EPA
United States
Environmental Protection
Agency

EPA's Report on the Environment

Highlights of National Trends

2008

We are pleased to present *EPA’s 2008 Report on the Environment: Highlights of National Trends (ROE Highlights)*, which provides an important resource for the general public for better understanding trends in our nation’s health and environment. This document presents some of the key findings from the more comprehensive technical report, *EPA’s 2008 Report on the Environment (ROE)* in an easy to understand format.

These reports are the culmination of an effort begun over five years ago to establish a set of scientifically sound measures, or indicators, that help answer questions of vital importance to EPA’s mission. Using these indicators, the reports present what we know—and don’t know—about the condition of air, water, land, human health, and ecological condition in the United States. The reports show both positive and negative trends.

We have made numerous improvements to the indicators as well as to the indicator selection and reporting process. This included the extraordinary step of having the *ROE Highlights* reviewed in a public forum to determine if citizens—in addition to scientists—found the proposed indicators useful. Through this open and transparent process, we have also created opportunities to establish and strengthen our partnerships among federal, state, and non-governmental organizations for data sharing and data needs planning to support indicator development and improvement.

These documents are not report cards on EPA’s programs, nor do they interpret the data or draw conclusions about the information presented. Instead, the reports present the best available, scientifically sound information on national-level environmental and health trends that are of interest to EPA and the public and that may help to inform EPA’s strategic planning.

We invite you to visit www.epa.gov/roe. There you will find the underlying data, metadata, references and peer review documentation for the ROE indicators as well as the full versions of the two reports. This website will be updated periodically so the information remains current and relevant.

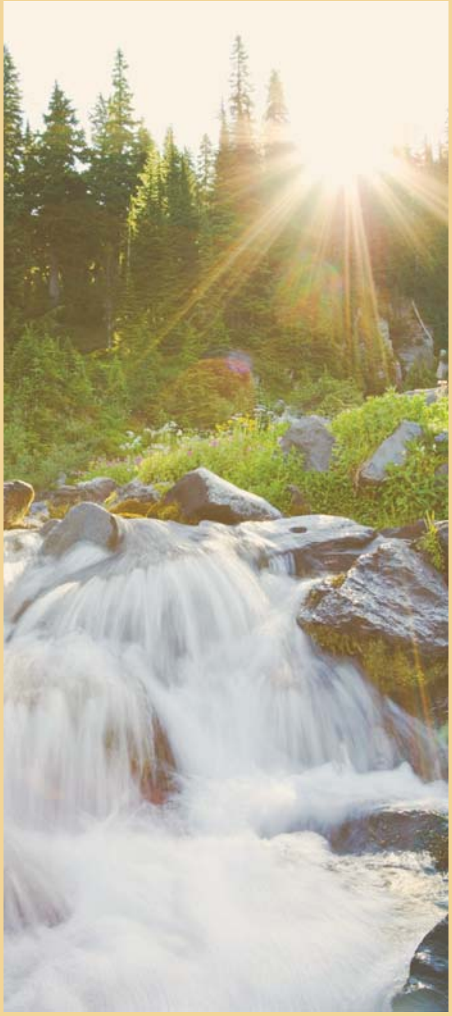
We welcome and encourage your involvement in this ongoing effort. You can provide feedback to us at www.epa.gov/roe.

Molly O’Neill
Assistant Administrator for Environmental Information and Chief Information Officer

George M. Gray, Ph.D.
Assistant Administrator for Research and Development

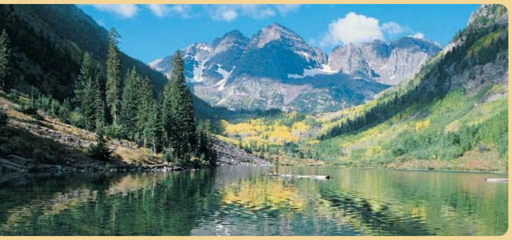
EPA's 2008 Report on the Environment: Highlights of National Trends

The U.S. Environmental Protection Agency (EPA) developed **EPA's 2008 Report on the Environment** *to help answer questions that are of critical importance to the Agency's mission to protect human health and the environment. The* **Report on the Environment** *documents trends in the condition of the nation's environment and human health and identifies significant gaps in our knowledge. It is not intended to be a report card on EPA's programs and activities.*



Contents

About This Document

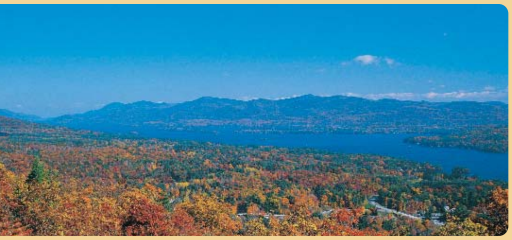


Written for a general audience, this document, *EPA's 2008 Report on the Environment: Highlights of National Trends*, summarizes some important findings from a more comprehensive companion report, *EPA's 2008 Report on the Environment*. An electronic version of the report, available at www.epa.gov/roe, facilitates navigation and searching across both documents.

Highlights of National Trends is organized around five chapters. Three of the chapters (Air, Water, and Land) focus on trends in these environmental media. The other two chapters address trends in human health and ecological condition more broadly.

The chapters are divided into 25 topic pages. Each page summarizes what we know—and don't know—about conditions and trends for the topic. The information on these topics comes from highly reliable indicators (see box below) and is based on the most recent data available from a variety of governmental and non-governmental organizations.

Highlights of National Trends features a subset of indicators from the more comprehensive *Report on the Environment*. The indicators were selected for inclusion based on their importance to the public and to scientists, as well as their ability to answer a series of key questions about the environment. These key questions and 85 associated indicators form the framework of the *Report on the Environment* and are listed at the end of this document.



In addition, only a few of the most important data gaps and limitations from the *Report on the Environment* are included in *Highlights of National Trends*. Readers are encouraged to consult the more comprehensive report for more information. You can also read about some actions that individuals can take to protect the environment and their own health in the electronic version of *Highlights of National Trends* at www.epa.gov/roe.

Environmental Indicators

The indicators used in the *Report on the Environment*:

- Rely on actual measurements of environmental and human health conditions over time.
- Meet a set of standards, which include quality, accuracy, relevance, and comparability.
- Were reviewed by an independent scientific panel to ensure that they meet these standards.
- Are national (or in some cases regional) in coverage. They do not describe trends or conditions for a specific locale.
- Come from many governmental and non-governmental organizations, which collect data at different time periods and for varying purposes.
- Can only partially answer the key questions.

About the Data in the *Report on the Environment*

The indicators in the *Report on the Environment* are based on actual measurements of the environment over time and do not describe activities to protect the environment.

The length of time and geographic area over which consistent data have been gathered varies from one indicator to another. Some indicators cover many years, while others address only one point in time (a baseline for measuring trends in the future). Most indicators in this report present data at the national level, but some regional indicators have been used to illustrate important scenarios and could be applied to the nation in the future.

All of the indicators were reviewed by an independent panel and meet strict definitions and criteria, including scientific quality and national (or in some cases regional) coverage. Other sources of information are not included in this report because they do not meet one or more of the criteria. While no data sources are cited in *Highlights of National Trends*, sources for all data are available in the larger *Report on the Environment* document.

Each topic page in *Highlights of National Trends* acknowledges some of the most important limitations of the indicators presented, or where gaps exist. Data limitations are noted to provide the reader with information about the quality or extent of the data presented that may affect the way in which they are used. Data gaps are noted to identify areas or aspects of the environment in which little or no measurement has been conducted. This report does not propose actions to reduce data limitations or fill gaps.

Updates to the *Report on the Environment*

EPA's 2008 Report on the Environment brings together the most consistent and reliable information on national environmental conditions and trends currently available under a single cover. It builds on *EPA's Draft Report on the Environment 2003*, which was the Agency's first effort to assemble scientifically sound indicators on the status and trends of the nation's environment.

Since the release of the 2003 report, EPA has revised, updated, and refined the information in the *Report on the Environment* in response to scientific developments as well as stakeholder feedback. EPA will publish periodic updates of the *Report on the Environment* and use it to inform the Agency's strategic planning process.

EPA's 2008 Report on the Environment

Highlights of National Trends is one of three products that collectively make up *EPA's 2008 Report on the Environment*. The other two products are:

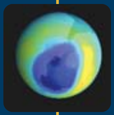
- ***EPA's 2008 Report on the Environment***, the source of the information presented in this document. The *Report on the Environment* is organized around key questions about the environment and presents 85 indicators to help answer those questions.
- ***A Web-based tool for navigating and searching*** *EPA's 2008 Report on the Environment* and *EPA's 2008 Report on the Environment: Highlights of National Trends*, available at www.epa.gov/roe.

1

Air

Outdoor Air 

Acid Rain and Regional Haze 

Ozone Depletion 

Greenhouse Gases 

Indoor Air 

Close to the Earth's surface, air provides the oxygen and carbon dioxide needed to sustain human, animal, and plant life. Higher up, a natural layer of ozone shields life on Earth from the sun's harmful rays, and at all levels of the atmosphere, naturally occurring greenhouse gases help maintain a climate suitable for life. Indoors and outdoors, from ground level to high above the planet's surface, the condition of the air is critical to human health and the environment.

Tracking the nation's air quality is challenging because of the many sources, types, and effects of air pollution. Most outdoor air pollutants can be directly traced back to emissions sources that release the pollutants into the air. However, some air pollutants, such as ozone, are formed in the air when an emission reacts with another airborne substance.

Once airborne, pollutants can be transported long distances by wind or transformed into other compounds. They also can fall back to Earth, contaminating water and land. Both the amount of pollutants emitted into the air and how these pollutants move through the atmosphere determine air pollution levels, which are measured as concentrations.

Many indicators are needed to characterize outdoor air quality separate from indoor air quality, to characterize air quality trends at ground level as well as higher in the atmosphere, and to characterize both emissions and concentrations. Also, air quality varies considerably with location and time, which makes it challenging to obtain a representative national picture.

Outdoor Air

Outdoor air pollutants come from human activities such as electricity production, industrial processes, and transportation, and from natural sources like wildfires and wind-blown dust. Some of these pollutants can harm human health, the environment, and other valued resources.

Beginning in the 1970s, EPA developed standards to protect human health and the environment from six common air pollutants that pose serious health and environmental effects: carbon monoxide, lead, nitrogen dioxide, ozone, airborne liquid and solid particles (known as particulate matter), and sulfur dioxide. These pollutants are often referred to as criteria pollutants.

Subsequently, EPA identified an additional 188 pollutants of concern, called air toxics, that are known or suspected to cause cancer, other serious health problems, and adverse environmental effects. Examples include benzene, which is found in gasoline; metals such as mercury and cadmium; dioxin; and asbestos.

There are several ways to measure outdoor air pollution trends. Emissions can be measured or estimated at their source, and concentrations of pollutants in the air can be monitored at numerous outdoor locations around the country.

Key Points

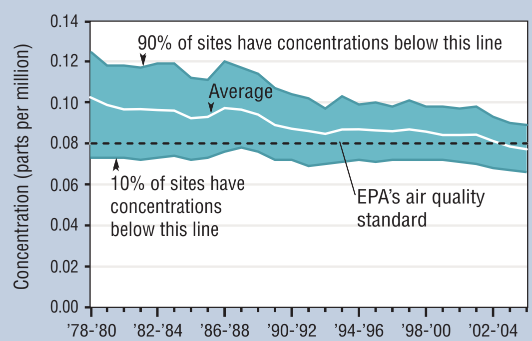
Nationwide, emissions of criteria pollutants (or the pollutants that form them) due to human activities have decreased. Between 1990 and 2002, emissions of carbon monoxide, volatile organic compounds (which lead to the formation of ozone), particulate matter, sulfur dioxide, and nitrogen oxides (which lead to the formation of ozone and particulate matter) decreased by differing amounts, ranging from 17 to 44 percent. For lead, emissions have decreased by 99 percent, but this reduction is based on data that span a longer time frame (1970 to 2002).

Outdoor air concentrations of carbon monoxide, lead, nitrogen dioxide, ozone, and particulate matter have decreased over the decades during which the current nationwide monitoring network has operated. These reductions are consistent with the observed decreases in emissions mentioned above. In most or all of the United States, outdoor air concentrations of carbon monoxide, lead, and nitrogen dioxide have decreased such that levels now meet EPA's standards to protect human health and the environment. Though outdoor air concentrations of ozone (see graphic) and particulate matter have decreased nationwide, concentrations still exceed EPA's standards for either or both pollutants in dozens of metropolitan areas.

For selected air toxics, emissions due to human activities and outdoor air concentrations have decreased. Nationwide, emissions summed across all 188 air toxics decreased between 1990 and 2002. This includes a 52-percent reduction in mercury emissions. Monitoring networks are extensive enough to determine corresponding national trends in outdoor air concentrations of benzene, which decreased 55 percent between 1994 and 2006.

National indicators are not available for other aspects of outdoor air quality. While indicators provide insights on emissions and outdoor air concentration trends for many pollutants, monitoring networks are not yet extensive enough to determine national trends in concentrations for all pollutants, including many air toxics. Further, the indicators are limited in quantifying how exposures to single pollutants and mixtures of air pollutants affect human health and the environment. Although strong evidence links outdoor air pollution to health effects at specific locations, few long-term studies at a national scale have measured the extent to which health effects are linked directly to outdoor air quality.

Ozone Concentrations in Outdoor Air, 1978-2006



Concentrations were measured at 201 trend sites nationwide and are expressed in terms of EPA's air quality standard.

The figure displays the 1997 National Ambient Air Quality Standard (0.08 ppm). Future versions of the *Report on the Environment* will compare ozone concentrations to the recently promulgated 2008 NAAQS (0.075 ppm) or to the NAAQS in effect at the time.

Source: *U.S. Environmental Protection Agency, 2007*

Acid Rain and Regional Haze

Each year in the United States, millions of tons of sulfur dioxide and nitrogen oxides are released into the air from the burning of fossil fuels. These pollutants react with other airborne substances to form acidic compounds (sulfates and nitrates). Acid deposition occurs when these compounds fall to the Earth in one of two forms: wet (dissolved in rain, snow, and fog) or dry (as gases or particles). Wet deposition is more commonly referred to as acid rain.

Acid deposition is of concern because it can make soils, lakes, and streams more acidic, which can harm fish, amphibians, water birds, and other species in affected areas. It can also damage trees, buildings, monuments, painted surfaces, and other materials. Acid rain can be tracked in several ways: by evaluating emissions of sulfur dioxide and nitrogen oxides (the pollutants that form sulfates and nitrates), by monitoring acid rain directly, and by measuring the acidity of water bodies.

