



# The Value of Animals to Humanity

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## Key Terms

|  |                     |
|--|---------------------|
| By-products  | Milk                |
| Civilization   | Nutrient density    |
| Companion animal   | Nutrients           |
| Compost  | Per capita          |
| Conservation   | Pest control        |
| Draft  | Pesticides          |
| Essential fatty acids  | Poultry             |
| Food and Agricultural Organization of the United Nations (FAO) | Power               |
| Health research  | Recombinant DNA     |
| Hides  | Spectator sport     |
| Meat   | Storage of capital  |
| Metric ton   | Wool                |
|  | Xenotransplantation |

## INTRODUCTION

What did humans derive from domestication? Why do we need domestic animals in today's world? The answer to both questions is essentially the same, and the answer comes in several parts: Food is the first answer. When humans turned from hunters to farmers by domesticating animals and plants, we created a much more readily available food supply and set the stage for great advancement in culture. What we think of as civilization began to develop.

Goods and services from the world's animal populations supply many social, religious, and economic functions in addition to food. The importance of each good or service varies depending on many factors, including the ethnicity of the owners, the country, and the environment. Nonfood uses for animals are generally more important in wealthier societies than they are in less wealthy ones, although there are notable exceptions. In this chapter, we examine the major contributions of agricultural animals to humanity.

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## Learning Objectives

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

- Describe the value of animal products in providing for the world's food.
- Explain the current rates of growth or decline of animal products on a worldwide basis.
- Elaborate on the milk-producing species, state their importance to world milk production, and understand what is happening to world milk production.
- Describe the value of eggs in feeding the world's people.
- Develop a modest understanding of some miscellaneous food uses for the world's animals.
- Explain the value of animal products in the human diet.
- Give a good overview of all the many nonfood uses humans have for the world's animals.



## THE FOOD USES OF AGRICULTURAL ANIMALS

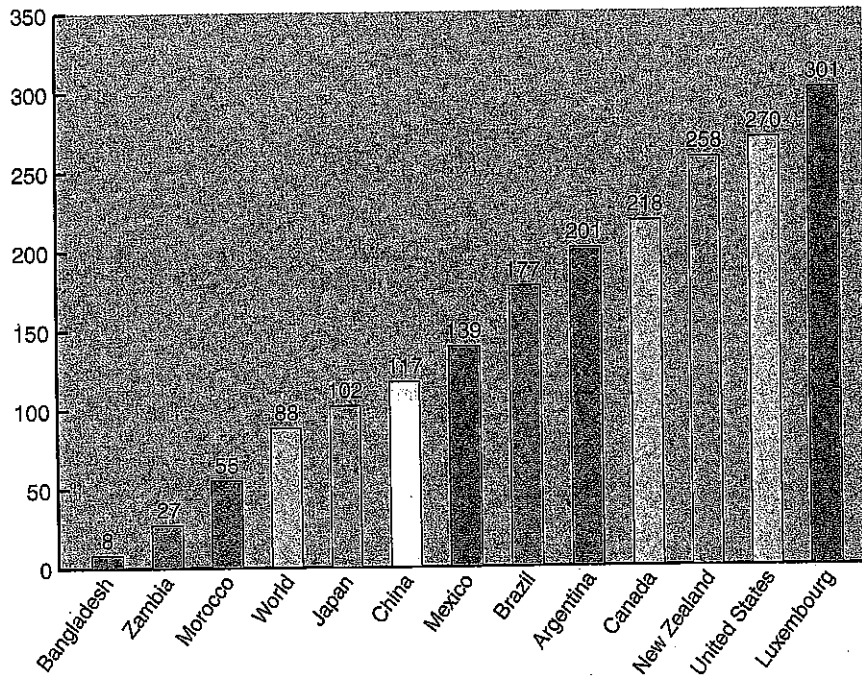
### Red Meat and Poultry Production

**Nutrients** Chemical substances that provide nourishment to the body. Essential nutrients are those necessary for normal maintenance, growth, and functioning.

**Per capita** Per unit of population, by or for each person.

The nutrients provided by meat are important for human survival. Protein and energy are quantitatively and qualitatively important and substantial shares of the vitamins and minerals in our diet are also contributed by meat. Annual per capita meat supply ranges from over 300 lbs in affluent countries to very little in poor countries (Figure 2-1). World meat production has increased steadily for many years at an average rate of 2% per year. Table 2-1 shows the meat production for most meat-producing species. The pig is the most important meat source, producing 38% of the world's meat (Figure 2-2). Chicken is next at 28%, followed by beef with approximately 23% (Figure 2-3). Together, these three sources produce 89% of all meat. Pork production is increasing at the rate of approximately 1-2% per year.

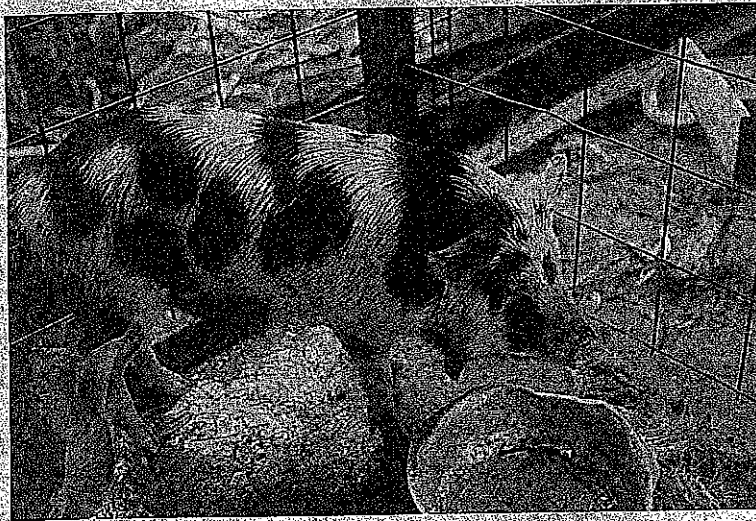
**Figure 2-1**  
Per capita meat supply in pounds, selected countries and the world.  
(Source: FAO, 2011.)



