# Factors Affecting World Agricultural Structure

## Learning Objectives

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

- Explain the process of adaptation.
- List the five major categories of environmental stressors and tell how animals react to them.
- Describe the climatic environments of the world.
- Summarize how climate and natural vegetation are tied together.
- Explain how social and cultural differences affect agriculture.
- Integrate information on levels of economic and agricultural development to explain how they are linked.

## Key Terms

Adaptation
Animal rights movement
Artificial environment
Centrally planned economy
Climate
Desertification
Developed agriculture
Economic development
Economic institutions
Grading up
Kosher
Literacy
Market economy
Nomadism
Parasite
Pathogen
Primitive agriculture
Religion
Stress
Subsistence agriculture
Symbiotic relationship
Taboo
Transhumance
Transition economy

## INTRODUCTION

To understand how animals are useful to humanity, we must understand the factors that influence where and how animals live, as well as their uses to humans. An extraordinarily rich and complex set of cultural and environmental factors influence both humans and our animals and, consequently, animal use. The various social and cultural norms of societies have a tremendous influence on what people value, tolerate, and eat. These norms also affect animal use and animal agriculture throughout the world. Religion, recreation, and social customs are very important in establishing an animal's value. A value established by one of these factors is often greater than the animal's food or work value. An animal species that has become a successful domesticated species has adapted to the conditions of its environment (natural and human-made) and has been of some utility to humans. This chapter discusses the factors to which animals have adapted to become successful domestic species and provides a rationale for why specific animals have value in various places.

## ADAPTATION

**Adaptation** is the sum of the adjustments occurring in an organism that promotes its welfare and favors its survival in a specific environment. These adjustments must be made to the unfavorable features, or stresses, of the environment. The environment is all of the combinations of conditions under which an organism must live. There are many conditions, and each is identifiable as part of either the natural or physical environment, or the artificial environment imposed by humans. The ability of an animal to adapt to the specific stresses of the environment in which it lives is very important. Agricultural animals must have the ability to adapt to the natural environment and the artificial environment imposed by humans if they are to be useful. This ability to adapt to a **symbiotic relationship** with humans and the stresses imposed by that association is a key element of domestication.

**Adaptation** The sum of the changes an animal makes in response to environmental stimuli.

**Symbiotic relationship** When organisms live together in a mutually beneficial relationship.

The natural environment refers to climate, geography, altitude, feed, and other such factors. The natural environment is very important because agriculture must always be practiced within its constraints. The artificial environment to which agricultural animals must adapt is a mixture of factors linked to the economic level and culture of a given society, as well as the steps taken to control the natural environment.

The stresses of the natural and/or artificial environment may be classified into five categories: (1) climatic stresses, (2) nutritional stresses, (3) internal stresses, (4) geographical stresses, and (5) social stresses. Each **stress** affects the distribution and utilization of the agricultural animals of the world. A brief discussion of each follows.

**Stress** A state of physical, emotional, or chemical strain or tension on the body.

***Climatic stresses.*** *Climate* is the long-time pattern of meteorological factors; *weather* is the immediate condition of these factors in a given area. The most important of these meteorological factors from the standpoint of animal comfort and performance are ambient temperature, precipitation, solar radiation, wind, and relative humidity. Each factor has both a direct and an indirect effect on animals (Figure 3–1). Indirect effects include those that affect the plants that the animal must use for food.

***Nutritional stresses.*** These are the stresses related to the quantity and quality of available feedstuffs. In most cases, climate primarily determines these stresses, with temperature and rainfall the most important. However, soil type, fertility, topography, and geographic location are also important (Figure 3–2).

***Internal stresses.*** These are the stresses that affect an individual animal by gaining entrance into its body. The two most common internal stresses are **pathogens** and **toxins** (Figure 3–3).

**Pathogen** Any living disease-producing agent.

**Toxin** One of several poisonous compounds produced by some microorganisms, plants, and animals.

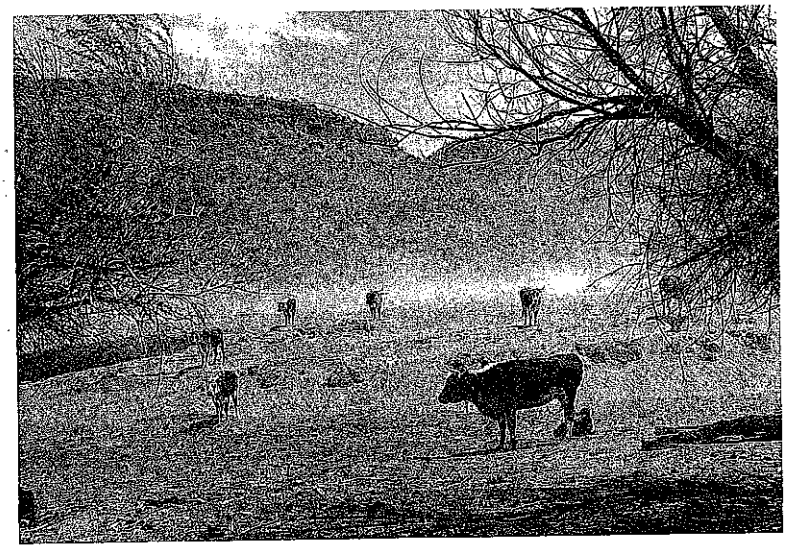


**Figure 3–1**
*These cattle are in a dust storm on a sparse range in New Mexico. They are being stressed by the climate and its effects.* (Photo courtesy of U.S. Department of Agriculture.)

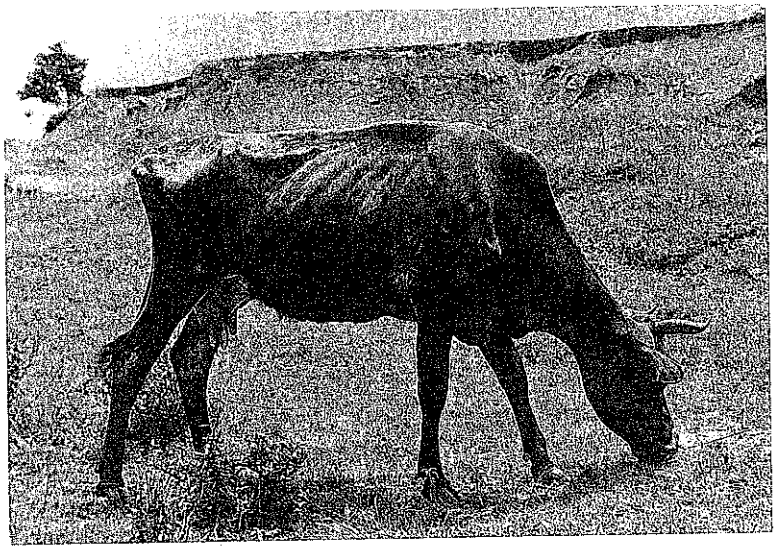


**Figure 3–2**
*This cow is suffering nutritional stress due to the lack of grass on this range.* (Photo courtesy of U.S. Department of Agriculture.)

