



Chapter 11

Feeding the World

Global Undernutrition

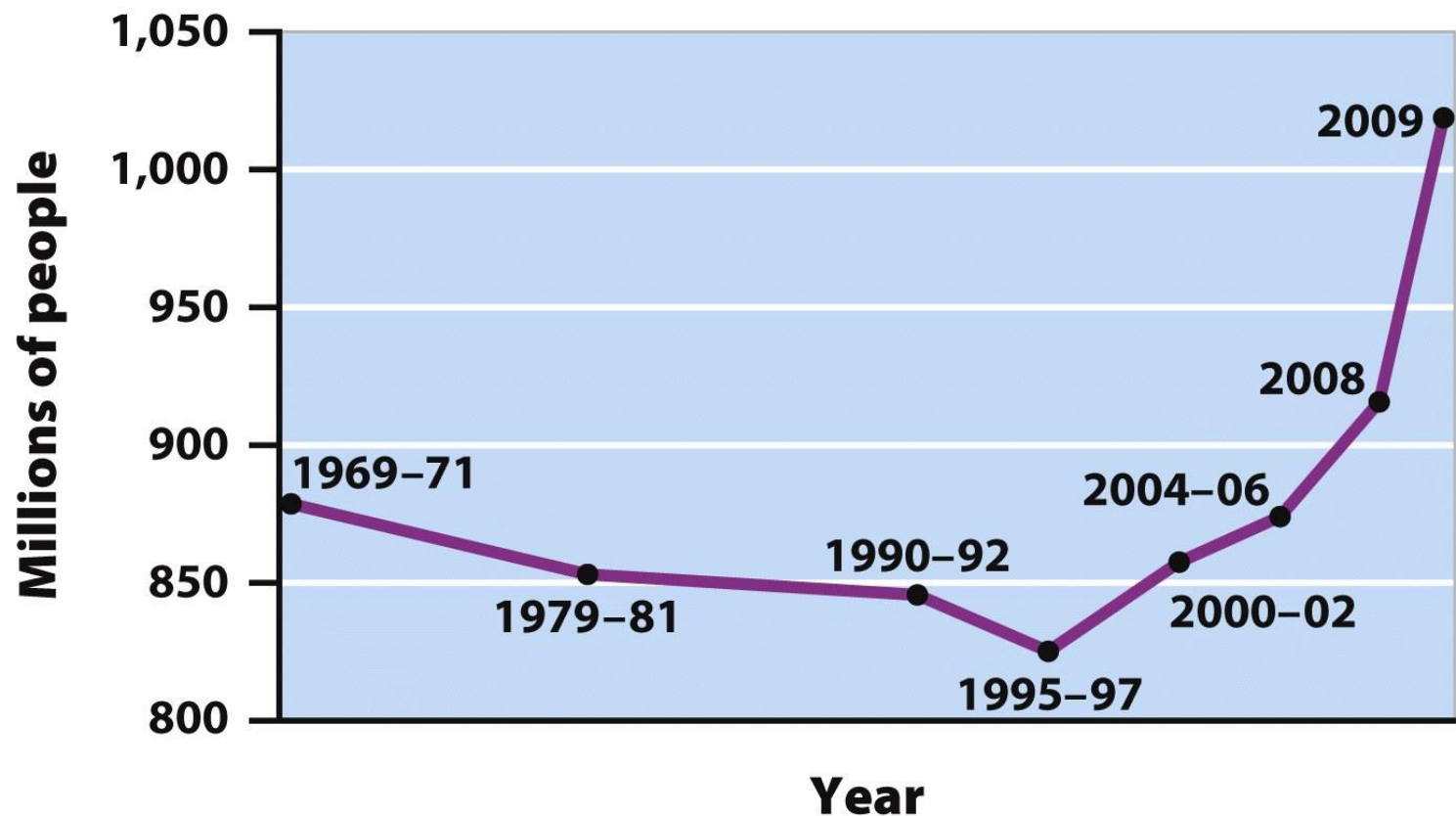


Figure 11.1
Environmental Science
© 2012 W. H. Freeman and Company

Nutritional Requirements

- ▣ Undernutrition- not consuming enough calories to be healthy.
- ▣ Malnourished- a persons diet lacks the correct balance of proteins, carbohydrates, vitamins, and minerals even though they get enough calories.
- ▣ Overnutrition- too many calories and improper foods that causes a person to become overweight.

