The global trends documented in *Vital Signs 1998*—from spreading water scarcity to big increases in wind power—will play a large part in determining the quality of our lives and our children's lives in the next decade.

This seventh volume in the series from the Worldwatch Institute shows in graphic form the key trends that often escape the attention of the news media and world leaders—and are often ignored by economic experts as they plan for the future. Written by the staff of the award-winning Worldwatch Institute, this book lets readers track key indicators that show social, economic, and environmental progress, or the lack of it. This authoritative data has been distilled from thousands of documents obtained from government, industry, scientists, and international organizations into "vital signs" of our times.

Each year, *Vital Signs* presents emerging trends in more than one hundred clear and compelling charts, tables, and graphs, accompanied by concise, thoughtful analysis. Among the findings:

- 1997 was the hottest year since record keeping began in 1866.
- The amount of carbon dioxide in the atmosphere reached its highest point in 160,000 years.
- China accounts for half of world pork production and consumption.
- The Internet has more than doubled in size each year in the last decade, but more than 90 percent of Internet users are in industrial countries.
- Nearly 6 million people contracted HIV—the virus that causes AIDS—in 1997, a new record. More than 40 percent of these new infections occurred in women.
- Every week more than one million people are added to the world's urban centers.
- The amount of private capital flowing into the "emerging markets" of the developing world exploded in the early 1990s.

Whether you read *Vital Signs* for a preview of the next decade or to verify a particular trend, you will find it comprehensive and authoritative. *Vital Signs* is an excellent companion to Worldwatch's annual *State of the World.*

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VITAL SIGNS

1998

THE ENVIRONMENTAL TRENDS THAT ARE SHAPING OUR FUTURE

Lester R. Brown
Michael Renner
Christopher Flavin

WORLDWATCH INSTITUTE

VITAL SIGNS 1998

The Environmental Trends That Are Shaping Our Future

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Worldwatch Database Disk

The data from all graphs and tables contained in this book, as well as from those in all other Worldwatch publications of the past two years, are available on disk for use with IBM-compatible or Macintosh computers. This includes data from the State of the World *and* Vital Signs *series of books, Worldwatch Papers,* World Watch *magazine, and the Environmental Alert series of books. The data are formatted for use with spreadsheet software compatible with Lotus 1-2-3 version 2, including all Lotus spreadsheets, Quattro Pro, Excel, SuperCalc, and many others. For IBM-compatibles, a 3½-inch (high-density) disk is provided. Information on how to order the Worldwatch Database Disk can be found on the final page of this book.*

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Part Two: SPECIAL FEATURES

ACKNOWLEDGMENTS

The research and writing to produce *Vital Signs 1998* have been generously supported by the W. Alton Jones Foundation, the United Nations Environment Programme, and the Surdna Foundation.

But *Vital Signs* could not easily be assembled without the work done to put together the Institute's other publications—the annual *State of the World*, the bimonthly *World Watch* magazine, and the monographs published in the Worldwatch Paper series. These efforts rely on financial support from additional foundations and donors. We therefore also thank the Geraldine R. Dodge Foundation, the Foundation for Ecology and Development, the Ford Foundation, the William and Flora Hewlett Foundation, the John D. and Catherine T. MacArthur Foundation, the Charles Stewart Mott Foundation, the David and Lucille Packard Foundation, the Rasmussen Foundation, the Rockefeller Brothers Fund, Rockefeller Financial Services, the Summit Foundation, the Turner Foundation, the Wallace Genetic Foundation, the Wallace Global Fund, the Weeden Foundation, and the Winslow Foundation.

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As in the previous editions of *Vital Signs*, independent editor Linda Starke played a crucial role in melding 54 individual manuscripts written by 17 different authors into a coherent set of indicators and features. Our in-house designer Elizabeth Doherty efficiently converted disparate file formats and graphs into the visually consistent series of texts, tables, and figures that our readers have come to expect. And we thank Lori Brown for making sure, as in years past, that all the tables and figures contained in the printed version of *Vital Signs* are properly incorporated into the Worldwatch Database Disk. Lori, together with Laura Malinowski, runs our library and keeps researchers amply supplied with everything from books and magazines to Web-derived materials.