**Figure 3–3**
*Internal stresses affect animals by gaining entrance into the body. These cows are infected with dermatophilosis caused by the bites of the tropical bont tick and* Cowdria ruminantium, *which causes infectious heartwater disease. The cows suffer fever, poor appetite, nervous disorders, and eventually die.* (FAO photo/17295/Photographer unknown. Used with permission by the Food and Agriculture Organization of the United Nations.)

***Geographical stresses.*** These are the nonclimatic stresses associated with a particular geographic location. The most important geographic stresses are the stresses of high altitudes or the stresses associated with the type of terrain. Examples include constant snow or ice cover; soft, shifting terrain such as sand; soft, wet terrain such as a swamp; steep areas; and rocky areas.

***Social stresses.*** These are stresses associated with the interactions of an animal with other animals (Figure 3–4). The most important social stresses that affect domesticated animals are those associated with humans. Interactions with the same species include competition for available space and food. Social stresses associated with animals of other species include the predator–prey relationship.

## ARTIFICIAL ENVIRONMENTS

As humans, we create artificial environments to make animals best serve us (Figure 3–5). For example, we can irrigate very dry areas or provide shelter for our livestock in very cold areas. We can carry out disease prevention measures to reduce the detrimental effects of a disease environment. We can also impose management practices that increase the detrimental effects of the physical environment, for example, confining animals and not permitting them to escape from unfavorable conditions and increasing their exposure to diseases and **parasites** by overcrowding.

**Parasite** An organism that lives at the expense of a host organism. Generally must live on or in the host.

**Figure 3–4**
*Animals suffer social stress due to their interactions with other animals. The sheep shown here are suffering stress.*

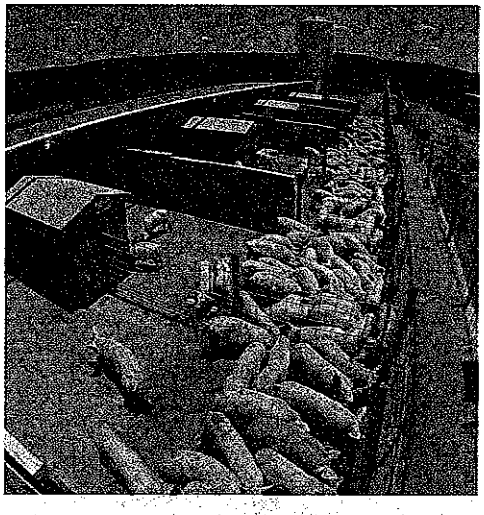


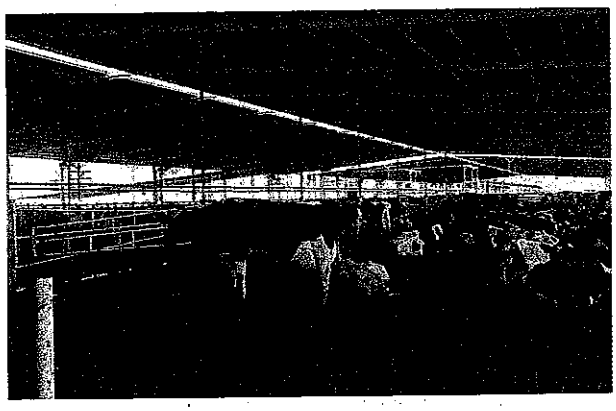
**Figure 3–5**
*Artificial environments like this pig feeding facility are created to help coax optimum production of useful products from available resources.* (Photo courtesy of USDA-NRCS.)

The specific nature of the artificial environment imposed by humans depends on the nature of the service demanded from the animals. In developed areas such as the United States and Europe, this service is usually the maximum production of some useful product, with the most common being food or some type of body covering. In developing countries, the nature of the service is usually quite different, such as work, transportation, or religion, with food sometimes being much less important. Because the major emphasis differs between developed and developing countries, it is not surprising that animals well adapted to the artificial environments of developed countries are not equally adapted to conditions in developing countries (Figure 3–6).

## ADAPTIVE CHANGES

The adjustments (changes) that occur in individual animals to make them adapt to specific environments (Figure 3–7) are of three types:

1. **Morphological** or **anatomical changes** are changes in form and structure. These changes are external in nature and are easily seen. They include changes in quantity, quality, and the nature of body coverings and body appendages such as differences in color and presence or absence of body parts such as horns or humps.
2. **Physiological changes** are primarily changes in the biochemistry of the body. These are internal changes, such as changes in blood chemistry, and are not often readily apparent.
3. **Behavioral changes** can be either genetically induced behaviors or learned responses of the animal to the environment. Examples include self-protection



(a)

(b)

**Figure 3–6**
*(a) Holstein dairy cows have been selected for developed agriculture conditions to produce the optimum amount of milk per cow. To best do this, they require considerable alteration of their environment as evident in this photo. These cows were giving about 80 lbs of milk a day. (b) These Holsteins in conditions where they are not well adapted were giving about 6 lbs of milk per day. Developed and developing agricultures emphasize different roles for livestock and provide different conditions. Animals well adapted to artificial environments of developed agriculture are not equally adapted to harsher conditions.*

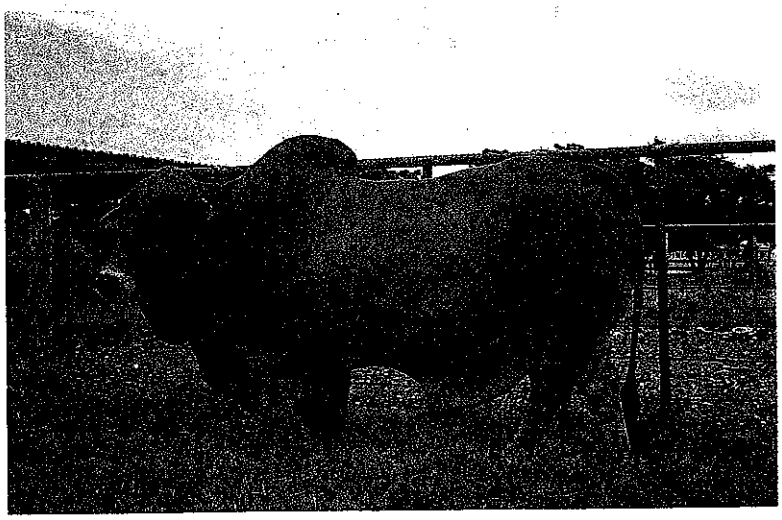


**Figure 3–7**
*Animals adapt to their environments in a variety of ways. The Boran has adapted through anatomical changes such as pendulous ears and sheaths to dissipate heat, light coloring to reflect solar radiation, and special muscles under the skin that help to shake off parasites. Changes in its physiology help conserve water and nitrogen. Behavioral adaptations include modified grazing behaviors.* (Photo courtesy of Keith Ramsay. Used with permission.)

behaviors and food- and water-seeking behaviors. Different species show different levels of instinctive behaviors versus learned behaviors. For instance, the poultry species rely more on instinct than the pig with its larger and more complex brain. A very important effect of domestication on behavior is reduced responsiveness to environmental change. This single behavioral change is found in virtually all populations of domestic animals (Price, 1998).

