**Chapter 18**

**Food Resources**

**Lecture Outline:**

1. Food and Nutrition
   1. 852 million people lack access to the food needed for healthy, productive lives; 3 billion people are malnourished
      1. The foods humans eat are composed of several major types of biological molecules necessary to maintain health
         1. *Carbohydrates*
         2. *Proteins*
         3. *Lipids*
      2. *Minerals, vitamins* and water are also required by humans to maintain health
      3. Two common diseases result from malnutrition
         1. *Marasmus* is progressive emaciation caused by a diet low in both total calories and protein
         2. *Kwashiorkor* is malnutrition resulting from protein deficiency
   2. Human foods
      1. Just 15 species of plants provide the bulk of food for humans
      2. Animals provide us with foods that are particularly rich in protein
2. World Food Problems
   1. During the 1990s and early 2000s, world increases in food production barely kept pace with population growth
   2. Famines
      1. *Famines* are temporary, but severe food shortages due to crop failures caused by drought, war, flood, or some other catastrophic event
      2. More people die from undernutrition and malnutrition than from starvation associated with famine
   3. Maintaining grain stockpiles
      1. *World grain carryover stocks* provide a measure of world food security
      2. Stockpiles of grain have decreased each year since 1987
         1. Stocks have dropped due to environmental conditions, declining investments in agricultural research, and an increase in the consumption of animal products
         2. When food is scarce, prices increase and the risk of political instability is a real concern in poor nations
   4. Poverty and food: making food affordable for the poor
      1. The main cause of undernutrition and malnutrition is poverty; chronic hunger is more common in rural areas than in urban areas
      2. Infants children, and the elderly are more susceptible to poverty and chronic hunger
   5. Economic and political effects on human nutrition
      1. It costs money to produce, store, transport, and distribute food
         1. Countries with the greatest need for food cannot afford to pay for it
         2. Food-producing nations cannot afford to give it away
      2. Getting food to the people who need it is largely a political problem
      3. Developing countries need to become agriculturally self-sufficient
3. The Principal Types of Agriculture
   1. Agriculture can be roughly divided into two types
      1. *Industrialized agriculture (high-input agriculture)* – relies on high inputs of capital and energy, produces high yields
      2. *Subsistence agriculture* – produces just enough to feed oneself and one’s family, high input of manual energy, produces low yields
         1. Various examples of subsistence agriculture include *shifting cultivation, slash-and-burn agriculture,* and  *nomadic herding*
         2. *Intercropping* allows for the growth of *polycultures* which produces higher yields than typical *monocultures*
4. Challenges of Producing More Crops and Livestock
   1. The effect of domestication on genetic diversity
      1. *Genetic diversity* contributes to a species’ long-term survival by providing the variation that enable each population to adapt to changing environmental conditions
         1. Genetic diversity is often lost during the *domestication* of plants and animals
         2. Most of the vegetable crops grown in the U.S. are of only a few varieties
         3. When a disease breaks out in a domesticated plant or animal population, the entire uniform population is susceptible
      2. The global decline in domesticated plant an animal varieties
         1. To preserve older, more diverse varieties of plants and livestock, many countries are collecting *germplasm*
         2. Germplasm includes seeds, plants, and plant tissues of traditional crop varieties, and the sperm and eggs of traditional livestock breeds
         3. In 2004 the International Treaty on Plant Genetic Resources for Food and Agriculture was created to limit the genetic materials that agricultural companies are allowed to patent, and affirm the right of farmers to save, use, exchange, and sell farm-saved seeds
   2. Increasing crop yields
      1. Greater knowledge of plant nutrition has resulted in fertilizers that promote high yields
      2. Use of pesticides and herbicides have also improved crop yields
      3. Selective breeding programs have resulted in agricultural plants with more desirable features
   3. Increasing livestock yields
      1. The use of *hormones* and *antibiotics* increase animal production
