

Sustainability is the capacity of the earth's natural systems and human cultural systems to survive, flourish, and adapt to changing environmental conditions into the very long-term future.

What Are Some Principles of Sustainability?

CONCEPT 1-1A

Nature has been sustained for billions of years by relying on solar energy, biodiversity, and chemical cycling.

CONCEPT 1-1B

Our lives and economies depend on energy from the sun and on natural resources and ecosystem services (*natural capital*) provided by the earth.

CONCEPT 1-1C

We could shift toward living more sustainably by applying full-cost pricing, searching for win-win solutions, and committing to preserving the earth's life support system for future generations.

Three Scientific Principles of Sustainability.

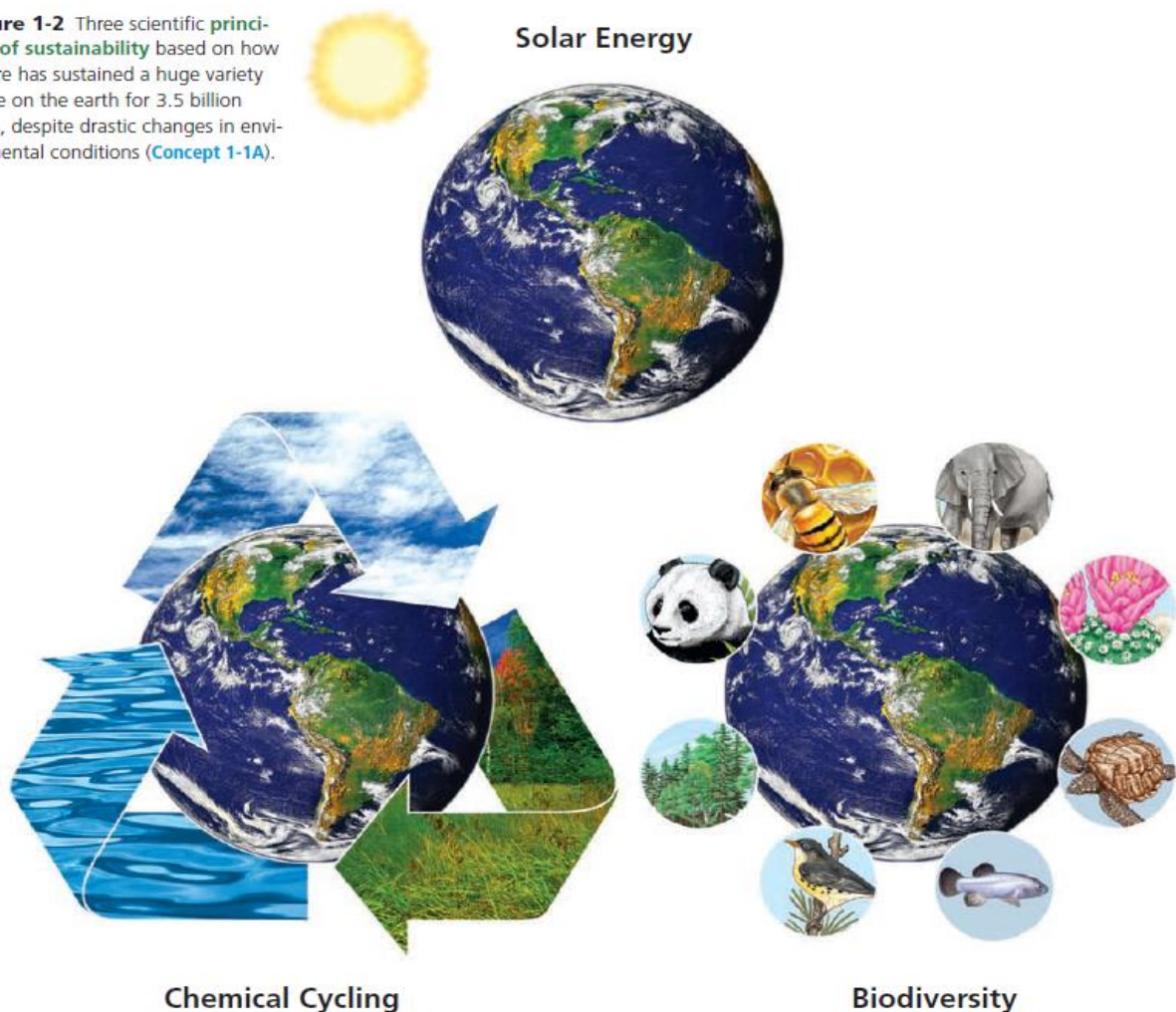
Many scientists contend that the earth is the only real example of a sustainable system. Our science-based research leads us to believe that three major natural factors have played the key roles in the long-term sustainability of life on this planet, as summarized below and show in Figure 1-2 (**Concept 1-1A**).