In addition to current Worldwatch researchers, alumni Nick Lenssen, Jennifer Mitchell, and Mike Strauss contributed to the book from Colorado, Tennessee, and California, respectively. John Tuxill continues to pitch in from rural Panama. Seth Dunn, Brian Halweil, and Jennifer Mitchell not only prepared their own pieces, but also assisted with several others. Research intern Sophie Chou also helped with the book.

Beyond the research team, we are grateful to Vice President Reah Janise Kauffman, who assists in fundraising and serves as liaison with our domestic and foreign publishers, 20 of whom have published editions of *Vital Signs*. And without the bedrock of support from our administrative team of Barbara Fallin and Suzanne Clift, our communications team headed by Vice President Richard Bell and assisted by Mary Caron and Amy

solar, and other renewable energy resources, these leading oil companies have, in effect, become energy companies. And they have indicated that they take the threat of global warming seriously.

From a commercial point of view, it is not too surprising that oil companies are beginning to look at renewable energy resources. Thus far during the 1990s, sales of coal and oil have grown just over 1 percent a year. (See pages 50–53 and Table 1.) The sale of natural gas, regarded by many as a transition fuel from the fossil fuel era to the solar/hydrogen age, has been growing at 2 percent a year since 1990. Wind power, meanwhile, has grown an amazing 26 percent a year. (See pages 58–59.) And sales of solar cells, averaging 15 percent annually from 1990 through 1996, jumped by a phenomenal 43 percent in 1997. (See pages 60–61.) At the end of the year, an estimated 400,000 homes, most of them in Third World villages, were getting their electricity from solar cell arrays.

Advancing technology is also fueling this growth in solar cell use. The use of a photovoltaic roofing material developed in Japan is now growing by leaps and bounds. The Japanese government plans to have in place 4,600 megawatts of rooftop generating capacity by 2010, an output comparable to the electricity generation of a country the size of Chile.

Corporations in the energy business that are interested in growth are starting to shift investments from oil, coal, and nuclear power, where growth is at a near standstill, to wind and solar, which have rather spectacular growth rates. Once thought of as fringe energy sources, wind and photovoltaic cells are seen increasingly as mainstays of the new energy economy now emerging. A wind resource survey by the U.S. Department of Energy, for example, concluded that North Dakota, South Dakota, and Texas had enough harnessable wind energy to meet all U.S. electricity needs. Today, the world gets roughly one fifth of its electricity from hydropower, but its potential is dwarfed by that of wind.

The energy revolution is not limited to new sources of energy. It also involves some dramatic gains in the efficiency of energy use. One of these involves the compact fluorescent light bulb, which provides the same amount of light as traditional incandescents, but with less than one fourth as much electricity. Sales of compact fluorescent bulbs have climbed from 45 million in 1988 to 356 million in 1997, an eightfold increase, with China now the leading manufacturer. (See pages 62–63.) The estimated 980 million compact fluorescent bulbs in use today lower electricity needs by the output of roughly 100 coal-fired power plants.

THE DESIRE FOR MOBILITY

Evidence of the human desire to become more mobile is reflected in sales of vehicles, such as bicycles, motorbikes, and automobiles. Although world production of bikes and cars was roughly the same in 1969, at just over 20 million, the gap between the two has widened dramatically since then. (See pages 86–87, pages 90–91, and Figure 3.) Now more than 100 million bicycles come off the assembly lines each year, compared with fewer than 40 million automobiles. In 1997, car production increased more than 5 percent over 1996. Bicycle production, meanwhile, suffering from too much capacity and excessive inventories, dropped in 1996 (the latest year for which data are available) to 101 million from 109 million the year before.

The enormous differences in the sales volume of bicycles and automobiles reflects more than anything else the number of people reaching the level of affluence that lets them buy bicycles versus the much smaller number who can afford an automobile. In addition, those living in cities, particularly crowded Asian cities, have discovered that they can often be more mobile with a modest investment in a bike than with a far larger investment in an car.