**Table 2-1**  
WORLD MEAT PRODUCTION (1,000 METRIC TONS)

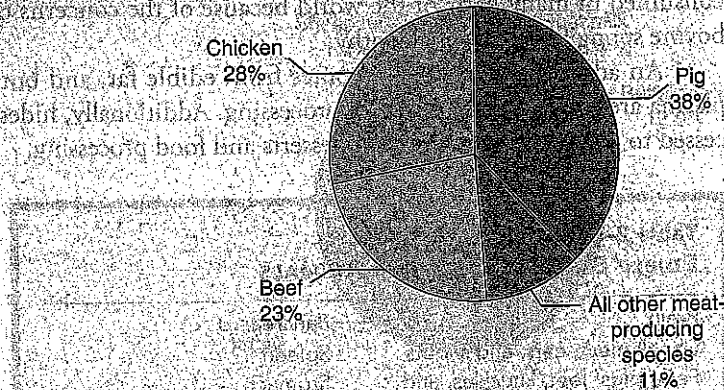
|                                   | 1990    | 2000    | 2005    | 2009    |
|-----------------------------------|---------|---------|---------|---------|
| Meat, total                       | 179,860 | 233,404 | 259,132 | 281,559 |
| Pig meat                          | 69,922  | 89,787  | 99,064  | 106,069 |
| Chicken meat                      | 35,350  | 58,307  | 69,188  | 79,596  |
| Beef and buffalo meat             | 55,818  | 59,100  | 62,145  | 65,146  |
| Sheep meat                        | 7,031   | 7,664   | 7,881   | 8,109   |
| Duck, goose, and guinea fowl meat | 1,853   | 4,779   | 5,413   | 6,321   |
| Turkey meat                       | 3,717   | 5,071   | 5,161   | 5,320   |
| Goat meat                         | 2,656   | 3,770   | 4,636   | 4,939   |
| Rabbit                            | 933     | 1,294   | 1,476   | 1,645   |
| Equine                            | 584     | 993     | 1,008   | 1,018   |
| Meat, all other                   | 856     | 716     | 1,070   | 1,222   |

Source: FAO, 2011.



**Figure 2-2**

The pig is the most important meat-producing species. Many pigs are unimproved animals that either scavenge or are fed household wastes.

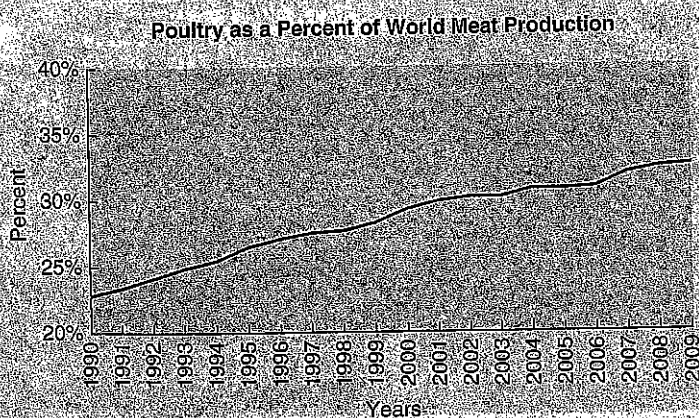


**Figure 2-3**

Relative contribution of the major meat species to world meat supplies.

(Source: FAO, 2011.)

Production from most other meat-producing species is increasing 1–2% yearly. Poultry meat production is growing the most rapidly at almost 3% per year, more than doubling since 1990. Poultry meat is increasing much faster than the average rate for all other meats and thus is becoming an increasingly larger part of total world meat production (Figure 2-4). Poultry meat could overtake pork as the world's most popular meat by 2020. Some developing countries are undergoing phenomenal production increases with several producing three times as much poultry meat per year as they were producing 10 years ago. This increase is primarily in response to two things. First, the technology, genetics, and management know-how associated with



**Figure 2-4**

World poultry-meat production is increasing more rapidly than any other meat.

(Source: FAO 2011.)

the poultry industry have made its production much more cost effective. Second, economic development in many countries has increased incomes, thus providing the economic means to a better diet for more people. Invariably, people demonstrate their willingness to purchase more meat for their diets as soon as they are able to afford it.

### Edible Slaughter By-Products

Once the products of greatest value are removed from a carcass, the substances and products remaining still have value. We commonly refer to these as *by-products*. Some of these by-products are edible, and others are not. Table 2-2 provides a partial list of edible by-products of meat animals. In developed countries, these by-products are usually considered specialty foods and are called variety meats. Most are organ meats such as liver, kidney, tongue, sweetbread, brain, heart, and tripe. These products are often considered delicacies (Figure 2-5). However, in the United States, we are not as fond of them as is the rest of the world, so we export large quantities to Europe and other countries. Liver is the most widely used. Brains and spinal cords are no longer consumed in many parts of the world because of the concerns over transmission of bovine spongiform encephalopathy.

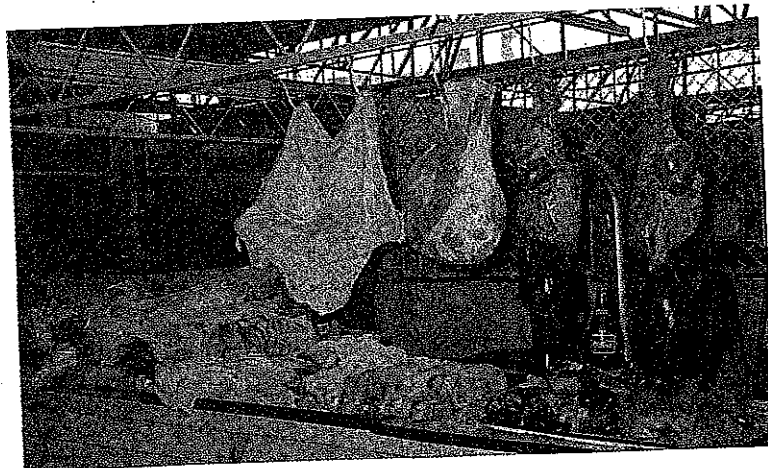
An additional large share comes from edible fat, and both blood and blood plasma are eaten and used in food processing. Additionally, hides and bones are processed to produce gelatins used in desserts and food processing.

**Table 2-2**  
**EDIBLE BY-PRODUCTS FROM ANIMALS**

|  |                                     |
|--|-------------------------------------|
| Brain  | Pancreas                            |
| Cheek meat, ears, and snouts                 | Spleen                              |
| Feet, pigs' feet, knuckles, and calves' feet | Stomach                             |
| Head meat                                    | Sweetbreads (thymus)                |
| Heart  | Tail or oxtails                     |
| Intestines (often used as sausage casings)   | Tallow and lard                     |
| Kidney                                       | Testes                              |
| Lips   | Tongue                              |
| Liver  | Tripe (usually rumen and reticulum) |
| Lungs  | Udders                              |
| Milks (spleen)                               | Uteri                               |

**Figure 2-5**

Offered side by side in this Mexican meat market are hearts, lungs, other organ meats, feet, tripe, and carcass meat, fresh and still warm from the morning's premarket slaughter. Food tastes and traditions vary, and not all people agree on what is the product of a carcass and what is a by-product.