## CLIMATIC ENVIRONMENTS OF THE WORLD

Human societies live and produce agricultural animals in a wide variety of climates. The majority of these climates impose some degree of climatic stress. It is important to consider the geographic location of the world's climates and consider briefly some of their more significant effects on agricultural animals serving human societies.

### Tropical Climates

Figure 3–8 shows the earth's *tropical* regions, with humid and subhumid areas indicated. Dense rain forests cover most of the humid tropics. They are only slightly

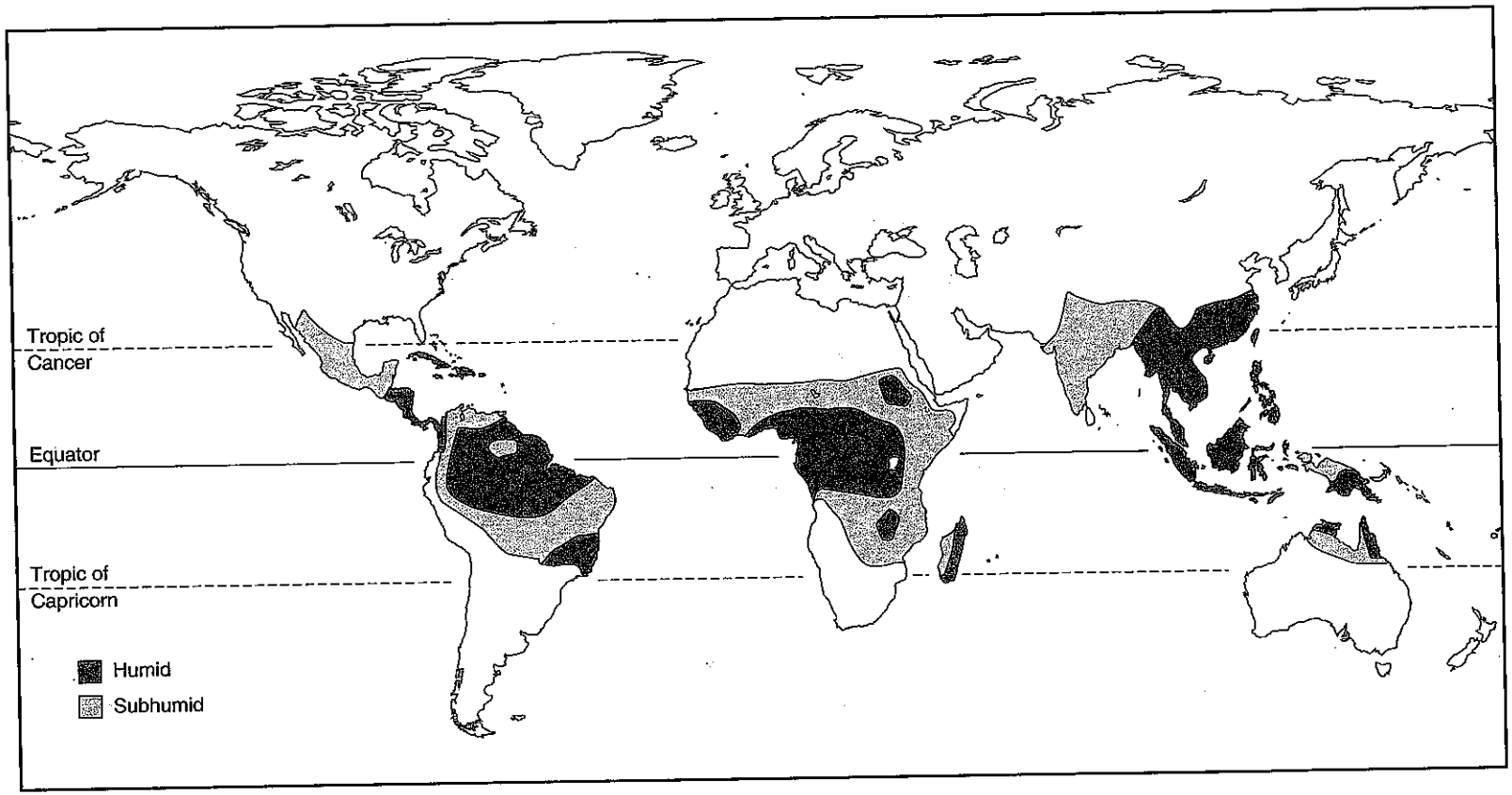



**Figure 3–8**
*Distribution of the tropical climates of the world.*
(Source: USDA, 1941 *Yearbook of Agriculture.*)

**Table 3–1**
**CLASSIFICATION OF REGIONS BETWEEN THE TWO TROPICS BASED ON LENGTH OF RAINY SEASON**

| Regions | Length of Rainy Season |
|---|---|
| Tropical rain forest | 11 months or more |
| Humid tropics | 7–11 months |
| Semihumid tropics | $4^1/_2$–7 months |
| Semiarid tropics | 2–$4^1/_2$ months |
| Semidesert to desert | 0–2 months |

Source: Turman, 1986.

used for agriculture. The subhumid areas are the major portions of the tropics used for agriculture.

The major climatic variation from season to season in the tropics is the amount and distribution of rainfall. There are only two seasons—rainy and dry, with little difference between the two in ambient temperature. These names are very descriptive. It rains nearly every day during the rainy season, and during the dry season, it may not rain at all (Table 3–1).

The length of the dry portion of the cycle has a very significant effect on the type and amount of vegetation produced, which largely determines the system of livestock production. In many of the developing countries, this cycle is the major factor that forces pastoralists to practice **transhumance** or **nomadism**. If the dry cycle is too long, people move their animals from area to area to find feed.

One of the two most important problems associated with any attempt to produce agricultural animals in the humid tropics is extreme heat stress. The second major problem limiting livestock production in the humid tropics is diseases and parasites, which thrive in the hot, humid environment and are a constant threat. Diseases and parasites are probably the major factor limiting the introduction of nonadapted animals to **grade up** local stock.

**Transhumance** The practice of moving animals seasonally from a permanent base to more abundant feed and water and then returning to the permanent base as the season changes.

**Nomadism** The practice of people without a permanent home base moving from place to place, generally in a pattern dictated by climate and/or season to find feed for their subsistence herds of livestock.

**Grade up** In animal species, the process of improving a stock of animals for some productive function by consecutive matings with animals considered genetically superior.

**Desertification** The degradation or destruction of the biological potential of land, leading to desert-like conditions.

## Deserts

Figure 3–9 presents the areas of the world that are either desert or very dry.

Two major problems limit livestock production in the semiarid regions of the world. To a lesser extent, they are also problems of the semihumid tropics. These problems are (1) seasonal and limited rainfall, resulting in a shortage of drinking water and water to grow food for the animals; and (2) stress caused by the heat.