Several countries in Europe systematically try to increase bicycle use. In Danish and Dutch cities, an estimated 20 percent and 30 percent respectively of all trips are taken by bicycle. Bikes have also been strongly encouraged in Germany, where use has increased by 50 percent over the last two decades.

In recent years, electric bicycles have begun to attract attention. Relying on a small battery, these provide electrical assistance on hills and in other situations that enable the average speed of the bicycle to increase. The technology is particularly attractive to older riders, to those who have to contend with hilly terrain, or to those who have a particularly long daily commute.

TABLE 1. TRENDS IN ENERGY USE, BY SOURCE, 1990–97[1]

ENERGY SOURCE	ANNUAL RATE OF GROWTH (percent)
Wind power	25.7
Solar photovoltaics	16.8
Geothermal power[2]	3.0
Natural gas	2.1
Hydroelectric power[2]	1.6
Oil	1.4
Coal	1.2
Nuclear power	0.6

[1]Energy use measured in varying units: installed generating capacity (megawatts or gigawatts) for wind, geothermal, hydro, and nuclear power; million tons of oil equivalent for oil, natural gas, and coal; megawatts for shipments of solar photovoltaic cells. [2]1990–96 only.
SOURCES: See pages 50–61.

WORLD GETTING WARMER

In 1997, carbon emissions, carbon dioxide (CO_2) concentrations in the atmosphere, and the Earth's average temperature all climbed to record highs. Carbon emissions in 1997 totaled 6.3 billion tons, up 1.5 percent from the 6.2 billion tons of 1996. (See pages 66–67.) Atmospheric concentrations of CO_2 climbed to 364 parts per million—the highest in 160,000 years. (See Figure 4.) The Intergovernmental Panel on Climate Change, a body of some 1,500 of the world's leading meteorologists and other scientists, estimates that annual carbon emissions will have to drop below 2 billion tons by 2050 if atmospheric concentrations of CO_2 are to stabilize.

With the record temperature of 1997, the 14 warmest years since recordkeeping began in 1866 have all occurred since 1979. (See pages 68–69 and Figure 5.) And the 5 warmest have come during the 1990s. Although this strong warming trend over the last two decades does not provide absolute proof of CO_2-induced climate change, it is yet another piece of evidence that global warming is indeed under way.

Additional evidence can be found in melting icecaps in the Andes, shrinking glaciers in the European Alps, and the shrinkage in the sea ice around Antarctica. The combination of ice melting and the expansion of water from warm-

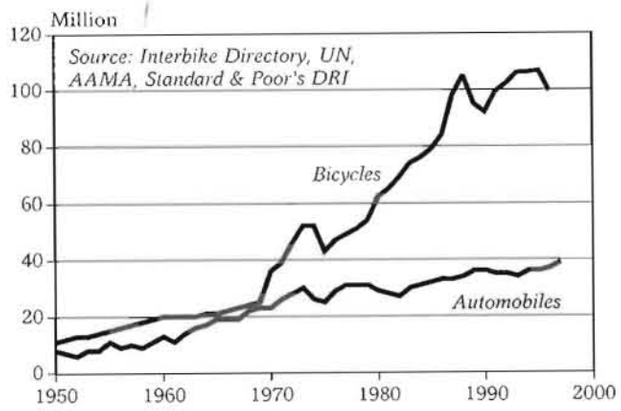

Figure 3: World Bicycle and Automobile Production, 1950–97

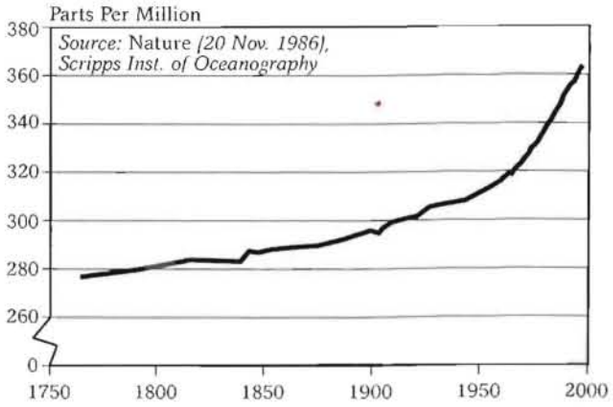

Figure 4: Atmospheric Concentrations of Carbon Dioxide, 1764–1997

ing has raised average sea level between 10 and 25 centimeters over the last century.