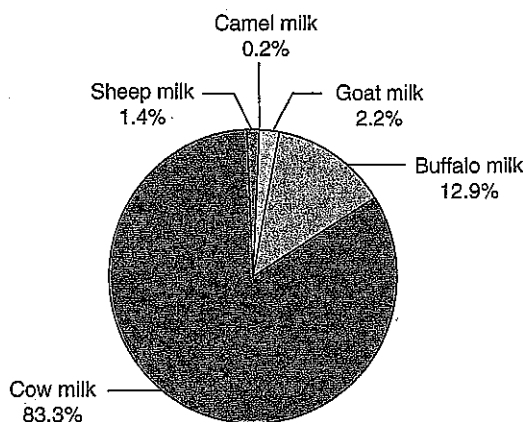
### Milk and Milk Products

Milk provides much-needed protein, energy, minerals, and vitamins to humankind's diet. Annual per capita whole milk supply ranges from over 500 lbs per year in some countries to little or none in others. The total production of milk in the world has increased slowly for the last two decades. Total world milk production is increasing by approximately 2% per year. World milk production for the major species is given in Table 2-3. On a worldwide basis, approximately 83% of milk is from cattle, 13% is from buffalo, and most of the remainder is from sheep, camels, and goats (Figure 2-6). Humans use almost 700 million **metric tons (MT)** of milk per year. This includes fluid milk and processed milk. Table 2-4 shows the world production of the major processed milk products. Often, dairy products supply the major source of fat in human diets. In addition to adding flavor to high-starch foods such as rice and root crops, fats also provide needed calories and **essential fatty acids** to the diet.

**Metric ton (MT)** Approximately 1.1 U.S. tons. Equal to 1 million grams, or 1,000 kilograms.

**Essential fatty acids** Fatty acids required in the diet.

**Ghee** Clarified liquid butter.



**Figure 2-6**  
Relative percentage of world milk supply by species.  
(Source: FAO, 2011.)

**Table 2-3**  
MILK PRODUCED IN METRIC TONS BY THE WORLD'S MAJOR SPECIES

|                         | 1980        | 1990        | 2000        | 2009        | Rank in 2009 |
|-------------------------|-------------|-------------|-------------|-------------|--------------|
| Cow milk (whole, fresh) | 422,351,163 | 479,029,292 | 490,130,037 | 580,481,508 | 1            |
| Buffalo milk            | 27,525,084  | 44,075,742  | 66,500,380  | 90,333,830  | 2            |
| Goat milk               | 7,738,026   | 9,979,850   | 12,652,528  | 15,128,186  | 3            |
| Sheep milk              | 6,822,721   | 7,978,108   | 8,034,961   | 8,974,689   | 4            |
| Camel milk              | 1,220,464   | 1,353,394   | 1,440,565   | 1,636,123   | 5            |
| Total milk              | 465,657,460 | 542,416,356 | 578,758,472 | 696,544,346 |              |

Source: FAO, 2011.

**Table 2-4**  
WORLD DAIRY PRODUCT PRODUCTION IN METRIC TONS

|                               | 1980       | 1990       | 2000       | 2009       | Rank in 2009 |
|-------------------------------|------------|------------|------------|------------|--------------|
| Cheese                        | 11,514,659 | 14,834,708 | 16,530,939 | 19,358,614 | 1            |
| Butter and ghee               | 6,955,142  | 7,838,819  | 7,408,557  | 9,639,570  | 2            |
| Evaporated and condensed milk | 4,339,639  | 4,240,879  | 4,046,042  | 4,732,761  | 3            |
| Skim milk and buttermilk, dry | 4,177,542  | 4,280,474  | 3,360,387  | 3,322,310  | 4            |
| Dry whole cow milk            | 1,726,766  | 2,085,963  | 2,503,471  | 2,957,307  | 5            |

Source: FAO, 2011.

Dairying has been promoted in the developing countries for several decades by several major international agencies. Dairy industry promotion assists development in several ways. In addition to improving nutrition, it also provides year-round employment (as opposed to crops that have seasonal labor needs). The year-round income bolsters the overall economy. Dairying is also a very efficient means of converting animal feed to people food.

### Poultry and Eggs

In addition to meat (Table 2-1), the various poultry species produce a second high-quality food for human consumption—eggs. Poultry offer great potential for improving the nutritional levels of all the world's peoples. As food producers, they have many advantages. Poultry require a low initial investment and, if necessary, can produce some food for their owners with only a minimal input in terms of feed, equipment, and housing. They are also generally fairly hardy and prolific.

Eggs are a very important global food source from both a volume and quality perspective. Chickens produce most of the eggs for human consumption (Table 2-5). Their production is increasing at a rate of approximately 2.2% per year worldwide. Ducks, turkeys, geese, and guinea fowl also contribute, but to a much lesser degree. Eggs are an excellent source of high-quality protein and fat. The protein is important to all economic classes. For poor societies, the fat content is a positive factor because it provides calories and essential fatty acids. Note that the number of metric tons of eggs produced in the world is only slightly less than the amount of meat from beef and exceeds meat production from many other species.

### Miscellaneous Food Uses

Animals provide several additional foods for humans. World production of honey is estimated by the **Food and Agricultural Organization of the United Nations (FAO)** at just over 1.5 million MT per year (Figure 2-7). A rather exotic way in

#### Food and Agricultural Organization of the United Nations (FAO)

The largest autonomous agency within the United Nations system. FAO works to alleviate poverty and hunger by promoting agricultural development.

**Table 2-5**  
**WORLD EGG PRODUCTION IN METRIC TONS**

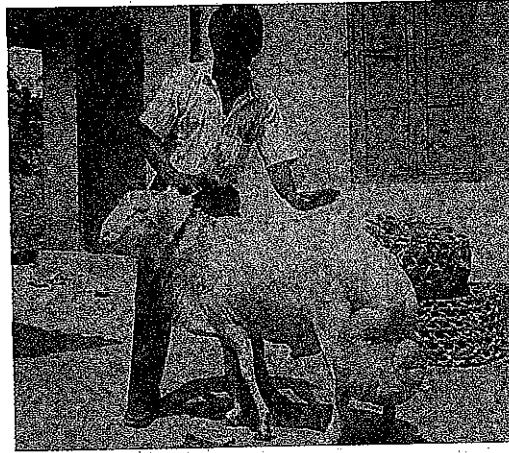
|                           | 1980       | 1990       | 2000       | 2009       |
|---------------------------|------------|------------|------------|------------|
| Hen eggs, in shell        | 26,217,375 | 35,245,563 | 51,113,006 | 62,426,378 |
| Other bird eggs, in shell | 1,199,336  | 2,302,657  | 4,057,432  | 4,981,371  |
| Total                     | 27,416,712 | 37,548,221 | 55,170,439 | 67,407,749 |

Source: FAO, 2011.

#### Figure 2-7

Honey is favored around the world for its sweetness and unique flavor. When fermented with water and yeast it becomes mead or "honey wine." Beeswax also has many uses, including candles and craft-making. (Source: FAO/19181/M. Marzot. Used with permission by the Food and Agriculture Organization of the United Nations.)



