

24.4 24.4 Working Toward a Sustainable Society

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LEARNING OUTCOMES

Upon completion of this section, you should be able to

- 1. **1.** Describe the characteristics of a sustainable society.
- 2. **2.** Identify methods of developing sustainability within rural and urban environments.
- 3. **3.** List the methods of determining economic well-being and quality of life.

A **sustainable** society would always be able to provide the same amount of goods and services for future generations as it does for the current one. At the same time, biodiversity would be preserved.

To achieve a sustainable society, resources cannot be depleted and must be preserved. In particular, future generations need clean air, water, an adequate amount of food, and enough space in which to live. This goal is not possible unless we carefully regulate our consumption of resources today, taking into consideration that the human population is still increasing.

Today's Unsustainable Society

We are quick to realize that population growth in the LDCs creates an environmental burden. However, we also need to consider that the excessive resource consumption of the MDCs also stresses the environment. Sustainability is incompatible with the current level of consumption of resources as well as the level of waste produced by the MDCs. Population growth in the LDCs and overconsumption by the MDCs account for many of the problems we are facing today (Fig. 24.18).

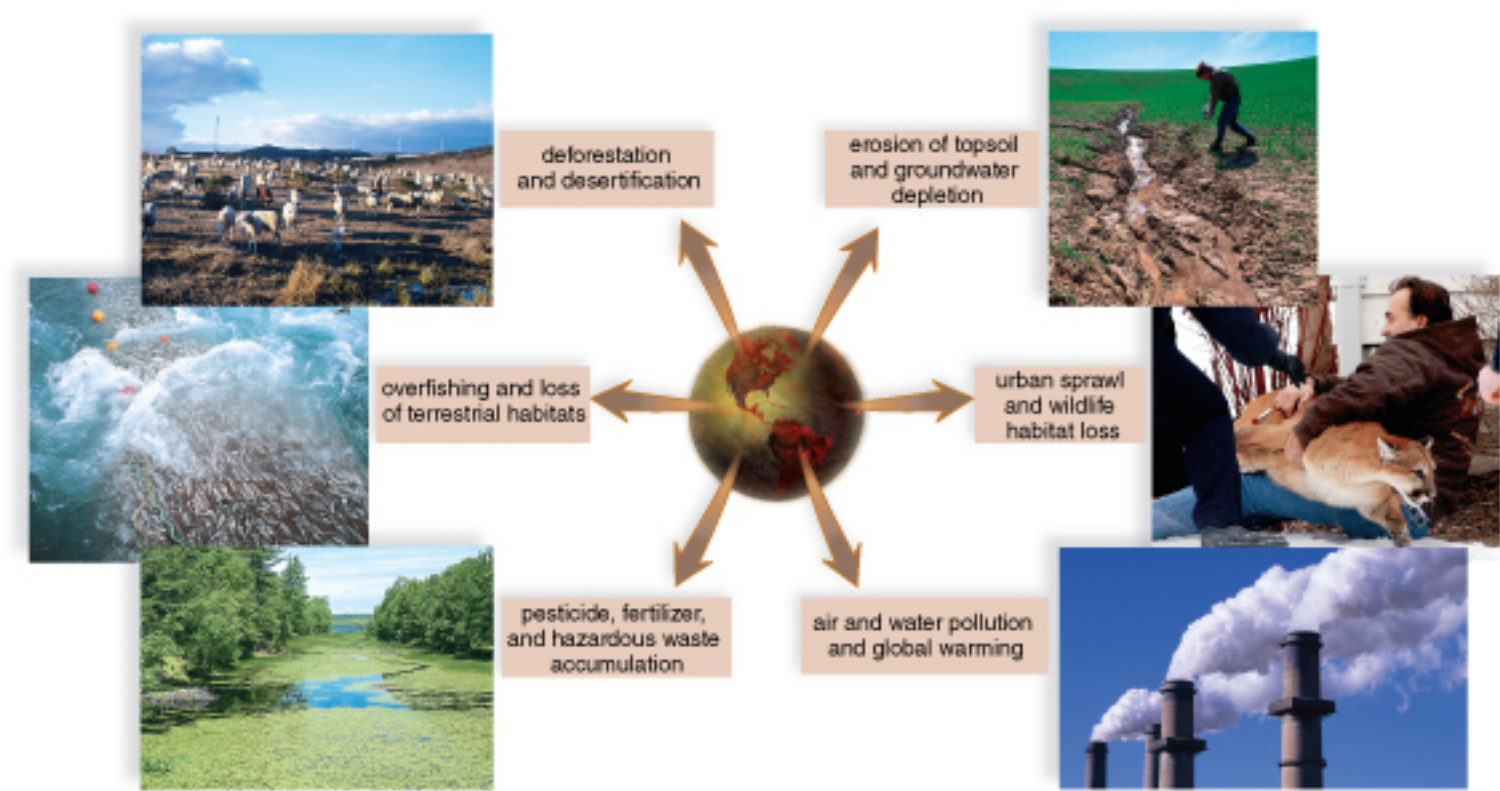


Figure 24.18
Characteristics of an unsustainable society.

Arrows point outward to signify that these types of activities reduce the carrying capacity of the Earth.

At present, a considerable proportion of land is being used for human purposes (homes, agriculture, factories, etc.). Agriculture uses large inputs of fossil fuels, fertilizer, and pesticides that create a large amount of pollution. More freshwater is used for agriculture than in homes. Almost half of the agricultural yield in the United States goes toward feeding animals. According to the ten-to-one rule of thumb, it takes 10 lb of grain to grow 1 lb of meat. Therefore, it is environmentally unsustainable for citizens in MDCs to eat as much meat as they do.