The semiarid tropics contain parasites and insects but not to the extent of the humid tropics. This problem is also of less magnitude in the subhumid tropics. This is one of the important reasons why a high percentage of the livestock in the tropics is in the subhumid and semiarid regions.

Another problem in the drier areas of the world is high winds due to the association between the wetness of an area and amount of wind. These winds are a major cause of erosion in very dry, overgrazed areas and are a contributing factor to **desertification** (Figure 3–10)

The problems of the semiarid regions are of even greater magnitude in the desert areas. However, there is little animal agriculture in deserts, so this is of little practical significance.

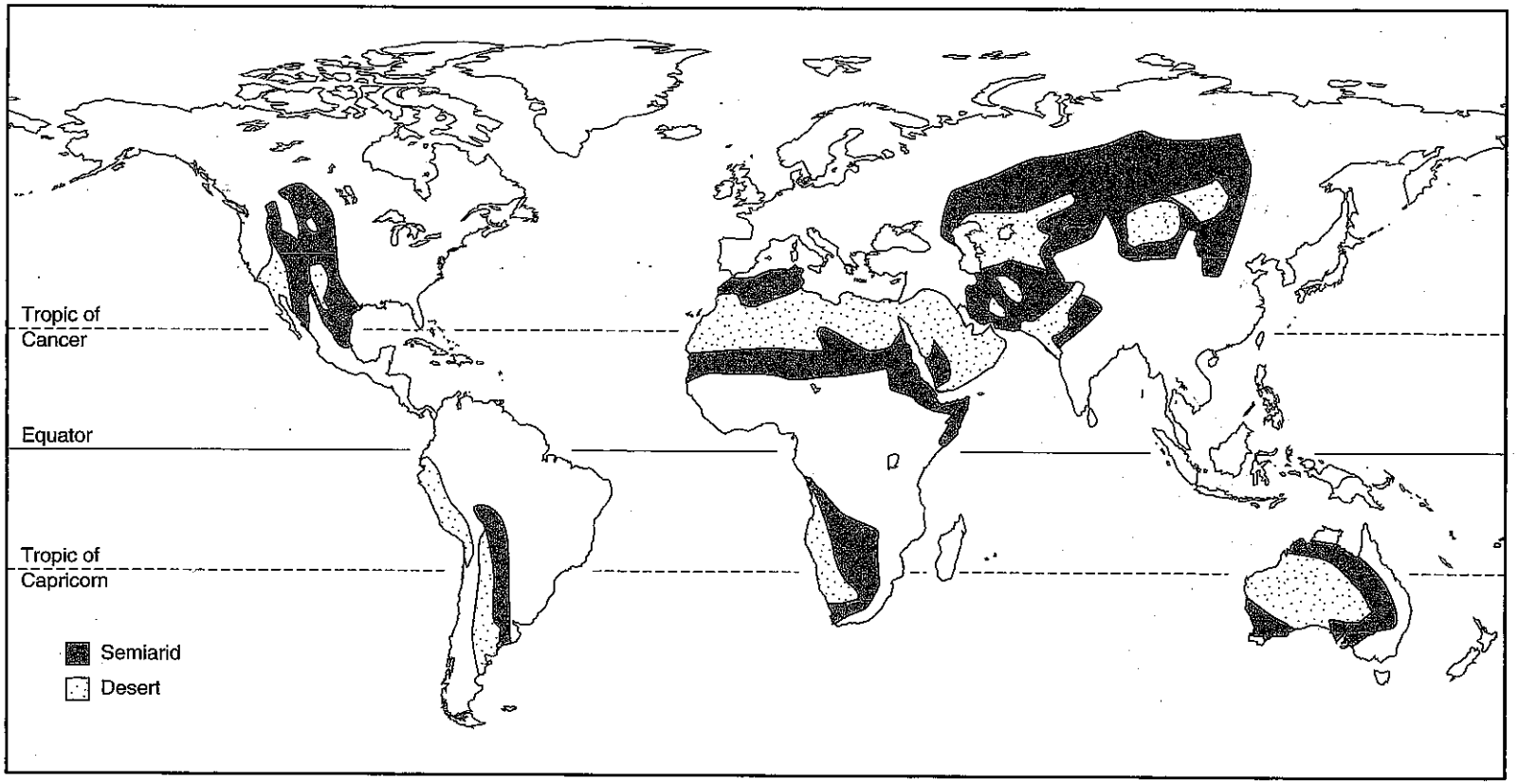



**Figure 3–9**
*Distribution of the desert and dry climates of the world.*
(Source: USDA, 1941 *Yearbook of Agriculture.*)

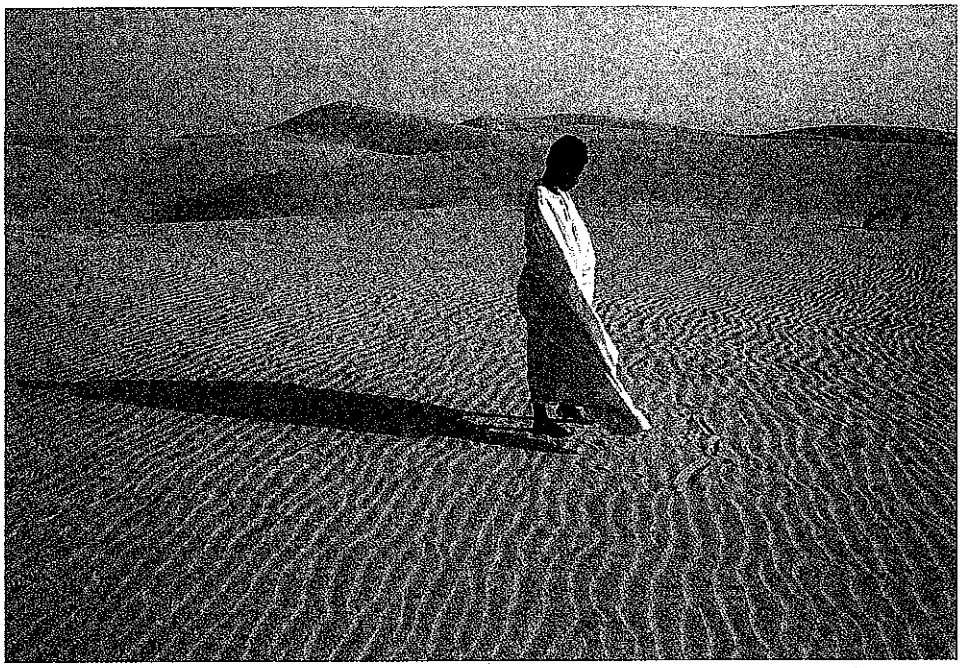


**Figure 3–10**
*Desertification in Mauritania. A Mauri writing in the sand the old name of Chinguetty: Arbweir. Considered the seventh holy city of Islam, the city is now completely buried by sand.*
(FAO photo/18828/I. Balderi. Used with permission by the Food and Agriculture Organization of the United Nations.)

### Cold Environments

The world's cold climates are shown in Figure 3–11. In these areas, livestock production is hampered by cold stress and food availability. From a practical standpoint, the very cold areas are so inhospitable that the only livestock present are the well-adapted reindeer (caribou) (Figure 3–12).