**Figure 2-8**

The large tails of the fat-tailed sheep breeds are fat storage organs. To acquire this fat, the tail is cut and a hollow reed used to suction out the fat for use in cooking.

which living animals are used for food is as a source of blood collected by venous puncture. Tibetan nomads and African tribesmen (especially the Masai) do this. The fat from the tails of fat-tailed sheep is collected from live animals in Africa and Asia (Figure 2-8). Hides and skins (especially roasted pig) are used for food in many countries, and cattle hides are eaten in Africa and a few other places (Figure 2-9).

### The Value of Animal Products in the Human Diet

Animal products are a very important part of human diets because they are high-quality food. They are excellent sources of protein, energy, minerals, and essential vitamins. The nutrient availability is good and the **nutrient density** is high. In wealthy societies, meat and fish are the foods around which meals are built—the meat or fish is chosen first, and the rest of the meal is selected to complement it. In most developed countries, meat accounts for the largest share of food cost. Affluent families in developing countries spend similar amounts. Low-income groups spend less, due to cost. However, these groups identify animal products of all types as desirable or essential food items. In addition to the nutritive value, animal products supplement the taste of the bland, starchy foods that, of necessity, form the bulk of their diets.

**Nutrient density** A measurement of the nutrients found in a food compared to the caloric content.

**Figure 2-9**

Roasted pigskins are a popular food in many countries. They are eaten as is or used in cooking. These were roasted and spiced and on sale in bulk.



## THE NONFOOD USES OF AGRICULTURAL ANIMALS

Table 2-6 lists the great variety of important contributions that various species of domestic animals provide for humans in addition to food. Some of these uses are outside the social context of people who live in developed countries, which makes it difficult for us to understand the great magnitude of these contributions to people's

**Table 2-6**  
**ANIMAL CONTRIBUTIONS OF SERVICES AND NONFOOD PRODUCTS**

| Classification     | Contribution  | Main Sources   |  |
|--------------------|---|--|--|
| Draft power        | Crop production   | Cattle, buffalo, yaks, camels, horses, donkeys, mules                              |  |
|                    | Cartage   | Cattle, buffalo, yaks, camels, horses, mules, donkeys, reindeer                    |  |
|                    | Packing   | Camels, yaks, horses, mules, donkeys, reindeer, llamas, sheep, goats               |  |
|                    | Herding   | Horses, mules, camels, asses   |  |
|                    | Irrigation pumping  | Buffalo, cattle, camels, asses   |  |
|                    | Threshing grains  | Cattle, horses, asses  |  |
|                    | Transportation  | Horses, donkeys, mules, buffalo, camels, reindeer                                  |  |
| Storage in animals | Human leisure time  | All working species  |  |
|                    | Capital   | All domestic species   |  |
|                    | Grains  | Buffalo, cattle, sheep, pigs, poultry  |  |
| Conservation       | Grazing   | All domestic herbivores  |  |
|                    | Seed distribution   | All domestic herbivores  |  |
|                    | Soil through crop rotation  | Most grazing animals   |  |
| Ecological         | Maintenance   | Most animals   |  |
|                    | Restoration   | Most animals   |  |
| Pest control       | Weeding crops   | Domestic ruminants, ducks, geese   |  |
|                    | Insects in crops  | Poultry, ducks, geese  |  |
|                    | Irrigation canals   | Buffalo, ducks, geese  |  |
| Cultural uses      | Exhibitions and sports  | Horses, cattle, goats, sheep, pigs, buffalo, chickens, dogs, cats                  |  |
|                    | Bride price   | Cattle, goats, sheep, camels   |  |
|                    | Religious sacrificial   | Sheep, goats, cattle, poultry, buffalo, pigs                                       |  |
|                    | Fighting  | Chickens, cattle, buffalo, sheep, dogs, camels                                     |  |
|                    | Pet   | All species  |  |
|                    | Racing  | Horses, cattle, dogs, camels, buffalo  |  |
|                    | Status symbol   | Horses, cattle, pigs, buffalo, camels, fighting cocks, most species to some degree |  |
|                    | Income  | Blood and death restitution  | Horses, cattle, buffalo, camels, pigs            |
|                    |   | Security   | Cattle, buffalo, goats, sheep, pigs, all poultry |
|                    |   | Liquidity  | All species                                      |
| Nonarable lands    | Reduce risks of cropping  | All species  |  |
|                    | Income  | Cattle, camels, goats, sheep   |  |
| Research           | Soil fertility in cropping  | Cattle, goats, sheep, buffalo  |  |
|                    | Biomedical and numerous other   | All domestic species and fowl  |  |
| Fiber              | Wool, hair, feathers  | Sheep, camels, llamas, alpacas, yaks, horses, goats, other mammals                 |  |
|                    |   | All fowl   |  |
| Skins              | Hides, pelts  | Almost all species   |  |
| Wastes             | Fertilizer, fuel, methane gas, construction material, feed (recycled) | Almost all species   |  |
| Inedible products  | Fat, horns, hooves, bones, tannage, endocrine extracts                | All species  |  |

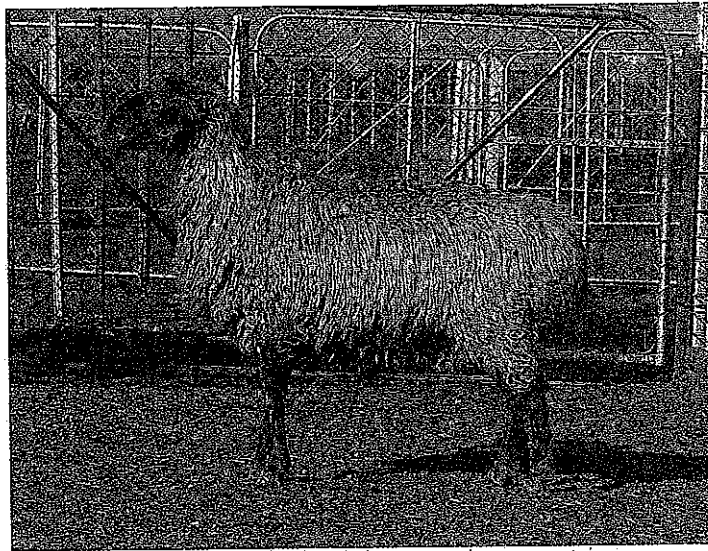
Source: McDowell, 1991, pp. 17, 45. Various other sources



lives. This section explores some of these contributions in greater detail and gives us all the opportunity to have an enhanced appreciation for human dependence on domestic animals.

