AN ALABAMA CITIZEN'S

GUIDE TO THE ENVIRONMENT

ALABAMA POLICY INSTITUTE

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An Alabama Citizen's Guide to the Environment

by Dr. John R. Hill

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An Alabama Citizen's Guide to the Environment
Executive Summary

It seems the common perception of Americans is that the environment is worsening, but there are signs of growing awareness that real progress and improvement has been made. *An Alabama Citizen's Guide to the Environment* demonstrates that, while problems still exist, the environment as a whole is becoming cleaner. The following facts help to show environmental improvements:

Global Warming

- Since 1880, the average temperature in the United States has risen at the rate of 0.01° F (.0055° C) per year. Man-made causes have contributed, at most, about one-half of one percent to this small rise in temperature; the remainder is the result of natural causes.

Air Quality

- By most standards, Alabama's air is cleaner than it was 30 years ago. Since 1975, ambient levels of carbon monoxide are down 30 percent; lead is down 22 percent; nitrogen dioxide is down 74 percent; ozone is down 9 percent; and since 1977, sulfur dioxide is down 68 percent.

Water Quality

- A large number of rivers and streams in the United States have above-average levels of phosphorus and nitrogen, particularly in those that are parts of agricultural watersheds. Some pesticides are also present in these waters, but few are in excess.

- Lake and stream acidities are on the decline across the nation, with the greatest decreases in the Adirondacks and the Northern Appalachian Plateau (declines of 52 percent and 32 percent, respectively).

- Most of the nation's coastal waters are in fair or good condition. Over 90 percent of the nation's coastal sediments contain no significant toxins.

Land Use

- Almost two-thirds of Alabama's surface area is forest; 72 percent of which is owned by private, non-industrial land owners.

- From 1982 to 2003, the degree of water-created erosion on farmland in Alabama fell 31 percent.

Toxics Releases

- Using the EPA's 1988 list of toxins, the amount of toxins released in Alabama fell 45.8 percent from 1988 to 2006. If the larger list of toxins (the 2000 baseline) is used, the total amount of toxins released in Alabama dropped 26.7 percent from 2000 to 2006.

Energy

- Alabama is the seventh largest generator of power from renewable sources (such as biomass) in the nation. Alabama produces more energy from renewable sources from industry (313,000 megawatt hours) than any other state.

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Global Warming[1]

Greenhouse gases are a small part of the Earth's atmosphere; however, they are critical to making the planet habitable. Human activities, primarily the burning of fossil fuels for energy, have contributed to an increase in greenhouse gases and many scientists believe this has caused the present warming trend.

Every year, the United States emits the equivalent of 20.4 metric tons of CO_2 per person, more than almost any other developed country. By comparison, Great Britain emits the equivalent of 9.4 metric tons of CO_2 per person per year; Japan, 9.7 metric tons; and Germany, 9.8 metric tons.

Man-made CO_2 contributions to the atmosphere account for only about 3.4 percent of all annual CO_2 emissions. However, small increases in annual CO_2 emissions, whether from humans or any other source, can lead to a large CO_2 accumulation over time because CO_2 molecules can remain in the atmosphere for more than a century.

Largely due to human activities, including the burning of fossil fuels and deforestation, CO_2 levels have risen approximately 35 percent since the beginning of the Industrial Revolution, from about 275 parts per million (ppm) in 1750 to approximately 370 ppm in 2000. Eighty percent of the increase in CO_2 levels has occurred since 1950.

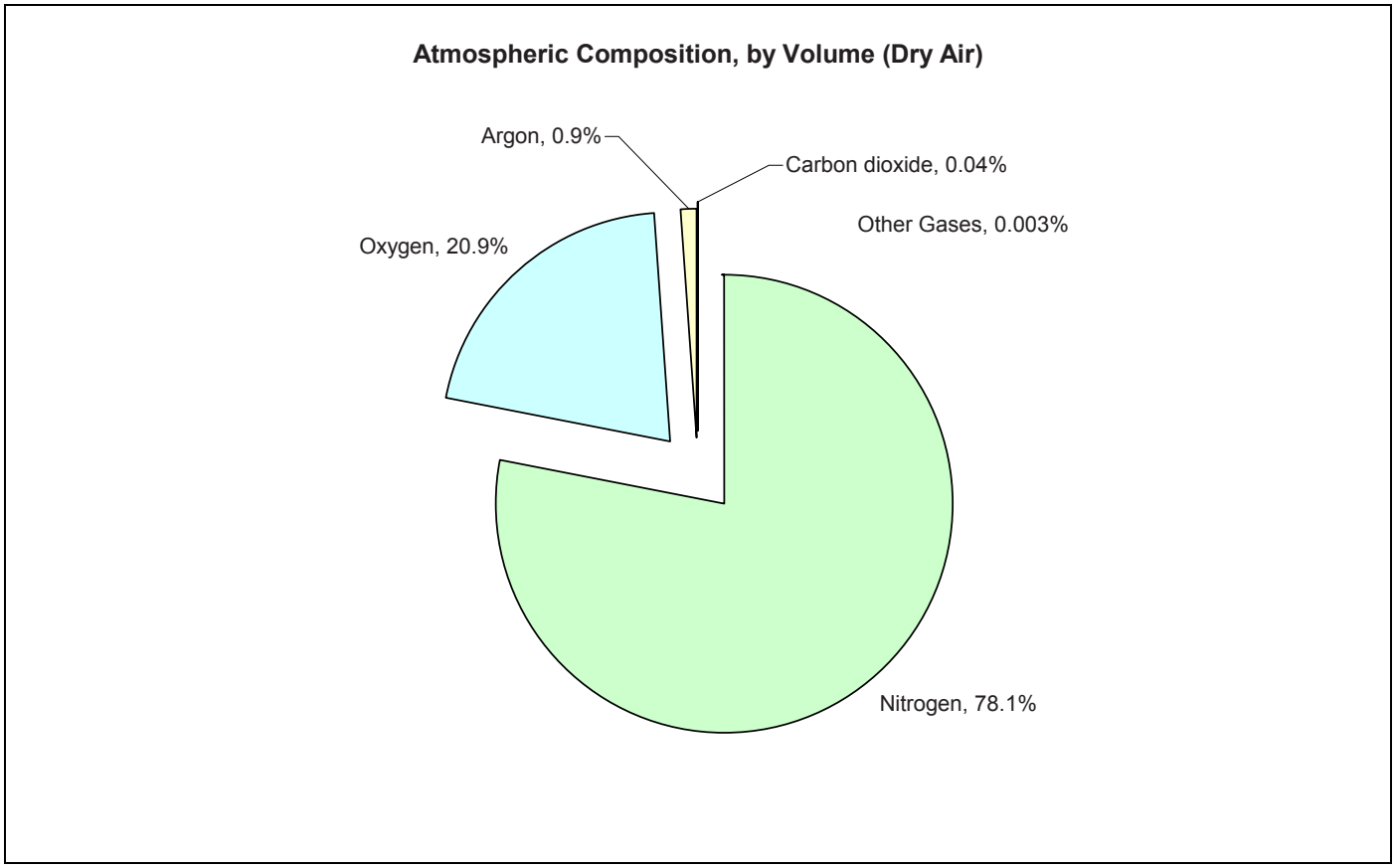
Despite these large-sounding numbers, the influence of man-made CO_2 in the environment is minimal. When the effect of natural conditions – such as water vapor, volcanoes, decaying plants, and oceanic activity – are subtracted from the overall change in climate, the human contribution to the greenhouse effect is less than one-half of 1 percent.

Moreover, considerable research suggests that climate shifts are a natural part of the Earth's existence. Over the past 400,000 years, there have been a series of ice ages lasting 100,000 years on the average, interrupted by warm periods lasting about 10,000 years. During ice ages, the temperature drops by as much as 21° F (11.7° F), sea levels fall dramatically, glaciers expand, and most living things are forced to migrate toward the equator. During periods of relative warmth, sea levels rise and glaciers retreat. We are currently at the tail end of a warm period.

For the past 400,000 years, temperature and CO_2 levels have varied together. However, the Earth's temperature has consistently risen and fallen hundreds of years *prior* to increases and declines in CO_2 levels.

[1] Talking points from the National Center for Policy Analysis, "A Global Warming Primer," 2007. Available at http://eteam.ncpa.org/files/GlobalWarmingPrimer_low.pdf.

What is the atmosphere made of?



- Approximately 99 percent of the Earth's dry atmosphere is comprised of two gases: nitrogen and oxygen. Of the remaining 1 percent, about nine-tenths is argon, followed by carbon dioxide (0.04 percent) and other gases (e.g., neon, helium, methane, krypton, and hydrogen).[2]

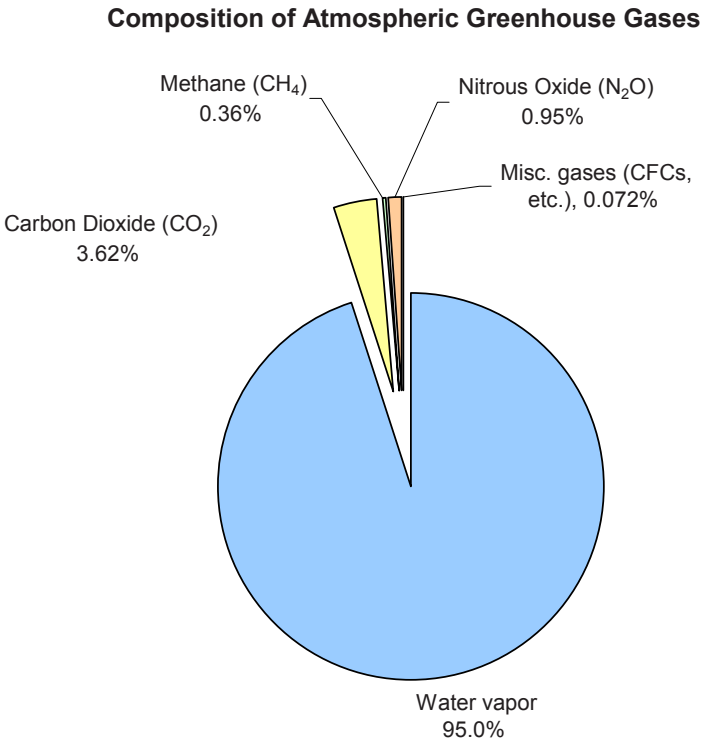
- Carbon dioxide (CO_2) is a naturally-occurring greenhouse gas. Humans and other animals emit CO_2 into the atmosphere when they exhale, and plants absorb it.