### Temperate Climates

Figure 3–13 shows the world's temperate climates. Generally, these are the most productive agricultural regions of the world. Because of this, we generally use the temperate regions as the standard to which all other climatic regions are compared (Figure 3–14). All developed countries have a temperate climate in at least part of their boundary.

## SOCIAL AND CULTURAL DIFFERENCES

**Animal rights movement**
A political and social movement that concerns itself with philosophy, sociology, and public policy as each deals with the standing of animals in relation to human society.

Many social and cultural influences on agriculture are region and/or people specific, although certainly not all. They are also dynamic and evolving and influenced by the economic situation. An example is the **animal rights movement.** This is more an issue in wealthy Western societies than in less-fortunate countries. However, regardless of the issue or the motivation, social and cultural structures have tremendous influence on what specific people eat. We rarely eat simply to satisfy hunger or fulfill nutritional needs, even though nourishment is one of our basic needs. The influences of culture and economics are often difficult to clearly separate because they are closely associated. It is also difficult to separate their effects on the number and kinds of agricultural animals of a given area and how they are produced and used by people of the area.

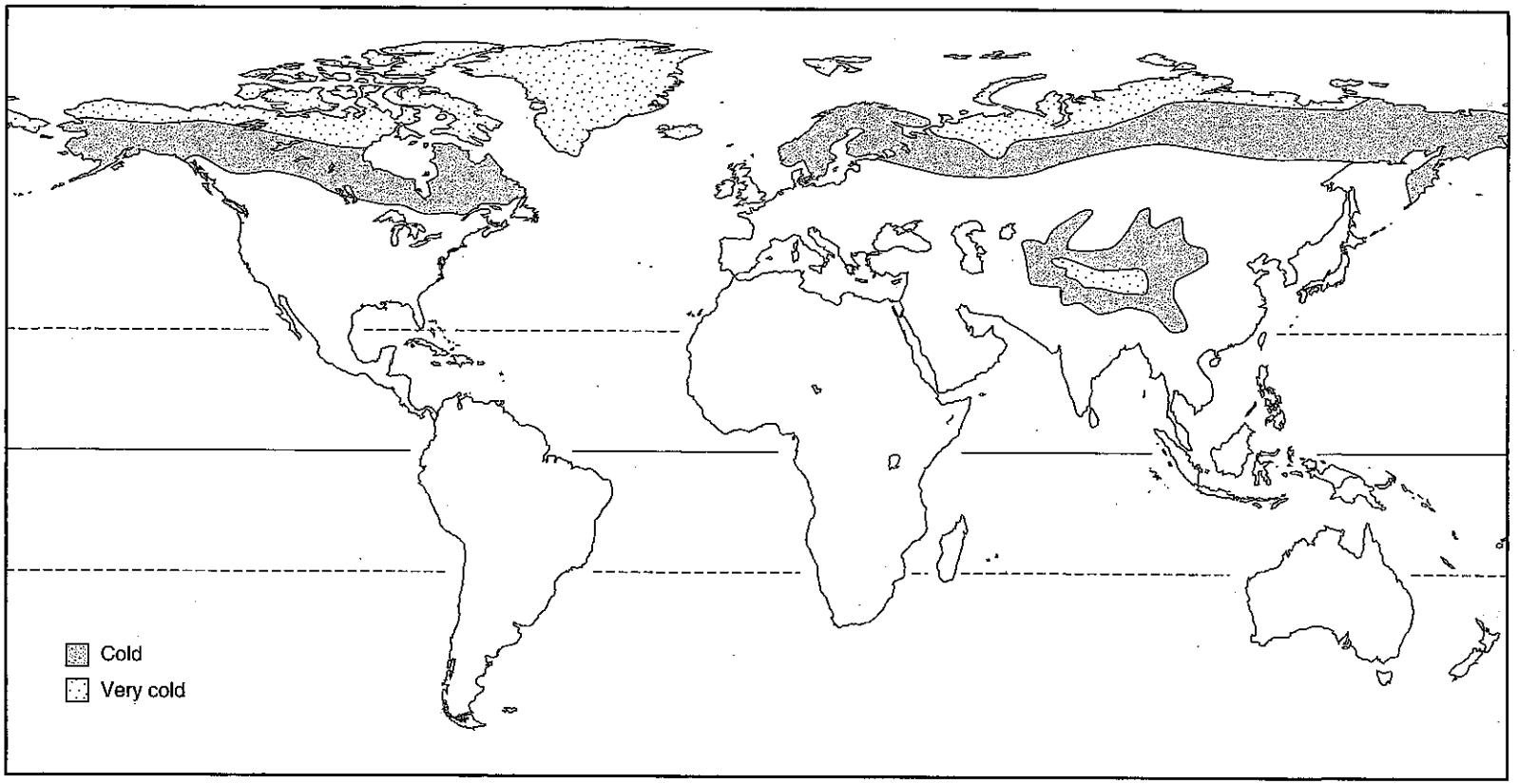



**Figure 3–11**
*Distribution of the cold climates of the world.*
(Source: USDA, 1941 *Yearbook of Agriculture.*)

**Figure 3–12**
*Reindeer (caribou) are the only livestock found in any numbers in the cold climates of the world. Uniquely adapted creatures, they thrive in conditions that defeat all other domestic livestock.*

## Religion

Religion is an important part of the culture of human societies that affects agriculture. Figure 3–15 presents the worldwide distribution of the major religions of the world.

**Effects of Religion on Agriculture** Three of the great religions of the world affect the numbers and utilization of livestock. Islam forbids all contact with swine. As a result, in Muslim areas (primarily North Africa and the Near East), pigs are completely absent. Judaism also considers pork unclean and forbids its consumption. Thus, there are very few pigs in Israel. Hinduism is the dominant religion of India. Under Hinduism the cow is protected and can neither be slaughtered nor sold for slaughter. As a result, there is a vast accumulation of cattle in India (Figure 3–16).

**Food and Religion** We owe many modern-day taboos about food and the way it is served to ancient rituals and customs that are part of religious codes. In some religions (cultures), the ritual may simply be blessing food to give it special powers. In others, religious law dictates selection and judgment of the quality of food before the gods will approve. In the past, these religious dictates often had a practical basis. It seems much more than coincidence that religious food laws frequently reflect a commonsense approach to the prevention of food contamination and foodborne disease. For instance, **kosher** food inspection and certification were in place long before modern food inspection. Many other examples exist in which religious leaders have affected the relationship of humans to animals, some with profound, long-term influence. Let's use China and India as examples.