The pollutants that form acid rain also form airborne particulate matter, which contributes to regional haze. Regional haze, tracked by visibility measurements, is caused when sunlight encounters tiny airborne particles that limit the distance one can see. Regional haze also degrades the color, clarity, and contrast of vistas, including those found in many National Parks and Wilderness Areas. Certain substances impair visibility more during humid conditions.

Key Points

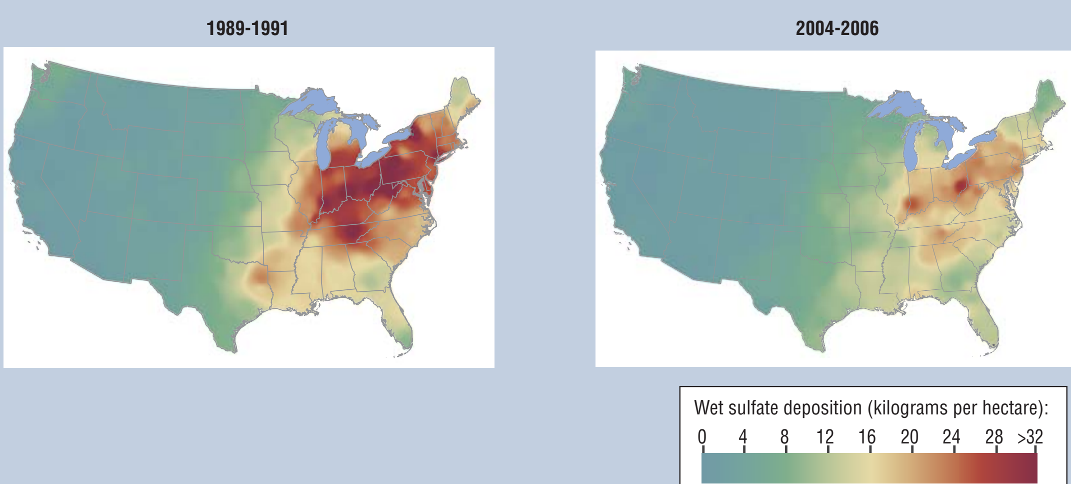
Nationwide, emissions of the main pollutants that form acid rain decreased between 1990 and 2002. Emissions of sulfur dioxide due to human activities decreased by 37 percent, and emissions of nitrogen oxides due to human activities declined by 17 percent.

Acid rain, as measured by wet deposition of sulfates and nitrates, decreased across most of the country from 1989 to 2006. Consistent with emissions data, average regional decreases in wet deposition of sulfate during this time were 35 percent in the Northeast, 33 percent in the Midwest, 28 percent in the Mid-Atlantic, and 20 percent in the Southeast (see graphic). Wet deposition of nitrate also decreased in some parts of the country, but to a lesser extent than wet deposition of sulfate.

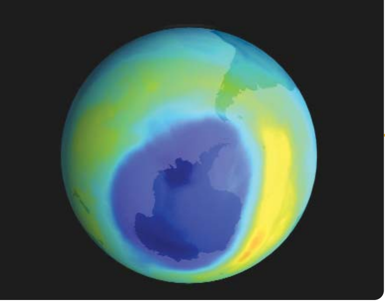
Many surface waters in the Adirondack Mountains, New England, and the northern Appalachian regions became less acidic between the early 1990s and 2005. This change corresponds to a decrease in acid rain in these regions. While acidic surface waters are still found in these areas, some surface waters are showing signs of recovery. National indicators are not available to track trends in other ways that acid rain has harmed the environment or human health.

Regional haze in 38 National Parks and Wilderness Areas improved between 1992 and 2004, with the average annual visual range (or distance that one can see) gradually increasing. On average, the West has substantially better visibility than the East due to regional differences in air pollution and the greater humidity in the East. National indicators have not been developed to track visibility in cities or other populated areas.

Wet Sulfate Deposition, 1989-1991 Versus 2004-2006



Source: *National Atmospheric Deposition Program, 2007*



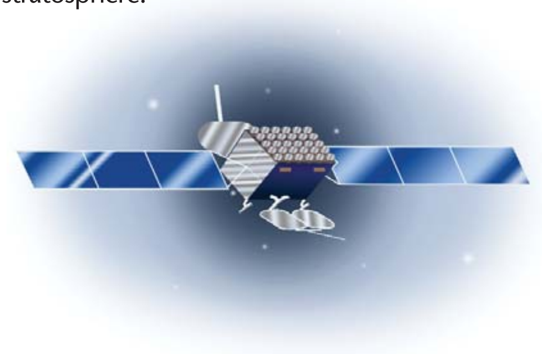
Ozone Depletion

Ozone is a gas present throughout the Earth's atmosphere. Most ozone is concentrated in a layer in the stratosphere—a portion of the atmosphere many miles above the planet's surface. The ozone layer protects people, animals, plants, and other living things by absorbing most of the sun's harmful ultraviolet radiation, which can lead to more cases of certain types of skin cancer and cataracts and can harm crops and ecosystems. In contrast, ozone in the troposphere (the portion of the atmosphere from ground level to the stratosphere) is a pollutant that poses a health risk.

Certain ozone-depleting substances, which are man-made and emitted at ground level by sources worldwide, have been damaging the ozone layer for many years. Once these chemicals rise from the troposphere into the stratosphere, they directly lead to ozone depletion: a thinning of the ozone layer over some areas of the world.

Ozone-depleting substances include chlorofluorocarbons (CFCs), which were once extensively used as propellants in spray cans and as refrigerants and solvents. Many countries, including the United States, are phasing out the production and use of CFCs and other ozone-depleting substances. Because many of these substances persist in air for a very long time, however, the ozone layer will take years to recover, even after these chemicals are no longer released.

Ground-based measurement networks and instruments on board aircraft, balloons, and satellites are used to monitor both the thickness of the ozone layer and concentrations of ozone-depleting substances in the troposphere and in the stratosphere.

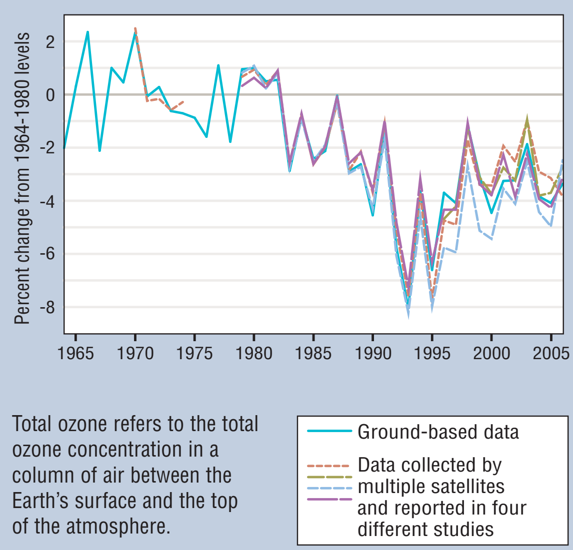


Key Points

Stratospheric ozone over North America decreased through the 1980s and early 1990s, but has started to recover. Before the late 1970s, there was little change, beyond natural variations, in the thickness of the ozone layer over North America. Since then, the thickness of the ozone layer decreased, reaching its lowest level in 1993 (see graphic), with no further decline occurring in more recent years. While the ozone layer has begun to recover, ozone levels over North America during 2002 to 2005 were still 3 percent lower, on average, than those observed 20 years earlier.

Tropospheric concentrations of total ozone-depleting substances have been slowly declining. Between 1995 and 2006, total ozone-depleting substances in the troposphere have declined 12 percent, and this decline has contributed to the recent recovery in stratospheric ozone levels. The trends for individual ozone-depleting substances vary. Tropospheric concentrations of many ozone-depleting substances have declined since the early 1990s, but concentrations of halons (fire extinguishing agents) and hydrochlorofluorocarbons (HCFCs), a class of chemicals being used to replace CFCs, increased.

Total Ozone Levels Over North America, 1964-2006



Total ozone refers to the total ozone concentration in a column of air between the Earth's surface and the top of the atmosphere.

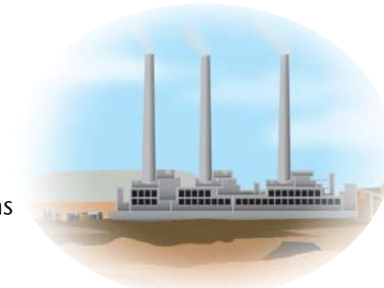
Source: *World Meteorological Organization, 2007*

Greenhouse Gases

Some gases in the atmosphere trap part of the Earth's outgoing energy, which causes the atmosphere to retain heat and affect climate. These gases are called greenhouse gases, and they include carbon dioxide, methane, nitrous oxide, and certain man-made chemicals. Some greenhouse gases occur naturally, while emissions due to human activities, such as electricity production and transportation, add to the natural concentrations in the atmosphere.

Greenhouse gases are important to track because increased concentrations due to human activity cause the atmosphere to retain heat which, in turn, is affecting various aspects of climate, such as temperature, evaporation, and precipitation. Natural phenomena, like volcanic activity and variations in the sun's output, and other human activities, such as land use changes, also affect climate. Human health, agriculture, water resources, forests, wildlife, and coastal areas all can be affected by climate change.

National trends in greenhouse gases are characterized by tracking emissions of these gases from human activities and concentrations of these gases in the air.



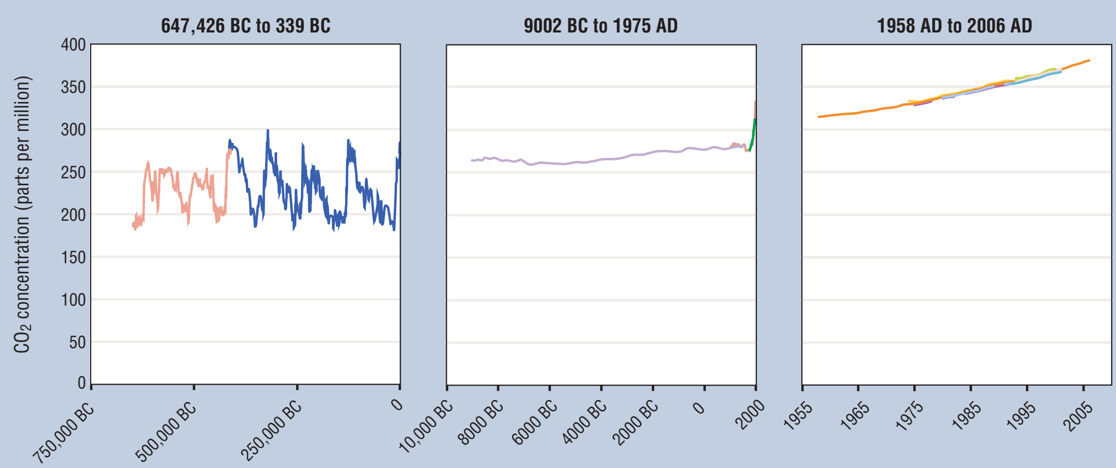
Key Points

Global atmospheric concentrations of several important greenhouse gases have risen substantially over the past 100 years. Measurements of gases trapped historically in Antarctic ice confirm that the current global atmospheric concentrations of carbon dioxide (see graphic) and methane are unprecedented over the past 650,000 years, even after accounting for natural fluctuations. Concentrations of nitrous oxide are 18 percent higher than pre-industrial levels; and concentrations of certain synthetic chemicals were essentially zero a few decades ago, but increased rapidly between 1980 and 2006.

Between 1990 and 2005, U.S. greenhouse gas emissions from human activities rose 16 percent; the primary source of these emissions was fossil fuel combustion. Carbon dioxide, widely reported as the most important greenhouse gas, makes up most of this increase. Energy use, primarily electricity generation and transportation, accounted for approximately 85 percent of the U.S. greenhouse gas emissions in 2005.

While trends in U.S. emissions and global atmospheric concentrations of greenhouse gases are based on robust data, gaps remain. For both emissions and concentrations, trends have been quantified for several of the most important greenhouse gases, but not for every greenhouse gas.

Global Atmospheric Concentrations of Carbon Dioxide (CO_2) Over Geological Time and in Recent Years



The concentration data shown are reported in multiple scientific publications. Complete citations for these peer-reviewed publications are provided in the *2008 Report on the Environment.*

Indoor Air

Many substances affect the quality of air inside homes, schools, workplaces, and other buildings. Some of these contaminants come from outdoor air and building materials; others are produced by indoor activities such as cooking, smoking, and using cleaning materials. Natural substances, such as mold, can also affect indoor air quality.

Indoor air quality is important because Americans, on average, spend most of their time indoors. In addition, the indoor concentrations of some pollutants can exceed levels typically found outdoors. Health effects associated with indoor air pollutants include irritation of the eyes, nose, and throat; headaches, dizziness, and fatigue; respiratory diseases; heart disease; and cancer.

National indicators are available for two harmful substances found in indoor air: radon and environmental tobacco smoke. Radon is a naturally occurring radioactive gas found underground. It can seep into buildings through cracks in floors and walls, and is a risk factor for lung cancer. For homes with radon levels above EPA's radon action level, EPA recommends that occupants take action to protect their health—for example, by installing a mitigation system to reduce radon levels.

Environmental tobacco smoke is associated with numerous health effects, including coughing, heart disease, and lung cancer. Children are at particular risk from exposure to environmental tobacco smoke because they are still developing physically.

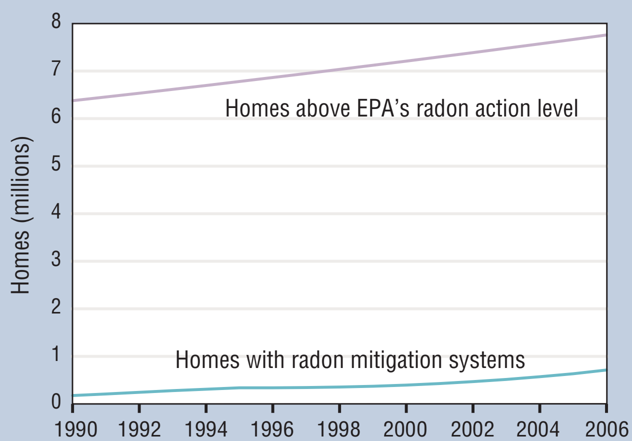
Key Points

Between 1990 and 2006, both the number of homes with radon mitigation systems and the number of homes needing mitigation increased. Homes with mitigation systems rose from 175,000 to 714,000, and homes needing mitigation increased from 6.4 million to 7.8 million due in part to an increase in housing stock, particularly in areas with the highest radon potential (see graphic). More than 90 percent of the nation's homes with indoor radon levels at or above EPA's action level do not have mitigation systems, though some of these homes have been built with new, radon-resistant construction features to reduce radon exposures.