- Water vapor is also an important component of the atmosphere. Its quantity varies greatly by area and altitude, and is usually thought to be about 1 percent of the entire atmosphere.[3]

[2] NASA, "Earth Fact Sheet," April 19, 2007. Available at http://nssdc.gsfc.nasa.gov/planetary/factsheet/earthfact.html. Access verified September 17, 2008.

[3] *Ibid*.

What are "greenhouse gases"?



- The greenhouse effect refers to the fact that some gases—water vapor, carbon dioxide, and methane—let in visible light from the sun, but absorb outgoing infrared light emitted by the Earth. This results in a warming of the atmosphere.[4]

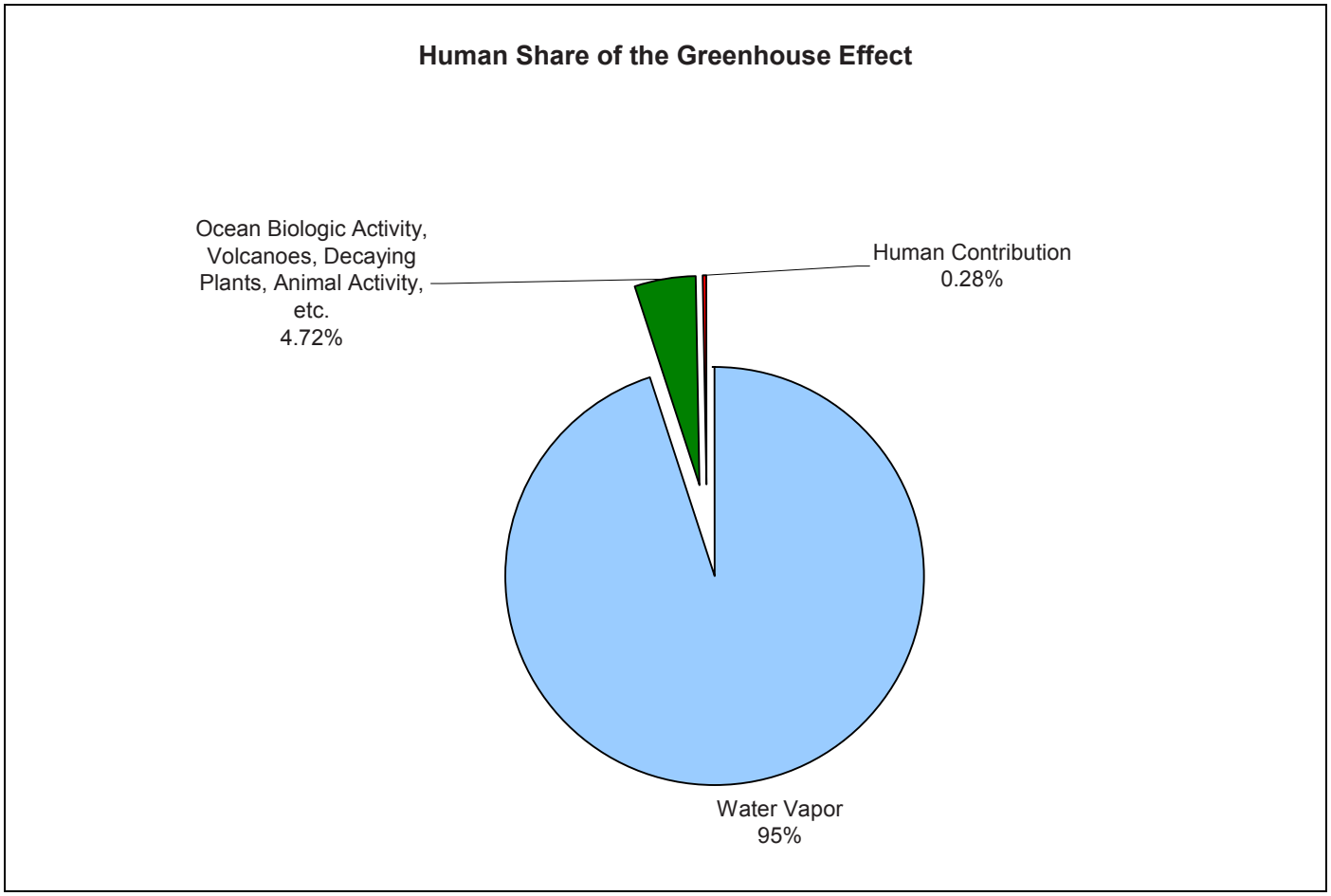
- Water vapor constitutes Earth's most significant greenhouse gas, accounting for about 95 percent of Earth's greenhouse effect. Practically all water vapor (99.999 percent) is from natural sources.

- Most other atmospheric greenhouse gases are also of natural origin: carbon dioxide (CO_2: 96.6 percent natural); methane (CH_4: 81.7 percent natural); and nitrous oxide (N_2O: 95 percent natural). Only chlorofluorocarbons (CFCs), which comprise less than one-tenth of 1 percent of all greenhouse gases, are mostly made by human-related activities (65.2 percent anthropogenic).[5]

[4] Joel Schwartz, "A North Carolina Citizen's Guide to Global Warming," July 2007, p. 2. Available at http://www.johnlocke.org/acrobat/policyReports/globalwarmingguide.pdf. Access verified February 9, 2009.

[5] Monte Heib, "Water Vapor Rules the Greenhouse System," in "Global Warming: A Closer Look at the Numbers," January 10, 2003. Available at http://www.geocraft.com/WVFossils/greenhouse_data.html. Access verified September 17, 2008.

What are the sources of greenhouse gases?



- Currently, about 7-8 gigatons of manmade CO_2 are put into the atmosphere every year, mostly from energy production, farming, manufacturing, and transportation. About half of this CO_2, though, is reabsorbed by the earth. Thus, only 3.5-4 gigatons actually stays in the atmosphere for any length of time. To put this amount in perspective, there are already about 740 gigatons of CO_2 in the atmosphere. This means that the human contribution of CO_2 to the global CO_2 bank is only about 0.5 percent per year.[6]

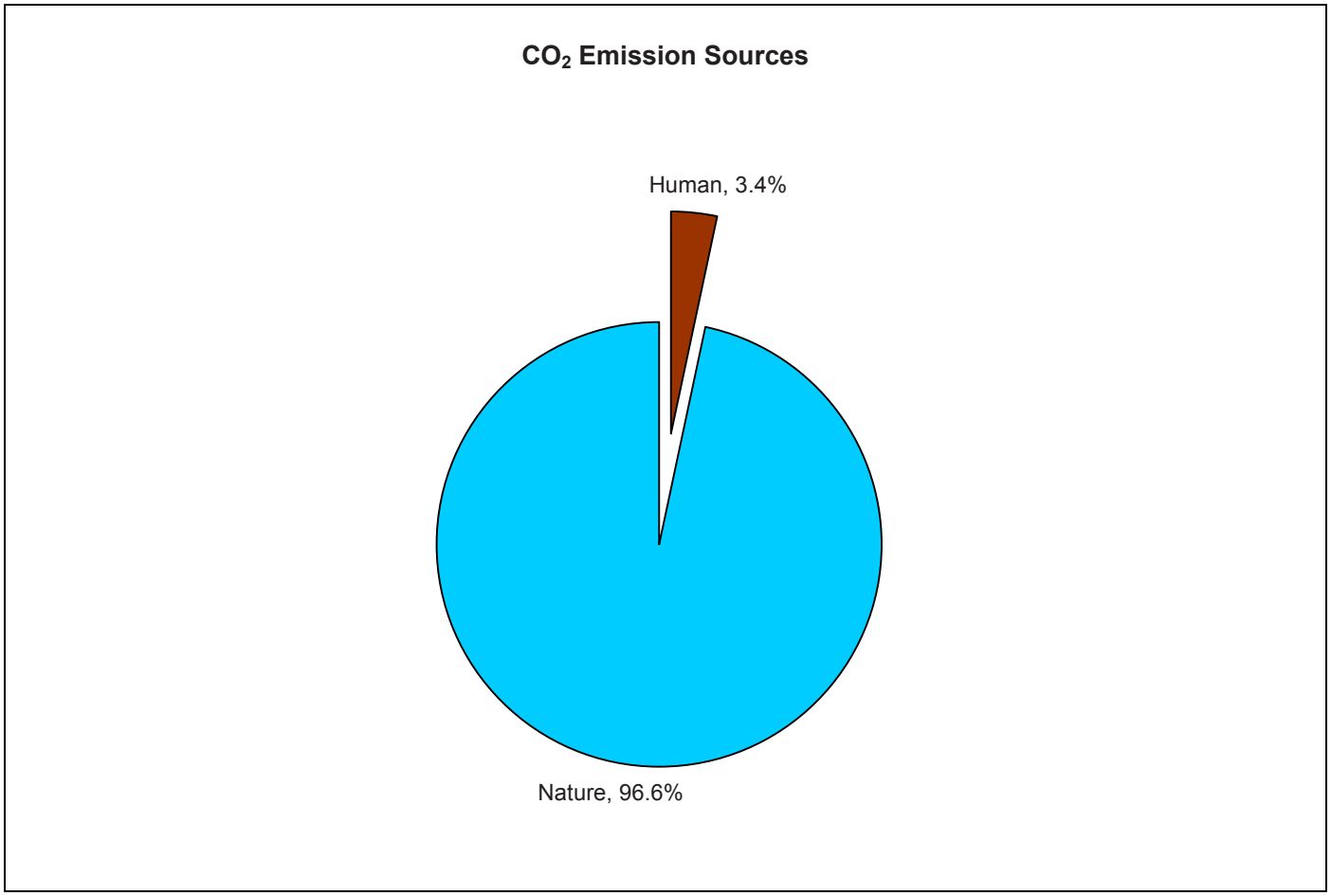
- When placed in the context of the other sources of total greenhouse gases, humanity is responsible for about one-quarter of one percent of all greenhouse gases.[7] Emissions made by humanity are so dwarfed, in comparison to emissions from natural sources we can do nothing about, that even the most costly efforts to limit human emissions would have a very small—perhaps undetectable—effect on global climate.[8]

[6] John R. Christy, "Searching for Climate Change: A More Temperate Take on Global Warming." Presented at the Center for the American Experiment (Minneapolis, MN), June 5, 2007.

[7] Lee C. Gerhard, "Geologic Constraints on Global Climate Variability." Available at http://www.warwickhughes.com/geol/index.htm. Access verified February 9, 2009.

[8] Monte Heib, "Water Vapor Rules the Greenhouse System."