Annual Meat Consumption

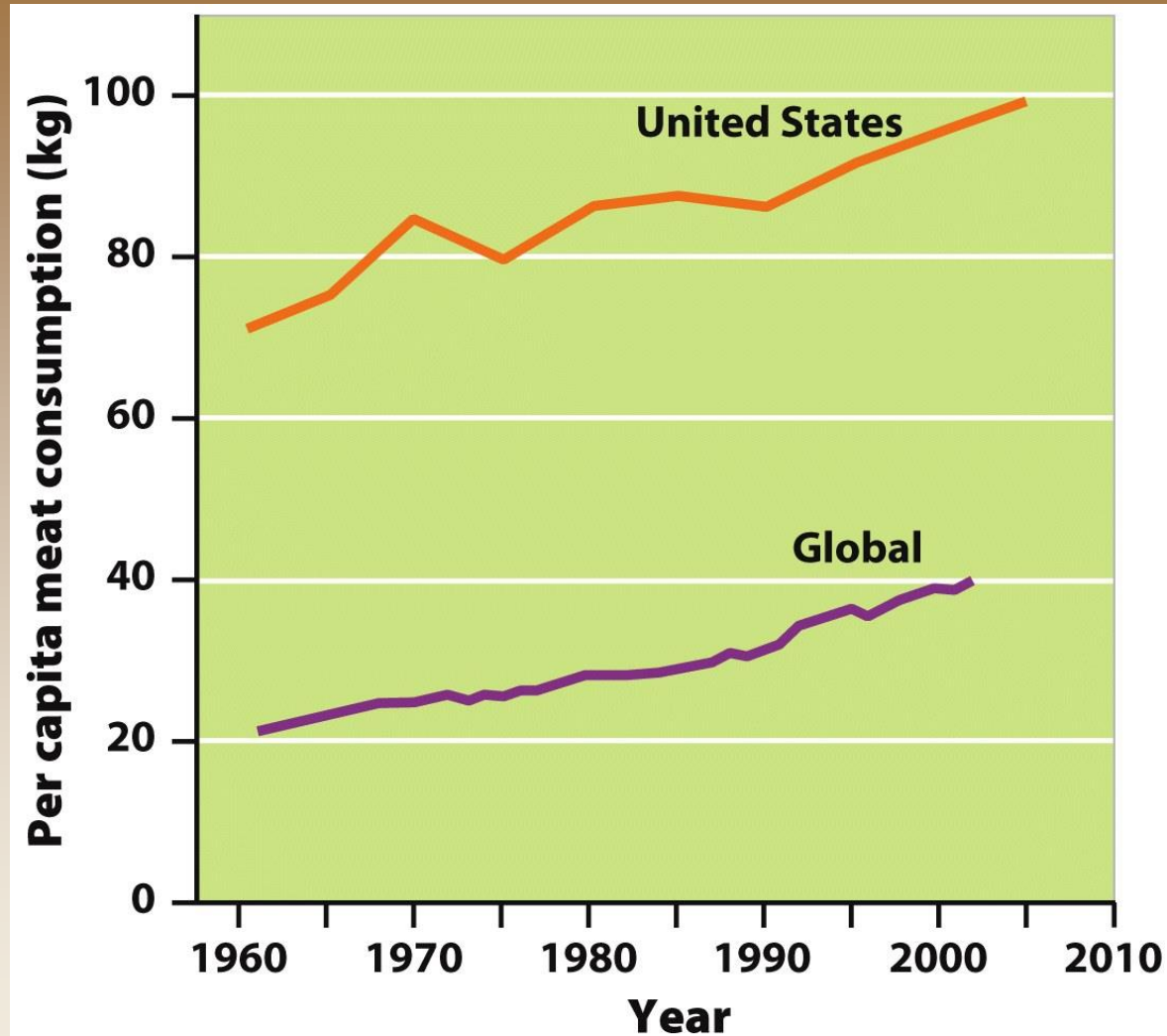