Over the past decade, exposure to environmental tobacco smoke among nonsmokers decreased considerably. All population groups, regardless of age, sex, or ethnicity, experienced this decrease, which was likely due to behavior changes such as reduced smoking and smoking restrictions in some public places. Exposure to environmental tobacco smoke is measured by blood levels of cotinine, a substance produced in the body when a person is exposed to nicotine. Among nonsmokers, children, on average, have more than twice the level of blood cotinine as adults.

National indicators currently are not available for a broader range of pollutants and substances found in indoor air. Scientists have studied numerous other indoor air quality issues, but the available information does not track trends over time or across the entire nation.

Radon in U.S. Homes, 1990-2006



Source: *U.S. Environmental Protection Agency, 1992, 2007*

2

WATER

From swiftly flowing streams to slow-moving water underground, the nation's water resources are integral to life. Water resources encompass water bodies (such as coastal waters, lakes, streams, ground water, and wetlands) and their associated ecosystems. They sustain a multitude of plant and animal species and provide for drinking water, irrigation, fishing, recreation, and many other needs.

The ability of water resources to support these functions depends on their extent and condition. The extent of a water resource refers to its depth, flow, volume, and area. Condition reflects the ability of a water resource to sustain ecological needs and human uses. The extent and condition of water resources can affect the health and well-being of people, ecosystems, and critical environmental processes.

In addition, because water is constantly cycling above and below the surface of the Earth, there are many connections between water resources and other parts of the environment. For example, fertilizers and pesticides used on land can leach into underground or surface water supplies. Also, chemicals released into the air can be deposited, via rain or snow, into a lake or stream.

A variety of methods are used to collect data on water resources, including targeted monitoring of specific water resources and select sampling of locations deemed to be representative of a larger area. One of the challenges in assessing the extent and condition of water resources is that a single data collection method is rarely perfect for every situation. This chapter provides an overview of national-level trends where nationally consistent data are available, but it does not describe the extent or condition of local water bodies or the full range of variations and extremes that occur within individual water bodies.

Fresh Surface Waters

Lakes, ponds, rivers, and streams sustain ecological systems and provide habitat for many plants and animals. They provide drinking water for people and support agriculture, industry, hydropower, recreation, and other uses. Both natural processes and human activities influence the condition of these waters. For example, discharges of industrial contaminants, agricultural and stormwater runoff, air pollutants deposited into water, and invasive species can all affect water bodies.

A variety of biological, physical, and chemical characteristics are used to assess the condition of fresh surface waters. An important biological characteristic is the presence and diversity of bottom-dwelling (benthic) macroinvertebrate communities, such as insect larvae, mollusks, and worms. Some species of macroinvertebrates are more sensitive than others to disturbances in their habitat, such as pollution.

Examples of physical characteristics are depth and flow. Major changes in stream flows can affect plant and animal species that have adapted to particular seasonal fluctuations in flow, such as those that require a period of low or no stream flow in their habitat at a certain time of year.

Key chemical characteristics include acidity and dissolved oxygen. Acidity in soils, lakes, and streams can harm aquatic species and ecosystems. Low dissolved oxygen content can also be harmful. Excess concentrations of the nutrients nitrogen and phosphorus (from sewage or agricultural runoff, for instance) can cause algae to bloom in water. As the algae die and decompose, they deplete the oxygen in the water needed by fish and other organisms.

Key Points

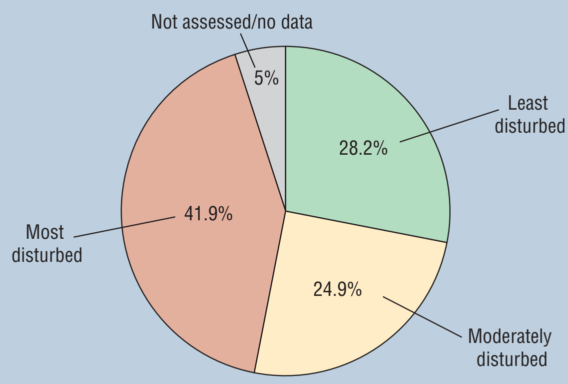
In about 42 percent of wadeable stream miles, benthic macroinvertebrate communities show substantial disturbance; about 28 percent show little disturbance (see graphic). Low biological diversity potentially indicates substantial pollution and higher disturbance. By contrast, communities that are biologically diverse and include many pollution-sensitive species likely indicate that a stream is less disturbed. Wadeable streams are streams and rivers shallow enough to sample without boats.

Since 1960, more than half of the rivers and streams measured nationwide have shown major changes in the volume of high and low flows over time. In largely arid grasslands and shrublands, the percentage of streams with no-flow periods decreased slightly between 1960 and 2006, along with the average length of no-flow periods.

Fresh surface waters show a mixed picture of chemical condition. Acidity has decreased since the early 1990s in lakes and streams in most regions sensitive to acid rain, although one region showed little change. Approximately 30 percent of the nation's wadeable stream miles contain high nitrogen and phosphorus concentrations. Over the last several decades, nitrate loads increased in the Mississippi River. Phosphorus loads decreased in the St. Lawrence and Susquehanna Rivers, but showed no clear trend in the Mississippi or Columbia rivers.

The extent of surface waters and many key stressors are not currently tracked by national indicators. Key stressors include pollution from various sources and toxic contaminants in sediments, which can impact water quality and potentially enter the aquatic food web.

Benthic Community Condition in Wadeable Streams, 2000-2004



Data gathered from 2000 to 2004 in the lower 48 states.

Categories based on the number and diversity of benthic species present, with "least disturbed" being the most diverse. Graphic shows the percent of stream miles in each category.

Source: *U.S. Environmental Protection Agency, 2006*

Ground Water

More than 1 million cubic miles of fresh water lies underground, stored in cracks and pores below the Earth's surface. The vast majority of the world's fresh water available for human use is ground water, which has 30 times the volume of the world's fresh surface waters. Many parts of the country rely heavily on ground water for important needs such as drinking water, irrigation, industry, and livestock.

Some ecological systems also depend on ground water. For example, many fish species depend on spring-fed waters for their habitat or spawning grounds. Springs occur when a body of ground water reaches the Earth's surface. By some estimates, ground water feeds about 40 percent of total national stream flow, and the percentage could be much higher in arid areas.

Human activities and natural factors can affect both the extent and condition of ground water. Pesticides, fertilizers, and wastes, as well as natural substances like arsenic, can contaminate ground water. For example, fertilizers and animal wastes used on land can release nutrients such as nitrate, which can seep into ground water.

Withdrawing too much ground water from a source can reduce the water depth in streams and lakes, affecting vegetation and wildlife habitat. It can also cause land to subside and sinkholes to form. Once depleted, some deep aquifers (underground geological formations containing water) can take thousands of years to recharge, affecting the supply of ground water available for future needs.

Key Points

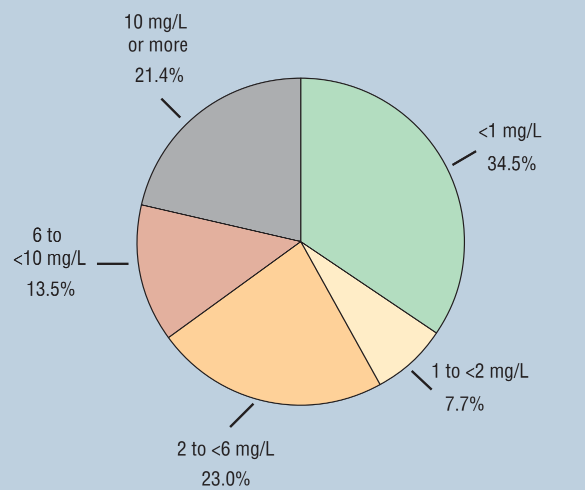
About 60 percent of shallow wells tested in agricultural areas contained pesticide compounds. Approximately 1 percent of the shallow wells tested had concentrations of pesticides above levels considered safe for human health.

In about 21 percent of shallow wells, average nitrate concentrations exceeded the federal drinking water standard and were much higher than the levels generally found in areas with little human influence (see graphic). Public water systems must test for nitrate and treat the water if levels exceed federal health-based standards.

The data in this report do not provide information about the condition of deeper aquifers, which are more likely to be used for public water supplies. These data only characterize the uppermost layers of shallow aquifers typically used by private wells. There are no national treatment or monitoring requirements for private wells; however, owners should test their water periodically to identify possible health risks.

There are no consistent national indicators for many aspects of ground water condition or extent. These aspects include the presence of chemicals other than nitrates and pesticides in agricultural areas and the condition of ground water in predominantly non-agricultural areas, including urban areas. Localized events, such as chemical spills or leaks from underground storage tanks, can affect ground water in urban areas; such events are difficult to measure at the national level.

Nitrate Concentrations in Shallow Ground Water in Agricultural Watersheds, 1992-2003



Data gathered in a survey of 1,423 wells in the lower 48 states from 1992 to 2003. Graphic shows percent of wells in each category.

The federal drinking water standard for nitrate is 10 milligrams of nitrate per liter of water (10 mg/L).

Totals do not add up to 100% due to rounding.

Source: *U.S. Geological Survey, 2007*

Wetlands

Wetlands—areas that are periodically saturated or covered by water—are an important ecological resource. Wetlands are like sponges, with a natural ability to store water. They act as buffers to flooding and erosion, and they improve the quality of water by filtering out contaminants. Wetlands also provide food and habitat for many plants and animals, including rare and endangered species. In addition, they support activities such as commercial fishing and recreation.

Both losses and gains can occur in wetland extent. Natural forces and human activities (such as hurricanes, sea level change, and certain agricultural and forestry practices) can affect wetlands through increased erosion and sedimentation. Draining or filling wetlands for agriculture or other development is the main cause of wetland loss. Gains can occur when wetlands are created or restored.

Changes in the extent or type of wetlands can have major ecological impacts. For example, the conversion of a forested wetland to shrub vegetation can change habitat types and alter the structure of plant and animal communities present. Such a conversion can occur through natural changes in plant communities or by clearing trees from a forested wetland.

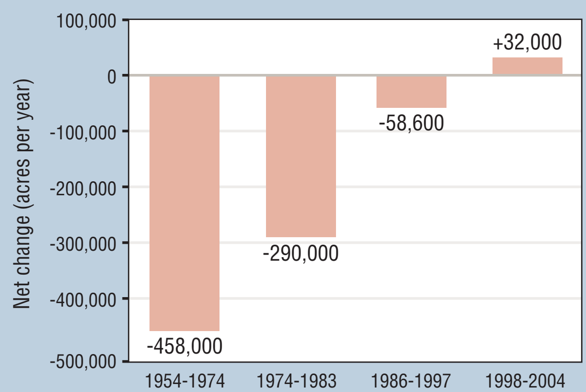
Key Points

The overall extent of wetlands in the lower 48 states declined over the past 50 years. The rate of loss has slowed over time, however, and the most recent data show a net gain in wetlands acreage nationwide (see graphic). Gains and losses vary by wetland type. Freshwater ponds account for most of the recent gains in wetland acreage. These ponds do not perform the same range and type of environmental functions as other types of wetlands that have been lost.

These data do not evaluate wetland quality or condition. Wetland condition is difficult to characterize fully, and there is no national indicator to measure it directly. This is partly because each wetland has unique characteristics, such as the movement and abundance of water, the minerals in the underlying soil, and the combinations of plant and animal species present.

National data do not capture locations or patterns of wetland change. Both are important for understanding condition—for example, whether large wetlands are being left intact or are being fragmented into smaller pieces that are less connected and, therefore, less able to perform their ecological functions.

Average Annual Change in Wetland Acreage, 1954-2004



Data gathered in the lower 48 states.

Source: *U.S. Fish and Wildlife Service, 2006*

Coastal Waters

Coastal waters—the interface between terrestrial environments and the open ocean—encompass many unique habitats such as estuaries, coastal wetlands, seagrass meadows, coral reefs, and mangrove and kelp forests. These ecologically rich areas support waterfowl, fish, marine mammals, and many other organisms.

Human activities and natural factors can affect the condition of coastal waters. Sewage overflow, agricultural runoff, storms, erosion, and sedimentation can all increase the amount of nutrients (such as nitrogen and phosphorus) and pathogens (disease-causing organisms) in coastal waters. Chemical contamination from industrial activities, electricity generation, and other sources are also concerns, as are invasive species and overharvesting of fish and other marine species.

Organisms that live in and on the ocean floor (benthic organisms) are a key measure of coastal water condition because these organisms are sensitive to pollution. One important group of benthic organisms, known as benthic macroinvertebrates, includes worms, clams, crabs, and lobsters.

Scientists monitor several interlinked characteristics of water quality in coastal areas: nutrients, chlorophyll-*a*, dissolved oxygen, and water clarity. Plants need nutrients to grow, but in excess, nutrients fuel the growth of algae. High levels of chlorophyll-*a* indicate overproduction of algae. Too much algae leads to low levels of dissolved oxygen in the water and decreased water clarity. The resulting lack of oxygen and sunlight can harm plant and animal life.

Scientists also monitor plants that grow under water in coastal areas, known as submerged aquatic vegetation (SAV). Like all plants, SAV needs sunlight to grow and survive. Its growth can be affected by excess nutrients, as well as suspended sediments (loose particles of clay and silt in the water), which can block sunlight from reaching the plants.

Key Points

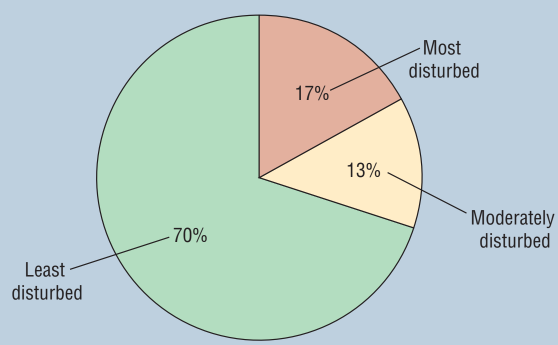
Coastal benthic communities in 70 percent of the areas sampled showed little evidence of disturbance (see graphic). The benthic communities in these areas showed high biological diversity and the presence of pollution-sensitive species, likely indicating that the waters were relatively unpolluted.