- 1- Dependence on solar energy:** The sun warms the planet and provides energy that plants use to produce **nutrients**, or the chemicals necessary for their own life processes along with those of most other animals, including humans. The sun also powers indirect forms of **solar energy** such as wind and flowing water, which we use to produce electricity.

2- **Biodiversity** (short for *biological diversity*): **Biodiversity** is the variety of genes, organisms, species, and ecosystems in which organisms exist and interact. The interactions among species, especially the feeding relationships, provide vital ecosystem services and keep any population from growing too large. Biodiversity also provides countless ways for life to adapt to changing environmental conditions, even catastrophic changes that wipe out large numbers of species.

3- **Chemical cycling: Chemical cycling, or nutrient cycling** : is the circulation of chemicals necessary for life from the environment (mostly from soil and water) through organisms and back to the environment. Because the earth receives no new supplies of these chemicals, organisms must recycle them continuously in order to survive. This means that there is little waste in nature, other than in the human world, because the wastes of any organism become nutrients or raw

Figure 1-2 Three scientific **principles of sustainability** based on how nature has sustained a huge variety of life on the earth for 3.5 billion years, despite drastic changes in environmental conditions (**Concept 1-1A**).



Sustainability Has Certain Key Components :

Sustainability, has several critical components that we use as subthemes. One such component is **natural capital**: the natural resources and natural services that keep us and other species alive and support human economies (Figure 1-3).