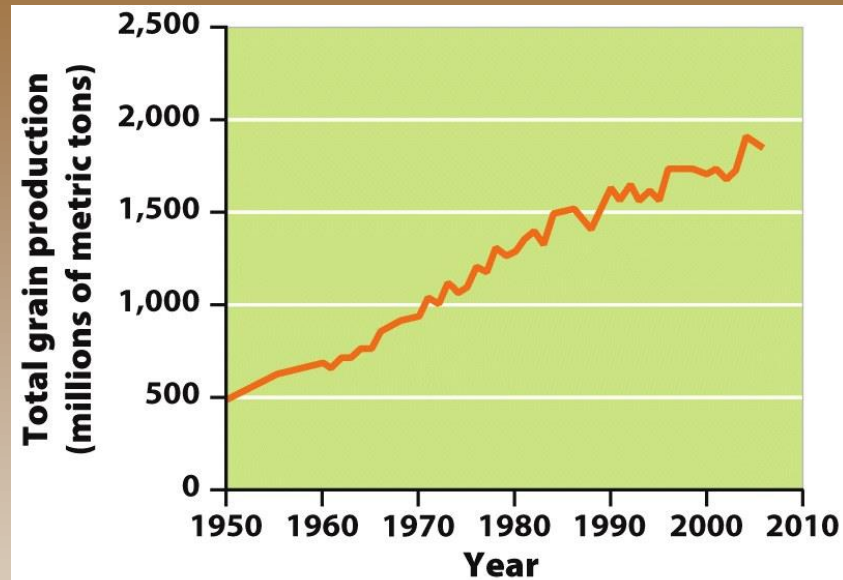
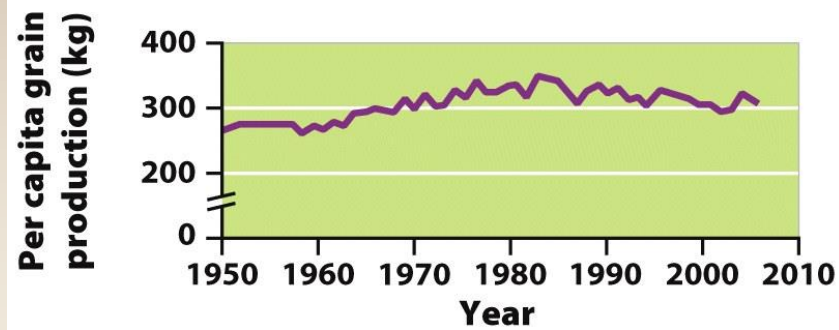