SAV plays an important ecological role, for example, in the Chesapeake Bay, where SAV increased from 41,000 to 59,000 acres from 1978 to 2006. However, current acreage is still less than half of the historical coverage (from the mid-1930s). The extent of these plants is important because the vegetation provides food and habitat for many organisms, adds oxygen to the water, filters sediments, inhibits wave action that erodes shorelines, and absorbs excess nutrients.

Elevated levels of nutrients and chlorophyll-*a* are present in slightly less than 10 percent of the nation's coastal waters. However, in areas such as the Gulf of Mexico dead zone and Long Island Sound, substantial areas of hypoxia (when dissolved oxygen is below levels necessary to sustain most animal life) are present.

There are no national indicators for the extent of coastal waters and many aspects of their condition. For example, there are no national indicators for SAV, invasive species, harmful algal blooms, condition of coral reefs, or status of coastal fish and shellfish communities.

Benthic Community Condition in Estuarine Waters, 1997-2000



Data gathered in the lower 48 states and Puerto Rico from 1997 to 2000.

Categories based on the number and diversity of benthic species present, with "least disturbed" being the most diverse. Graphic shows the percent of estuarine area in each category. Estuarine areas are where a freshwater stream or river meets the ocean.

Source: *U.S. Environmental Protection Agency, 2004*

Drinking Water

Virtually all drinking water in the United States comes from fresh surface water and ground water. These source waters can contain industrial, domestic, and agricultural contaminants, as well as naturally occurring contaminants such as arsenic and radionuclides. Also, some contaminants, such as lead from corroded pipes, can enter drinking water between the treatment plant and the tap. If these contaminants are present in drinking water at sufficient levels, they can lead to adverse health effects, including gastrointestinal illnesses, nervous system and reproductive effects, and chronic diseases such as cancer.

To protect public health, EPA sets federal health-based standards for drinking water for public water systems. Public water systems include community water systems—systems that supply drinking water to 25 or more of the same people year-round in their residences. Community water systems serve more than 286 million people, or about 95 percent of the U.S. population.

Public water systems must test for regulated contaminants and treat the water, if needed, to meet the federal standards. Disinfection of drinking water effectively protects against the risk of waterborne diseases such as typhoid, cholera, and hepatitis. Filtration, required for most public water systems that use surface water, provides additional protection against microbial contaminants.

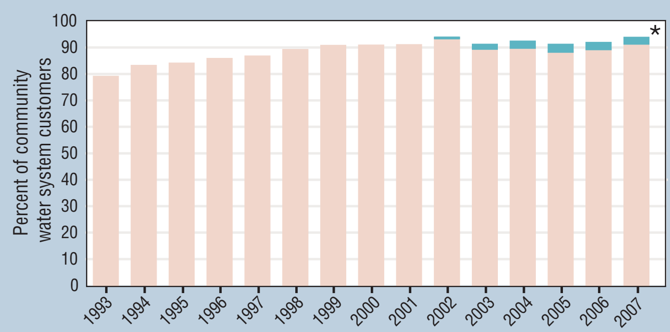
Key Points

In 2007, 92 percent of community water system customers (262 million people) were served by facilities for which states reported no violations of EPA's health-based drinking water standards (see graphic). Approximately 24 million people in 2007 were served by systems for which states did report violations of these standards. A portion, but not all, of these people might have been exposed to contaminants in drinking water at levels above standards. Most of these violations involved rules addressing microbial contaminants or disinfection byproducts (chemicals that can form when disinfectants, such as chlorine, react with naturally occurring materials in water). The level of health risk associated with violations varies, depending partly on which contaminants were involved, the extent to which a standard was exceeded, the extent to which the distribution system was affected, and how long the violation lasted. Microbial violations, in particular, can be short term.

These data address drinking water from community water systems only. They do not address the quality of drinking water that people get from nonpublic supplies (such as private wells and untreated surface water sources), from public water systems serving transient populations (such as roadside rest stops and campgrounds), or from nonresidential users (such as some workplaces and schools). National data are not available for bottled water, which is regulated by the Food and Drug Administration.

Health effects that could be caused by contaminants in drinking water are not currently tracked by national indicators. For example, no national indicator is available for disease occurrence or outbreaks caused by harmful microorganisms in drinking water.

Population Served by Community Water Systems With No Reported Violations of EPA Health-Based Standards, 1993-2007



*Several new standards went into effect after December 31, 2001. For the years 2002 through 2007, the darker segment at the top of each column shows the additional population that would have been served by systems with no reported violations if the new standards had not gone into effect.

Data are presented by EPA fiscal year (October 1-September 30).

Source: *U.S. Environmental Protection Agency, 2007*

Recreational Waters

People enjoy many recreational activities on the nation's rivers, lakes, and coastal waters. Several characteristics determine whether these waters are suitable for recreation. For example, the levels of chemical contaminants and disease-causing microorganisms in water affect whether the water is suitable for swimming, boating, and other contact activities.

The condition of ecosystems and the wildlife within them, which support recreational activities such as fishing and bird watching, is also important. While many of these characteristics can be measured at a local level, there are several barriers to compiling these data into national indicators.

Key Points

While information exists about many individual water bodies, consistent national indicators for recreational waters are not yet available. Many states and localities collect information about individual water bodies in their region. States also monitor coastal beaches for levels of certain disease-causing bacteria and report the results to EPA. However, different states monitor in different ways (for example, by using different methods or monitoring more or less frequently), making it difficult to compile the results into national indicators.

Improved data collection could lead to suitable indicators in several areas. For example, with a comprehensive national system for gathering data, scientists could develop consistent national indicators for bacteria levels at beaches.

Consumable Fish and Shellfish

Fish and shellfish are an important part of a healthy diet for many Americans. Some fish and shellfish from lakes, rivers, estuaries, and deep ocean fisheries, as well as farmed fish and shellfish, can contain chemicals or disease-causing organisms at levels that can pose human health risks. Sources of these contaminants include runoff from urban and agricultural areas, pollutants deposited in water from the air, and direct discharges into water bodies.

Concerns about fish and shellfish safety are higher for people who eat a lot of fish and groups of people who are particularly vulnerable to contaminants that may be present in fish—such as infants, children, the elderly, and women who are pregnant or might become pregnant.

Of particular interest in measuring the condition of consumable fish and shellfish are chemicals such as mercury, polychlorinated biphenyls (PCBs), the pesticide DDT or dichloro-diphenyl-trichloroethane, and polycyclic aromatic hydro-carbons (PAHs), which form during the combustion of oil, gas, and other organic substances. These compounds can persist in sediments for a long time, increasing their potential for entering the food web and ultimately concentrating in fish that may be eaten by people and wildlife.

Key Points

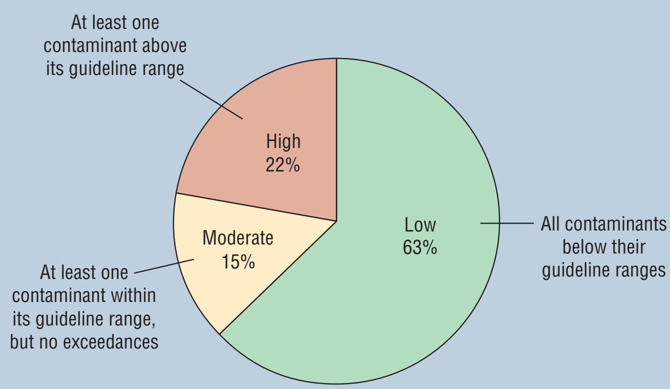
Estuarine sites (sites in areas where a freshwater stream or river meets the ocean) across the nation showed varying levels of contamination in fish tissue. Sixty-three percent of the sites showed low fish tissue contamination, 15 percent showed moderate contamination, and 22 percent had high contamination based on health-based consumption guidelines (see graphic). PCBs, mercury, DDT, and PAHs were most often responsible for high contamination scores. The condition of coastal fish varied greatly among different areas of the country. The survey did not include Hawaii, the Caribbean, the Pacific territories, or Alaska, which is notable because Alaska produces more than half the nation's commercial fish.

Lake fish surveys found that several chemicals, including mercury, dioxins and furans, PCBs, and DDT, are widely distributed in the nation's lakes and reservoirs. However, some other chemicals, including certain pesticides, were detected rarely or not at all. These data do not consider whether the detected levels are a health concern, as this portion of the analysis is not yet complete. The surveys did not include Hawaii, the Caribbean, Alaska, or the Great Lakes.

While fish consumption advisories provide information on fish from many individual water bodies, these advisories cannot be compiled into a national indicator of fish and shellfish condition. The states and tribes that issue fish consumption advisories use different ways of monitoring waters and making advisory decisions, so the information is not comparable.

There are no consistent national indicators for disease-causing organisms in fish and shellfish, or for the biological and chemical condition of commercially farmed fish and shellfish.

Contaminants in Fish From Estuarine Waters, 1997-2000



Data gathered in the lower 48 states from 1997 to 2000.

Categories are based on comparison to EPA's health risk guidelines for fish consumption. Graphic shows the percent of estuarine sites in each category.

Source: *U.S. Environmental Protection Agency, 2004*

3

LAND

Land Cover

Land Use

Wastes and the Environment

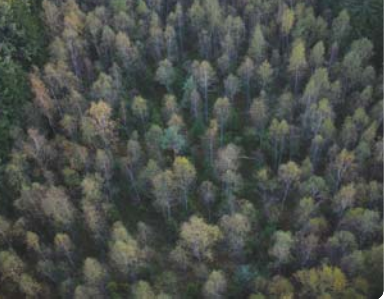
Chemicals Applied and Released to Land

Contaminated Lands

Land provides food, shelter, fuel, and raw materials for people, as well as habitat for many species. It is the source of many resources such as minerals, timber, and petroleum and helps to filter the nation's water and break down wastes and chemicals. While the amount of land in the United States is relatively constant, how land is used changes continuously. Changes in land use affect the distribution and nature of land cover (such as forests, developed land, and agricultural land) and the condition of land and its resources.

Land is intricately connected to other environmental resources and to human health. For example, land cover affects the energy exchange between the Earth's surface and atmosphere, which in turn influences climate and weather. Changes in land cover can increase or decrease erosion, water runoff, sedimentation, and flooding. Chemicals and wastes can affect human health and the environment when they are applied to or disposed of on land.

Many federal agencies with varying responsibilities collect data on land resources using satellite imagery, national surveys, and regulatory data. These data, in general, represent only a small sample of the total picture of land cover, land use, waste management and disposal, chemicals used on land, and land contamination. States also collect these kinds of data, but differ in their approaches, making it difficult to compile national data on land issues.



Land Cover

Land cover is the vegetation and other materials, such as rock, snow, or pavement, that are present and visible on land. Satellite data are frequently used to identify land cover types over large areas. Land cover can be grouped into six major categories: forest cover, grass cover, shrub cover, developed land, agriculture, and other (which includes ice/snow, bare rock, and other types of land cover with limited extent). Land cover differs from land use. Land cover is physically obvious, while land use is determined by a government agency or individual landowner and might not always be visible. Because of these differences, land cover acreages differ from land use acreages in the United States.

A number of factors affect land cover, including geology, climate, population changes, and human activities such as industrial and urban development, deforestation or reforestation, water diversion, and road building. The extent and type of land cover in an area can affect habitat quality and availability, species distribution, water quality, climate, and distribution and movement of chemicals.

Key Points

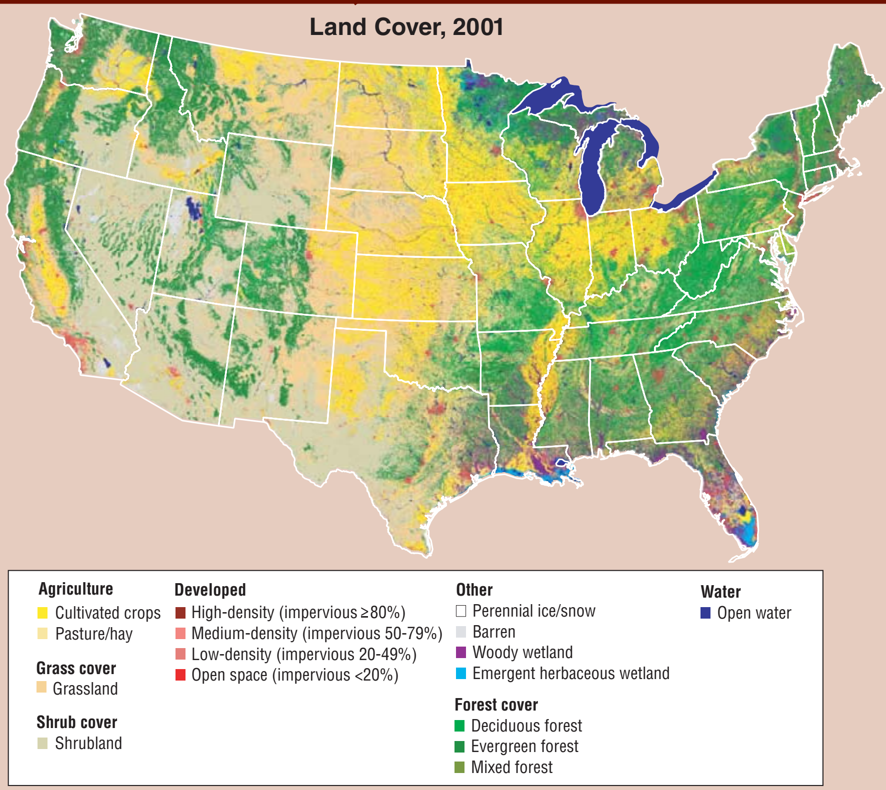
Forest cover and agriculture are the two most common types of land cover in the United States. In 2001, of the approximately 2.3 billion acres of land in the nation, 641 million acres were forest cover, 449 million acres were agriculture, 419 million acres were shrub, 291 million acres were grass, and 103 million acres were developed land. These estimates were derived from satellite data.

Land cover types vary greatly by region (see graphic). Forest cover is predominant in the East and Pacific Northwest, agriculture and grass cover in the Midwest, and shrub cover in the Southwest.

The total amount of forest in the United States declined over the last century, but has been increasing in recent years. Regional variations exist. Forest cover has increased in the Northeast, Mid-Atlantic, and Midwest, and decreased in the West and Southwest.

Comparing and integrating land cover information is difficult. Different agencies collect data on land cover, often at varying times and for different purposes. These agencies also define and classify land cover differently and at varying levels of detail. The most recent comprehensive data available are from 2001.