ALTERING NATURAL SYSTEMS

By far the most visible human alteration of the planet has been the destruction of forests. Almost half the forests that once covered vast expanses of the Earth are already gone. Between 1980 and 1995, the world lost at least 200 million hectares of forest—an area three times as large as Texas. In recent years, the world has experienced an estimated net loss of 16 million hectares a year. (See pages 124–25.)

The amount of nitrogen fixed in forms that plants can use through fertilizer manufacturing, the burning of fossil fuels, and the extensive planting of leguminous crops such as soybeans now exceeds the amount fixed by nature. (See pages 132–33.) Synthesized nitrogen fertilizer, the use of which has increased ninefold since 1950, is the major form of nitrogen fixation as a result of human activities. Wherever it leads to excessive nutrient runoff, as it does in the Midwest and the lower Mississippi Valley, it often leads to vast algal blooms that then decay, absorbing the free oxygen in the water and depriving fish of oxygen. The hypoxic region, or "dead zone," now formed through this process each year in the Gulf of Mexico is roughly the size of New Jersey.

Closely associated with the burning of fossil fuels is the emission of sulfur dioxide and nitrous oxides, which combine with moisture in the atmosphere to form acid rain. Although emissions of these two pollutants have been sharply reduced in North America and Western Europe, they are still climbing rapidly in Asia. (See pages 134–35.) Acid deposition in parts of China is now far higher than the levels reached in Japan in 1975 before that nation established stringent emission limits. Acids can eliminate fish in freshwater lakes, rendering them lifeless.

Another economic activity that is particularly disruptive of the environment is mining. In recent years, mineral exploration has expanded dramatically in developing countries as mines have been depleted in industrial nations. (See pages 148–49.) Gold mining is especially disruptive. The 2,400 tons of gold produced in 1997 generated 725 million tons of waste—one ton of waste for every eight people on the planet. In addition to the physical disruption that gold mining brings, the resulting waste includes large quantities of cyanide solution and mercury, which are used to separate gold from the ore.

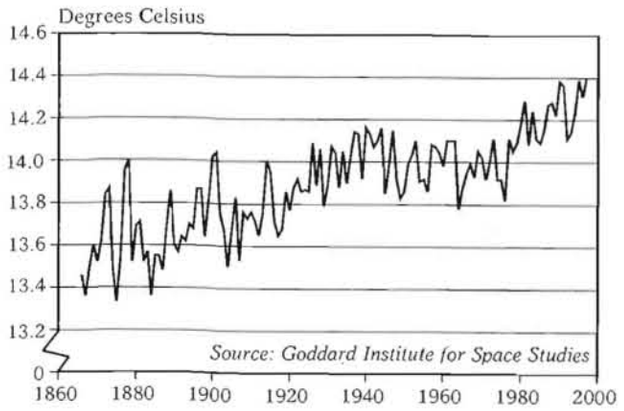

Figure 5: Average Temperature at the Earth's Surface, 1866–1997

One of the consequences of the many alterations in the environment just described is an accelerating loss of species. The most recent study of the state of life on Earth by the World Conservation Union–IUCN estimates that 11 percent of all bird species are threatened with extinction. (See pages 128–29.) For fish, the figure is far higher—34 percent. In the U.S. Colorado River basin, 29 of 50 native fish species are either endangered or already extinct. Among the 233 species of primates, of which humans are one, half are now threatened with extinction. The surviving populations of some primate species are measured in the hundreds.

CHANGING SOCIAL CONDITIONS

As noted earlier, at the end of 1997 we shared the planet with 80 million more people than at the beginning of the year. (See pages 102–03.) Close to 60 percent of these people were added in Asia, in countries that are already densely populated. If recent urbanization trends continue, in a few years—for the first time in human history—more people will live in cities than in the countryside. (See pages 108–09.)