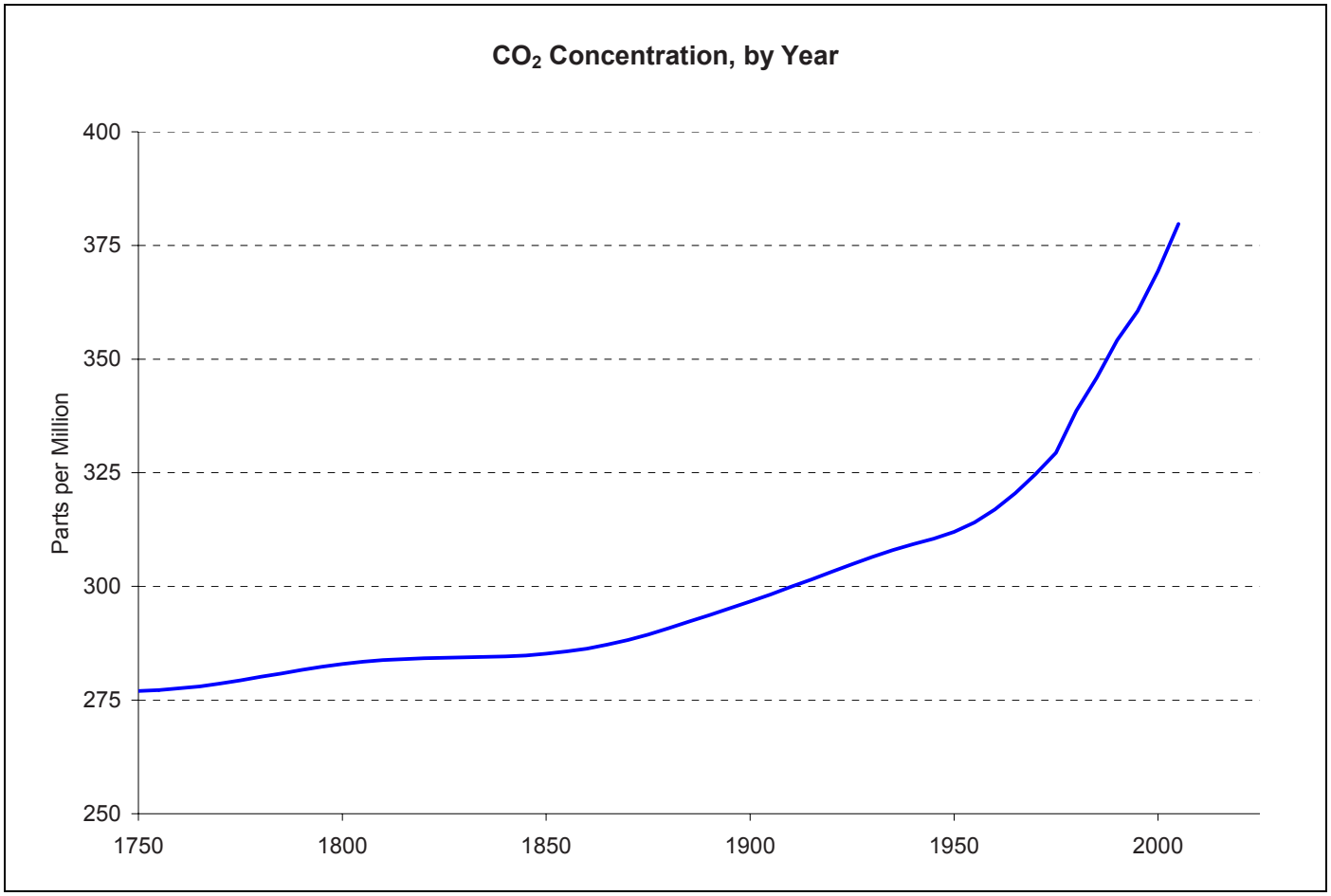
What are the main sources of carbon dioxide?



- Humans contribute approximately 3.4 percent of annual carbon dioxide (CO_2) emissions through, among other things, breathing, the burning of fossil fuels and deforestation. However, small increases in annual CO_2 emissions, whether from humans or any other source, can lead to a large CO_2 accumulation over time because CO_2 molecules can remain in the atmosphere for more than a century.[9]

[9] Amy Kaleita, "Sense and Sequestration: The Carbon Sequestration Cycle Explained," Pacific Research Institute, November 2006, p. 9; available at http://liberty.pacificresearch.org/docLib/20070202_2006_Carbon_seq.pdf. Access verified February 10, 2009. See also Volcano Hazards Program, U.S. Geological Survey, "Volcanic Gases and Their Effects," January 10, 2006.

How have CO_2 levels changed since 1750?



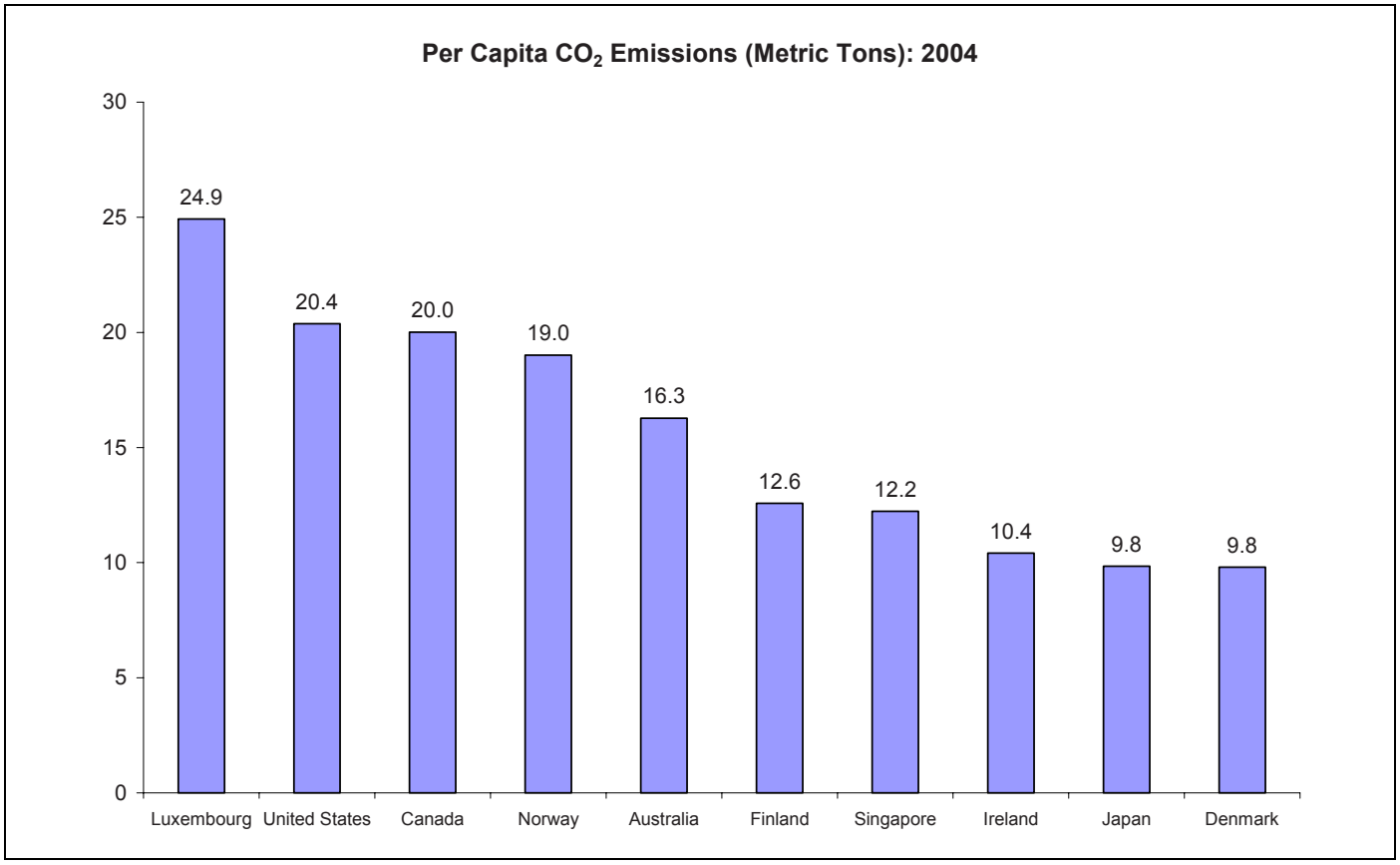
- Since 1750—about 80 years prior to the Industrial Revolution—the most accurate historical data tells us that the amount of manmade CO_2 in the atmosphere has increased by about 38 percent, from about 275 ppm to 380 ppm.[10] Most of this is due to the burning of coal, oil, and natural gas. Moreover, about 80 percent of this increase—about 80 ppm—has occurred since 1950.[11]

- While a 38 percent increase in atmospheric CO_2 is significant, its share of the atmosphere remains extremely small. Even with this increase in CO_2 in the past 250 years, only one in about 2,600 molecules in the atmosphere is CO_2.

[10] Data from 1750 to 1980 from Carbon Dioxide Information Analysis Center, "Historical CO_2 record from the Law Dome DE08, DE08-2, and DSS ice cores," June 1998. Available at http://cdiac.ornl.gov/trends/co2/lawdome-data.html. Access verified February 9, 2009. Data from 1980 to present from National Oceanic and Atmospheric Administration, "Monthly Carbon Dioxide Levels at Mauna Loa," January 12, 2009. Available at http://www.esrl.noaa.gov/gmd/ccgg/trends/. Access verified February 9, 2009.

[11] National Center for Policy Analysis, "A Global Warming Primer," 2007.

How much CO_2 do developed nations produce per person?