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Farm animals and crops require freshwater from surface water and groundwater, and so do humans. Available supplies are dwindling, and the remaining groundwater is in danger of being contaminated. Sewage and animal wastes wash into bodies of surface water and cause overenrichment, which robs aquatic animals of the oxygen they need to survive.

Our society primarily uses nonrenewable fossil fuel energy, which leads to climate change, acid deposition, and smog. The result is weakened ecosystems. The demand for goods has increased to the point that facilities to meet the demand are strained. Construction of improved infrastructure to support increased transportation needs only increases the use of nonrenewable energy resources. LDCs have increased needs for energy, making it imperative for the MDCs to develop renewable energy sources.

The human population is expanding into all regions on the face of the planet, so habitats for other species are being lost, resulting in a significant extinction of wildlife.

Characteristics of a Sustainable Society

A natural ecosystem can offer clues about how to make today's society sustainable. A natural ecosystem makes use of only renewable solar energy. Its materials cycle through the various populations back to the producer once again. For example, coral reefs have been sustaining themselves for millions of years. At the same time, the reefs have provided sustenance to the LDCs. The value of coral reefs has been assessed at over \$300 billion a year. Their aesthetic value is immeasurable.

It is clear that if we want to develop a sustainable society, we need to use renewable energy sources and recycle materials. We should protect natural ecosystems that help sustain our modern society. At least a quarter of the coral reefs exist close to the shores of an MDC country, and the chances are good that these coral reefs will be protected. Unfortunately, other coral reefs are threatened by unsustainable practices. The good news is that reefs are remarkably regenerative and will return to their former condition if left alone for a long enough period of time. The message of today's environmentalists is about what can be done to improve matters and use sustainable practices (Fig. 24.19). There is still time to make changes and improvements.