### Body Coverings

The most important products from some animals are their body coverings. Examples are sheep (wool, Persian lambskins, Figure 2-10), goats (cashmere and mohair), and alpacas (Figure 2-11). For other species, the body covering is a by-product rather than the main product. A major advantage of the fiber products is that they are renewable—they can be harvested repeatedly from the same animal. Skins and hides are nonrenewable, at least from the same animal. In countries with a highly developed agriculture, the skins and hides obtained at the time of slaughter are a valuable by-product. However, their contribution to the total value



**Figure 2-10**

*The Karakul sheep produces Persian lambskins that are used in the manufacture of luxurious coats. (Photo courtesy Keith Ramsay.)*



**Figure 2-11**

*Alpaca fibers are used to make many products, including novelty items such as this Peruvian crafted rug/wall hanging made exclusively from different colors of alpaca fiber.*

**Table 2-7**  
**WORLD HIDE AND FIBER PRODUCTION IN METRIC TONS**

|                               | 1980      | 1990      | 2000      | 2009      | Rank in 2009 |
|-------------------------------|-----------|-----------|-----------|-----------|--------------|
| Cattle hides, fresh           | 5,658,314 | 6,307,585 | 7,393,408 | 7,869,020 | 1            |
| Wool, greasy                  | 2,794,157 | 3,347,708 | 2,318,537 | 2,080,190 | 2            |
| Sheepskins, fresh             | 1,108,708 | 1,345,602 | 1,763,805 | 1,916,847 | 3            |
| Goatskins, fresh              | 390,168   | 579,437   | 852,953   | 1,084,038 | 4            |
| Buffalo hides, fresh          | 478,623   | 613,667   | 792,824   | 860,739   | 5            |
| Silkworm cocoons,<br>reelable | 341,660   | 363,587   | 342,454   | 497,529   | 6            |
| Hair of horses                | 110       | 100       | 130       | 140       | 7            |

Source: FAO, 2011.

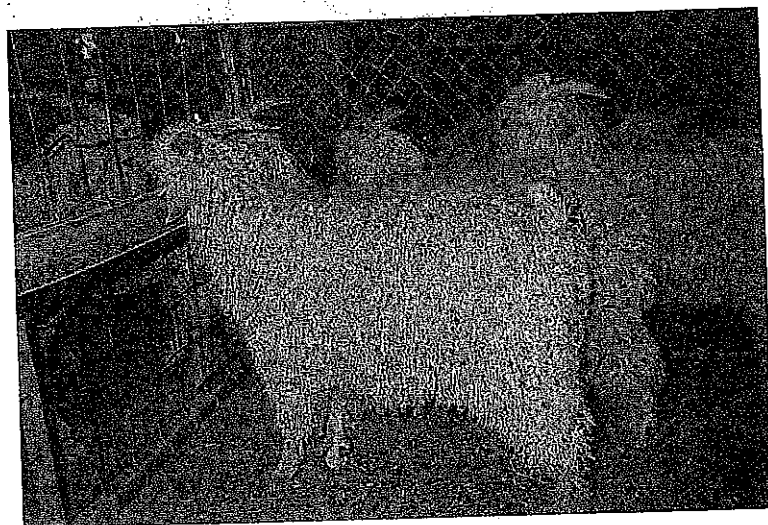
of the slaughter is relatively small compared to the value of the carcass. Often, they are shipped to a developing country for processing. In poorer countries, hides or skins (rather than the meat) may be the most valuable animal export product, and they may provide valuable foreign currency. In addition, wool, hair, and feathers are often used in cottage industries to produce clothing, pillows, bedding, carpets, brushes, and handicrafts. World hide and fiber production is shown in Table 2-7. As one might expect, cattle hides, wool, and sheepskins are produced in greatest volume.

Goats yield two types of body coverings that are used for making fabrics—mohair and cashmere. Mohair is clipped from the Angora goat each year just as the fleece is shorn from sheep (Figure 2-12). The average yield is about 6 lbs. Angora goats are raised in several parts of the world. Cashmere, also called pashmina, is the very fine underfur of the Kashmir goat. Kashmir goats are really a type rather than a breed. Almost all goats produce some cashmere. It must be combed out of the coarse, outer guard hair by hand. The average yield is only about 4 oz. Kashmir goats are raised in the high plateaus of Tibet, China, and northern India.

Yaks produce a coarse fiber from which clothing and one of the best horse blankets are made. The long hair of the camel is woven into cloth or blankets primarily for use by the people who own the camels. Camel-owning nomads also use camel

**Figure 2-12**

The Angora goat produces mohair, which is a valuable fiber in fine-clothing manufacture.



hair as tent fabric material. Camel hair paintbrushes are highly valued by some artists. The other domestic animals of the camel family that yield fiber are the llama and alpaca native to the Andes Mountains of South America. The alpaca produces wool that is of higher quality than most sheep wool.

The Karakul and Kuche are fur-bearing breeds of sheep. Lambs are slaughtered within a few days of birth and the pelts are removed. The Karakul is the best known of the two, yielding Persian lambskins used in the manufacture of very expensive coats. The Karakul thrives in very dry environments. Most are produced in Afghanistan and Namibia. The skins are exported to the developed countries. The pelt of the Kuche is used in making fur hats, collars, and coats. It is seldom exported out of northern Asia.

Feathers are used for pillows, bedding, and clothing (down coats), for jewelry and adornments on clothing (hats), for fishing lures, and as a protein supplement to feed animals. Silk from silkworms is important in production agriculture in China, India, and Uzbekistan, with nine countries producing at least 1,000 MT annually (Figure 2-13).

### Power Sources

In a developed agriculture, almost all farm power is provided by machines rather than by animals. In developing countries, however, 50% of the arable land is tilled by **draft** animals. Animals are used for plowing, pulling carts or sleds, and packing. As a general rule, the poorer the country, the greater the dependence on animal power. Oxen, donkeys, horses, buffalos, mules, and camels are the major animal species used for draft purposes. Several other species are used in specific geographic locations, such as yaks, llamas, goats, reindeer, and dogs. Oxen and buffalo are the most powerful in pulling, with oxen being faster on dry land. Horses and mules move the fastest, which is an advantage if high-quality implements are available. Donkeys and camels carry the heaviest loads in relation to body size and are preferred in drier climates. Yaks are best adapted to high altitudes. For many of the world's people, there is no alternative to draft power (Figure 2-14).