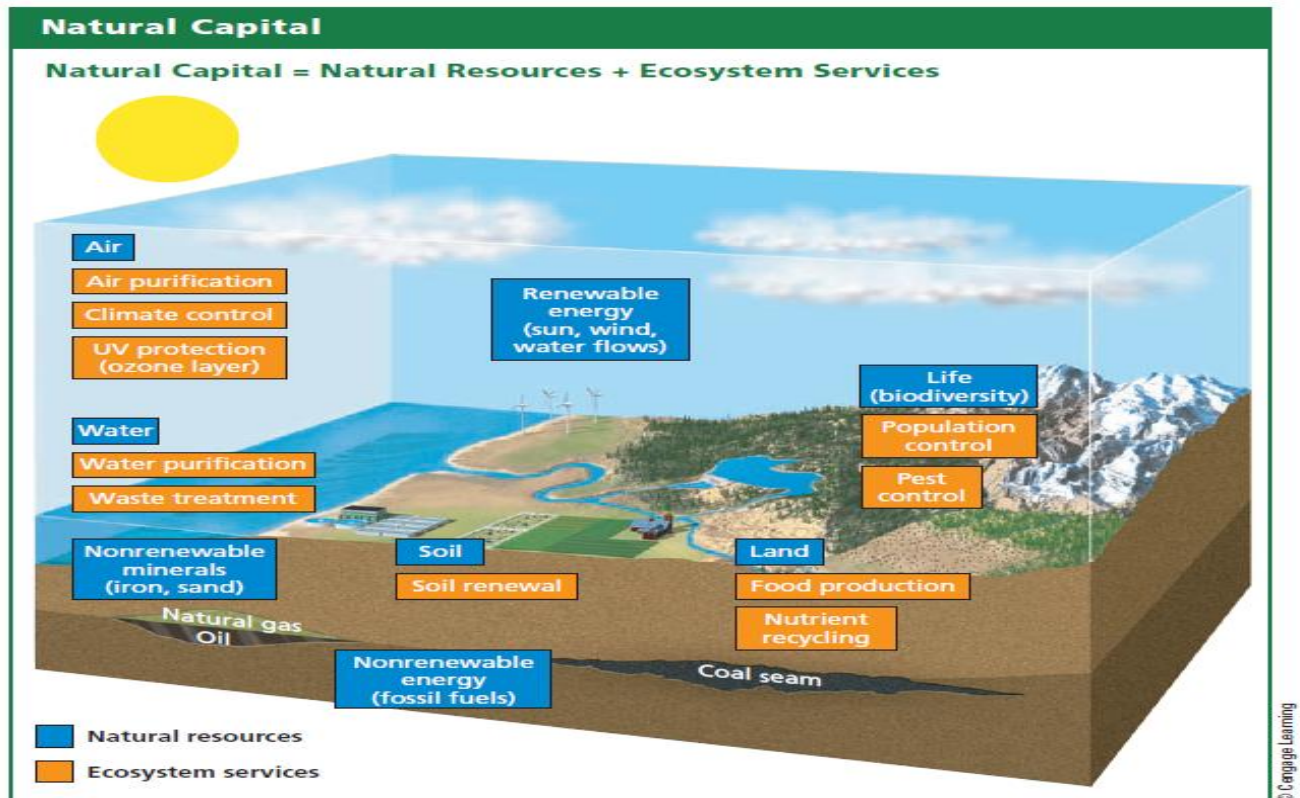


Figure 1-3 Natural capital consists of natural resources (blue) and natural or ecosystem services (orange) that support and sustain the earth's life and human economies (**Concept 1-1A**).

Natural resources: are materials and energy in nature that are essential or useful to humans. They are often classified as *inexhaustible resources* (such as energy from the sun and wind), *renewable resources* (such as air, water, topsoil, plants, and animals), or *nonrenewable* or *depletable resources* (such as copper, oil, and coal).

Natural services, or ecosystem services, are processes provided by healthy ecosystems.. Examples include:

- ✓ purification of air and water.
- ✓ renewal of topsoil.
- ✓ and pollination.

which support life and human economies at no monetary cost to us. For example, forests help to purify air and water, regulate climate, reduce soil erosion, and provide countless species with a place to live. One vital natural service is chemical, or nutrient, cycling—one of the three scientific **principles of sustainability**. An important component of nutrient cycling is *topsoil*—a vital natural resource that provides us and most other land-dwelling species with food. Without nutrient cycling in topsoil, life as we know it could not exist on the earth's land. Natural capital is also supported by energy from the sun—another of the scientific **principles of sustainability** (Figure 1-2). Thus, our lives and economies depend on energy from the sun, and on natural resources and natural services (natural capital) provided by the earth (Concept 1-1B).

A second component of sustainability—and another subtheme of this text—is to recognize that many human activities can *degrade natural capital* by using normally renewable resources such as trees and topsoil faster than nature can restore them and by overloading the earth's normally renewable air and water systems with pollution and wastes. For example, in some parts of the world, we are replacing diverse and naturally sustainable forests (Figure 1-4) with crop plantations that can be sustained only with large inputs of water, fertilizer, and pesticides. We are also adding harmful chemicals and wastes to some rivers, lakes, and oceans faster than these bodies of water can cleanse themselves through natural processes. This leads us to a **third component of sustainability: solutions**. While environmental scientists search for scientific solutions to problems such as the unsustainable degradation of forests and other forms of natural capital, social scientists are looking for economic and political solutions. **For example:**

- 1- **A scientific solution to the problems of depletion of forests is to stop burning or cutting down biologically diverse, mature forests.**
- 2- **A scientific solution to the problem of pollution of rivers is to prevent the excessive dumping of harmful chemicals and wastes into streams and to allow them to recover naturally.**

However, to implement such solutions, governments might have to enact and enforce environmental laws and regulations. History shows that almost all of the significant changes in human systems have come from the bottom up, through the collective actions of individuals and from individuals inventing more sustainable ways of doing things. Thus, *sustainability begins with actions at personal and local levels.*

Other Principles of Sustainability Come from the Social Sciences:

Our search for solutions to environmental problems has led us to propose three **social science principles of sustainability**, derived from studies of economics, political science, and ethics. We believe that these, along with our three *scientific principles of sustainability* (Figure 1-2), can serve as general guidelines for living more sustainably.