Figure 11.2
Environmental Science
© 2012 W. H. Freeman and Company

Global Grain Production, 1950-2006



(a) Total grain production



(b) Per capita grain production

Figure 11.3

Environmental Science

© 2012 W. H. Freeman and Company

Reasons for Undernutrition and Malnutrition

- ▣ Poverty
- ▣ Political and economic factors
- ▣ Agricultural resources being diverted to feed livestock and poultry rather than people

The Green Revolution

- ▣ New management techniques and mechanization as well as the triad of fertilization, irrigation, and improved crop varieties. This has increased food production dramatically.

Irrigation Problems

- ▣ Waterlogging- when the soil remains under water for prolonged periods which impairs root growth because the roots cannot get oxygen.
- ▣ Salinization- when the small amounts of salts in irrigation water become highly concentrated on the soil surface through evaporation.

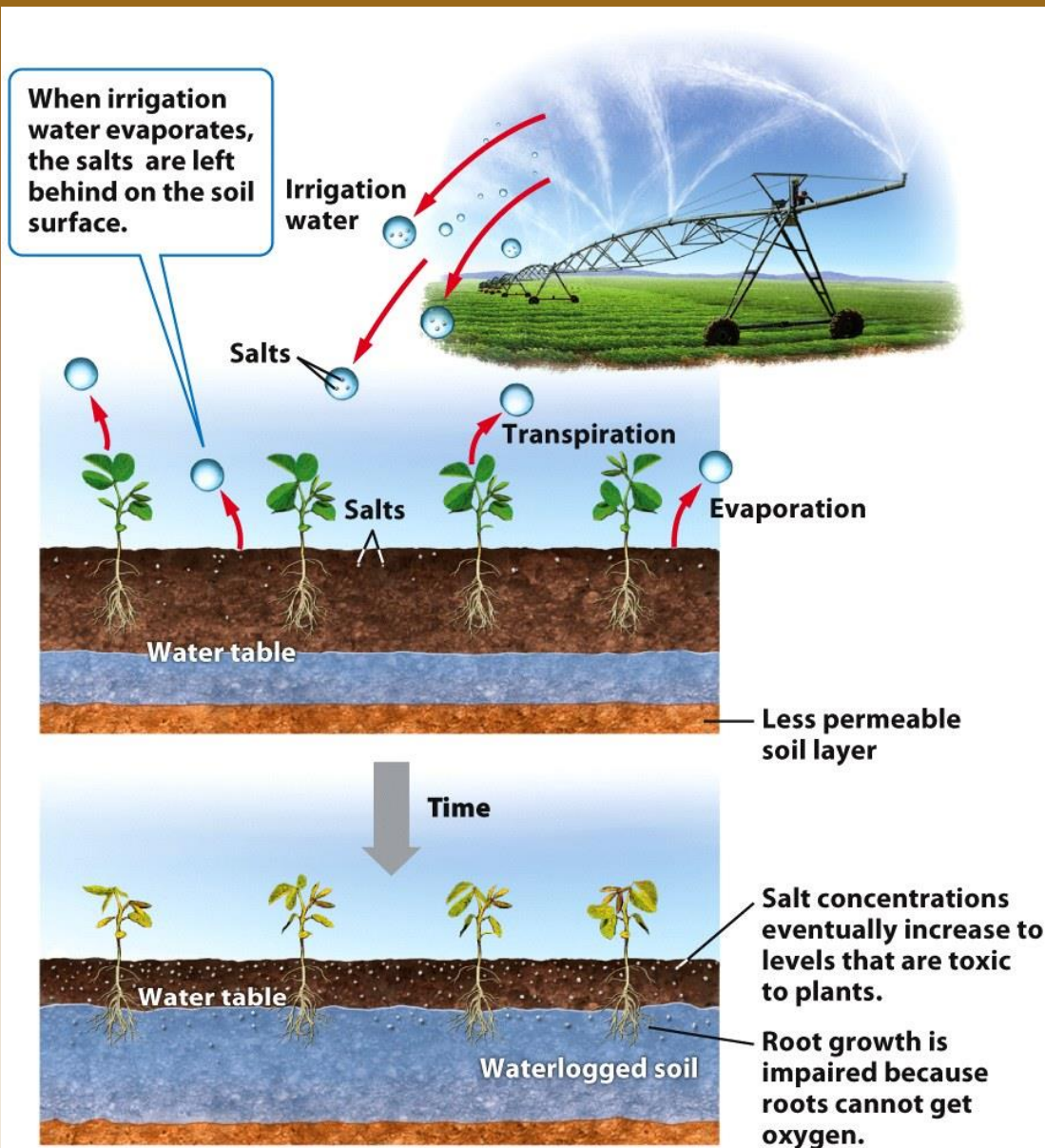


Figure 11.6

Environmental Science

© 2012 W. H. Freeman and Company

Fertilizers

- ❑ Organic fertilizers- organic matter from plants and animals. Typically made from animal manure that has been allowed to decompose.
- ❑ Inorganic fertilizers (synthetic)- fertilizers that are produced commercially. This is usually done by combusting natural gas, which allows nitrogen from the atmosphere to be fixed and captured in fertilizer.



Figure 11.7
Environmental Science
© 2012 W. H. Freeman and Company

Monocropping

- ▣ Growing a large amount of a single species of plant.



Figure 11.8

Environmental Science

© 2012 W. H. Freeman and Company

Pesticides

- ▣ Pesticide- a substance that kills or controls organisms that people consider pests.
- ▣ Insecticide- target insects
- ▣ Herbicides- target plants

Pesticides

- ▣ Broad-spectrum pesticides- designed to kill many different types of pests.
- ▣ Selective pesticides- designed to kill a narrower range of organisms.