**Draft** To move loads by drawing or pulling. A draft animal is one that is used to draw or pull loads.

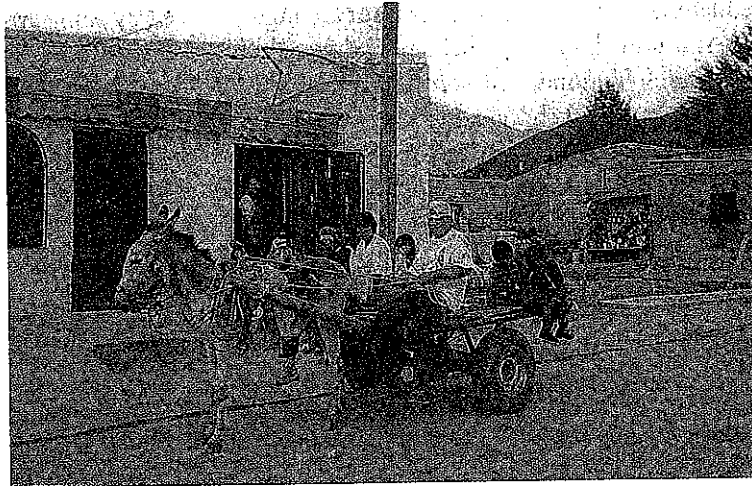


**Figure 2-13**

*Silk is one of the most valued natural fibers in the world and is often woven into fine fabrics such as these.*  
(Brynn Bruijn/ Saudi Aramco World/ SAWDIA. Used with permission.)

**Figure 2-14**

Family coming to market in a donkey-powered cart. Oxen, donkeys, horses, water buffalo, mules, and camels are the major draft species, but yaks, llamas, goats, reindeer, and dogs are also used for work.



**Compost** Decayed organic matter used for fertilizing and conditioning land.

**Poultice** A soft moist mass held between layers of cloth, usually warm, and applied to some area of the body.

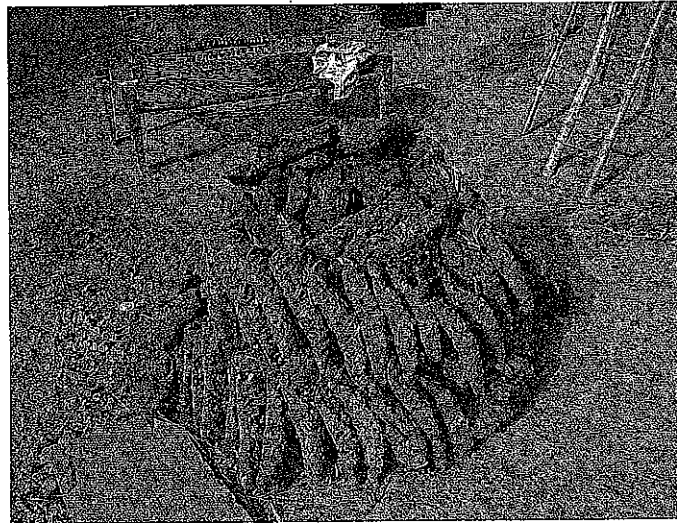
### Body Wastes

**Manure** As many as half of the world's farmers depend on animal manure and **compost** from plant residues as their only source of fertilizer (Figure 2-15). Manure is preferred over chemical fertilizers by small farmers who till the land by hand or use crude plows because manure improves soil texture. Manure is also used in the developed countries as a source of soil fertility but not very efficiently. A recent study determined that only 5% of U.S. cropland is fertilized with livestock manure, and most of that is from dairy and hog operations. In many of the poorer areas of the world, manure must be used as a fuel. This is particularly true in very densely populated areas where trees have been cut and used as fuel or for other purposes. In these areas, dried manure, particularly from cattle and buffalo, is an important source of fuel for cooking and heating (Figure 2-16). At higher elevations, yak dung becomes especially important. The sale of this product is an important source of income for many farm families who take dried dung cakes to the cities and sell them. A third use of manure is for construction. Many people in Africa and Asia use cow and/or buffalo manure as plaster for their huts (Figure 2-17). In the upper elevations of Peru and Uruguay, houses are built of blocks made from a mixture of approximately 50% manure plus soil and straw. In other cultures, cow manure is used as an important ingredient in **poultices** for wound healing.

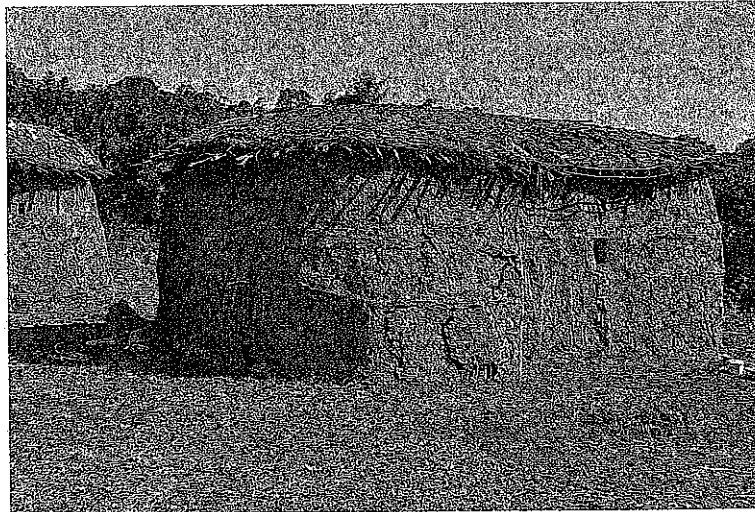
**Figure 2-15**

Body wastes and compost from crops are preferred crop fertilizers for millions of farmers around the world. (Source: FAO Photo/18658/G. Blank. Used with permission by the Food and Agriculture Organization of the United Nations.)



**Figure 2-16**

Manure is commonly used for fuel in many places around the world. Shown here are dried-manure-and-straw cakes stacked beside a house for easy access.

**Figure 2-17**

In many parts of the world, manure is used as a construction material. This Masai hut is plastered with a mixture of mud and dung. (Photo courtesy of R. Dudley and Barbara B. Koy. Used with permission.)

**Urine** Urine is used to enhance soil fertility in many parts of the world due to its nitrogen, phosphorous, and potassium content. In Asia, cow urine is sprinkled on dirt floors to control dust and pests. In Africa, urine and blood are used to extend the low volume of milk available for human food. Some systems of leather making use urine, and it has historically been used in some methods of textile manufacture and dyeing. It is even used as a rinse for hair, in medicinals, and in religious ceremonies.

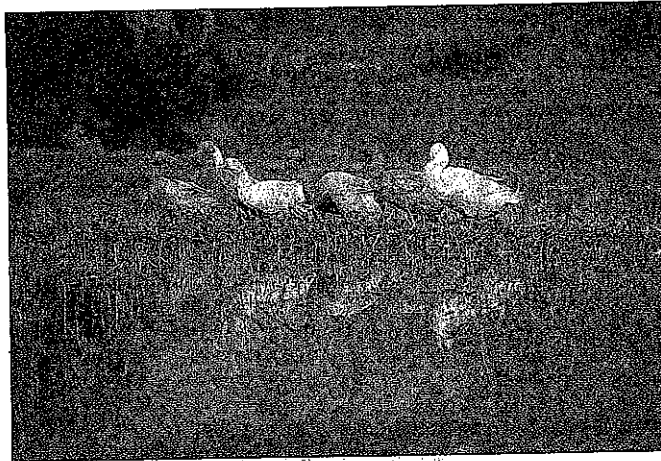
### **Pest and Weed Control**

Land that is being left to fallow (rest) can be grazed by animals to control weeds. Their manure rejuvenates the soil. Grazing animals are also frequently used along the edges of canals to control vegetation. Grazing the canals also helps control snailborne diseases in the human population because large numbers of snails are killed under the hooves of the grazing animals. Ducks are also used in irrigation canals because they eat snails and leeches. It is common to use ducks in rice fields after harvest to pick up missed grain and reduce insect populations (Figure 2-18). Animals provide a tremendous service globally by reducing weeds and crop residues on cropland, which must be removed if the land is to be prepared by hand

**Figure 2-18**

Animals serve important roles in pest and weed control. Ducks are invaluable in rice paddies. They pick up dropped grain after harvest, reduce snail and insect populations, and provide their manure for the next crop.