**Kosher** Kosher food is considered ritually fit for use as sanctioned by Jewish religious law.

When a low-density population has access to grasslands, they historically have high beef consumption. These conditions fit the people of ancient northern India, and the ancestral Chinese of the Yellow River basin. In ancient times, both peoples raised cattle and ate beef. The populations grew in both areas, and farming intensified. Cattle became too valuable in both places for food use because the need for draft animals to produce crops was too great. In China, pork gradually became the preferred meat. This was probably because pigs used household wastes and agricultural by-products more efficiently than did cattle. Cattle were used for draft, if at all. Gradually their numbers diminished. Religion was not significantly involved in the process. In India, a different course was taken. The fierce summer heat, the monsoons, and periodic droughts were not good conditions for hogs and they did not flourish. As the cattle population density increased, cow's milk became the major source of animal protein to India's people. Prohibiting the slaughter of cattle soon became a religious principle of Hinduism, and subsequently, Buddhism (which sprang from Hinduism), to protect the supply of draft animals. The Hindus carried this to the greatest extreme and a civilization arose in which beef eating is **taboo** to the faithful.

**Taboo** A prohibition imposed by social custom against some action or object. Frequently found as part of religious codes.

Examples abound where mistakes were made (from a practical perspective, that is) in the name of religion. Although there is logic in Hinduism's taboo on beef slaughter for protection of the milk and work animals, fish eating is also taboo to

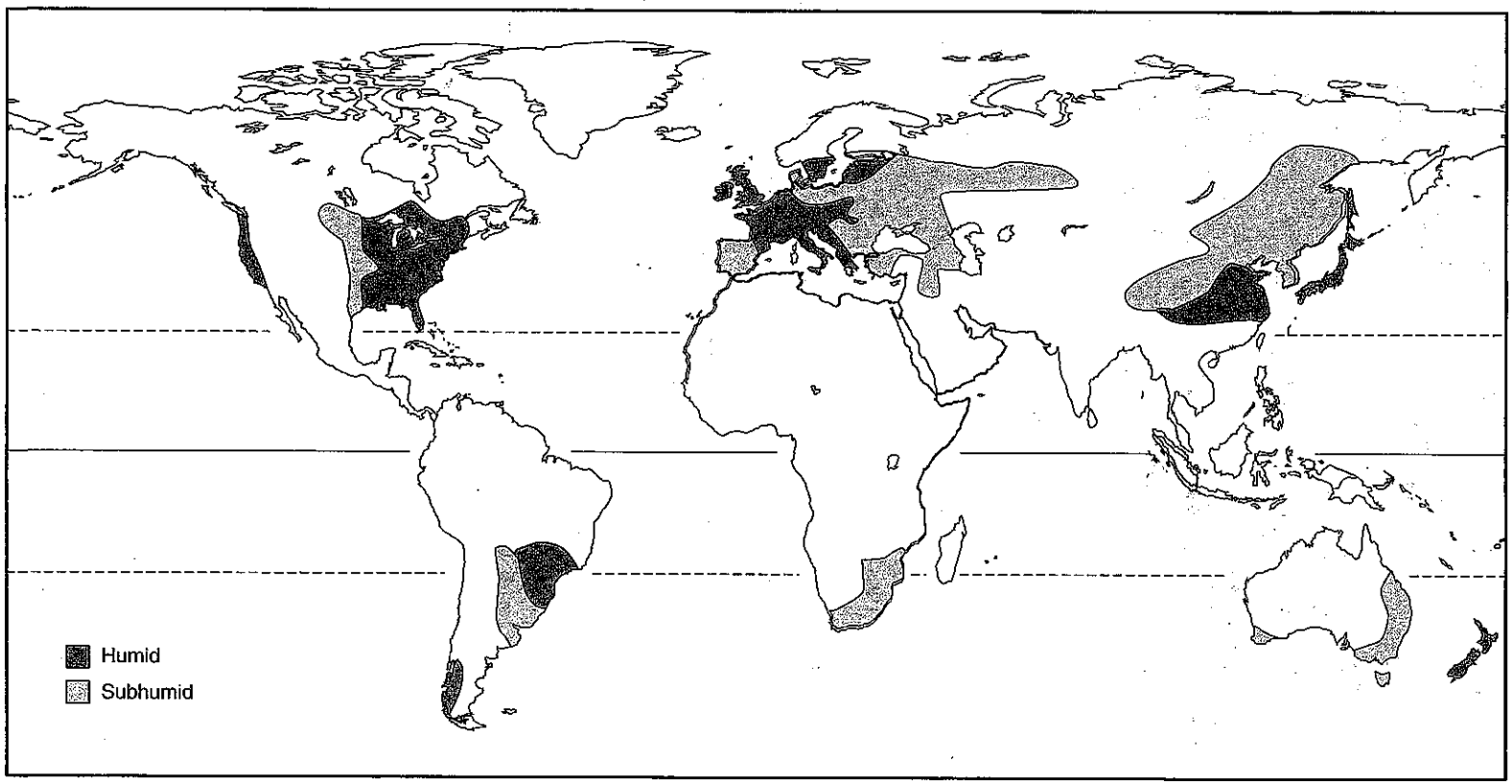



**Figure 3–13**
*Distribution of the temperate climates of the world.*
(Source: USDA, 1941 *Yearbook of Agriculture.*)

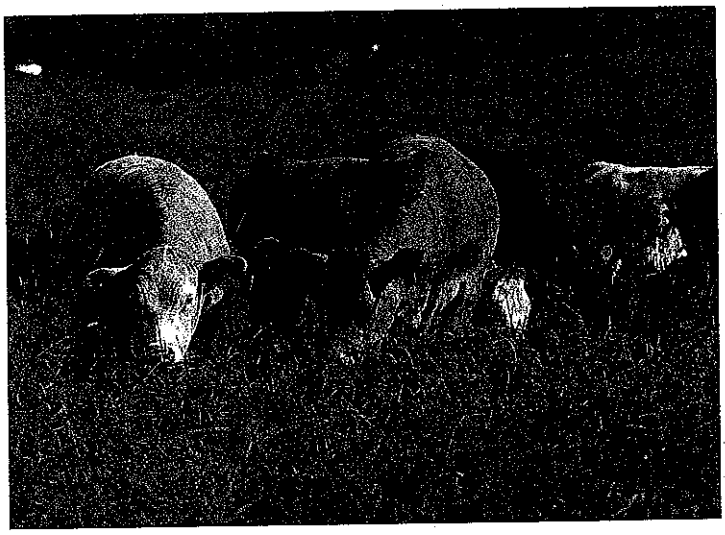


**Figure 3–14**
*Beef cows grazing in a temperate zone pasture. Because temperate regions present the best overall set of conditions for agriculture, the conditions and production of all other zones are compared to temperate regions.* (Photographer Bob Nichols. Courtesy of USDA-Natural Resources Conservation Service.)

most Hindus. Even though fish-containing oceans surround India, protein and general food deficiencies are a way of life for its people because they do not consume fish. Seventh-Day Adventists also have a finless fish taboo and a taboo against pork. After their missionaries converted the Pitcairn Islanders, the self-sufficient economy of the island disintegrated. Before their conversion, they had depended on pork and finless fish in their diet.

It is a human tendency to compare values. Our own religious beliefs make it difficult to fully understand and appreciate the beliefs of others, particularly if the beliefs differ radically. The important thing to remember is that there is no chance that major segments of any religion will easily change their religious laws. Thus, the situations that exist are the situations that are likely to continue. Whether the general population thinks it is right is beside the point. One of the great lessons of life is to learn to accept graciously when one's opinions are considered irrelevant.