Educational levels are rising worldwide. Among the more prominent gains in recent years has been the increase in female education in developing countries. (See pages 154–55.) Between 1990 and 1995, female enrollment in some 47 developing countries surveyed by the U.S. Agency for International Development increased from 226 million to 254 million. As a result, nearly 70 percent of girls of primary-school age worldwide were in school in 1995. Notwithstanding this progress, a third of all children in the developing world fail to complete even four years of education.

In industrial countries, the big difference between men and women in educational achievement traditionally has been in graduate degrees in professional schools. But now this, too, is changing. Law and business school enrollments are approaching gender parity. In medical schools in the United States and Canada, more than 40 percent of students are female. For veterinary schools, it is nearly 70 percent. In engineering and architecture schools, however, men still greatly outnumber women.

Of the social trends that affect human health most directly, the spread of HIV is among the most destructive. In 1997, nearly 6 million people were newly infected with the virus that causes AIDS, bringing the total infected worldwide to 42 million. (See pages 106–07.) Although a majority of HIV infections are found in Africa, the number of new infections is growing fastest in Asia. Some countries, such as Uganda and Thailand, have made impressive progress in checking the spread of HIV. In sheer numbers, the principal threats today are in India and China: prostitutes in Bombay, India, and intravenous drug users in parts of China have infection rates over 50 percent. If the virus cannot be contained in these early centers of infection, it could spread rapidly in these huge populations, infecting record numbers. With 2.3 million fatalities in 1997, this new disease now claims more than twice as many lives as malaria.

One threat to health that affects far more people than AIDS is cigarette smoking. Roughly half of those who smoke will eventually be killed by the effects of this habit, either through heart disease, stroke, or lung cancer or through one of the many other life-threatening illnesses associated with smoking.

In 1997, the world produced some 5.8 trillion cigarettes, roughly 1,000 for each of its 5.8 billion men, women, and children. (See pages 110–11.) The one encouraging sign is that production is not expanding as fast as population. As a result, the number of ciga-

Carbon Emissions Resume Rise

Seth Dunn

Annual global emissions of carbon from the burning of fossil fuels rose 107 million tons in 1997 to a new high of 6.3 billion tons.[1] (See Figure 1.) The 1.5-percent increase was due to continued emissions growth in the industrial and developing worlds, and a drop of emissions in the former Eastern bloc.[2] (See Figure 2.) World carbon emissions have risen nearly fourfold since 1950.[3]

Western industrial countries account for approximately 55 percent of the carbon emitted since 1950, and for 45 percent of current emissions.[4] The world's leading emitter is the United States, with 23 percent of the total.[5] U.S. carbon output expanded 8.8 percent between 1990 and 1996, with a 3.5-percent increase in 1996 alone.[6] Emissions from Japan grew 12.5 percent over this six years, and Australia's increased 9.6 percent.[7]

The European Union was only 1 percent above 1990 levels by 1996, however, thanks largely to reductions of 7.6, 2.0, and 1.1 percent in Germany, the United Kingdom, and France.[8] These cuts resulted, respectively, from energy reforms and the shutdown of energy-intensive industries, coal subsidy removal, and reduced reliance on fossil-fuel-based electricity.

In Eastern Europe and the former Soviet Union, which account for 21 percent of historical emissions since 1950 and 15 percent of today's output, emissions have plateaued after dropping dramatically earlier in the decade.[9] Emissions from Russia, the world's third highest, are nearly 33 percent below 1990 levels; those in the Ukraine are almost 56 percent under this mark.[10] Although emissions from these countries are expected to rebound as economies continue their recovery, they are unlikely to return to 1990 levels.