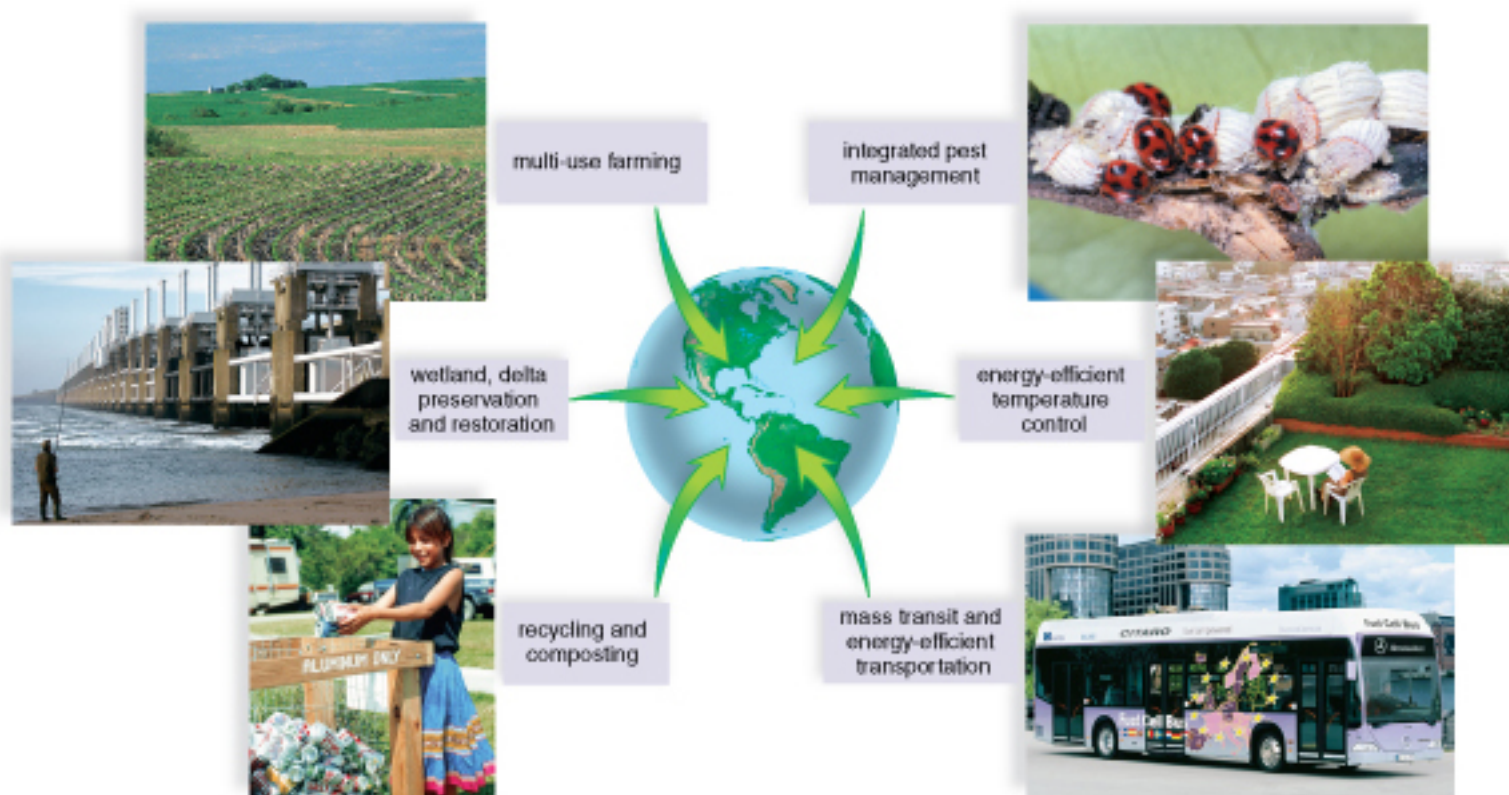


Figure 24.19
 Characteristics of a sustainable society.

Arrows point inward to signify that these types of activities increase the carrying capacity of the Earth.

Sustainability should be practiced in various areas of human endeavor, from agriculture to business enterprises. Efficiency is the key to sustainability. For example, an efficient car would be ultralight and fuel efficient. Efficient cars could be just as durable and speedy as the inefficient ones of today. Only through efficiency and conservation can we meet the challenges of limited resources and finances in the future.

People generally live in either the country or the city, but the two regions depend on one another. Achieving sustainability requires that we understand how the two regions are interconnected. It would be impossible to have one sustainable and not the other because the two regions are linked. What happens within one ultimately affects the other. Let's consider, therefore, the importance of both rural and urban sustainability.

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 Rural Sustainability

Rural Sustainability In rural areas, we must put the emphasis on preservation. We need to preserve both terrestrial ecosystems (such as forests and prairies) and aquatic ecosystems (freshwater and brackish ones along the coast). We should also preserve agricultural lands and other areas that provide us with renewable resources.

It is imperative that we take all possible steps to preserve what remains of our topsoil and replant areas with native plants. Native grasses stabilize the soil, rebuild soil nutrients, and can serve as a source of renewable biofuel. Native trees can be planted to break the wind, protect the soil from erosion, and provide consumable products. Creative solutions to today's ecological problems are very much needed.