The social science principles of sustainability are:

- **Full-cost pricing (from economics):** Many economists urge us to find ways to include the harmful environmental and health costs of producing and using goods and services in their market prices—a practice called **full-cost pricing**. This would give consumers better information about the environmental impacts of their lifestyles.

- **Win-win solutions (from political science):**

We can learn to work together in dealing with environmental problems by focusing on solutions that will benefit the largest possible number of people, as well as the environment. This means shifting from an *I win, you lose* approach to a *we both win* approach (*win-win* solutions), and to an *I win, you win, and the earth wins* approach (*win-win-win* solutions).

- **A responsibility to future generations (from ethics):** We should accept our responsibility to leave the planet's life-support systems in at least as good a shape as what we now enjoy, for future generations.

Why Do We Have Environmental Problems?

CONCEPT 1-3A

Major causes of environmental problems are population growth, unsustainable resource use, poverty, avoidance of full-cost pricing, and increasing isolation from nature.

CONCEPT 1-3B

Our environmental worldviews play a key role in determining whether we live unsustainably or more sustainably.

Experts Have Identified Several Causes of Environmental Problems :

According to a number of environmental and social scientists, the major causes of the environmental problems we face are :

- (1) population growth,
- (2) wasteful and unsustainable resource use,
- (3) poverty,
- (4) failure to include the harmful environmental costs of goods and services in their market prices, and
- (5) increasing isolation from nature (Figure 1-15) ([Concept 1-3A](#)).

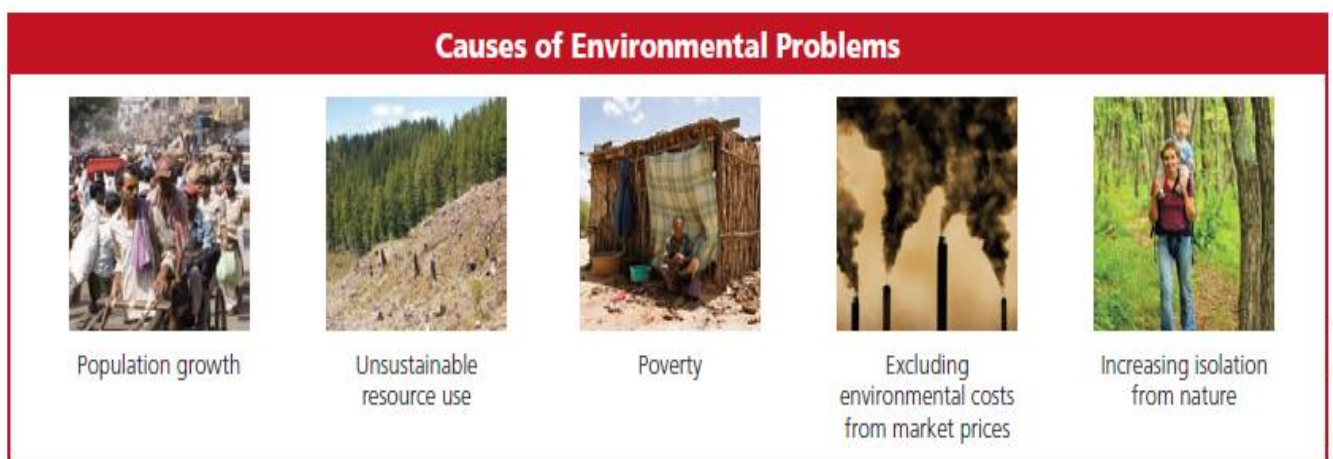


Figure 1-15 Environmental and social scientists have identified five basic causes of the environmental problems we face ([Concept 1-3A](#)). **Question:** For each of these causes, what are two environmental problems that result?