Land Cover, 2001



Source: *U.S. Environmental Protection Agency, 2007*

Land Use

U.S. lands support many uses, including crop production, timber production, livestock grazing, recreation, and residential and commercial development. Designated through zoning and other regulations, these uses are often less physically obvious than land cover. For example, developed land use can include land that has visibly developed features, such as asphalt, concrete, and buildings, as well as undeveloped land designated for residential or transportation use.

Land use can adversely affect numerous aspects of the environment, including air and water quality, habitat availability, and species distribution. In some cases, land use can also have positive environmental effects, such as when communities restore habitats or clean up and redevelop contaminated lands.

Key Points

Widespread land uses in the United States include grazing, timberland, and food crop production. As of 2003, of the approximately 2.3 billion acres of land in the nation, as many as 721 million acres were used for grazing, 504 million acres were classified as potentially productive forest (known as timberland), 374 million acres were used for food crop production, and 108 million acres were used for development. These data are based on aerial photo interpretation and ground surveys.

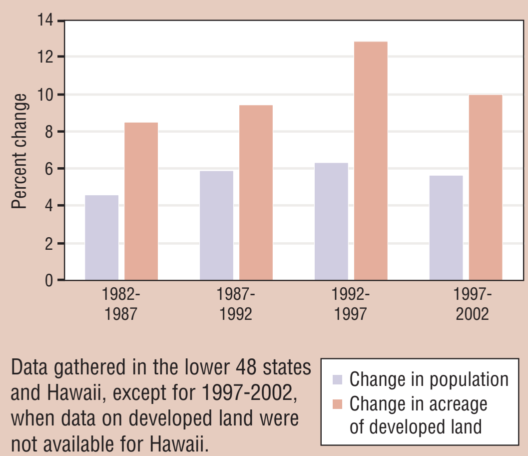
Land use patterns vary greatly by region of the country. More than three-quarters of the nation's grazing land is in the West, while much of the timberland is concentrated in the East and Southeast.

The amount of land used for crop production and pasture has declined since 1982, while the amount of developed land has increased and timberland has remained constant. Conversions of forest land, cropland, and pastureland have contributed to the increases in developed land. Additionally, highly erodable cropland has been removed from production.

Between 1982 and 2002, the amount of developed land in the United States increased at nearly twice the rate of the population (see graphic). The amount of developed land grew by about 47 percent, while the population grew by just over 24 percent. Population and development trends varied in different parts of the country. For example, in the West, the amount of land developed since 1982 closely matched population growth, while in the Northeast, the amount of developed land increased at more than three times the rate of population growth.

The data to track land use trends are limited and derived from many sources, which inhibits the ability to track changes over time. Various agencies collect land use data, often at different times and for different purposes. Classifications of land use can also vary, making it difficult to integrate and compare data.

Change in Population and Developed Land, 1982-2002



Data gathered in the lower 48 states and Hawaii, except for 1997-2002, when data on developed land were not available for Hawaii.

Source: *U.S. Census Bureau, 1996, 2002, 2006; U.S. Department of Agriculture Natural Resources Conservation Service, 2000, 2004*

Wastes and the Environment

The amount, composition, and management of wastes provide insight into the nation's efficiency in using materials and resources. Such information also can be useful in understanding the effects of wastes on human health and the environment. The type and amount of waste produced in the United States varies and can depend on the size and activities of an organization. For example, households primarily produce municipal solid waste (paper, packaging, yard trimmings, and other materials) and discard some products with potentially hazardous ingredients and small amounts of hazardous waste. Commercial and manufacturing entities and institutions produce municipal solid waste, industrial waste, and larger quantities of hazardous waste. Hazardous wastes have properties (toxicity, corrosiveness, ignitability, reactivity) that make them potentially harmful to human health or the environment.

Activities such as agriculture, construction/demolition, mining, and other resource extraction and industrial processes generate large quantities of other types of waste. Presently, however, the United States regularly collects information on only municipal solid waste and hazardous waste. These two types of waste make up a small fraction of all of the waste generated in the country.

Once wastes are generated, they must be managed—collected, transported, stored, reused, recycled, processed or treated, or disposed of. Because wastes can contain hazardous chemicals, their generation and management have the potential to contaminate land, air, or water; compromise their use; affect human health; or impact ecological condition. For example, the decomposition of certain kinds of wastes in landfills is a major source of methane. In contrast, industry has taken steps to reduce certain high-priority chemicals (documented contaminants of air, water, land, plants, and animals) found in waste in recent years.

Key Points

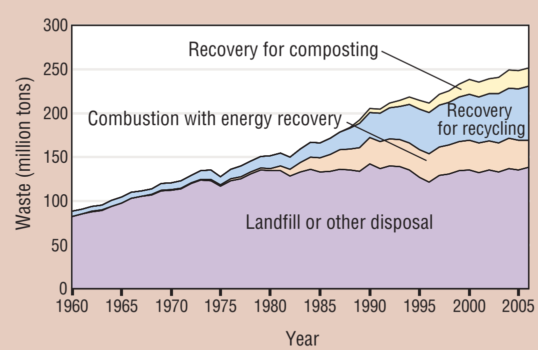
Since 1990, the per capita municipal solid waste generation rate has remained stable at four-and-one-half pounds per person per day. As the U.S. population has increased, however, the nation has steadily generated more municipal solid waste. Generation increased from 88 million tons in 1960 to 251 million tons in 2006.

Hazardous waste generation has declined. Hazardous waste generation dropped from roughly 36 million tons in 1999 to 28 million tons in 2005. Recycling or composting of municipal solid waste increased from 6 percent to 33 percent since 1960 (see graphic). Hazardous waste recycling rose only slightly between 1999 and 2005 and remains at less than 10 percent.

Most waste is still disposed of on land. In 2006, 55 percent of municipal solid waste was disposed of in landfills, compared to 94 percent in 1960 (see graphic). Of the hazardous waste disposed of on land in 2005, 90 percent was injected deep into the ground in permitted wells, and the remaining 10 percent was treated and disposed of in a manner to minimize risk to human health and the environment.

Information about many types of waste is not currently available at the national level. Also, data are lacking about exposure and the effects of waste and management practices on human health and the environment. The potential effects associated with waste vary widely and are influenced by the substances or chemicals found in waste and how they are managed.

Municipal Solid Waste Management, 1960-2006



Source: *U.S. Environmental Protection Agency, 2007*

Chemicals Applied and Released to Land

Chemicals are commonly used in manufacturing, in food and consumer products, and in efforts to manage diseases. They can be intentionally applied to land for purposes of increasing crop yields and controlling pests, or in some cases, accidentally spilled on land. Some chemicals also occur naturally or can enter the environment through acts of nature, such as volcanoes and hurricanes.

Chemicals released or applied to the environment can pose a range of challenges to human health and the environment. Some chemicals break down quickly in the environment, while others, such as persistent, bioaccumulative, and toxic (PBT) chemicals, persist for long periods of time and can accumulate in the food web.

Some chemicals can lead to health problems if people receive sufficient doses. For many other chemicals, though, the possible health effects are not yet well known. The effects of long-term exposure to chemicals are often unknown. In addition, some chemicals can harm ecosystems, such as when excess fertilizers are carried in runoff, which can affect water quality and aquatic life.

Key Points

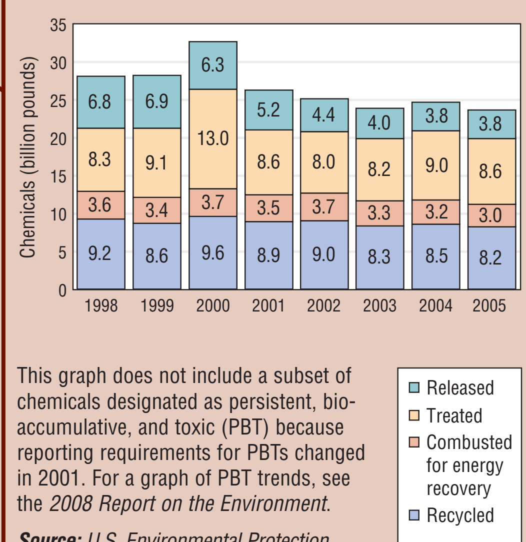
The amount of certain toxic chemicals in industrial waste materials decreased by more than 4 billion pounds (16 percent) between 1998 and 2005 (see graphic). In 2005, the United States handled 1.1 billion pounds of PBT chemicals in industrial waste, along with 24 billion pounds of other toxic chemicals (shown in graphic) that are subject to reporting to EPA under the Toxics Release Inventory (TRI) program. The metal mining industry has accounted for 35 percent of the total TRI chemicals in production-related wastes released to the environment since 1998.

Over the past 45 years, the use of fertilizers, including nitrogen, phosphate, and potash, has increased nearly three-fold. The combined use of these three chemicals rose from 46 pounds per acre per year in 1960 to 138 pounds per acre in 2005. Nitrogen accounted for the steepest increase. While fertilizers are not inherently harmful, they have the potential to contaminate ground and surface water when applied improperly or in excessive quantities.

In annual surveys conducted since 1994, 42 to 71 percent of food samples have shown detectable amounts of pesticide residue. A small fraction of samples (approximately 1 out of every 500) had pesticides at concentrations that exceeded tolerance levels designed to protect human health. Foods tested include fruits, vegetables, grains, meat, and dairy products.

Data about chemicals used on land are limited. Some data are available on pesticide and fertilizer use on agricultural lands. Agencies collect national information on only a fraction of all chemicals used in the United States, however. Consistent national indicators are lacking regarding when, where, and how frequently chemicals are applied to land and the potential impact when they contain toxic ingredients.

Disposition of Toxics Release Inventory (TRI) Chemical Waste, 1998-2005



This graph does not include a subset of chemicals designated as persistent, bioaccumulative, and toxic (PBT) because reporting requirements for PBTs changed in 2001. For a graph of PBT trends, see the *2008 Report on the Environment.*

Source: *U.S. Environmental Protection Agency, 2007*

CONTAMINATED LANDS

Contaminated lands range from abandoned properties in inner cities to large areas of land once used for industrial or mining activities. Improper handling or disposal of toxic and hazardous materials and wastes, improper application of chemicals to land, deposition of toxic substances on land via winds or water, and accidental spills can all contaminate land. Except for spills and natural events, most land contamination is the result of historical activities that are no longer practiced.

The Comprehensive Environmental Response, Compensation, and Liability Act, also known as Superfund, and the Resource Conservation and Recovery Act (RCRA) are two of the major federal laws governing contaminated lands to protect human health and the environment. The most toxic abandoned waste sites in the nation are listed on the Superfund National Priorities List (NPL). High-priority facilities subject to cleanup under RCRA are included in the RCRA Cleanup Baseline.

Completing cleanups at these complex sites can take years and even decades; therefore, EPA tracks whether people are exposed to contamination above levels of concern, and whether contaminated ground water is spreading above levels of concern.

KEY POINTS

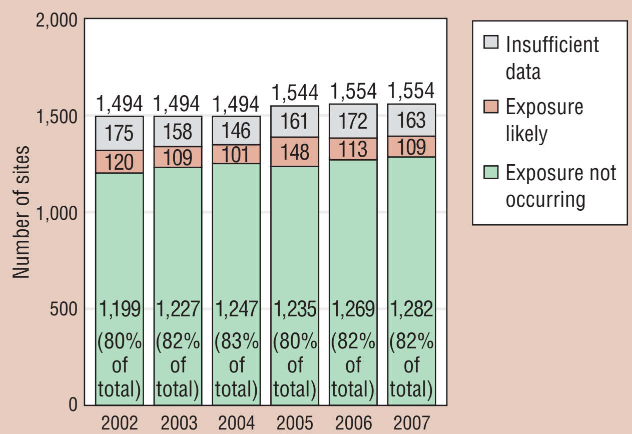
Between 2002 and 2007, the percentage of Superfund NPL sites where human exposure to contamination was under control (that is, unlikely to be occurring) remained relatively constant at 82 percent (see graphic). The other 18 percent of sites either had documented exposure or had not been classified yet.

Between 2000 and 2007, the percentage of RCRA Cleanup Baseline sites where human exposure to contamination was demonstrated to be under control increased from 37 to 93 percent. This increase was due to completion of site investigations, actions taken to prevent exposure to contamination, and further site cleanup.

Sites where contaminated ground water was demonstrated not to be spreading above levels of concern increased from 61 to 70 percent of Superfund NPL sites (2002-2007) and from 32 to 79 percent of RCRA Cleanup Baseline facilities (2000-2007). The increases are due to completion of site investigations, actions taken to mitigate the spread of contaminated ground water, and further site cleanup.

The total number and extent of contaminated sites nationwide is not known, nor are their specific effects on human health and the environment. Although EPA tracks the most contaminated sites through the RCRA Cleanup Baseline and Superfund NPL, these sites do not represent the full extent of contaminated lands in the United States. Many other sites managed by local, state, and other federal authorities are not inventoried at the national level.

Human Exposure to Contamination at Superfund National Priorities List (NPL) Sites, 2002-2007



"Exposure likely" means that there is a reasonable expectation that humans are exposed to contamination above health-based standards.

Data are presented by EPA fiscal year (October 1-September 30).

Source: *U.S. Environmental Protection Agency, 2005, 2006, 2007*

4

Human Exposure and Health

Exposure to Environmental Contaminants

Health Status

Diseases and Health Conditions

Many factors can influence human health, including exposure to environmental contaminants. People can be exposed to environmental contaminants in a variety of ways, and many contaminants are known or suspected of causing human disease. The relationships among environmental contaminants, exposure, and human disease are complex, however. Despite these complexities, studying overall patterns of disease or exposure helps determine where further study or public health interventions could be needed.

For people to experience adverse health effects from exposure to an environmental contaminant, various events must occur. First, a contaminant released from its source requires some sort of contact (via air, water, or land) with a person and then must enter the body through inhalation, ingestion, or skin contact. Additionally, a contaminant needs to be present within the body at sufficient doses to ultimately result in a health effect. Understanding the connections between environmental exposure and adverse health effects is particularly challenging because many risk factors other than the environment—including genetics, personal behavior, and health care—also affect health.

Exposure and health data are drawn from many sources. These include records of vital statistics, such as births and deaths; surveys and questionnaires; and surveillance activities, such as cancer registries and other systems. As used in this report, these data are representative of the national population. They are not based on data from targeted populations or tied to specific exposures or releases.