## Levels of Economic Development

**Market economy** Economies in which prices are freely determined by the laws of supply and demand.

**Centrally planned economy** An economy under government control. Prices, labor, and other economic inputs are controlled and not allowed to fluctuate in accordance with supply and demand.

Two terms, *developed countries* and *developing countries*, appear repeatedly in this textbook. The terms refer to a country's level of economic development. In this book, the developed countries are the same as those historically identified as such by the Food and Agricultural Organization of the United Nations (FAO), with modifications, and are listed in Table 3–2.

Other terms in common use are *First World, Second World*, and *Third World.* First World refers only to the developed countries with a **market economy**. Third World countries are developing countries with a market economy. All Second World countries have a **centrally planned economy**, whether developed or developing. The

**Table 3–2**
**DEVELOPED COUNTRIES**

| |
|---|
| North America: Canada and the United States |
| Europe (excluding countries emerging from the former Yugoslavia and some former Eastern block countries that are transition countries) |
| Oceania: Australia and New Zealand |
| Asia: Israel, Japan, Hong Kong, Singapore, South Korea, and Taiwan |
| Africa: South Africa |

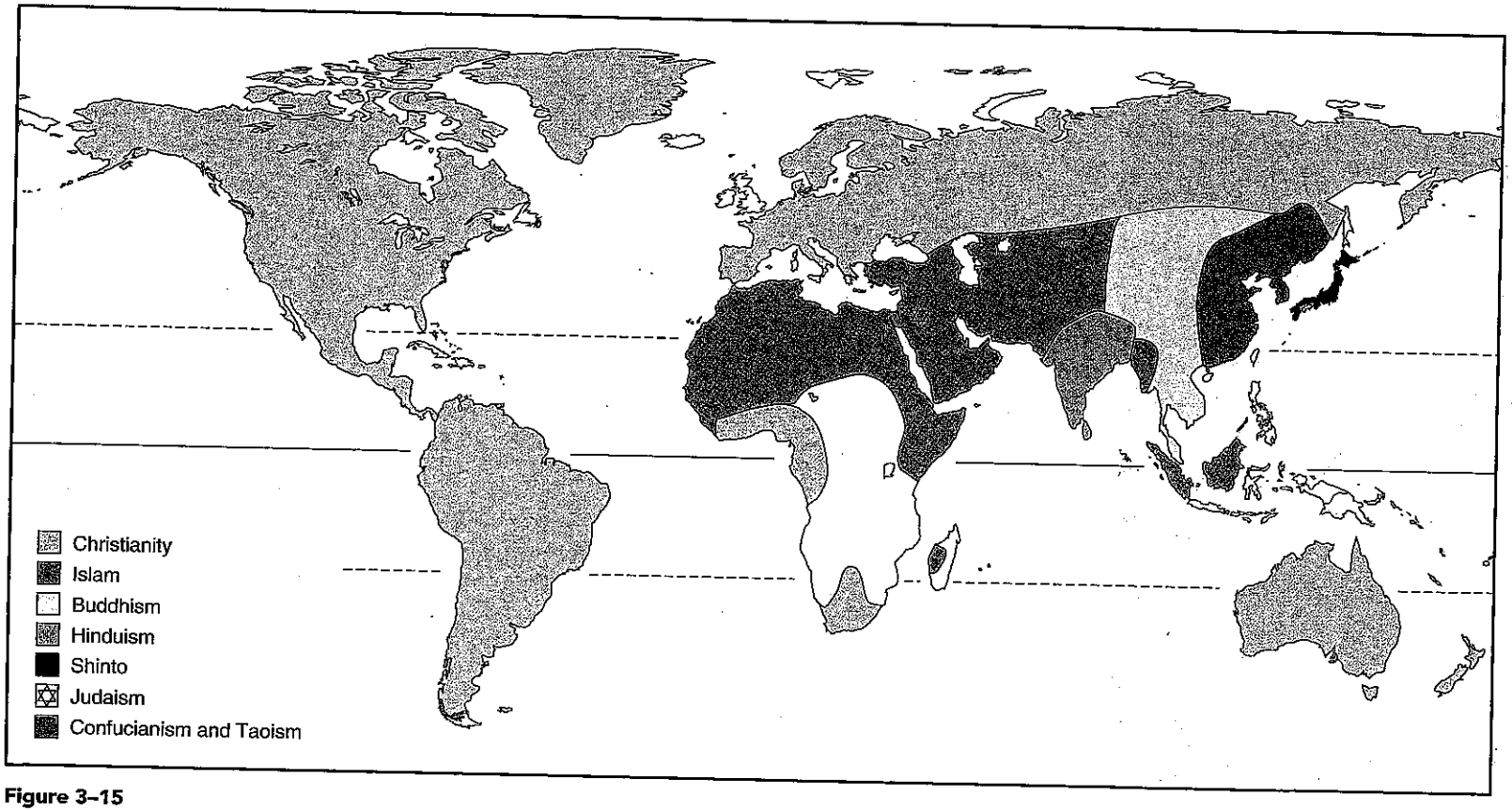



**Figure 3–15**
*Worldwide distribution of the major religions of the world.*
(Source: USDA, 1941 *Yearbook of Agriculture.*)

**Figure 3–16**
*The Hindu religion prohibits the slaughter of cattle, which results in a vast accumulation of cattle in India.* (Photo courtesy of Paige Rabalais. Used with permission.)

term *Second World* has been fading from use since the fall of the Berlin Wall in 1989. Many former Second World countries are moving from centrally planned to market economies and are often labeled **transition economies.**

**Transition economy** An economy once centrally planned that is changing to a market economy.

As the name implies, the developed countries have reached a higher level of economic development than have the developing countries. The same is true of the countries with a market economy as compared to those with a centrally planned economy. Considerable variation is seen in the economic development of different nations within each category, particularly among the developing nations. Third World countries range from those that are poor but enjoy a fairly high standard of living to the extremely poor countries where per capita income is less than $100 per year.

## Levels of Agricultural Development

The three levels of agricultural development are developed, subsistence, and primitive. The livestock systems in a developed agriculture are further subdivided into intensive and extensive. The intensive systems are usually small, labor-intensive farm units. The extensive systems are usually large range units. In extensive systems, the type and breed(s) of livestock that are most popular are determined by whether the range area is humid or dry.

Most developed agricultures are found in developed countries. Although some countries with developed agricultures are not classified as either developed or developing countries, there are no countries that have a developed agriculture classified as being a developing country.

A *developed agriculture* is usually associated with the following characteristics:

- A very small proportion (usually less than 10%) of the total population on the farm actively engaged in farming.
- A highly specialized agriculture with each unit producing only one or two products.
- A highly mechanized agriculture with little or no animal or hand labor.
- A high per capita income for the total population.
- A high literacy rate for the total population.

Subsistence agriculture is the level of agricultural development found in most of the developing countries outside of Africa, although there are regions of Africa that also practice subsistence agriculture. Some European transition countries have again begun practicing subsistence agriculture during the transition from centrally planned economies to market economies.