Emissions are growing fastest in the developing world—responsible for 24 percent of emissions since 1950 and a 40-percent share today.[11] China, the world's second leading emitter with a 14-percent share, has seen a 29-percent rise in carbon output since 1990.[12] India has registered a 38-percent increase, and Indonesia, 47 percent.[13] On a per capita basis, however, developing-country emissions are well below those of the industrial world: the average American accounts for 21 times as much carbon as the typical Indian.[14] And the volume of industrial-country output is far greater: the increase in U.S. emissions alone between 1990 and 1996 exceeded the combined total annual output of Brazil and Indonesia.[15]

When released to the atmosphere, carbon reacts with oxygen to form carbon dioxide (CO_2), the greenhouse gas responsible for 64 percent of ongoing human-induced changes in climate.[16] Atmospheric concentrations of CO_2 reached 363.6 parts per million (ppm) in 1997, their highest point in 160,000 years.[17] According to the Intergovernmental Panel on Climate Change (IPCC), a doubling of preindustrial concentrations to 550 ppm would increase global average surface temperatures 1–3.5 degrees Celsius over the next century.[18] This would cause a wide array of dislocations to human and natural systems.[19]

The IPCC estimates that annual carbon emissions must be reduced to below 2 billion tons by 2050 to stabilize concentrations at 350 ppm—a level scientists believe would keep temperature within the maximum rates of change during the last 200,000 years.[20] Movement toward this accelerated decarbonization was made in Kyoto, Japan, in December 1997, when 171 nations agreed to a legally binding protocol to the U.N. climate treaty committing western industrial and former Eastern bloc nations to cut their collective greenhouse gas emissions 5.2 percent below 1990 levels between 2008 and 2012.[21]

Meeting the Kyoto target would actually require only a 2.9-percent cut from current levels, as emissions from this group of countries are already 2.3 percent below the 1990 mark.[22] Countries will also be permitted to trade emissions, allowing western industrial nations to purchase from former Eastern bloc countries the right to emit as much as 300 million tons of carbon annually in order to meet their goals.[23] Rules for trading and new developing-country commitments will be discussed at the next climate conference, being held in Buenos Aires in November 1998.[24]

WORLD CARBON EMISSIONS FROM FOSSIL FUEL BURNING, 1950–97

YEAR	EMISSIONS (mill. tons of carbon)
1950	1,609
1955	2,009
1960	2,520
1965	3,068
1966	3,222
1967	3,334
1968	3,501
1969	3,715
1970	3,986
1971	4,143
1972	4,306
1973	4,538
1974	4,545
1975	4,518
1976	4,777
1977	4,910
1978	4,950
1979	5,229
1980	5,159
1981	4,988
1982	4,948
1983	4,935
1984	5,103
1985	5,273
1986	5,459
1987	5,580
1988	5,795
1989	5,897
1990	5,952
1991	6,017
1992	5,915
1993	5,876
1994	6,011
1995	6,219
1996 (est)	6,212
1997 (prel)	6,305

SOURCES: Worldwatch estimates based on ORNL, BP, DOE, EC, PlanEcon, and *Journal of Commerce*.