(Photo courtesy of Suzanne Tolleson. Used with permission.)



**Pesticides** Any agent or poison used to destroy pests including fungicides, insecticides, herbicides, and rodenticides.

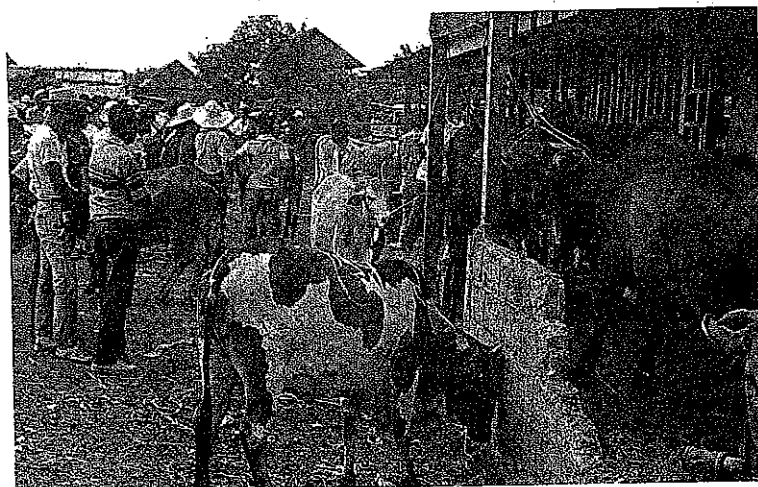
tools or animal-drawn plows. One method used to accomplish this is to stock the land heavily with animals to remove the weeds, grasses, and residues just before planting. Farmers and pastoralists in Africa often have a centuries-old arrangement to provide mutual service to each other in this way. Consumption of these nuisances adds additional economic value to the cropland through the animal product gained. In Africa, close grazing of vegetation around cropped areas reduces insect numbers by creating a vegetation-free barrier around the crop. The use of animals to control insects and weeds has potential for the developed world as a means of reducing the use of **pesticides** in certain areas.

### Storage of Capital and Food

In many of the poorer developing countries, banks are nonexistent. Even if they exist, people either do not have access to them or do not trust them. As an alternative to banks, people use livestock (particularly cattle) as a vehicle for storing their surplus capital. If money is needed, animals can be sold or often bartered for other needed items (Figure 2-19). Use of livestock for storage of capital has several undesirable effects. Clearly, large herds are desirable, and when they are acquired and maintained, severe overgrazing often results. This is a major reason why desertification increases when the human population increases. A second very undesirable effect is the reluctance of people to sell animals unless money is needed. This prevents the development of an orderly program of marketing and slaughtering of animals such as that found in the developed countries. For maximum utilization of the livestock of a country, such a marketing program must be in place.

**Figure 2-19**

Cattle are often used to store wealth. When cash is needed, they are sold or bartered, like these animals photographed at a trade day in a remote part of Luzon, Philippines.



The use of animals as storage of food is very important in many countries of the world because animals represent one of the most reliable reserve food supplies. In the richer countries of the world, livestock populations can support the energy and protein requirements of the population for a year or more. Most poor countries have inadequate facilities for storing grain (especially for any long period) without suffering large losses from pests. This is not a problem with animals. Animals assume even greater importance in the storage of food in countries subjected to periodic and prolonged droughts. When the rains do not come, crops fail. Animals can continue to survive for several months, even years, and may be the only means of survival of the human population.

### Cultural Uses

For some of the world's peoples, the roles of animals in food supplies and other services can be less important than the cultural roles the animals hold. The most important reason to a given group of people for keeping animals may be cultural.

Religion is a very important cultural role that is given high priority by the world's people. The following is a partial listing of the contributions animals make to cultures; a more detailed explanation is given in Chapter 3.

**Exhibitions and Spectator Sports** The animal industries have long used shows as a means of promoting their breeding stock to potential buyers. However, the love of competition is also an important part of this activity. Some people believe the purebred livestock industry in the United States would disappear without this social dimension. The excitement of this activity is catching, as evidenced by 4-H and FFA club animal projects (Figure 2-20). Horses, dogs, cats, small mammals, llamas, and other species are also exhibited in many countries. Activities such as rodeos, fighting (bulls, buffalo, sheep, and chickens), and racing (camels, horses, buffalo, dogs, fowl, turtles, and frogs), together provide billions of person days of recreation annually. In many developing regions, these combined animal recreation events represent the largest source of entertainment for people. In developed countries, they provide viable outlets for viewers and participants and contribute to the economy.

**Companionship and Service** The dog and the cat have long and venerable histories of companionship and service to humans (Figure 2-21). However, other species, such as ferrets and small rodents (hamsters, gerbils, rabbits, and so on), and several new species, such as alpacas, llamas, small pigs, hedgehogs, and small primates, are also used. Domestic livestock are also used extensively as pet species in both developed and developing countries. Modern research has demonstrated a myriad of benefits to



**Figure 2-20**

*Exhibition of livestock has a social dimension, in addition to helping promote breeding stock to potential buyers. Here, 4-H and FFA students show their animals at a youth livestock exposition. (Photo courtesy of Kellie Whipple. Used with permission.)*

**Figure 2-21**

*Dogs and other animals have long and venerable histories of companionship and service to humans.*

(Photo courtesy of Dawne Damron-Belote. Used with permission.)



humans from animal companionship. In addition, Seeing Eye dogs, hearing-ear dogs, monkeys to assist paraplegics, drug-search dogs, and a variety of others make valuable contributions to humanity.

**Social Structure** The less developed the agriculture, the more livestock are a part of the cultural fabric of the people. In pastoral societies, animals are the wealth left to the next generation. This is especially true of nomads. Animals play an important role in the traditional way that formal contracts are sealed and social obligations met. Marriage contracts involve exchanges of livestock. In tribes where polygamy is practiced, there is pressure to accumulate animals to obtain additional wives. In some tribes, the traditional bride price is so high that young men must work for several years to obtain the necessary livestock for payment. This thus serves an important social function in birth control.