Pesticides

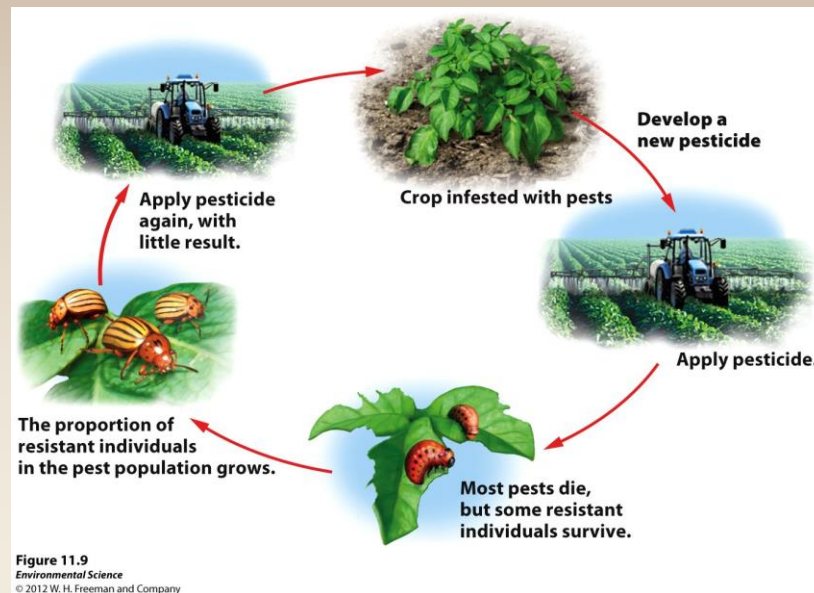
- ▣ Persistent- pesticides that remain in the environment a long time.
- ▣ Nonpersistent- pesticide that breaks down relatively rapidly, usually in weeks to months.

Pesticides

- ▣ Bioaccumulation- some pesticides are found to build up over time in the fatty tissues of predators.
 - ▣ An example was DDT.
 - ▣ When an organism containing the pesticide is eaten, the chemical is transferred to the consumer.
 - ▣ This eventually leads to very high pesticide concentrations at high trophic levels.

Pesticides

- Resistance- pest populations may evolve resistance to a pesticide over time. These are said to be resistant.
- Pesticide treadmill- the cycle of pesticide development followed by pest resistance, followed by development of a new pesticide.



Benefits of Genetic Engineering

- ▣ Greater yield
- ▣ Greater food quality
- ▣ Reductions in pesticide use
- ▣ Reduction of world hunger by increased food production
- ▣ Increased profits

Concerns about Genetically Modified Organisms

- ▣ Safety for human consumption
- ▣ Effects on biodiversity
- ▣ Regulation of genetically modified organisms

Farming Methods

- ▣ Conventional agriculture- industrial agriculture where labor is reduced and machinery is used.
- ▣ Traditional farming- still used in the developing world where human labor is used and not machinery.
- ▣ Shifting agriculture- used in areas with nutrient poor soils. It involves planting an area for a few years until the land is depleted of nutrients and then moving to another area and repeating the process.
- ▣ Nomadic grazing- moving herds of animals to find productive feeding grounds.

Desertification

- ▣ Desertification- When soil is degraded by agriculture to the point at which they are not longer productive.