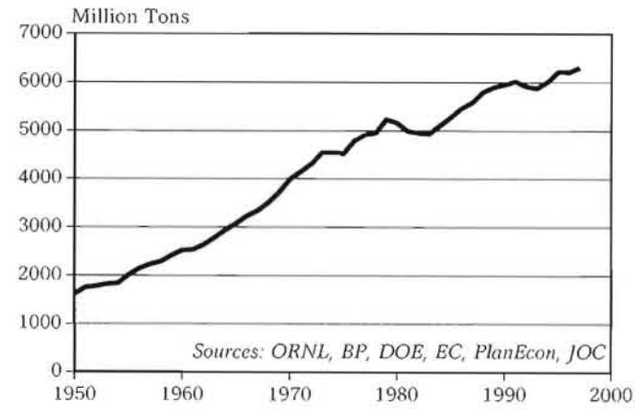

Figure 1: World Carbon Emissions from Fossil Fuel Burning, 1950–97

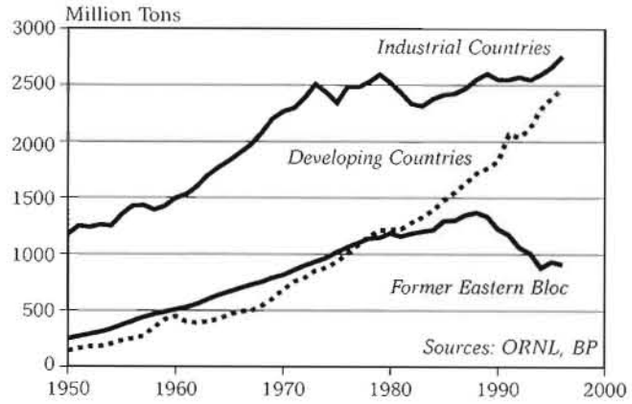

Figure 2: Carbon Emissions from Fossil Fuel Burning, by Economic Region, 1950–96

Global Temperature Reaches Record High

Molly O'Meara

Spurred by a strong El Niño in the tropical Pacific, the air temperature at the Earth's surface in 1997 averaged 14.40 degrees Celsius, just barely surpassing the record high set in 1995, according to NASA's Goddard Institute of Space Studies in New York.[1] (See Figure 1, which uses a lower base number than earlier *Vital Signs*.)[2] Long-term surface temperature data sets maintained by the Climatic Research Unit of the University of East Anglia in England and the U.S. National Oceanic and Atmospheric Administration (NOAA) also show 1997 as the hottest year on record.[3] (The data sets are based on slightly different combinations of worldwide land and sea measurements.)

The 1990s—the hottest decade since recordkeeping began in 1866—appear to be part of a twentieth-century warming trend.[4] Ice core records from Antarctica show that temperatures this century are higher than any since at least 1400 AD.[5] With warmer temperatures, the timing of the seasons appears to have shifted in northern latitudes in the past half-century, with spring now occurring earlier and fall later.[6]

Lonnie Thompson of Ohio State University has found that ice caps in the Andes are melting more quickly since the 1970s; glaciers atop the European Alps have lost half their volume since 1850, according to Wilfried Haeberli, director of the World Glacier Monitoring Service.[7] Satellite radar shows that North Greenland's ice cap is thinning by about 2.5 centimeters a year.[8] And at the South Pole, analysis of whaling records suggests that a quarter of the sea ice around Antarctica has disappeared, with a 15-year period of dramatic loss starting in the late 1950s.[9] Average sea level worldwide has risen 10–25 centimeters in the last century as water has expanded and ice has melted.[10]

Announcing the record-breaking warmth of 1997, NOAA Senior Scientist Tom Karl linked the sustained trend toward increasingly warmer global temperatures to heat-trapping "greenhouse gases" released by human activities, such as the burning of fossil fuels.[11] Indeed, this is the consensus of the world's top climate scientists, assembled by the United Nations in the Intergovernmental Panel on Climate Change.[12] The magnitude, timing, and geographic pattern of observed temperature changes over the past century match closely those simulated by computer models.[13]

The El Niño that influenced temperatures in 1997 characteristically began with a warming of the ocean off the coast of Peru, bringing heavy precipitation to the eastern Pacific while stranding the western Pacific in a drought.[14] By the fall of 1997, sea surface temperatures in the equatorial Pacific were warmer than those recorded at the same time in 1982, during the last strong El Niño.[15] This warming contributed to a record high global average sea surface temperature in 1997.[16] (See Figure 2.) Although the link between El Niño and human-induced climate change is not well understood, El Niños have occurred more often since 1977, with an unusually prolonged event from 1990 to 1995.[17]

If average temperatures continue to rise as projected, the consequences are likely to include a greater incidence of floods and droughts, diminished food production, and an expanded range for disease vectors.[18] In concert with other problems that stem from a growing human population, warmer temperatures could push ecosystems past tolerable thresholds.[19] These unhealthy synergisms may already be spurring events such as the worldwide decline of amphibians, the large-scale growth of toxic algae in the oceans, and the death of coral reefs.[20]

One of the gravest threats is the effect of higher temperatures on the North Atlantic "conveyor belt": an infusion of fresh water from melting ice caps could lessen the subtle differences in water temperature and salinity that drive the oceanic conveyor.[21] Without the heat that the conveyor brings to the North Atlantic, Europe might be plunged into a mini-ice age—an ironic side effect of global warming.[22]

