

6-4 Charting a Course for the Future

Researchers are gathering data to monitor and evaluate the effects of human activities on important systems in the biosphere. Two types of global change are:

- the ozone layer high in the atmosphere
- the global climate system

Ozone Depletion

Between 20 and 50 kilometers above Earth's surface, the atmosphere contains a relatively high concentration of ozone gas. This layer of the atmosphere is called the **ozone layer**.

The ozone layer absorbs a good deal of harmful ultraviolet, or UV, radiation from sunlight before it reaches Earth's surface.

Exposure to UV can:

- cause cancer
- damage eyes
- decrease organisms' resistance to disease
- damage plant leaf tissue and phytoplankton in the oceans

Early Evidence

In the 1970s, scientists discovered a hole in the ozone layer over Antarctica. After it was first discovered, the ozone hole grew larger. A similar ozone hole also appeared over the Arctic. In 1974, a research team published data showing that gases called chlorofluorocarbons, or CFCs, could damage the ozone layer.

One Solution

CFCs were once widely used:

- as propellants in aerosol cans
- as coolant in refrigerators, freezers, and air conditioners
- in the production of plastic foams

The U.S. and other nations began reducing the use of CFCs in 1987, and eventually banned them. Since the ban, the level of CFCs in the atmosphere has decreased, indicating that the ban will have positive, long-term effects on the global environment. Current data predict that the ozone holes should shrink and disappear within 50 years.

Global Climate Change

All life on Earth depends on climate conditions such as temperature and rainfall.

Many ecologists are concerned about strong evidence that climate is changing.

Since the late 19th century, average temperatures have risen about 0.6 Celsius degrees.

Data indicate that since 1980, average temperatures have risen between 0.2 and 0.3 Celsius degrees.

The term used to describe the increase in the average temperature of the biosphere is **global warming**.

One sign of global warming is melting polar ice.



This map of the Arctic is based on images taken by satellites in 1979 and 1999. Sea ice in the Arctic Ocean has receded so quickly that some scientists suggest that, within the next 50 years, the ice could disappear completely.

Evidence of Global Warming

The geological record shows that Earth's climate has changed repeatedly during its history.

Researchers must determine whether the current warming trend is part of a larger, natural cycle of climate change, or whether it is caused by human activity.

A widely accepted hypothesis is that current warming is related, in part, to human activities that add carbon dioxide and other greenhouse gases to the atmosphere. The burning of fossil fuels, along with the cutting and burning of forests, adds carbon dioxide to the atmosphere faster than the carbon cycle removes it. Data show that concentrations of carbon dioxide in the atmosphere have been rising for 200 years. As a result, the atmosphere's natural greenhouse effect is intensified, causing the atmosphere to retain more heat.












Possible Effects of Global Warming

Most recent computer models suggest that average global surface temperatures will increase by 1 to 2 Celsius degrees by the year 2050. Sea levels may rise enough to flood coastal areas, affecting coastal ecosystems as well as human communities. Parts of North America may experience more droughts during the summer growing season. New organisms may be able to live in places where they once could not. Other organisms may become threatened or extinct in areas where they once thrived.

The Value of a Healthy Biosphere

Ecosystems provide many goods and services, such as water purification and waste recycling.

Ecosystems are also a reservoir of organisms that may one day provide humans with new medicines and new crops. Human society depends on healthy, diverse, and productive ecosystems because of the environmental and economic benefits they provide.

Ecosystem Services		Ecosystem Services	
Solar Energy		Food production	
Production of oxygen		Nursery habitats for wildlife	
Storage and recycling of nutrients		Detoxification of human and industrial waste	
Regulation of climate		Natural pest and disease control	
Purification of water and air		Management of soil erosion and runoff	
Storage and distribution of fresh water			

People can make wise choices in the use and conservation of resources.

- Avoid using more water than necessary.
- Plant trees to replace those that have been cut down.
- Recycle and reuse trash and other wastes.
- Safely remove hazardous materials.