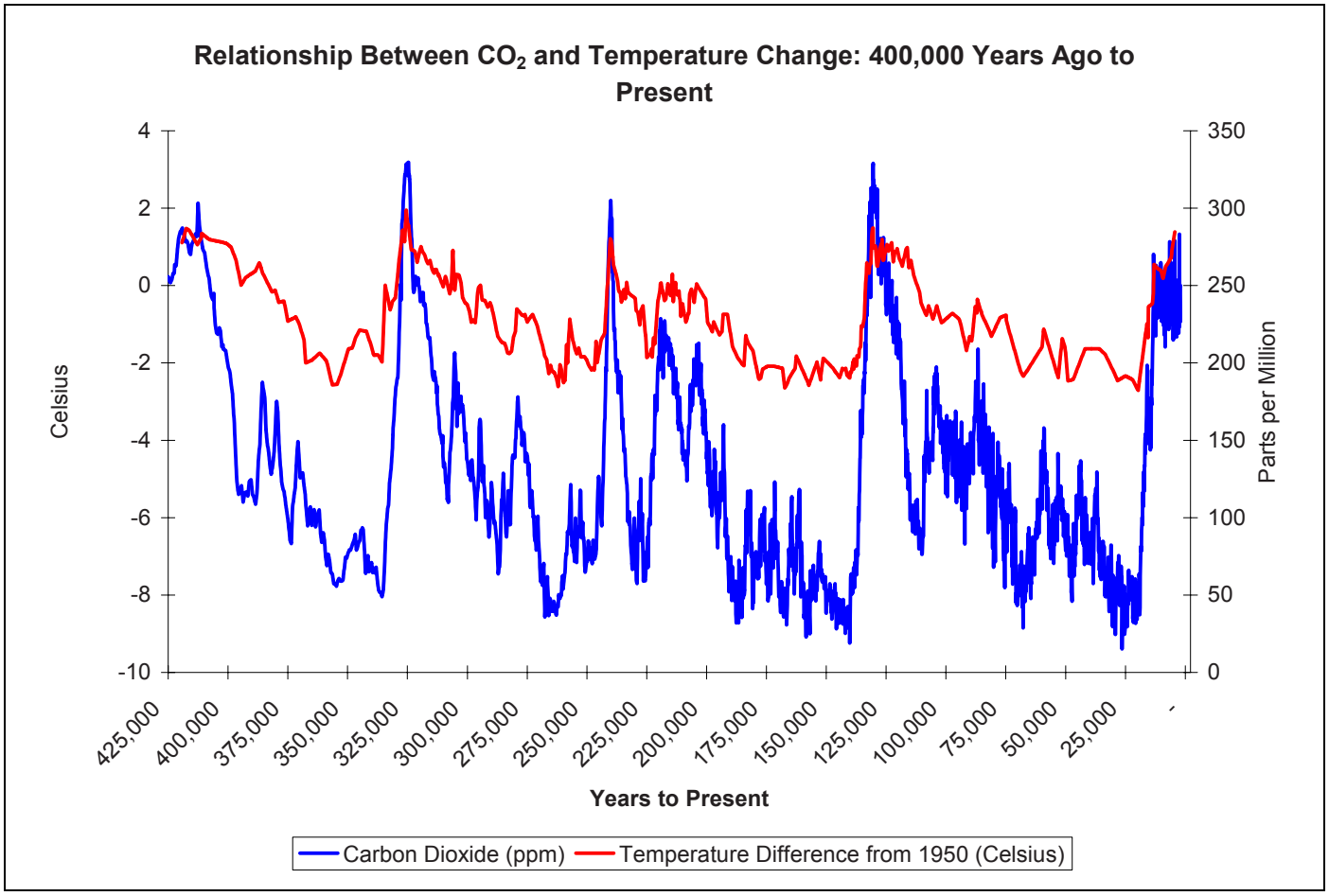
- Compared to the other developed countries of the world, the United States emits more CO_2 per person than almost all other nations.[12]

- At the same time, the growth rate of CO_2 emissions from the United States has slowed more than emissions from the European Union. This has happened even though the United States has experienced higher levels of both economic growth and population growth.[13]

[12] United Nations, Millennium Development Goals Indicators, "Carbon dioxide emissions (CO_2), metric tons of CO_2 per capita (CDIAC)." Available at http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=751&crid=. Access verified February 9, 2009.

[13] Marlo Lewis, Jr., "Al Gore's Science Fiction: A Skeptic's Guide to An Inconvenient Truth," Competitive Enterprise Institute, Congressional Working Paper, March 16, 2007, p. 115. Available at http://www.cei.org/pdf/5820.pdf. Data from the Energy Information Administration.

What is the relationship between CO_2 levels and temperatures over the past 400,000 years?



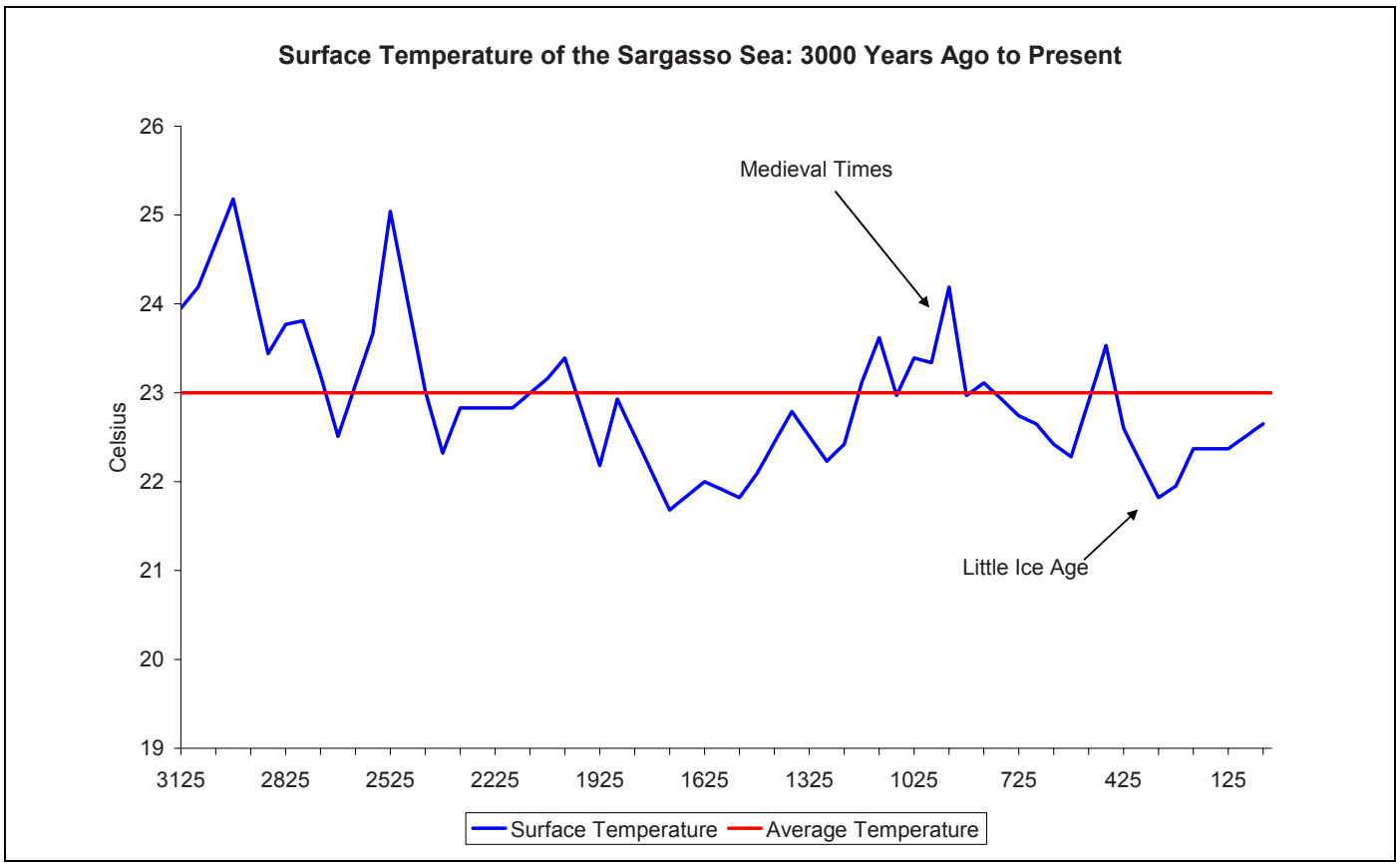
- Climate shifts are a natural part of the Earth's existence. Over the past 400,000 years, there have been a series of ice ages lasting about 100,000 years, interrupted by warm periods lasting about 10,000 years. We are currently at the end of a warm period.[14]

- For the past 400,000 years, temperature and CO_2 levels have varied together. Interestingly, global temperatures appear to rise and fall *before* CO_2 levels do the same, often hundreds of years in advance.[15]

[14] Temperature data from Jean Robert Petit et al., "Climate and Atmospheric History of the Past 420,000 Years from the Vostok Ice Core in Antarctica," *Nature*, Vol. 399, No. 6735, June 3, 1999, pp. 429-36. Carbon dioxide data from Hubertus Fischer et al., "Ice Core Records of Atmospheric CO_2 Around the Last Three Glacial Terminations," *Science*, Vol. 283, No. 5408, March 12, 1999, pp. 1712-14.

[15] Leonid F. Khilyuk et al., "Global Warming: Are We Confusing Cause and Effect?" *Energy Sources, Part A: Recovery, Utilization and Environmental Effects*, Vol. 25, Issue 4, April 2003, pp. 357-370.

How has the global temperature changed during the past 3,000 years?