At present, trends in national-level exposure and health indicators cannot be linked to trends in environmental conditions described in other parts of this report, or to predict cause-and-effect relationships between environmental contaminant exposure and an adverse health effect. Instead, these national-level data can help researchers track overall trends in population exposure, health, and disease, including trends across different age, gender, race, and ethnic groups.

Exposure to Environmental Contaminants

People can be exposed to many different contaminants in the environment. Although researchers can measure the levels of contaminants in air, water, and land, these measurements alone cannot reveal whether or how much of those chemicals have contacted or entered people's bodies. Biomonitoring is used to measure internal body levels of contaminants (or substances produced when the body interacts with contaminants) in human blood, urine, or tissues. This type of direct measure offers more information about the extent of exposure to people than environmental levels alone.

Biomonitoring data can help track levels of people's exposure to environmental contaminants, but cannot be used to determine how people might have been exposed to a contaminant, or in most cases whether they will become sick. Currently, biomonitoring techniques exist for only a subset of the many environmental contaminants.

Key Points

Blood lead levels show a steady decline since the 1980s. Lead can harm the brain, nervous system, and other organ systems. Children aged 1 to 5 years have the greatest health risk from lead exposure because their systems are still developing. Between 1999 and 2002, 1.6 percent of children aged 1 to 5 years had elevated blood lead levels, decreasing from 88 percent in the late 1970s. The Centers for Disease Control and Prevention define elevated blood lead levels as 10 micrograms of lead per deciliter of blood.

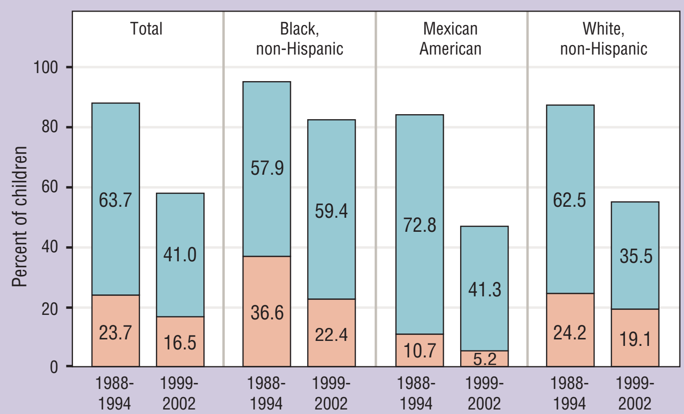
About 6 percent of women of child bearing age had at least 5.8 parts per billion of mercury in their blood from 1999 to 2002. EPA has determined that children born to women with blood concentrations of mercury above 5.8 parts per billion are at increased risk of adverse health effects.

Exposure to environmental tobacco smoke among nonsmokers decreased considerably in the last decade (see graphic). Nonsmokers who are exposed to environmental tobacco smoke can have elevated levels of cotinine in their blood. Cotinine is a substance that forms in the body following exposure to nicotine.

Baseline measurements of exposure are also available for other biomonitoring indicators. These measurements can be used in the future to track possible trends. Baseline measurements are available for cadmium, a metal that enters the environment through natural and man-made processes; phthalates, used to soften and increase flexibility of plastics and vinyl; persistent organic pollutants (POPs); man-made chemicals (such as polychlorinated biphenyls, dioxins, and furans) that can remain in the environment for years or decades; and pesticides, including chemicals to control weeds, insects, and other organisms.

Biomonitoring data currently have limitations as indicators of exposure. Because biomonitoring data do not include the sources of exposure, these indicators alone do not indicate whether measured levels are related to environmental exposures.

Blood Cotinine Concentrations in Children Aged 4-17 by Race and Ethnicity, 1988-1994 Versus 1999-2002



Cotinine concentrations are reported for nonsmoking children only.

Concentrations are measured in nanograms of cotinine per milliliter of blood (ng/mL).

Concentration:
- 0.05 to 1.0 ng/mL
- More than 1.0 ng/mL

Source: *Federal Interagency Forum on Child and Family Statistics, 2005*

Health Status

A nation's health status can be measured in many ways. Life expectancy and death rates are generally regarded as good overall measures of population health because they represent the combined effects of many different risk factors. Infant death rates are particularly useful because they indicate the current health status of the population, predict the health of the next generation, and reflect the overall state of maternal health.

Tracking these kinds of broad health measures helps to identify general patterns in the nation's health status and lay a foundation for studying trends in specific diseases and conditions. In addition, such tracking can help identify possible environmental factors that could contribute to the diseases or conditions that are the leading causes of death in the United States.

Key Points

Overall, the health of the U.S. population has continued to improve. Mortality rates continue to decline, and life expectancy continues to increase, due to factors such as improved medical care over the past few decades.

Life expectancies in the United States are lower, however, than in many other countries. In 2004, the United States ranked 35th in life expectancy for men and women among the 192 nations and states that are members of the World Health Organization.

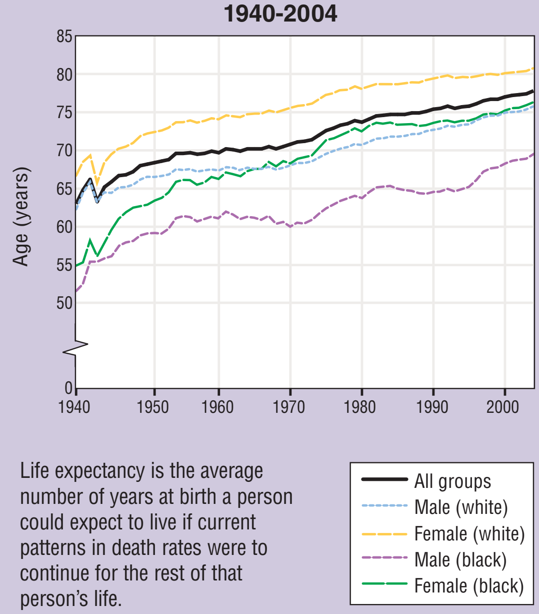
The three leading causes of death in the United States—heart disease, cancer, and stroke—remain unchanged since 1999. Measures of premature death show that injuries are the leading cause of death, followed by cancer and heart disease.

Infant mortality in the United States shows a long-term decline, although it remains among the highest in the industrialized world at nearly seven deaths per every 1,000 live births in 2004. U.S. infant mortality rates were two to three times higher than the lowest rates reported worldwide.

Although national health is generally improving, racial, ethnic, and gender differences persist. The mortality rate for black infants is still more than twice that of white or Hispanic infants. The gap in life expectancy between the black and white populations, and male and female populations, is approximately five years (see graphic). Though the largest decline in overall mortality rates has been observed in black males, overall mortality in this group continues to be highest compared with white males and white and black females. Currently, data available for other racial or ethnic groups enable only limited analysis.

Life expectancy and death rates do not address other aspects of health such as perceived well-being or quality of life. Though life expectancy and death rates are widely accepted measures of health status, they alone do not completely describe the nation's health.

Life Expectancy at Birth by Race and Sex, 1940-2004



Life expectancy is the average number of years at birth a person could expect to live if current patterns in death rates were to continue for the rest of that person's life.

Source: *National Center for Health Statistics, 2006, 2007*

Diseases and Health Conditions

Exposure to environmental contaminants has been linked to many human diseases and conditions, including cancer, cardiovascular disease, respiratory disease, some infectious diseases, and low birthweight. These links have been established through well-designed studies with specified populations and specific environmental exposures. Many other risk factors can also lead to these diseases and conditions, however. For all the diseases and conditions described here, exposure to environmental contaminants is just one of the possible risk factors.

Tracking the occurrence of these human diseases and conditions at the national level helps identify general patterns or trends over time and across subgroups. Some notable differences are seen across different age groups, races, or ethnic groups for many conditions, such as heart and lung conditions, cancer, asthma, and some birth outcomes, such as birth defects, pre-term deliveries, and low birthweight.

Key Points

As the U.S. population ages, many chronic diseases—including various cancers and heart and lung diseases—are occurring more frequently in adults. For a number of these diseases, however, occurrence has stabilized in recent years. The annual incidence (proportion of new cases in a year) of cancer increased slowly from the early 1970s to the early 1990s and then leveled off. Rates for most of the major cardiovascular and chronic obstructive pulmonary diseases remained fairly constant between 1997 and 2006, though death rates associated with these diseases declined.

There has been a slight overall rise in the incidence of cancer in children ages 0 to 19 years since the early 1970s. Leukemia and cancers of the brain and nervous system remain the leading cancers in children. Higher rates of cancer consistently occur among white children compared to black children.

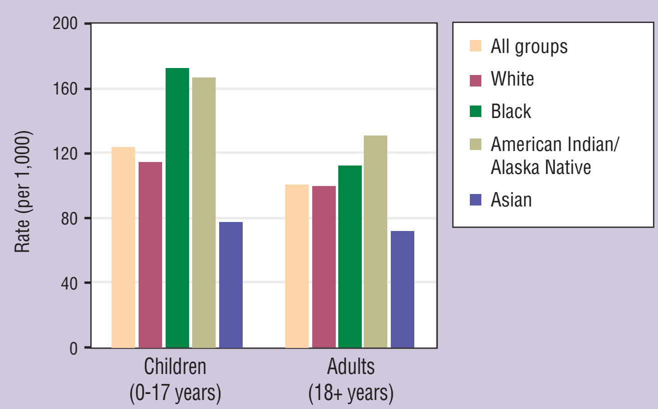
Asthma rates are higher in children and adolescents than in adults, with some distinct patterns across races (see graphic). Between 1980 and 1996, childhood asthma rates increased about 4 percent each year, with no major shifts observed since 1997. Based on data from 2006, approximately 10 million children (about one in eight) in the United States were reported as having been diagnosed with asthma. American Indians/Alaska Natives and blacks experience the highest asthma rates compared to those reported in other races. Rates are lower in Hispanic/Latino children and adults than in non-Hispanics/Latinos.

No notable patterns were observed for most reportable infectious diseases between 1995 and 2005. However, some increases were reported between 2002 and 2005 in Lyme disease, Rocky Mountain spotted fever, and Legionnaires' disease.

The proportion of mothers that gave birth early (before 37 weeks of gestation) increased by 14 percent from 1990 to 2002, with a smaller increase from 1995 to 2004. Data from 1995 to 2004 also show that black mothers were about one-and-a-half to two times more likely to give birth early than white mothers. Also, black babies born at full term were more likely to have a low birthweight (less than 2,500 grams, or 5 pounds 8 ounces) than white babies.

These indicators provide important insights on disease patterns but cannot be used alone to understand the role of environmental contaminant exposures. This is because these diseases and conditions are linked to other causes besides environmental exposures. Also, national indicators are not available for other diseases with possible links to environmental contaminants, such as behavioral and neurodevelopmental disorders, and other diseases still being studied for possible connections to environmental contaminant exposure, like Alzheimer's disease and diabetes.

Asthma Prevalence by Race, 2003-2005



Asthma prevalence represents individuals who were ever told that they have asthma.

Data were collected from 2003 to 2005.

Source: *National Center for Health Statistics, 2007*

5

Ecological Condition

Patterns in Ecological Systems

Biological Diversity

Ecological Processes

Physical and Chemical Attributes of Ecological Systems

Ecological Exposure to Contaminants

Ecological condition refers to the state of the physical, chemical, and biological characteristics of the environment and the processes and interactions that connect them. Ecological condition reflects a wide array of factors, including the natural development of plant and animal communities, natural disturbances, resource management, pollution, and invasive species.

One approach to assessing the nation's ecological condition is to examine its essential attributes, including the extent, distribution, and diversity of ecosystems; ecological processes; physical and chemical attributes; and exposure to pollutants.

Human activities and natural factors can directly or indirectly affect one or more of these attributes, resulting in changes to an ecological system. For example, plant growth might increase in response to heavy rainfalls or decrease in response to contaminant exposure. Such changes can affect the way an ecosystem functions and can have positive or negative consequences for society—such as by altering crop, timber, or fishery yields.

Measuring the nation's ecological condition is challenging. It is not as straightforward as measuring pollutant levels in air, water, and soil. For example, there are numerous groups of animals and plants, but indicators are available for only some of these. Major groups known to be undergoing changes, such as amphibians, are not captured by the available indicators.

Patterns in Ecological Systems

Ecological systems—ranging from forests and watersheds to wetlands and coral reefs—make up the environment. Changes in patterns of the extent and distribution of ecological systems have a fundamental influence on the health of the planet and the people who depend on these systems. For example, the extent of a forest affects both air and water quality, while the type of trees in a forest influences ecosystem structure and function, including which animals and plants are present.

Ecological systems are not isolated, but connected to one another. Connectivity refers to the way in which matter, energy, and organisms flow within and among ecosystems. Fragmentation refers to the breaking up of an ecological system into smaller, more isolated parts. When ecological systems become fragmented, habitat is broken up into patches interspersed with other habitat types that might not support the species that were originally present.

Patterns in ecological systems can change in response to natural factors as well as human activities. Natural changes can occur gradually as a result of geological and climatic changes, or more quickly due to events such as extreme weather or wildfires. Human activities that can affect ecological systems include urbanization, agriculture, forest management, introduction of invasive species, and the release of greenhouse gases, which contributes to climate change.

The impact of such changes varies depending on the geographic scale. For example, a storm could create a gap in a forest canopy that only affects the immediate area for several decades. In contrast, widespread loss of wetlands over a large region could permanently shift bird migration routes or make coastlines more vulnerable to hurricanes.

Key Points

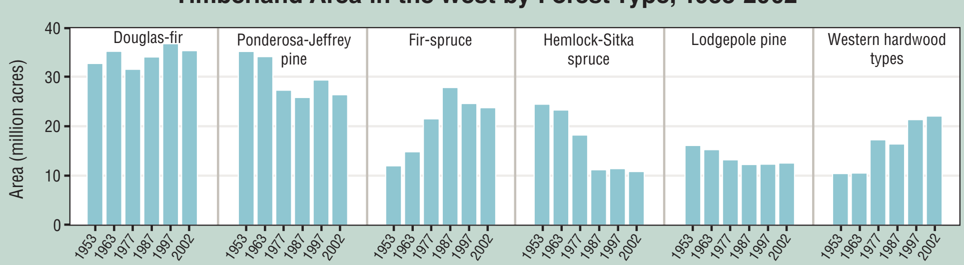
The total acreage of forest land nationwide declined between the 1930s and the 1970s, but increased over the last three decades. Trends in forest acreage vary by region and by forest type. For example, in the West, the acreage of fir-spruce and hardwood forest increased over the past 50 years, while the extent of other forest types, including many pine forests, decreased (see graphic).