GLOBAL AVERAGE TEMPERATURE, 1950–97

YEAR	TEMPERATURE[1] (degrees Celsius)
1950	13.86
1955	13.92
1960	13.98
1965	13.88
1966	13.95
1967	13.99
1968	13.93
1969	14.05
1970	14.02
1971	13.92
1972	14.00
1973	14.11
1974	13.92
1975	13.92
1976	13.82
1977	14.11
1978	14.05
1979	14.09
1980	14.18
1981	14.29
1982	14.08
1983	14.24
1984	14.11
1985	14.09
1986	14.15
1987	14.27
1988	14.28
1989	14.22
1990	14.38
1991	14.36
1992	14.11
1993	14.14
1994	14.23
1995	14.39
1996	14.31
1997 (prel)	14.40

[1]Base number is 1 degree Celsius lower than in earlier *Vital Signs*.
SOURCE: Surface Air Temperature Analyses, Goddard Institute for Space Studies, New York, 14 January 1998.

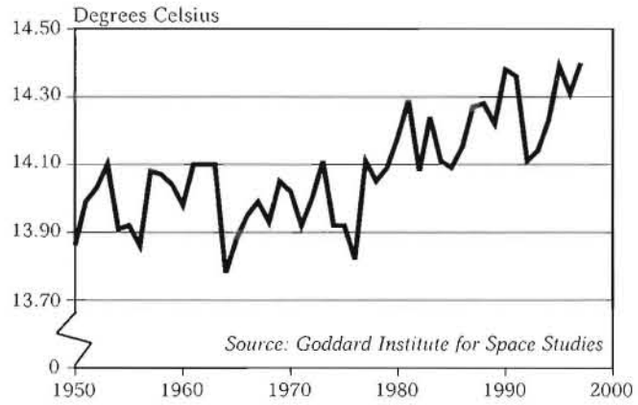

Figure 1: Average Temperature at the Earth's Surface, 1950–97

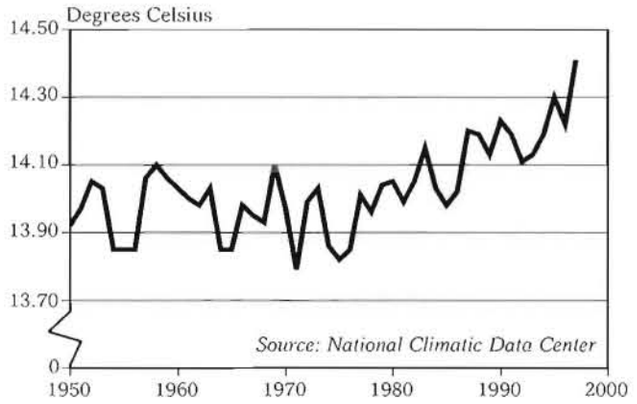

Figure 2: Global Average Sea Surface Temperature, 1950–97

December 1997, Kyoto, Japan.
24. "Report of the Third Conference," op. cit. note 21.

GLOBAL TEMPERATURE REACHES RECORD HIGH
(pages 68–69)

1. James Hansen et al., Goddard Institute for Space Studies, Surface Air Temperature Analyses, "Global Land-Ocean Temperature Index," as posted at <http://www.giss.nasa.gov/Data/GISTEMP>, viewed 14 January 1998.
2. The importance of Figure 1 is the change in temperature over time, as the Goddard Institute analyzes temperature change rather than absolute temperature. In earlier versions of *Vital Signs*, Worldwatch added the temperature change reported by the Goddard Institute to an estimated global temperature of 15 degrees Celsius, but the institute has since informed Worldwatch that a better base number would be 14 degrees Celsius. James Hansen, Goddard Institute for Space Studies, New York, e-mail to author, 18 January 1998.
3. "World Warms Into Record Books," (London) *Daily Telegraph*, 28 November 1997; National Climatic Data Center (NCDC), National Oceanic and Atmospheric Administration (NOAA), "The Climate of 1997," as posted at <http://www.ncdc.noaa.gov/pw/cg/ghcn/ghcn_sst/>, viewed 12 January 1998.
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Some topics are included each year in Vital Signs*; others, particularly those in Part Two, are included only in certain years. The following is a list of the topics covered thus far in the series, with the year or years each appeared indicated in parentheses.*

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