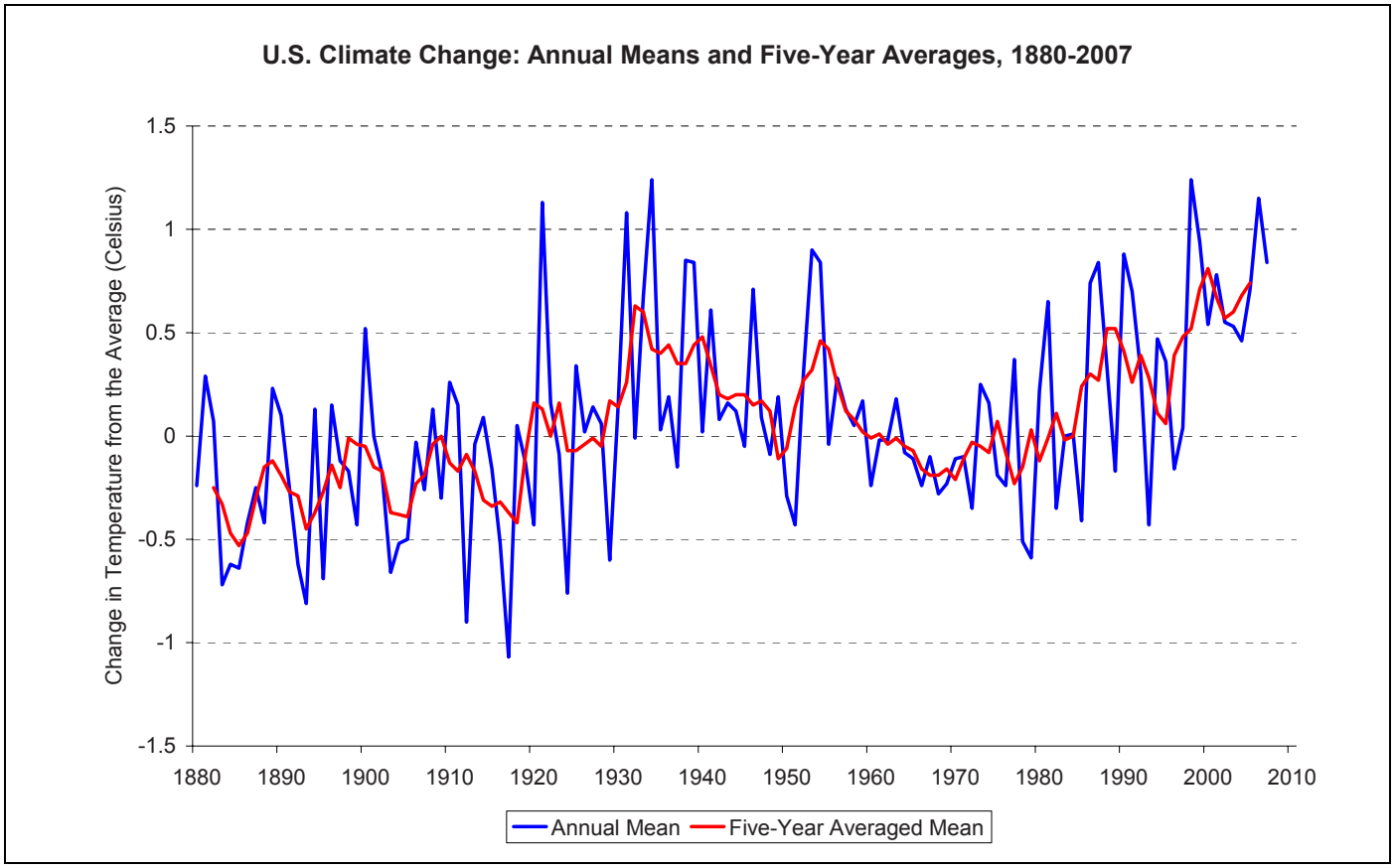
- During Roman and medieval times, the Earth was as warm as or warmer than it is today. Since then, a four-century period of colder temperatures known as the "Little Ice Age" occurred, beginning in the 1300s and ending in the mid-1800s.[16]

- The fact that the Earth has gone through several periods of heating and cooling in the past 3,000 years tells us several things. First, since the climate was as warm as or warmer in the past as it is now, human-created greenhouses are not necessary for climate change. Second, "since past warming was not accompanied by disastrous consequences for humanity or other life—polar bears clearly survived the Medieval Warm Period which occurred between the 10th and 14th centuries—there would be less reason to assume that current warming will necessarily have grave consequences."[17]

[16] John P. Bluemle, Joseph M. Sabel, and Wibjorn Karlen, "Rate and magnitude of past global climate changes," *Environmental Geosciences* (June 1999), 6(2): pp. 63-75. Available at http://eg.geoscienceworld.org/cgi/content/abstract/6/2/63. Access verified February 9, 2009. Sargasso Sea data from ftp://ftp.ncdc.noaa.gov/pub/data/paleo/contributions_by_author/keigwin1996/fig4bdata. Access verified February 11, 2009.

[17] Joel Schwartz, "A North Carolina Citizen's Guide to Global Warming," July 2007, pp. 4-5. Available at http://www.johnlocke.org/acrobat/policyReports/globalwarmingguide.pdf. Access verified February 9, 2009.

How has the temperature changed in the U.S. since 1880?

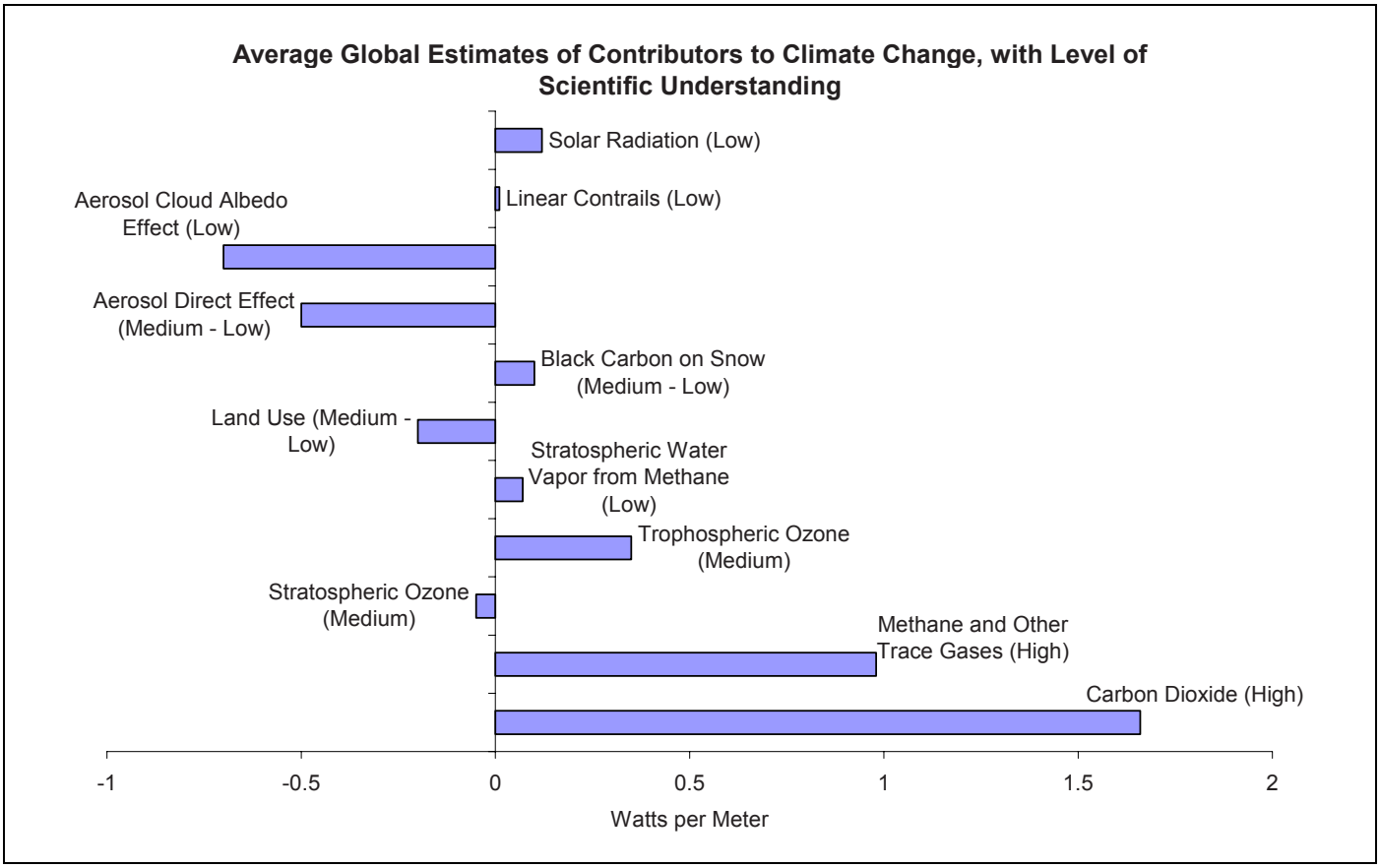


- Since 1880, the average temperature in the United States has risen, albeit slowly, at the rate of about 0.01° F (0.0055° C) per year. Put another way, the temperature has risen by only 1.27° F (0.79° C) in the past 128 years.[18]

- While temperatures have recently been above average, many of the highest temperature variations occurred between 1921 and 1954, before manmade greenhouse gas emissions rose substantially.

[18] National Aeronautics and Space Administration (NASA), Goddard Institute for Space Studies, "Contiguous 48 U.S. Surface Air Temperature Anomaly (Celsisus)." Available at http://data.giss.nasa.gov/gistemp/graphs/Fig.D.txt. Access verified September 17, 2008.

How well do scientists understand the causes of global warming?



- The Intergovernmental Panel on Climate Change (IPCC) is a body of scientists and government officials established by the World Meteorological and the United Nations Environment Programme. It was created "to provide decision-makers and others interested in climate change with an objective source of information about climate change …. Its role is to assess on a comprehensive, objective, open and transparent basis the latest scientific, technical and socio-economic literature produced worldwide relevant to the understanding of the risk of human-induced climate change, its observed and projected impacts and options for adaptation and mitigation."[19]
- According to the IPCC, one way to measure the influence that a particular factor has on the heating or cooling of the global environment is through radiative forcing, which it defines this way:

  > The energy balance of the Earth-atmosphere system is influenced when factors that affect climate are altered …. Positive forcing tends to warm the surface while negative forcing tends to cool it. Forcing values are expressed in watts per square meter.[20]

- According to the literature examined by the IPCC, we know very little about 75 percent of the factors that scientists believe influence global temperature, particularly the effects of aerosols.[21]