Slightly more than 26 percent of the forest land in the lower 48 states occurs in landscapes completely dominated by forest, while 19 percent of forest land is considered highly fragmented. Forests can be fragmented by human activities and by natural factors such as forest fires.

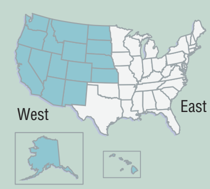
Some ecological systems remain highly connected and intact. In the Northeast and Mid-Atlantic and on the West Coast, roughly 30 percent or more of forest land remains unfragmented. In the Southeast, forests, wetlands, and open water ecological systems remain connected to each other across 43 percent of the landscape.

Little information is available on the extent of ecological systems other than forests and wetlands, or about the effects of fragmentation on biodiversity and ecological processes at different geographic scales.

Timberland Area in the West by Forest Type, 1953-2002



Graphic depicts data for states in the western United States (including Alaska and Hawaii), based on U.S. Department of Agriculture Forest Service reporting regions (see map at right). Forest type is measured only on timberland, which is forest that could potentially be used to produce commercial timber. Timberland covers 39 percent of the forested land in the West.



Source: *U.S. Department of Agriculture Forest Service, 2001, 2004*

Biological Diversity

Biological diversity, or biodiversity, refers to the amount of variation within biological systems. This diversity occurs on multiple levels—from the genetic makeup of a single organism to the composition of an entire ecosystem. Biological diversity provides many tangible benefits to society, including medicines and crops; for many people, it also contributes in important ways to the quality of life.

Trends in the number and composition of species within an ecological system are important indicators of the system's health and robustness. Scientists generally agree that as the number of species in an ecological system declines, the system is less able to recover from stress. These relationships are not straightforward and can vary in degree, depending on the types of species introduced or removed from a system.

Diversity arises over time when adaptation results in new species that fill available niches in the environment. This is a dynamic process involving colonization, evolution of species adapted to new conditions, and extinction of species that are less well adapted to a changing environment. This process has occurred over millions of years across large geographic areas, punctuated occasionally by significant natural events such as meteor strikes, periods of intense volcanic activity, and ice ages.

Human activities—such as urbanization, water management, and land use changes—can have profound effects on biological diversity, and in a much shorter timeframe. For example, in sewage-polluted waters, dense beds of a single species, sludgeworms, can replace the more diverse communities of bottom-dwelling organisms ordinarily present. Invasive species also can have widespread effects. As the sea lamprey spread through the Great Lakes in the mid-20th century, for instance, sweeping changes occurred throughout the entire food web.

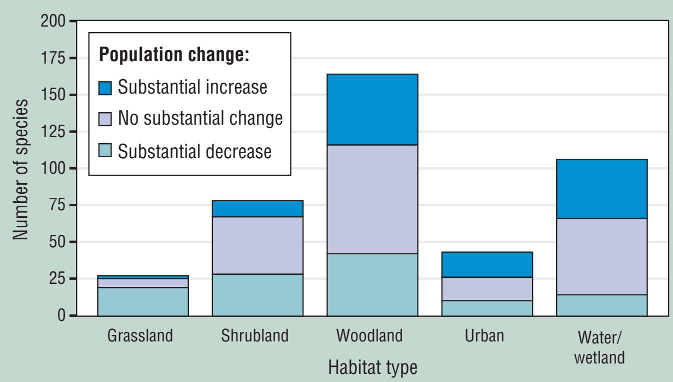
Key Points

Watersheds covering almost one-quarter of the area of the lower 48 states have lost at least one-tenth of the native freshwater fish species known to have been present at some time prior to 1970. Losses are especially severe in the Southwest and the Great Lakes, where eight watersheds have lost more than half their native fish species. Fish diversity can decline for a number of reasons, such as pollution, habitat alteration, fisheries management, and invasive species. In contrast, watersheds covering about 21 percent of the lower 48 states have retained all of their native species.

In recent years, changes (both decreases and increases) have occurred in bird populations in various habitats. Changes in bird populations reflect changes in landscape and habitat, food availability and quality, toxic chemical exposure, and climate. Since 1966, substantial decreases occurred in 70 percent of grassland species and 36 percent of shrubland species. Substantial increases occurred in 40 percent of urban species and 38 percent of water and wetland species (see graphic).

For several aspects of biological diversity, there are no consistent national indicators. These include major groups of animals such as amphibians, reptiles, and mammals; plants; and the numbers of threatened, endangered, and invasive species.

Change in Bird Populations by Habitat Type, 1966-2003



Data gathered by the North American Breeding Bird Survey, which covers the lower 48 states and southern Canada.

Substantial increases or decreases are those in which the observed populations increased or decreased by more than two-thirds.

Source: *Audubon Society, 2004*

Ecological Processes

Ecological systems are sustained by biological, physical, and chemical processes. One such process is carbon cycling. During photosynthesis, plants use the sun's energy to produce organic matter from carbon dioxide. This organic matter provides the food at the base of the food web. Carbon dioxide is regenerated through the respiration of animals in the food web and through decomposition by the microbial community when organisms die.

Organisms that produce organic matter from inorganic matter using energy from the sun are known as primary producers. They range in size from microscopic ocean plants to the giant redwoods of California. Decreases in primary production affect all the animal populations that depend on that production for food. Too much primary production (for example, algal blooms in water bodies) is also a problem.

Many human and natural factors impact ecological processes, including pollution and changes in land use, such as conversion of forests to urban or agricultural land. Trends in ecological processes, such as the cycling of carbon and carbon storage, provide insight into the structure and function of ecological communities and how human and natural factors affect them.

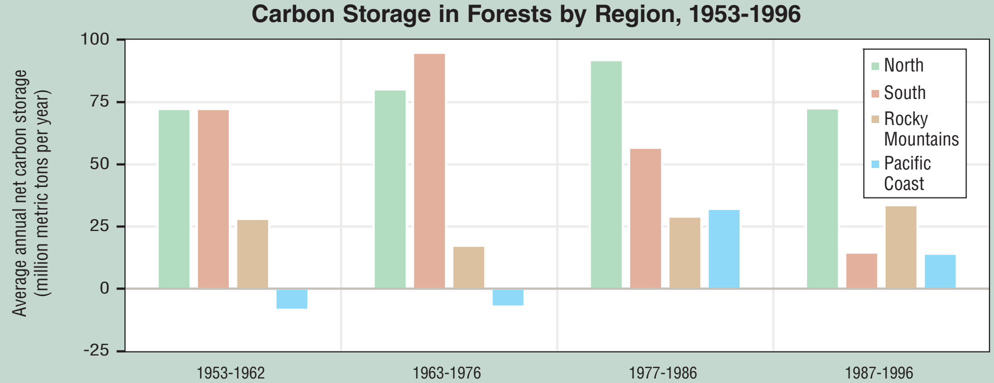
Although there are numerous components of the carbon cycle, an indicator is available for only one of these components—carbon storage in forests. This indicator provides insight into a portion of the carbon cycle for forest ecosystems.

Key Points

Overall, the net storage of carbon in U.S. forests has been positive since 1953. The rate of storage increased between the 1950s and 1980s, but declined from 1987 to 1996. Net storage reflects the growth of trees minus the amount of carbon lost through harvesting, land use change, or disturbances such as fire, insects, and disease. The greatest amount of carbon is being stored in the North, followed by the Rocky Mountain region. Carbon storage has decreased in the South, possibly due to an increase in harvesting compared to growth (see graphic).

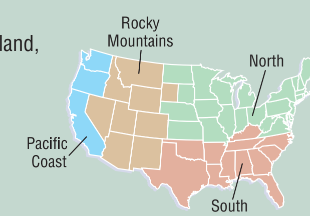
A number of gaps exist in understanding trends in ecological processes. Currently, no reliable national indicators are available for primary production, nutrient retention and processing, or reproduction and growth rates for plant and animal populations. There are also no national indicators for other functions that ecosystems perform, such as the provision of natural resources and regulation of air and water quality. No indicator is available for carbon stored in forest soil or in other ecosystems.

Carbon Storage in Forests by Region, 1953-1996



Data gathered in the lower 48 states. Carbon storage is measured only on timberland, which is forest that could potentially be used to produce commercial timber. Timberland covers about two-thirds of the forested land of the lower 48 states.

Source: *U.S. Department of Agriculture Forest Service, 2004*



Physical and Chemical Attributes of Ecological Systems

Physical attributes of ecological systems include air temperature, light, rainfall, and sea level. Chemical attributes include dissolved oxygen, nutrient levels, acidity, and salinity. These attributes shape evolution, drive ecological processes, and govern the nature of ecological systems. Even small changes in these attributes, such as changes in the acidity of a stream or the timing of rainfall in a desert, can have potentially large effects on ecological systems.

As species evolve, they respond to and reflect the physical and chemical attributes of the ecological systems in which they live. For example, species that evolved in tropical waters require higher, less variable temperatures than species that evolved in temperate waters, where average temperatures are lower and fluctuate more. Similarly, periodic floods or fires are essential to sustain many species in areas where such events have occurred over thousands or millions of years.

Many factors can alter the physical and chemical characteristics of ecological systems. For example, acid rain can increase the acidity of lakes in some regions. Damming or channelizing rivers can alter the flooding and sedimentation processes that sustain particular types of systems, such as wetlands. Changes in climate can alter species diversity and nearly every aspect of ecological structure and function.

Key Points

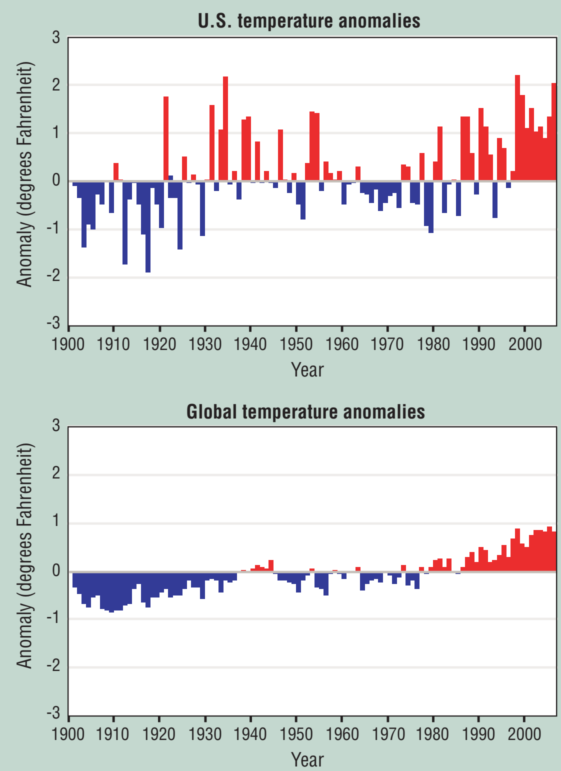
Since 1901, U.S. and global temperatures have risen at an average rate of 0.12°F per decade (see graphic). Lately, the rate of warming has increased. Over the last 30 years, temperatures rose by 0.59°F per decade in the lower 48 states and 0.31°F per decade worldwide (see graphic). These trends are consistent with reduced snow cover, earlier spring ice melt, and increased sea surface temperature, all of which can affect ecological systems. It is very likely that most of the observed temperature increase is due to rising levels of greenhouse gases in the atmosphere caused by human activities.

Sea levels rose steadily at many coastal locations between 1950 and 1999, particularly the Mid-Atlantic coast (3 to 6 millimeters per year) and at two sites in Louisiana (as high as 9 to 12 millimeters per year). These rates are based on tidal gauges that measure relative sea level rise, which accounts for sea and land height changes but does not distinguish between the two. Sea level rise can alter ecological conditions in coastal areas. Effects can include increased flooding and loss of freshwater systems as they are transformed into inland salt waters or open coastal waters.

About 25 percent of the nation's small streams show strong evidence of excess fine sediments, which can diminish habitat for aquatic life. Various land use practices, as well as modifications in stream flows, can lead to excess sedimentation in streams.

Gaps remain in assessing national trends in the physical and chemical attributes of ecological systems. Recent monitoring programs have provided a baseline for national trends in nutrients, acidity, and other factors in streams and estuaries. However, there still is a lack of trend data or historical baselines for some attributes, such as water levels in lakes, amount of snowpack, and long-term patterns of flooding and fires.

U.S. and Global Mean Temperatures, 1901-2006



U.S. data gathered in the lower 48 states.

"Anomaly" is the difference between the observed temperature and a standard that was chosen for comparison. In this case, the standard is the average temperature over the period 1961-1990.

Source: *National Oceanic and Atmospheric Administration, 2007*

Ecological Exposure to Contaminants

Plants and animals can be exposed to chemicals in the environment through air, water, soil, and food. If concentrations of these chemicals are too great, the reproduction, health, or survival of the individual plant or animal—or organisms that consume it—can be threatened. If enough individuals in a species (or more than one species) are affected, changes in the ecosystem structure and function can result.

Once inside an organism, certain chemicals build up over time with repeated exposure. This process is called bioaccumulation. Exposure to these chemicals can be determined by measuring chemical concentrations in plant and animal tissues. Other chemicals do not bioaccumulate but can still cause harm. For example, ozone pollution can damage the leaves of plants. Direct observations can indicate exposure to contaminants if the damage is visible.

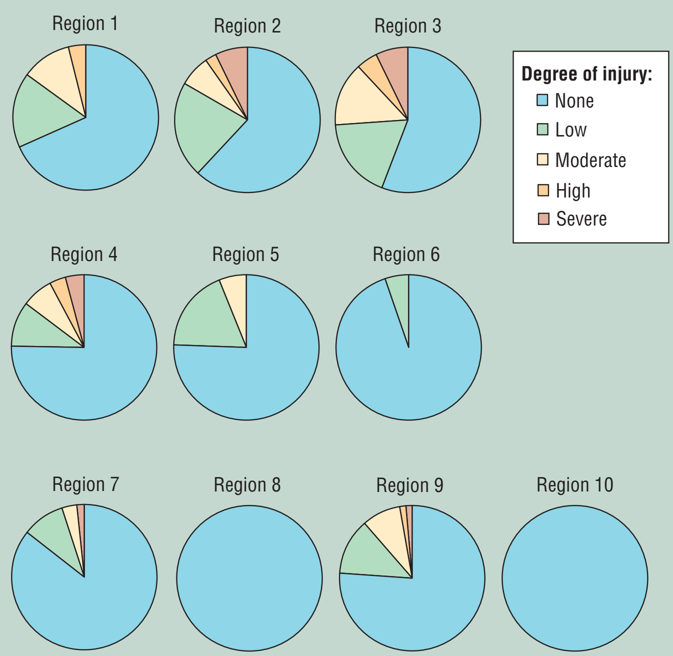
Key Points

In many areas of the country, at least 20 percent of ozone-sensitive forest plants show at least some injury from ozone pollution (see graphic). The Mid-Atlantic and Southeast show the highest levels of injury, while the Rocky Mountains and Pacific Northwest show no damage. Ozone pollution in the lower atmosphere can affect forest ecosystems. Damage to leaves is usually the first visible sign of injury to plants from ozone exposure.