Here are some other possible ways to help make rural areas sustainable:

- Plant *cover crops*, which often are a mixture of legumes and grasses, to stabilize the soil between rows of cash crops or between seasonal plantings of cash crops.
- Use *multiuse farming* by planting a variety of crops, and use a variety of farming techniques to increase the amount of organic matter in the soil.

- Replenish soil nutrients through composting, organic gardening, or other self-renewable methods.
- Use low-flow or trickle irrigation, retention ponds, and other water-conserving methods.
- Increase the planting of *cultivars* (plants propagated vegetatively), which are resistant to blight, rust, insect damage, salt, drought, and encroachment by noxious weeds.
- Use *precision farming (PF)* techniques that rely on accumulated knowledge to reduce habitat destruction and improve crop yields.
- Use *integrated pest management (IPM)*, which encourages the growth of competitive beneficial insects and uses biological controls to reduce the abundance of pest populations.
- Plant a variety of species, including native plants, to re-duce dependence on traditional crops.
- Plant *multipurpose trees*—trees with the ability to provide numerous products and perform a variety of functions, in addition to serving as windbreakers (Fig. 24.20). Remember that mature trees can provide many different types of products. For example, mature rubber trees provide us with rubber, and tagua nuts are an excellent substitute for ivory.
- Maintain and restore wetlands, especially in hurricane- or tsunami-prone areas. Protect deltas from storm damage. By protecting wetlands, we protect the spawning ground for many valuable fish nurseries.
- Use renewable forms of energy, such as wind and biofuel.
- Support local farmers to reduce the environmental impact that occurs when goods are transported long distances.



Figure 24.20
The roles of trees in a sustainable society.

Trees planted by a farmer to break the wind and prevent soil erosion can also have other purposes, such as supplying nuts and fruits.

Urban Sustainability

Urban Sustainability More and more people are moving to urban environments. Much thought needs to be given about how to serve the needs of new arrivals without overexpansion of the city. Resources need to be shared in a way that will allow urban sustainability.

Here are some other possible ways to help make a city sustainable:

- Design an energy-efficient transportation system to rapidly move people about.
- Use solar or geothermal energy to heat buildings. Cool them with an air-conditioning system that uses seawater. In general, use conservation methods to regulate the temperature of buildings.
- Use *green roofs*. Grow a garden of grasses, herbs, and vegetables on the tops of buildings. This will assist temperature control, supply food, reduce the amount of rainwater runoff, and be visually appealing (Fig. 24.21).
- Improve storm-water management by using sediment traps for storm drains, artificial wetlands, and holding ponds. Increase use of porous surfaces for walking paths, parking lots, and roads. These surfaces reflect less heat and soak up rainwater runoff.
- Instead of traditional grasses, plant native species that attract bees and butterflies. These require less water and fewer fertilizers.
- Create *greenbelts* that suit the particular urban setting. Include plentiful walking and bicycle paths.
- Revitalize old sections of a city before developing new sections.
- Use lighting fixtures that hug the walls or ground and send light down. Control noise levels by designing quiet motors.

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- Promote sustainability by encouraging recycling of business equipment. Use low-maintenance building materials rather than wood.



Figure 24.21
A green roof.

A green roof has plants growing on it that help control temperature, supply food, and reduce water runoff.

Assessing Economic Well-Being and Quality of Life

The gross national product (GNP) is a measure of the flow of money from consumers to businesses in the form of goods and services purchased. It can also be considered the total costs of all manufacturing, production, and services. Costs include salaries and wages, mortgage and rent, interest and loans, taxes, and profit within and outside the country. In other words, GNP pertains solely to economic activities.

When calculating GNP, economists do not necessarily consider whether an activity is environmentally or socially harmful. For example, destruction of forests due to clear-cutting, strip mining, or land development is not a part of the GNP. In the same way, the cost of medical services does not include the pain or suffering caused by illness, for example.