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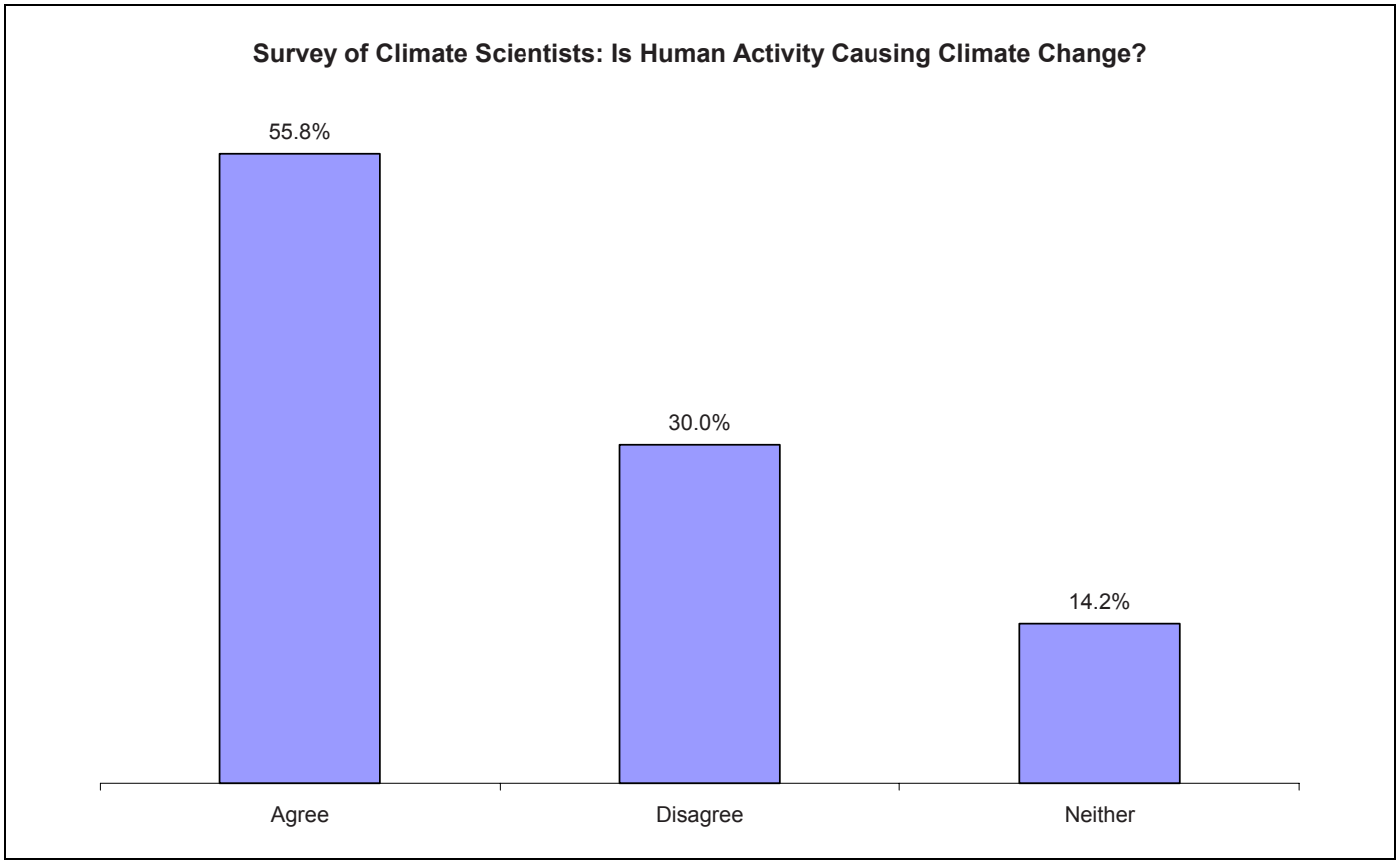
[19] "About IPCC." Intergovernmental Panel on Climate Change. Available at http://www.ipcc.ch/about/index.htm. Access verified March 1, 2009.

[20] "Radiative forcing." *Encyclopedia of Earth*, June 14, 2007. Available at http://www.eoearth.org/article/Radiative_forcing.

[21] Graph from "Climate Change 2007: The Physical Science Basis," Intergovernmental Panel on Climate Change, February 2007. Available at http://ipcc-wg1.ucar.edu/wg1/docs/WG1AR4_SPM_PlenaryApproved.pdf. Access verified February 11, 2009. See also Committee on Radiative Forcing Effects on Climate, Climate Research Committee, National Research Council, *Radiative Forcing of Climate Change: Expanding the Concept and Addressing Uncertainties*, 2005. Available at www.nap.edu/catalog.php?record_id=11175#toc. Access verified February 11, 2009.

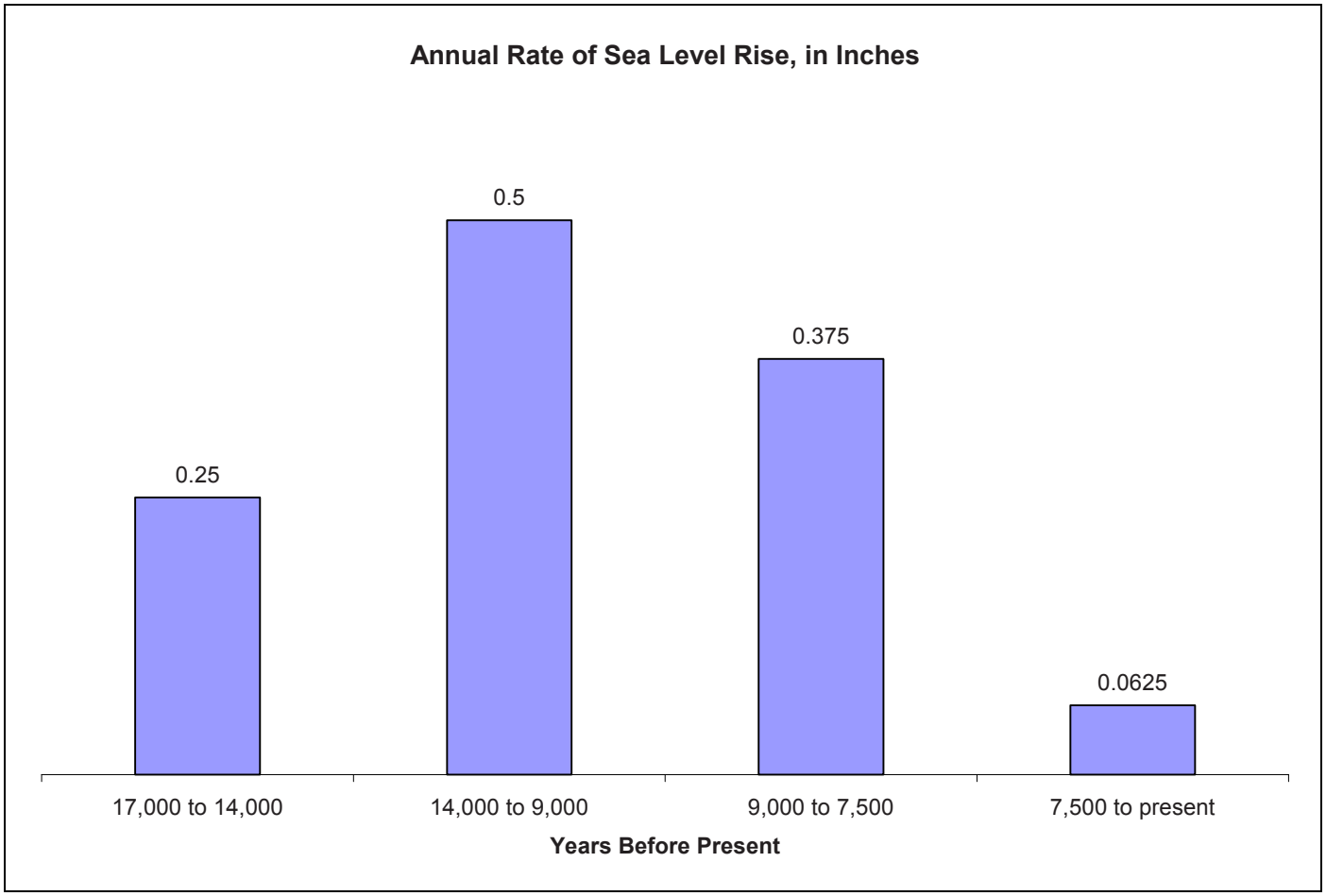
How much scientific agreement is there on man-made global warming?



- In 2003, environmental scientists Dennis Bray and Hans von Storch surveyed 530 climate scientists from 27 different countries regarding the subjects of global warming and climate change.
- While 82 percent agreed with the statement, "global warming is a process already underway," 66 percent disagreed with the idea that the body of scientific knowledge available was sufficient to assess the effects of greenhouse gases.
- Likewise, 30 percent disagreed with the statement, "climate change is the result of anthropogenic [man-made] causes."[22]

[22] Joseph Bast and James M. Taylor, *Scientific Consensus on Global Warming* (Chicago: The Heartland Institute, 2007).

How rapidly are sea levels rising?



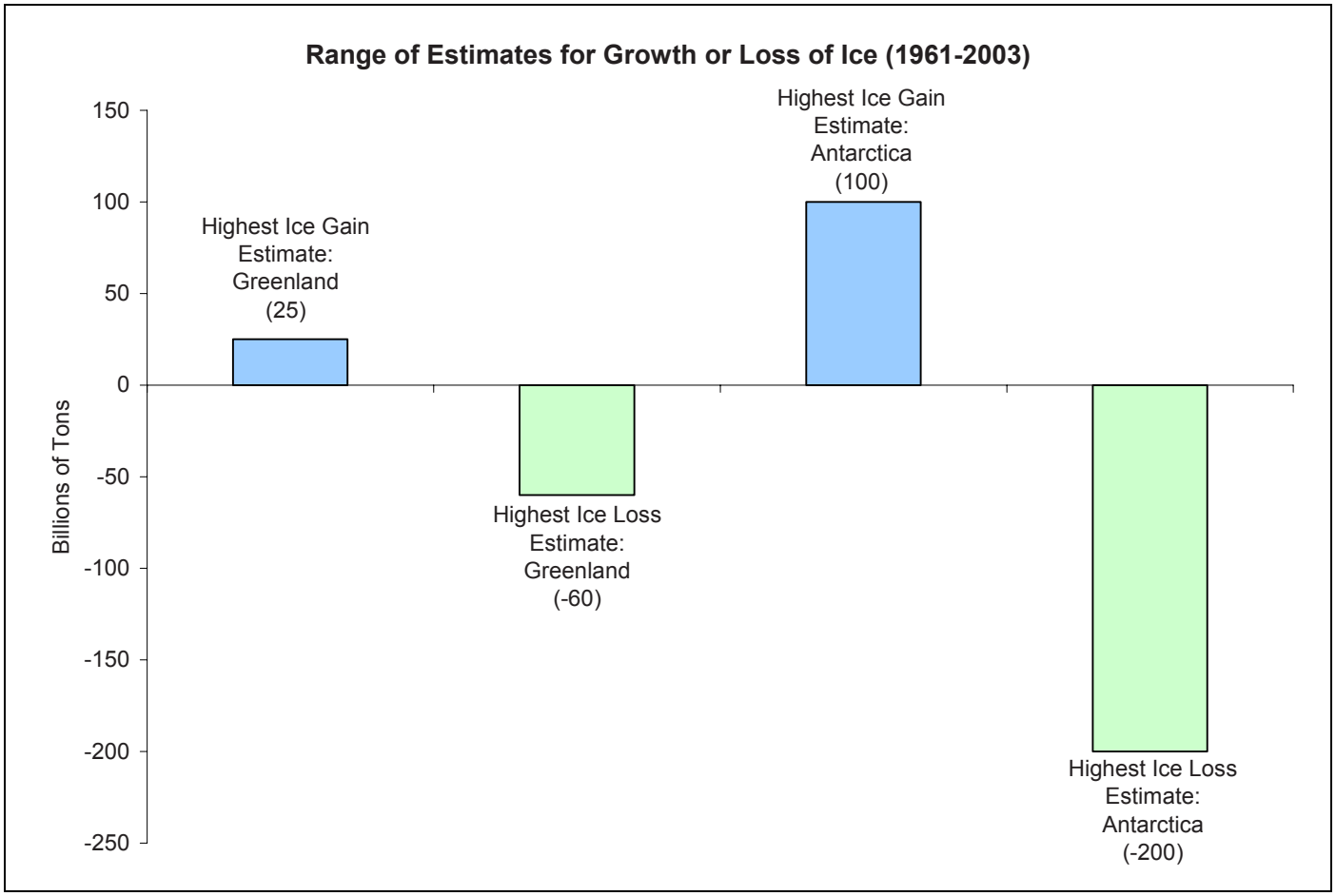
- Global sea levels have risen about 400 feet since the earth emerged from the last Ice Age 20,000 years ago. Rising sea levels are a natural phenomenon during interglacial periods (the times between ice ages).