### **Nonfood or Inedible Slaughter By-Products**

Opinions vary about what is edible on a carcass and what is not. Many things that people in developed countries consider inedible are eaten in developing countries. However, a large number of nonfood products are derived from slaughter at all levels of development. A partial listing of sources and products is provided in Table 2-8. In developing countries, various by-products become jewelry, religious implements, tools, fuel, construction material, fly swatters, or musical instruments. These products are often considered indispensable for daily life. In developed countries, many pharmaceuticals and drugs are extracted from animal organs and other tissues. Intestines become sutures; pigskin is used to help burn victims; heart valves are harvested from pigs and used to replace defective valves in human hearts. Many of the inedible meat products are used in pet foods and livestock feeds. Bones and hooves are converted to fertilizer and mineral supplements; inedible fat is used for a variety of purposes, such as lubricants, candles, detergents, crayons, plastics, insecticides, shaving cream, and livestock feeds. These represent multibillion-dollar industries worldwide.

### **Human Health Research**

The number of animal applications to health research are simply too numerous to mention. The average American life span increased by 30 years in the 20th century. Much of that increase was due to health research conducted on animals. In addition,



**Table 2-8**  
**NONFOOD SLAUGHTER BY-PRODUCTS**

| Source           | Some Products                    |
|------------------|----------------------------------|
| Blood            | Glue, feed, vaccines, serums     |
| Bones            | Buttons, jewelry, gelatin, glue  |
| Digestive tract  | Feed, fertilizer                 |
| Endocrine glands | Pharmaceuticals                  |
| Hides            | Leather                          |
| Inedible fat     | Fatty acids, fuel, soap, candles |
| Hooves           | Gelatin, glue                    |
| Horns            | Handicrafts, cultural symbols    |

Source: Adapted from McDowell, 1991, p. 42. Used with permission.

the quality of life for people afflicted with chronic diseases has been improved immeasurably. During World War II, biomedical research began making extraordinary strides in the pursuit of human health. Animals have been used extensively as models in that research. Rats, mice, guinea pigs, hamsters, and rabbits have been the most important species used. In recent decades, more dogs and cats have been used, and currently, pigs and other traditional livestock species are proving very useful. Medical research depends on the use of animals as models and will continue to do so for the foreseeable future. **Recombinant DNA** technology is making animals in research an even more promising aid in fighting disease; for example, animals have been genetically engineered to mimic human disease conditions. Such developments greatly reduce the amount of time needed by scientists to offer cures and treatments for diseases. In addition, **xenotransplantation**, the replacing of human organs with those from animals, is an active and promising area of research.

### Income

In developed countries, the economic structure depends on specialization. This is true of agriculture as well as other sectors of the economy. Animal agriculture is a highly specialized means of using land and labor to generate earnings. The yearly earnings from animal products represent roughly half the total from agriculture in the United States. Annual cash receipts from animal agriculture exceed \$110 billion, with a general upward trend. The average annual increase in cash receipts from animal agriculture was \$2.2 billion during the 2000s.

Developing-country agriculture also depends on animals for income. This is evident in the most developed of the developing countries. Their economic systems are operating in much the same way as the developed countries they hope to join in economic status. However, it is also true of the least-developed countries as well. In subsistence systems, animals are frequently the major source of income generated from the farm. Extra income from the livestock is used to buy items such as fertilizer and improved seeds that help the farmers increase overall productivity and increase the standard of living for the family. The local economy is stimulated through increased availability and demand of jobs and products.

### Conservation

Domestic animals play vital roles in many land- and water-conservation practices. These roles include controlling pests and adding manure to lands being left to fallow; using alley-cropping systems where leguminous trees are planted in strips with animals and crops alternated between them; and providing alternative use in

**Recombinant DNA** DNA molecules that have had new genetic material inserted into them. A product and tool of genetic engineering.

**Xenotransplantation** The transplanting of animal organs into humans.

**Figure 2-22**

Sheep grazing under a stand of rubber trees eat weeds and other plants that would otherwise compete with the rubber trees. Valuable food and fiber products are then harvested from the sheep flock.



**Stover** Parts of the plant left after grain harvest.

tree-cropping systems and weeding stands of palms and other trees (Figure 2-22). The entire concept of sustainable agriculture often depends on having animals in the system.

## SUMMARY AND CONCLUSION

Agricultural animals help humans extend their use of the available resources by converting nonedible material to humanly edible food. This conversion is not always efficient or fast. However, allowing animals to eat wheat straw or corn **stover**, or to browse brush or even catch their own insects, reptiles, and rodents, is the only way these resources can be converted to food for humans. People have historically consumed animal products and will go to great lengths to procure them. In so doing, we are balancing our diet, which might otherwise be of a very low quality. The high biological

value of protein, coupled with needed vitamins and minerals, makes animal products an essential part of the human diet.

Animals provide humans with a myriad of services in addition to providing food. Without the goods and services provided by animals in addition to food, peoples in developed and developing countries would find it difficult to maintain their living standard and perhaps even to survive. New products are constantly being developed that increase that dependence.

## STUDY QUESTIONS

- Using numbers, compare and contrast the quantity of meat consumed by people in developed and developing countries.
- What species provide most of the world's meat?
- Describe the rates of growth in the production of the various meats used by human societies in the world.
- Cattle produce approximately what percentage of the total milk produced in the world? Which species produces the second largest amount of total milk?
- Describe the value that dairying can bring to economic development of a country.
- What species is most important to world egg production?
- Describe some miscellaneous food uses of animals.
- Describe the differences in the ways in which meals are selected in wealthy versus poor societies.
- What is the physiological and nutritional significance of animal products in the human diet?
- List ten nonfood uses for animals that are most important to you.

11. What are the various body coverings provided by animals? Which animal produces which product?
12. What is meant when we say that skins and hides are nonrenewable but wool is renewable?
13. What is different about the Karakul and the Kuche breeds of sheep as compared to other sheep?
14. What is the value of animal fibers, feathers, and so on, in the cottage industries of poor countries?
15. What are the various uses of draft power? What places in the world rely most on draft power? What species provide the bulk of draft power?
16. Describe the various uses humans have found for the body wastes of animals.
17. Explain how animals are used in pest and weed control. With the expanding number of ranchettes and hobby farms in the United States and other developed countries, can you see opportunities for a resurgence of interest in this low-tech approach to pest control?
18. Explain how animals can be used as storage for capital and food.
19. Describe the significance of animals as a provider of cultural dimensions to people's lives.
20. Compare and contrast the various uses the people of developed and developing countries have for nonfood slaughter by-products.
21. Human health research depends on the use of animals as models for humans. Most diseases for which we have a cure are under control because of the contributions of animals. Which animals are the most important to this research?
22. How do animal industries contribute to income generation in developed and developing countries?
23. How do animals aid in land conservation?

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