      2. Several studies link the indiscriminate use of antibiotics in humans and livestock to the *evolution* of bacterial resistance
   4. Genetic engineering
      1. *Genetic engineering* is a controversial technology that has begun to revolutionize medicine and has the potential to improve agriculture
         1. It differs from traditional breeding methods in that desirable genes from any organism can be used, not just those from the species of plant or animal being improved
         2. It may produce food plants that will be more nutritious
         3. Crop plants resistant to insect pests, viral diseases, drought, heat, cold, herbicides, or salty or acidic soils are being developed
         4. The first genetically modified (GM) crops were approved for commercial planting in the U.S. in the early 1990s
      2. The safety of genetic engineering
         1. A growing body of evidence has determined that current GM crop plants are safe for human consumption and pose little threat to the environment
         2. More research on the environmental impact of GM crops is required
         3. The Cartagena Protocol on Biosafety (2003) lessens the threat of gene transfer from GM organisms to their wild relatives
      3. The backlash against genetically modified foods
         1. Inserted genes could spread in an uncontrolled manner from GM crops to weeds or wild relatives and thus harm natural ecosystems
         2. Consumers might develop food allergies to GM foods
      4. Should foods from genetically modified crops and livestock be labeled?
5. The Environmental Impacts of Agriculture
   1. The agricultural use of fossil fuels and pesticides produces air pollution
   2. Animal wastes and agricultural chemicals cause water pollution
   3. The quantity of manure produced by livestock factories can cause severe waste disposal problems and soil, surface water, and groundwater pollution
   4. Pesticide resistance is developing in many insect, weeds, and disease-causing organisms
   5. *Land degradation* results from industrialized agriculture
   6. Clearing grasslands and forests and draining wetlands to grow crops have resulted in *habitat fragmentation*, resulting in the decline of various species
6. Solutions to Agricultural Problems
   1. Sustainable agriculture
      1. *Sustainable agriculture* is not a single program but a series of programs adapted for specific soils, climates, and farming requirements
         1. *Integrated pest management (IPM)* is used to minimize dependence on agricultural chemicals
         2. Crop rotation, conservation tillage, and contour plowing help control erosion and maintain soil fertility
      2. *Organic agriculture* uses no commercial inorganic fertilizers or pesticides and causes fewer environmental problems to the *agroecosystem*
         1. Federal standards for certification of organically grown food went into effect in 2002
         2. The trend from intensive techniques that produce high yields to method that focus on long-term sustainability of the soil has sometimes been referred to as the *second green revolution*
   2. Making subsistence agriculture sustainable and more productive
      1. Heavy mulching lessens soil infertility and erosion
      2. Insect damage is reduced by planting several crops together
      3. Legumes help restore nitrogen fertility to the soil
7. Fisheries of the World
   1. Problems and challenges for the fishing industry
      1. No nation lays legal claim to the open ocean; overuse, overharvesting, and degradation result
         1. Many countries have a policy of *open management*, in which all fishing boats of that country are given unrestricted access to fishes in national waters
         2. The Magnuson Fishery Conservation Act (1977) regulates marine fisheries in the U.S.
         3. The Magnuson-Stevens Fishery Conservation and Management Act (1996) requires protection of “essential fish habitat”
      2. *Longlines, purse-seine nets, trawl nets,* and *drift nets* all have respective drawbacks to the health of the marine environment and *bycatch*
   2. Ocean pollution and deteriorating habitat
      1. The same ocean used to provide food is used as a dumping ground
      2. Coastal areas are in high demand for recreational and residential development, and many coastal waters are polluted
      3. Stormwater runoff from cities, agricultural areas, and roads is the single largest source of ocean pollution
   3. Aquaculture: fish farming
      1. *Aquaculture* is carried out both in fresh water and marine water (*mariculture*)
      2. It produces finfish, shellfish, seaweeds, oysters, mussels, clams, lobsters, and crabs