- Coming out of the Ice Age, sea levels rose at an annual rate varying from 1/16 to 8/16 inches. Over the last 7,500 years the rate has averaged 1/16 inch per year. The most recent report of the Intergovernmental Panel on Climate Change (IPCC) noted that there is no evidence of acceleration in the rate of sea level rise over the past century.

- The IPCC report also asked whether the observed sea level rise can be tied to the estimated average global temperature increase of 0.5 to 1.1 degrees Fahrenheit during the century. The IPCC examined five possible sources of sea level rise: thermal expansion of water as temperature rises, melting of inland glaciers, melting of Greenland's ice sheets, melting of Antarctica's ice sheets and changes in surface and ground water levels. They concluded that, except for data from inland glaciers, there were insufficient data to demonstrate a temperature effect on sea level rise for the past 100 years.[23]

[23] Gerald T. Westbrook, "Sea Levels and Globalization," National Center for Policy Analysis, *Brief Analysis* No. 282, October 9, 1998. Available at http://www.ncpa.org/ba/ba282.html. Access verified February 11, 2009.

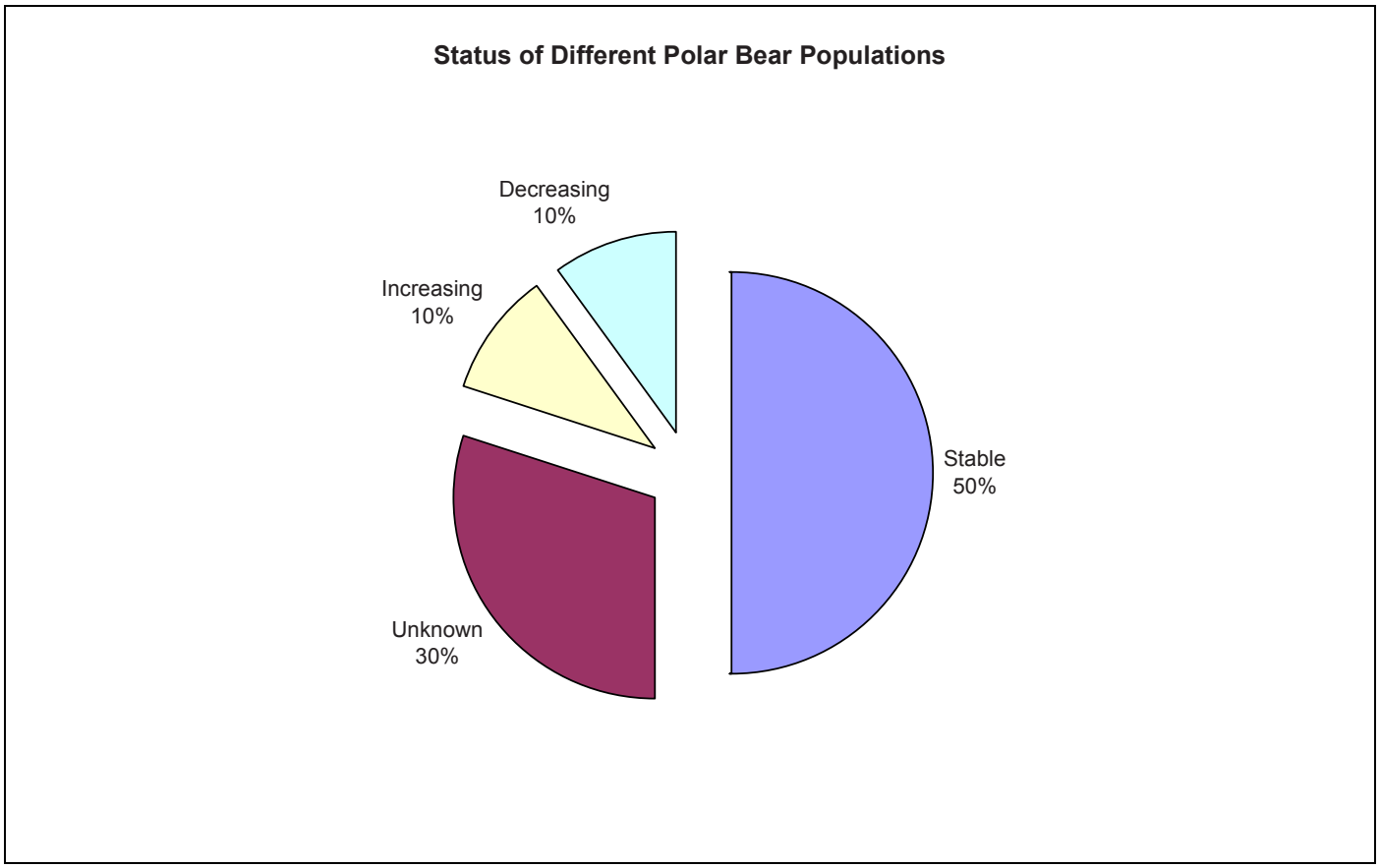
Are the Earth's ice sheets growing or shrinking?



- While ice has melted at the edges and thinned in other locations in Greenland and Antarctica, much of their interiors have thickened due in part to increased annual snowpack. Estimates of the net effect range from ice gains of up to 125 billion tons to losses of up to 260 billion tons. At most, ice loss in the two regions since 1993 has contributed 0.8 mm to annual sea level rise per year—a rate that would total 3 inches by 2100.[24]

[24] Peter Lemke et al., "Observations: Changes in Snow, Ice and Frozen Ground," in "Climate Change 2007: The Physical Science Basis," Intergovernmental Panel on Climate Change, 2007, pp. 363-66. Available at http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Pub_Ch04.pdf. Last accessed February 11, 2009.

Are polar bear populations shrinking as a result of climate change?



- In 1965, the first large-scale survey of polar bear nesting sites suggested that the total number of polar bears worldwide was between 5,000 and 8,000. Since then, polar bear populations have increased to as many as 25,000 today. Several reasons exist for this increase in polar bear populations, none of which have anything to do with climate change:

  > The Soviets, despite their horrendous environmental legacy on many issues, banned most polar bear hunting in 1956. Canada and the U.S. followed suit in the early 1970s—with limited exceptions for some native hunting, and permitted, high-priced trophy hunts. And a curtailment of some commercial seal hunting has sparked a seal population explosion—angering fishermen, but providing populations in eastern Canada and Greenland with plenty of polar bear chow, leading in turn to localized polar bear population growth in spite of the ice decline.[25]

- According to the World Wildlife Federation, there are about 20 distinct populations of polar bears. These populations vary in size from a few hundred to a few thousand animals. In their words, "the status of this species is stable, although there are pronounced differences between populations."[26]

- Of the 20 distinct polar bear populations worldwide, half are stable, two are increasing, and two are decreasing. The remaining six populations have unknown status, either because they are in areas with few humans and are not harvested, or they are in harvest areas but no quota systems are in place.[27]

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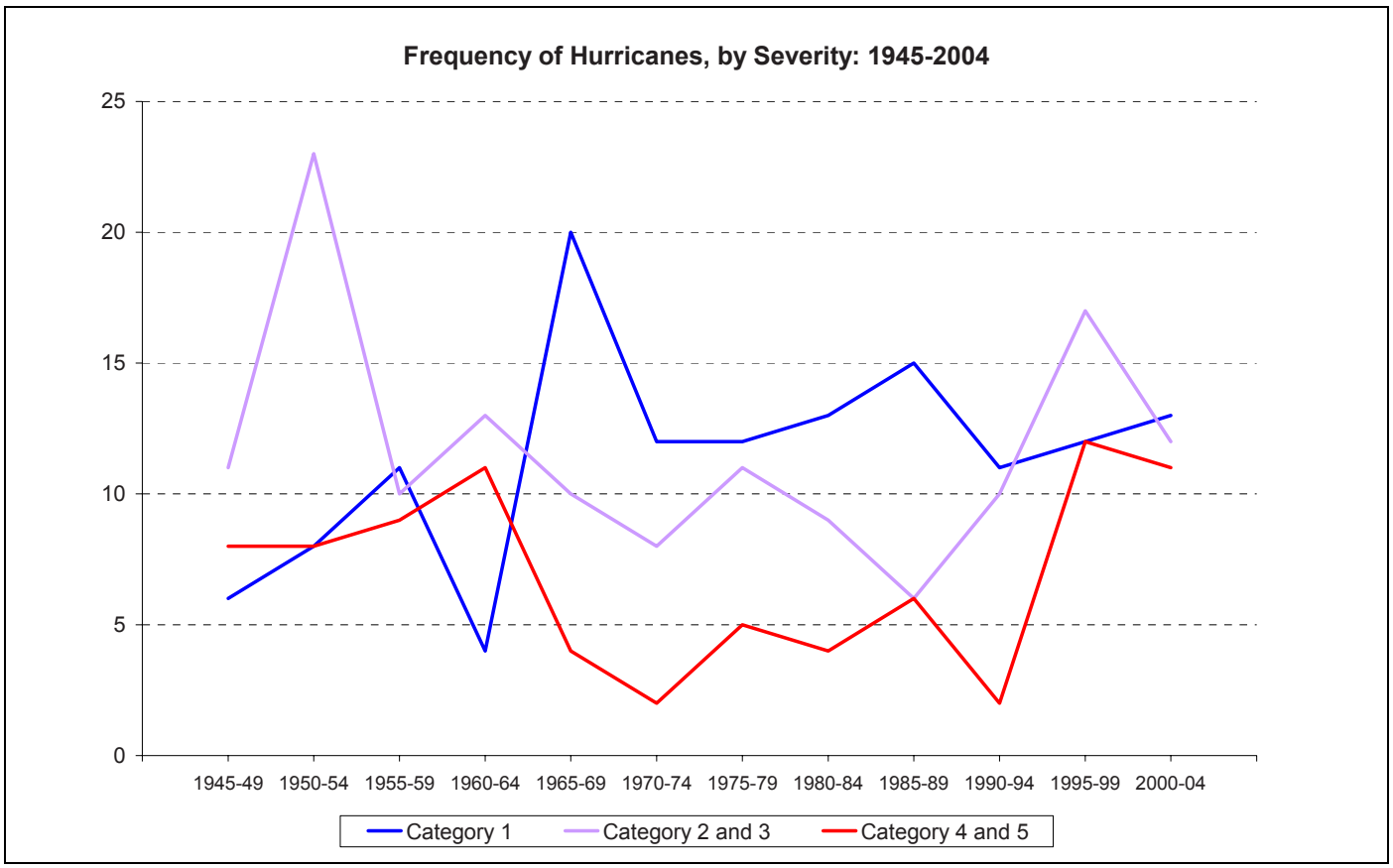
[25] Peter Dykstra, "Magic Number: A sketchy "fact" about polar bears keeps going ... and going ... and going," The Society of Environmental Journalists, July 23, 2008. Available at http://www.sej.org/pub/SEJournal_Excerpts_Su08.htm. Access verified April 6, 2009.
[26] Stefan Norris, Lynn Rosentrater and Pal Martin Eid, "Polar Bears at Risk: A WWF Status Report," World Wildlife Fund, May 2002, p. 6. Available at http://www.wwf.org.uk/filelibrary/pdf/polar_bears_at_risk_report.pdf. Access verified April 6, 2009.
[27] *Ibid*, p. 14.