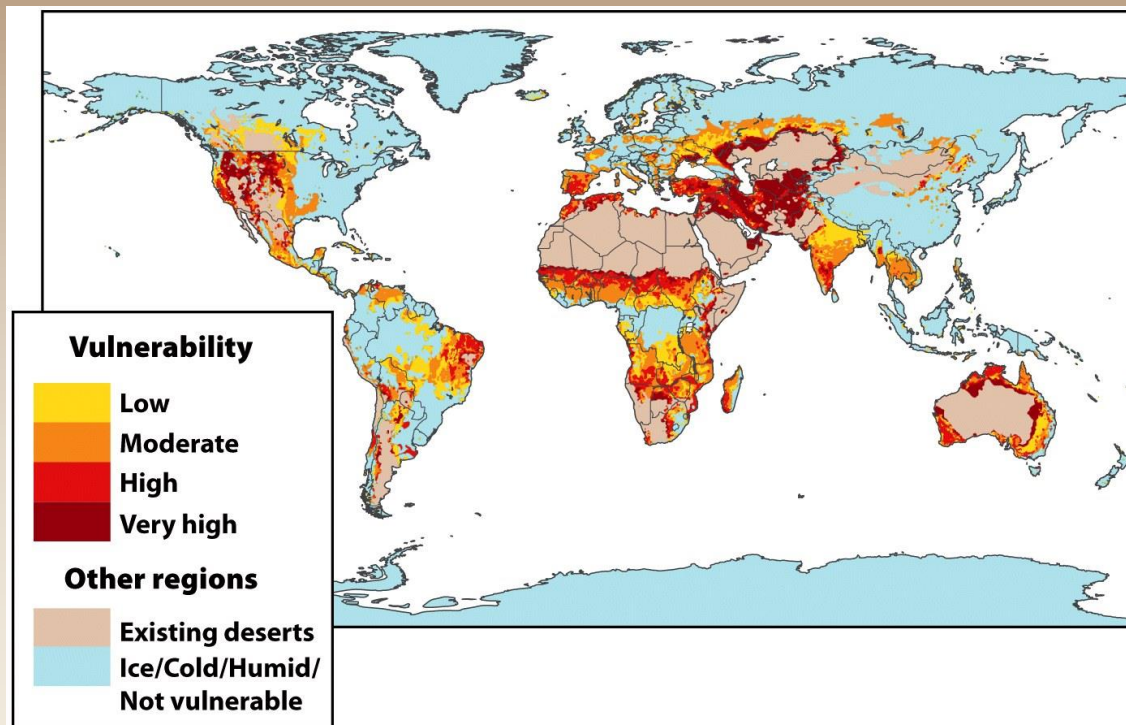


Figure 11.12
Environmental Science
© 2012 W. H. Freeman and Company

Sustainable Agriculture

- ▣ Sustainable agriculture- producing enough food to feed the world's population without destroying the land, polluting the environment, or reducing biodiversity.
 - ▣ Intercropping- two or more crop species are planted in the same field at the same time.
 - ▣ Crop rotation- rotating crops species from season to season.
 - ▣ Agroforestry- intercropping trees with vegetables.
 - ▣ Contour plowing- plowing and harvesting parallel to the land to prevent erosion.



Intercropping

Figure 11.13a
Environmental Science
 © 2012 W. H. Freeman and Company



Contour plowing

Figure 11.13c
Environmental Science
 © 2012 W. H. Freeman and Company



Agroforestry

Figure 11.13b
Environmental Science
 © 2012 W. H. Freeman and Company

No-till Agriculture

- ▣ No-till agriculture- helps to stop soil degradation by leaving crop residues in the fields and not tilling the land after each harvest.



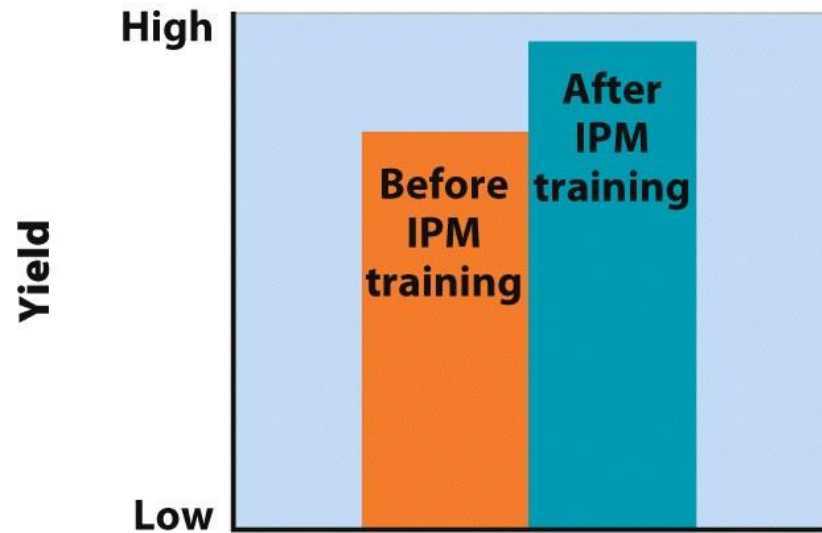
Figure 11.15
Environmental Science
© 2012 W. H. Freeman and Company

Integrated Pest Management

- ▣ Integrated pest management- using a variety of techniques designed to minimize pesticide inputs.
 - ▣ Crop rotation
 - ▣ Intercropping
 - ▣ Planting pest resistant crop varieties
 - ▣ Creating habitats for predators
 - ▣ Limited use of pesticides



(a) Pesticide use



(b) Harvest

Organic Agriculture

- ▣ Organic agriculture- production of crops without the use of synthetic pesticides or fertilizers.



Figure 11.18
Environmental Science
© 2012 W. H. Freeman and Company

High-Density Animal Farming

- ▣ CAFOs (concentrated animal feeding operations)- large structures where animals are being raised in high density numbers.