Measures that include noneconomic indicators are most likely better at revealing our quality of life than is the GNP. The index of sustainable economic welfare (ISEW) includes real per capita income, distributional equity, natural resources depletion, environmental damage, and the value of unpaid labor. The ISEW *does* take into account other forms of value, beyond the purely monetary value of goods and services. Another such index is called the genuine progress indicator (GPI). This indicator attempts to consider the quality of life, an attribute that does not necessarily depend on worldly goods. For example, the quality of life might depend on how much respect we give other humans. The Grameen Bank in Bangladesh decided that if women were loaned small amounts of money, they would pay it back after starting up small businesses. The loans give women the opportunity to make choices that can improve the quality of their lives. For these women, a loan is a way to sustain their lives while, in part, fulfilling their dreams. It is difficult to assign a value to well-being or happiness. However, economists are trying to devise a way to measure these values. The following criteria, among others, can be used.

- *Use value*: actual price we pay to use or consume a resource, such as the entrance fees into national

parks.

- *Option value*: preserving options for the future, such as saving a wetland or a forest.
- *Existence value*: saving things we might not realize exist yet. This might be flora and fauna in a tropical rain forest that, one day, could be the source of new drugs.
- *Aesthetic value*: appreciating an area or creature for its beauty and/or contribution to biodiversity.
- *Cultural value*: factors such as language, mythology, and history that are important for cultural identity.
- *Scientific and educational value*: valuing the knowledge of naturalists, or even an experience of nature, as a type of rational fact.

Development of the environment will always continue. Still, we can use these values to help us direct future development. Growth creates increases in demand, but development includes the direction of growth. If we permit unbridled growth, resources will become depleted. However, if development restrains resource consumption and still promotes economic growth, perhaps a balance can be reached. We can then preserve resources for future generations.

Each person has a particular comfort level, and humans do not like to make sacrifices that reduce their particular comfort level. So, despite our knowledge of the need to protect fisheries and forests, we continue to exploit them. People from LDCs directly depend on these resources to survive and so have much to lose. Even so, it is difficult for them to sacrifice today for the sake of the future. Yet, there is still hope because nature is incredibly resilient. One solution to deforestation is reforestation. Costa Rica has been successfully reforesting since the early 1980s. Also, declining fisheries can be restocked and then managed for sustainability. It will take an informed citizenry, creativity, and a willingness to bring about change for the better to move toward sustainability.

APPLICATIONS AND MISCONCEPTIONS

What are some simple things you can do to conserve energy and/or water and help solve environmental problems like global warming?

A few things you could easily do include the following:

- Change the lightbulbs in your home to compact fluorescent bulbs. They use 75–80% less electricity than incandescent bulbs.
- Walk, ride your bike, carpool, or use mass transit. It will save you a lot of money, too!
- Get cloth or mesh bags for groceries and other purchases. Plastic bags may take 10–20 years to degrade. They're also dangerous to wildlife if mistaken for food and consumed.
- Turn off the water while you brush your teeth. If you don't finish a bottle of water, use it to water your plants. In dry climates, plant native plants that won't require frequent watering.

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CHECK YOUR PROGRESS 24.4

- 1** **1** Describe the characteristics of today's society that make it unsustainable.

Answer

2 2 Discuss what changes are needed to convert today's society into one that is sustainable.

Answer

3 3 Summarize how scientists assess economic well-being and quality of life.

Answer

CONNECTING THE CONCEPTS

For more information on the material presented in this section, refer to the following discussions:

Section 23.2 describes how the 10% rule relates to energy flow in an ecosystem.

Section 23.3 examines human influence on the major biogeochemical cycles.

CASE STUDY CONCLUSION

Gills Onions processes over 1 million lb of onions every day, producing approximately 300,000 lb of waste. Previously the waste was composted and hauled to local farm fields and spread as fertilizer. This technique resulted in a variety of environmental concerns as well as a significant amount of financial loss. To help resolve the problem, Gills Onions developed an Advanced Energy Recovery System that would turn the onion waste into a methane-rich biogas that powers two fuel cells. The fuel cells in turn supply energy to the processing plant, saving an estimated \$700,000 in electricity costs per year. The remaining onion waste is then sold as livestock feed, eliminating the \$400,000 in expenses associated with the waste disposal. Gills Onions has become the first food-processing facility in the world to produce ultra-clean energy from their own waste. They have also reduced their carbon footprint by an estimated 14,500 metric tons of CO₂ emissions per year.