Tissues from both coastal and freshwater fish contain bioaccumulative chemicals, such as the pesticide DDT or dichloro-diphenyl-trichloroethane, mercury, and polychlorinated biphenyls (PCBs). While exposure to these chemicals is occurring at variable levels throughout the country, scientists have not fully assessed the ecological effects of these exposures. These chemicals are known to affect coastal and freshwater fish species, but there are currently no national threshold levels for harmful effects to fish.

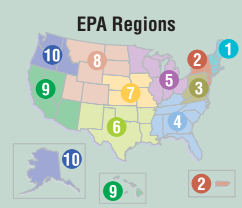
No consistent national indicators are available that measure the level of chemicals in plants or in wildlife other than fish. Therefore, no national trends are available for exposure of plants and animals to many common environmental pollutants.

Ozone Injury to Forest Plants by EPA Region, 2002

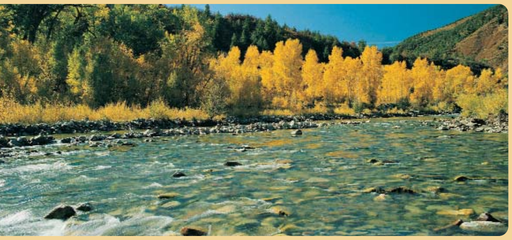


Data gathered from 945 monitoring sites in 41 states. Graphic shows the percent of monitoring sites in each category.

Source: *U.S. Department of Agriculture Forest Service, 2006*



Looking Ahead



Written for a general audience, *EPA's 2008 Report on the Environment: Highlights of National Trends* summarizes some of the more important findings from a more comprehensive companion report, *EPA's 2008 Report on the Environment*. The topics presented in this document provide important insight into what scientists know—and do not know—about current conditions and trends for the nation's air, water, land, human health, and ecological systems.

This information is based on environmental indicators and is presented at a national or regional level. Many other sources on the environment are available, including some that address issues at a more local level:

- EPA's Web site, www.epa.gov, is a good starting place to get more information on a particular topic or on a specific city or region of the country.
- Links to individual state environmental departments are available at: www.epa.gov/epahome/state.htm.
- Links to some actions that individuals can take to protect the environment and their own health are available at: www.epa.gov/roe.

EPA is just one of many organizations working to fill the gaps in our understanding of the environment. As those gaps are filled, a more complete picture of the nation's environment will emerge.

EPA plans to report periodically on the state of the environment through publications like this one. In addition, the electronic version of the report (www.epa.gov/roe) will present new data as they become available and allow users to offer suggestions for making this report more useful. Your input is welcome.

About the Indicators

The content of *Highlights of National Trends* is derived from *EPA's 2008 Report on the Environment*, which features detailed information on 85 environmental indicators. Most of these indicators are national in scope; however, regional indicators have been used in some cases to illustrate important scenarios and could be applied to the nation in the future. A subset of these indicators is presented in this document.

EPA selected indicators to highlight in this document based on their completeness, importance to the public and the scientific community, ability to show a meaningful trend, and ability to address a key environmental question. Indicators developed since *EPA's Draft Report on the Environment 2003* were also given priority.

Environmental Indicators

The indicators used in the *Report on the Environment*:

- Rely on actual measurements of environmental and human health conditions over time.
- Meet a set of standards, which include quality, accuracy, relevance, and comparability.
- Were reviewed by an independent scientific panel to ensure that they meet these standards.
- Are national (or in some cases regional) in coverage. They do not describe trends or conditions for a specific locale.
- Come from many governmental and non-governmental organizations, which collect data at different time periods and for varying purposes.
- Can only partially answer the key questions.

List of Indicators

Indicators included in *EPA's 2008 Report on the Environment* are listed below, along with the key environmental question each indicator attempts to answer. Indicators with an asterisk* are featured in *Highlights of National Trends*.

Air

Outdoor Air

What are the trends in outdoor air quality and their effects on human health and the environment?

- Carbon Monoxide Emissions*
- Ambient Concentrations of Carbon Monoxide*
- Lead Emissions*
- Ambient Concentrations of Lead*
- Nitrogen Oxides Emissions*
- Ambient Concentrations of Nitrogen Dioxide*
- Volatile Organic Compounds Emissions*
- Ambient Concentrations of Ozone*
- Ozone Injury to Forest Plants
- Particulate Matter Emissions*
- Ambient Concentrations of Particulate Matter*
- Sulfur Dioxide Emissions*
- Percent of Days With Air Quality Index Values Greater Than 100
- Mercury Emissions*
- Air Toxics Emissions*
- Ambient Concentrations of Benzene*
- Ozone and Particulate Matter Concentrations for U.S. Counties in the U.S./Mexico Border Region
- Ambient Concentrations of Manganese Compounds in EPA Region 5

Acid Rain and Regional Haze

What are the trends in outdoor air quality and their effects on human health and the environment?

- Nitrogen Oxides Emissions*
- Regional Haze*
- Sulfur Dioxide Emissions*
- Acid Deposition*
- Lake and Stream Acidity*
- Particulate Matter Emissions

Ozone Depletion

What are the trends in outdoor air quality and their effects on human health and the environment?

- Concentrations of Ozone-Depleting Substances*
- Ozone Levels Over North America*

Greenhouse Gases

What are the trends in greenhouse gas emissions and concentrations?

- U.S. Greenhouse Gas Emissions*
- Atmospheric Concentrations of Greenhouse Gases*

Indoor Air

What are the trends in indoor air quality and their effects on human health?

- U.S. Homes Above EPA's Radon Action Level*
- Blood Cotinine Level*

Water

Fresh Surface Waters

What are the trends in the extent and condition of fresh surface waters and their effects on human health and the environment?

- High and Low Stream Flows*
- Streambed Stability in Wadeable Streams
- Lake and Stream Acidity*
- Nitrogen and Phosphorus in Wadeable Streams*
- Nitrogen and Phosphorus in Streams in Agricultural Watersheds
- Nitrogen and Phosphorus Loads in Large Rivers*
- Pesticides in Streams in Agricultural Watersheds
- Benthic Macroinvertebrates in Wadeable Streams*

Ground Water

What are the trends in the extent and condition of ground water and their effects on human health and the environment?

- Nitrate and Pesticides in Shallow Ground Water in Agricultural Watersheds*

Wetlands

What are the trends in the extent and condition of wetlands and their effects on human health and the environment?

- Wetland Extent, Change, and Sources of Change*

Coastal Waters

What are the trends in the extent and condition of coastal waters and their effects on human health and the environment?

- Wetland Extent, Change, and Sources of Change
- Trophic State of Coastal Waters*
- Coastal Sediment Quality
- Coastal Benthic Communities*
- Coastal Fish Tissue Contaminants
- Submerged Aquatic Vegetation in the Chesapeake Bay*
- Hypoxia in the Gulf of Mexico and Long Island Sound*

Drinking Water

What are the trends in the quality of drinking water and their effects on human health?

- Population Served by Community Water Systems With No Reported Violations of Health-Based Standards*

Recreational Waters

What are the trends in the condition of recreational waters and their effects on human health and the environment?

There are currently no national indicators available for this topic.

Consumable Fish and Shellfish

What are the trends in the condition of consumable fish and shellfish and their effects on human health?

- Coastal Fish Tissue Contaminants*
- Contaminants in Lake Fish Tissue*

Land

Land Cover

What are the trends in land cover and their effects on human health and the environment?

- Land Cover*
- Forest Extent and Type*
- Land Cover in the Puget Sound/Georgia Basin

Land Use

What are the trends in land use and their effects on human health and the environment?

- Land Use*
- Urbanization and Population Change*

Wastes and the Environment

What are the trends in wastes and their effects on human health and the environment?

- Quantity of Municipal Solid Waste Generated and Managed*
- Quantity of RCRA Hazardous Waste Generated and Managed*

Chemicals Applied and Released to Land

What are the trends in chemicals used on the land and their effects on human health and the environment?

- Fertilizer Applied for Agricultural Purposes*
- Toxic Chemicals in Production-Related Wastes Combusted for Energy Recovery, Released, Treated, or Recycled*
- Pesticide Residues in Food*
- Reported Pesticide Incidents

Contaminated Lands

What are the trends in contaminated lands and their effects on human health and the environment?

- Current Human Exposures Under Control at High-Priority Cleanup Sites*
- Migration of Contaminated Ground Water Under Control at High-Priority Cleanup Sites*

Human Exposure and Health

Exposure to Environmental Contaminants

What are the trends in human exposure to environmental contaminants including across population subgroups and geographic regions?

- Blood Lead Level*
- Blood Mercury Level*
- Blood Cadmium Level
- Blood Cotinine Level*
- Blood Persistent Organic Pollutants Level*
- Urinary Pesticide Level*
- Urinary Phthlate Level*

Health Status

What are the trends in health status in the United States?

- General Mortality*
- Life Expectancy at Birth*
- Infant Mortality*

Diseases and Health Conditions

What are the trends in human disease and conditions for which environmental pollutants may be a risk factor, including across population subgroups and geographic regions?

- Cancer Incidence*
- Childhood Cancer Incidence*
- Cardiovascular Disease Prevalence and Mortality*
- Chronic Obstructive Pulmonary Disease Prevalence and Mortality*
- Asthma Prevalence*
- Infectious Diseases Associated With Environmental Exposures or Conditions*
- Birth Defects Prevalence and Mortality
- Low Birthweight*
- Preterm Delivery*

Ecological Condition

Patterns in Ecological Systems

What are the trends in the extent and distribution of the nation's ecological systems?

- Land Cover
- Forest Extent and Type*
- Forest Fragmentation*
- Wetland Extent, Change, and Sources of Change
- Land Use
- Urbanization and Population Change
- Land Cover in the Puget Sound/Georgia Basin
- Ecological Connectivity in EPA Region 4*
- Relative Ecological Condition of Undeveloped Land in EPA Region 5

Biological Diversity

What are the trends in the diversity and biological balance of the nation's ecological systems?

- Coastal Benthic Communities
- Benthic Macroinvertebrates in Wadeable Streams
- Bird Populations*
- Fish Faunal Intactness*
- Submerged Aquatic Vegetation in the Chesapeake Bay
- Non-Indigenous Species in the Estuaries of the Pacific Northwest

Ecological Processes

What are the trends in the ecological processes that sustain the nation's ecological systems?

- Carbon Storage in Forests*

Physical and Chemical Attributes of Ecological Systems

What are the trends in the critical physical and chemical attributes and processes of the nation's ecological systems?

- U.S. and Global Mean Temperature and Precipitation*
- Sea Surface Temperature
- High and Low Stream Flows
- Streambed Stability in Wadeable Streams*
- Sea Level*
- Nitrogen and Phosphorus Loads in Large Rivers
- Nitrogen and Phosphorus in Streams in Agricultural Watersheds
- Nitrogen and Phosphorus in Wadeable Streams
- Lake and Stream Acidity
- Hypoxia in the Gulf of Mexico and Long Island Sound

Ecological Exposure to Contaminants

What are the trends in biomeasures of exposure to common environmental pollutants in plants and animals?

- Coastal Fish Tissue Contaminants*
- Ozone Injury to Forest Plants*
- Contaminants in Lake Fish Tissue*

Acknowledgements

Highlights Document Team

Ethan McMahon (EPA)
Project Lead

Suzanne Annand (EPA)

Gerry Bakker (EPA)

Gail Bentkover (EPA)

Vipul Bhatt (EPA)

Paul Borst (EPA)

Ethel Brandt (EPA)

Gerard Bulanowski (EPA)

Deborah Burgin (EPA)

Lael Butler (EPA)

Robert Cassell (EPA)

Heather Case (EPA)

Arden Calvert (EPA)

Andrea Cherepy (EPA)

Julie Damon (EPA)

Nicoletta DiForte (EPA)

Sandra Duque (EPA)

Rick Durbrow (EPA)

Vance Fong (EPA)

Tom Forbes (EPA)

Debra Forman (EPA)

Michael Hadrick (EPA)

Belinda Hawkins (EPA)

Michelle Hiller-Purvis (EPA)

Matt Hoagland (EPA)

Elizabeth Jackson (EPA)

Marjorie Jones (EPA)

Monica Jones (EPA)

Stuart Kerzner (EPA)

Carrie Knowlton (EPA)

Danelle Lobdell (EPA)

Macara Lousberg (EPA)

Maricruz MaGowan (EPA)

Lawrence Martin (EPA)

Carmen Maso (EPA)

Jeff Maurer (EPA)

Ronald McHugh (EPA)

Jay Messer (EPA)

Patricia Murphy (EPA)

Laura Neilsen (EPA)

William Nickerson (EPA)

Nicole Paquette (EPA)

Randolph Perfetti (EPA)

William Rhea (EPA)

Denice Shaw (EPA)

Madalene Stevens (EPA)

Richard Sumpter (EPA)

Guy Tomassoni (EPA)

Winona Victery (EPA)

Beth Walls (EPA)

Nancy Wentworth (EPA)

Sherri White (EPA)

Ann Williamson (EPA)

National Advisory Council for Environmental Policy and Technology ROE Workgroup

Arleen O'Donnell
Massachusetts DEP
Co-chair

Don Watts
New Jersey Institute of Technology
Co-chair

Jeff Crane
Colorado Watershed Assembly

Carolyn Green
Sunoco

John Howard
Vinson & Elkins
NACEPT Chair

George Lambert
University of Medicine and Dentistry of New Jersey
SAB member

Stan Laskowski
University of Pennsylvania

Robert Olson
Institute for Alternative Futures

Bradley Smith
Western Washington University

Victoria Tschinkel
1000 Friends of Florida

Robert Twiss
University of California-Berkeley
SAB member

Sonia Altieri
EPA
Designated Federal Officer for NACEPT

Thomas Armitage
EPA
Designated Federal Officer for SAB

EPA
United States
Environmental Protection
Agency

Office of Research and Development
National Center for Environmental Assessment
Washington, DC 20460

Official Business
Penalty for Private Use
$300

EPA-260-R-08-002
June 2008
www.epa.gov