Figure 11.19
Environmental Science
© 2012 W. H. Freeman and Company

Harvesting of Fish and Shellfish

- ❑ Fishery- a commercially harvestable population of fish within a particular ecological region.
- ❑ Fishery collapse- the decline of a fish population by 90% or more.
- ❑ Bycatch- unintentional catch of non-target species.

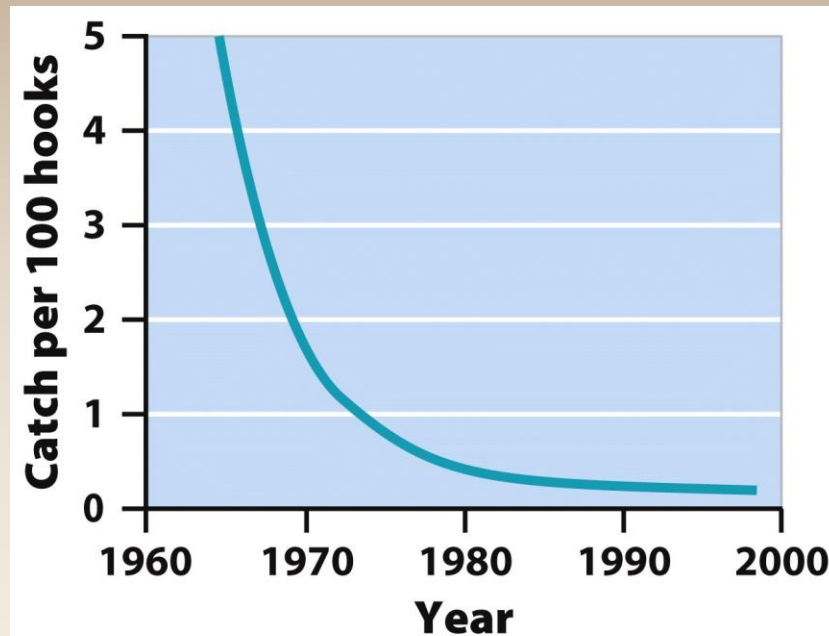


Figure 11.21