*Subsistence agriculture* is usually associated with the following characteristics:

- Approximately half of the total population is engaged in farming.
- Each farm family produces roughly what it consumes with only a small surplus for sale or barter. This surplus is barely enough to supply the needs of the portion of the population that is not on a farm producing its own food.
- Little mechanization and much hand and animal labor.
- A relatively low per capita income for the entire population.
- A relatively low literacy rate for the entire population.

Primitive agriculture is found in the most undeveloped of the developing countries. Most of the primitive agriculture is in Africa with some in the forests of Central and South America.

*Primitive agriculture* has the following characteristics:

- Almost the entire population involved in producing their own food because no one produces a surplus.
- Generally a scarcity of food and a low nutritional level.
- No mechanization and very little animal power is used in farming. Almost all of the labor is hand labor, which means that only small acreages can be farmed by one individual.
- Extremely low per capita income for the farm population.
- Very few literate individuals in the farm or nonfarm population.

Table 3–3 presents a comparison of the percentage of the population in various levels of economic development that is engaged in agriculture. Farmers are a very small percentage of the total population in the United States and other developed countries, yet that small group of people provides enough food for their nations and a great

**Table 3–3**
**PERCENTAGE OF TOTAL POPULATION ENGAGED IN AGRICULTURE**

| Country/Continent/Classification | Agricultural Population as a Percentage of Total Population |
|---|---|
| **All developed countries** | 5.2 |
| **All developing countries** | 46.2 |
| **Africa, developing countries** | 50.7 |
| **Asia** | 46.4 |
| **World** | 37.6 |
| United States | 1.6 |
| Canada | 1.8 |
| Denmark | 2.5 |
| Australia | 3.8 |
| Argentina | 7.5 |
| Greece | 9.2 |
| South Africa | 9.4 |
| Brazil | 10.4 |
| Cuba | 12.7 |
| Poland | 14.4 |
| Azerbaijan | 22.4 |
| Turkmenistan | 29.3 |
| Bangladesh | 44.2 |
| China | 60.2 |
| Rwanda | 89.3 |
| Bhutan | 92.9 |

Source: FAO, 2011.

deal more to export. It is evident from looking at the list that there are tremendous differences in countries from the top of that list to the bottom. The higher the level of economic development, the more developed the economy of the nation and the higher the standard of living for its people. The reverse is also true. Thus, knowing just this one statistic about a nation tells us a great deal about the nation's economy and the standard of living of its people.

**Literacy** The ability to read and write.

**Literacy** refers only to the ability to read and write and indicates nothing about native intelligence or the ability to learn. However, it is a definite handicap to a nation to have an illiterate population. Illiteracy is one of the major obstacles in efforts to introduce new technology to improve levels of agricultural development. If people cannot read, they learn new technology only by being told and shown. An extension specialist can write agricultural bulletins on improved agricultural methods that can reach hundreds of thousands of literate people. However, if educating requires personal contact and verbal explanation, that same extension worker can reach only a few hundred people per month. Agricultural development is one of the most important reasons for providing literacy to all of the world's peoples.

## Economic Institutions and Agricultural Development

In countries with a developed agriculture, a number of essential economic institutions are highly developed and functional. In contrast, these institutions are relatively poorly developed, if present at all, in countries with subsistence agriculture and are almost totally absent in countries with a high incidence of primitive agriculture. These economic institutions are (1) financial institutions, (2) marketing agencies, (3) industrial institutions, and (4) governmental agencies. The following is a very brief discussion of their importance.

**Financial Institutions** Included in this group are all the institutions that handle money. Financial institutions are a source of loans to finance agricultural enterprises and a place for the investment of profits from agriculture. They serve as a safe repository of money and provide a means for the safe and orderly transfer of money in financial transactions. These functions are vital to the development of a country's agriculture. One of the undesirable side effects of the lack of banks and other financial institutions in the developing countries is the overuse of livestock, particularly cattle, for storage of capital.

**Marketing Agencies** Marketing agencies are essential to provide a means for people engaged in agriculture to sell their products at a satisfactory price and at a time when they want to sell. Included are agencies such as local auction sale barns or large terminal markets. In most of the poorer countries, farmers do not have access to such competitive markets and are at the mercy of local traders who offer very low prices (Figure 3–17). Marketing agencies also provide the means by which those engaged in agriculture can purchase the goods they need and want.

**Industrial Institutions** It is impossible for a nation to reach a high level of agricultural development without also having a high level of nonagricultural development. Three important reasons explain why this is true. The first is that industrial institutions, such as factories, provide employment for the nonfarm population. Second, the wages paid to these workers provide a cash market for agricultural products. Third, these industrial workers produce the consumer goods needed in agriculture, either as essentials or as luxuries. The availability of these consumer goods provides incentives to farmers to produce even more agricultural products.

**Governmental Agencies** Governmental agencies include the agencies responsible for transportation (road building and maintenance, and so on), education, protection (both police for internal and a military for external protection), equitable land policies,

**Figure 3–17**
*In many developing countries, marketing agencies are nonexistent. Farmers are at the mercy of local traders who offer very low prices.* (FAO photo/7056/Photographer Franco Mattioli. Used with permission by the Food and Agriculture Organization of the United Nations.)

and sound money. Often the people who have the power to make changes in government to improve these services are unwilling to do so. They profit from the fact that the masses are illiterate or lack good markets. They may be large landholders who do not favor land redistribution. Corruption is often the norm. Reform is a formidable task.

## SUMMARY AND CONCLUSION

Agricultural animals must adapt to a wide variety of stresses if they are to be of use to humans. Our domestic animals and improved varieties of plants are influenced by a wide variety of factors, including cultural issues, economic development, and religion. Levels of economic development of various peoples influence the different levels of agricultural development. The world's economic institutions also affect development. In the next chapter, we assimilate this information to see exactly what types of agricultures have developed to accommodate all of these factors.

## STUDY QUESTIONS

1. What is adaptation?
2. What is the difference between the natural and the artificial environment?
3. List and briefly describe the five stresses of the physical environment under which organisms must live.
4. Study the figures that show the climatic environments of the world. Be able to identify the regions.
5. What are the three major religions of the world that have a direct and marked effect on the numbers and utilization of livestock in the countries where they predominate? What class of livestock does each religion primarily affect and what is the effect on numbers and utilization of each class of livestock?
6. What is the difference between a market economy and a centrally planned economy? What is meant by the terms *First World, Second World, Third World,* and *transition economy?*
7. Which continents are primarily composed of developing countries? What are the developed countries of Asia and Africa?
8. What are the three levels of agricultural development? Describe the characteristics of each from the standpoint of percentage of the population that is engaged in agriculture and type of farm power used.
9. Describe the three essential services provided by financial institutions and explain why each is important.
10. Describe the two essential services provided by marketing institutions and explain why they are important.
11. Discuss the three major reasons why industrial development is essential for the existence of a highly developed agriculture.
12. What are the functions of government as it relates to development?