higher levels of development, presuming that they wish to. Perhaps most important, understanding how others live and practice agriculture, given the constraints they are under, offers us an opportunity to appreciate their ways of doing things.

STUDY QUESTIONS

1. What are the major factors that determine the type of livestock systems found in a given location?
2. Based on your knowledge of the world's climate regions, write a short summary of how climate influences each of the agricultural types.
3. What are the characteristics that differeniate primitive, subsistence, and developed agricultures?
4. Consider the use of animals in each of the agricultural types described in this chapter. Which systems could use more species of animals? Why do you think this is so? Which could substitute different species than are now used? Why would your suggested changes be effective?

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