Environmental Science
© 2012 W. H. Freeman and Company

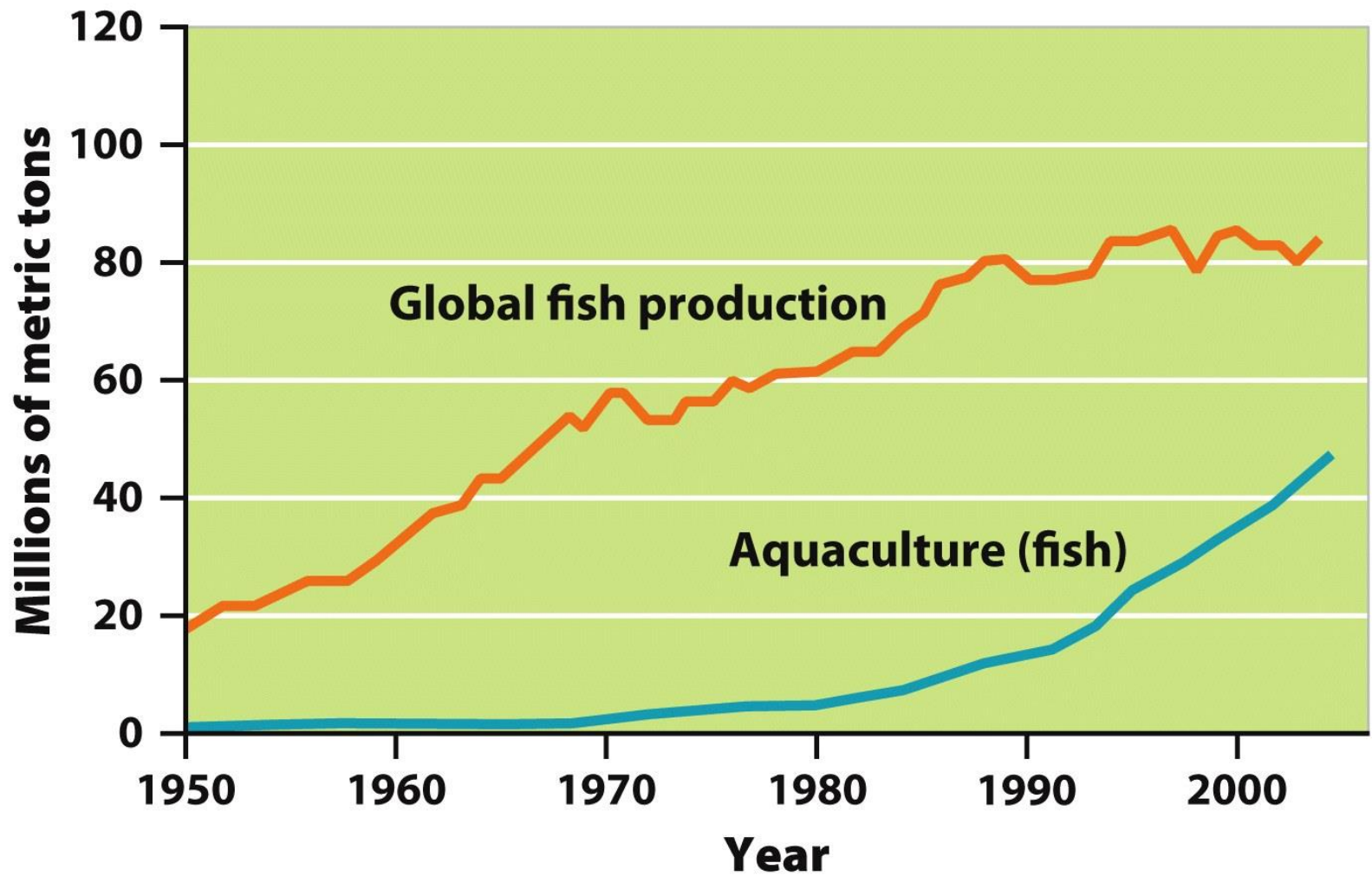


Figure 11.20
Environmental Science
© 2012 W. H. Freeman and Company

Aquaculture

- ▣ Aquaculture- the farming of aquatic organisms such as fish, shellfish, and seaweeds.

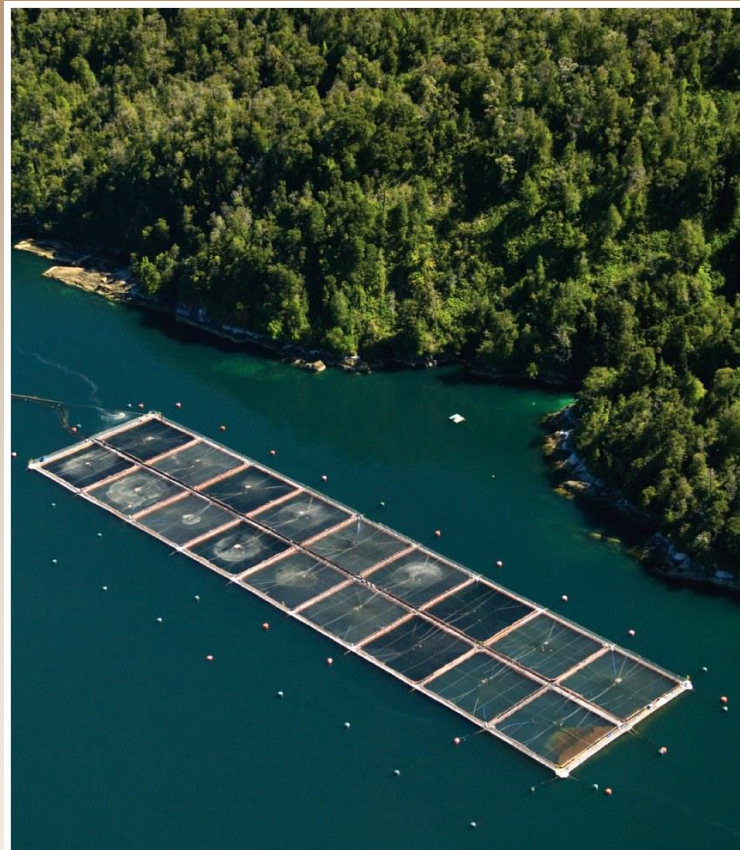


Figure 11.23
Environmental Science
© 2012 W. H. Freeman and Company