Is global warming causing more frequent or more severe hurricanes?

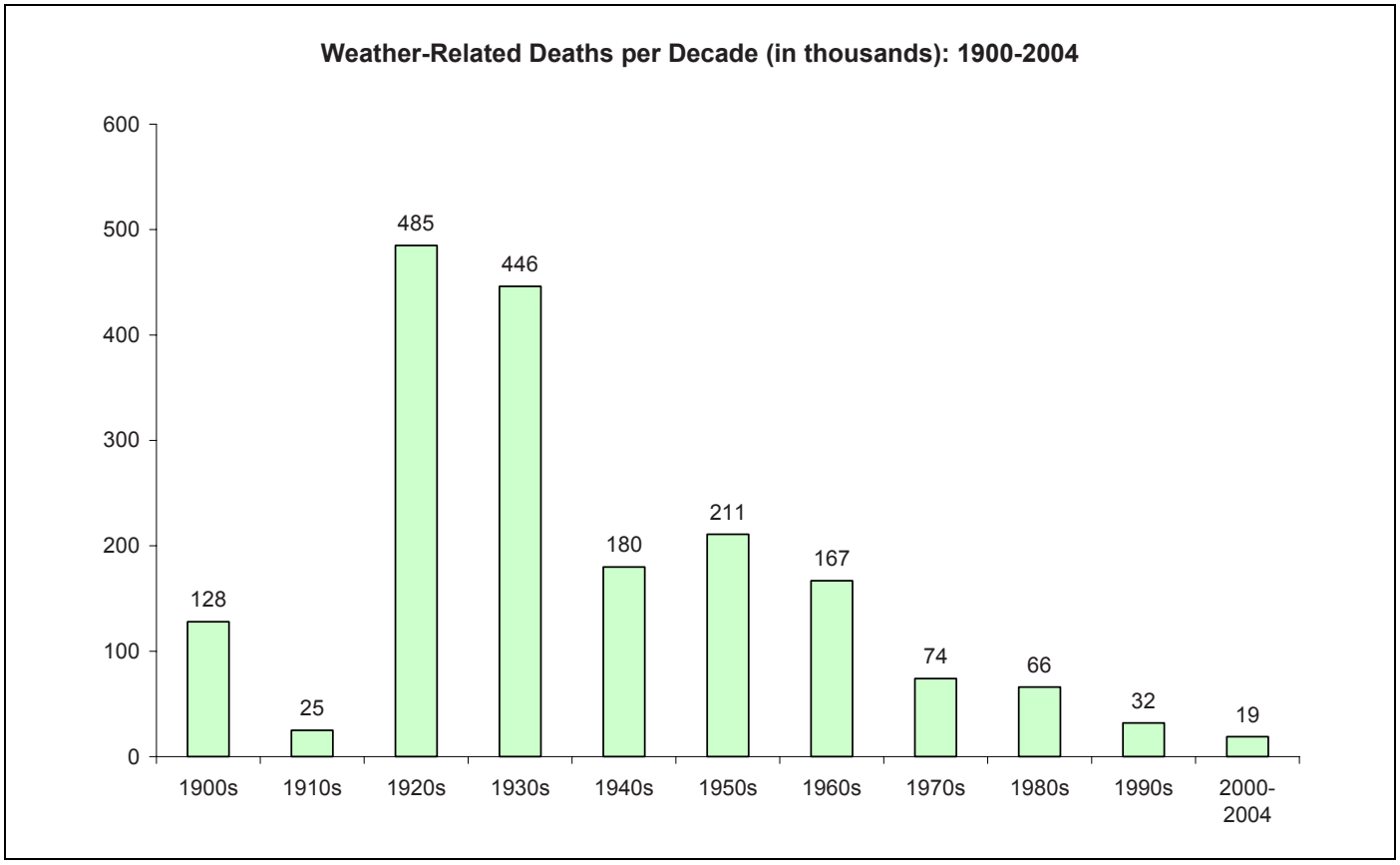


- Many scientists worry that global warming will cause droughts, floods, hurricanes of greater intensity, coastal flooding and the extinction of species that cannot adapt to change. So far, these effects are not evident.

- Neither the number nor the strength of hurricanes has increased significantly (category 1 is the lowest wind velocity and category 5 is the highest).[28] Moreover, not all of these storms made landfall as hurricanes.

[28] National Oceanic and Atmospheric Administration (NOAA), Hurricane Research Division, "Atlantic Storms Sorted by Year (1851-2002)." Available at http://www.aoml.noaa.gov/hrd/Storm_pages/Atl/date_frame.html. Access verified September 17, 2008.

Is global warming causing more weather-related deaths?



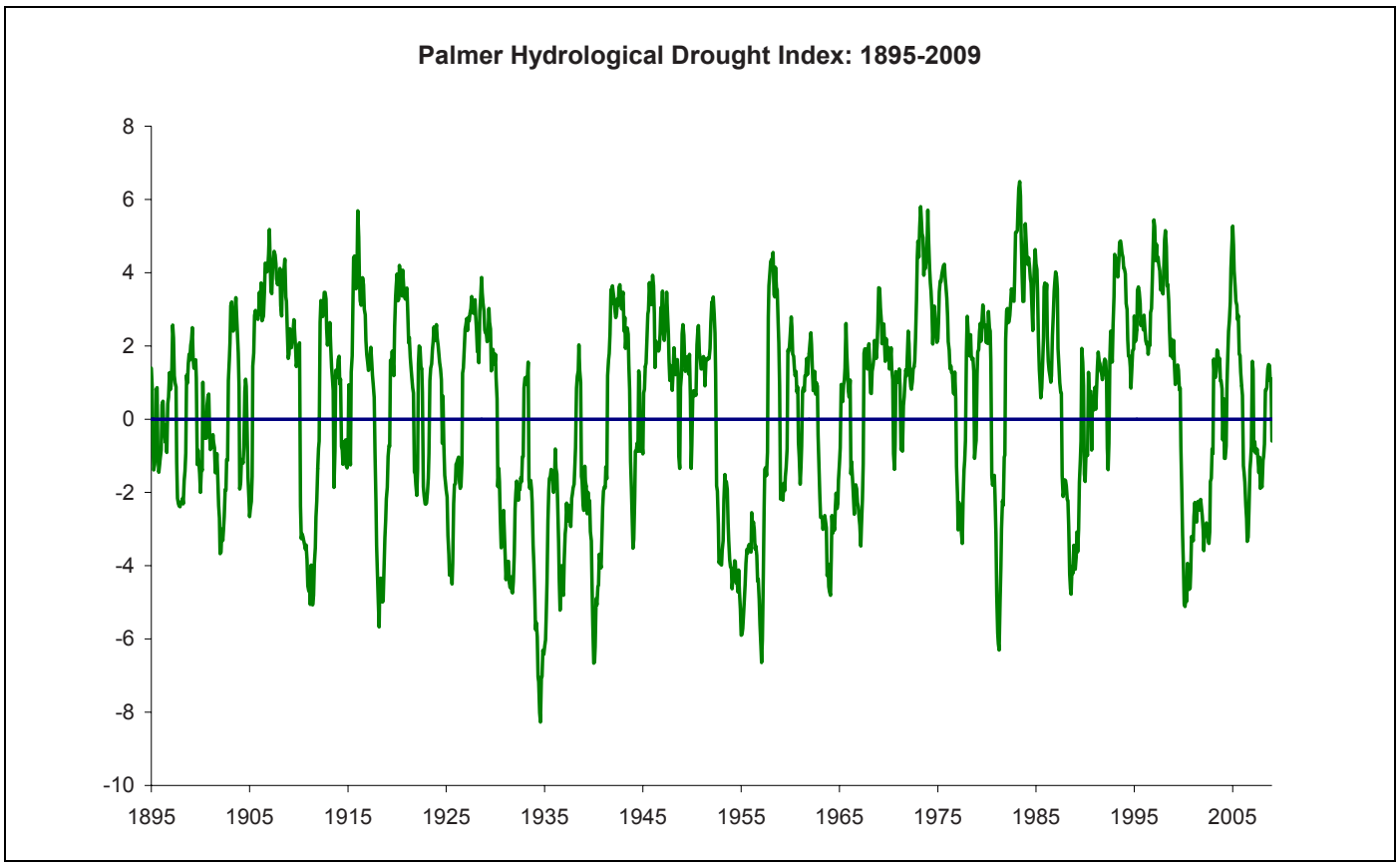
- "Despite the recent spate of deadly extreme weather events such as the 2003 European heat wave and the hurricanes of 2004 and 2005, aggregate mortality and mortality rates due to extreme weather events are generally lower today than they used to be. Globally, mortality and mortality rates have declined by 95 percent or more since the 1920s. The largest improvements came from declines in mortality due to droughts and floods, which apparently were responsible for 95 percent of all deaths caused by extreme events during the 20th century. For windstorms, which contributed most of the remaining 5 percent of fatalities, mortality rates are also lower today but there are no clear trends for mortality. Cumulatively, the declines more than compensated for increases due to the 2003 heat wave."[29]

- With regard to the U.S., current mortality and mortality rates due to extreme temperatures, tornadoes, lightning, floods and hurricanes are also below their peak levels of a few decades ago. The declines for the last four categories range from 55 to 95 percent. If extreme weather has indeed become more extreme for whatever reason, global and U.S. declines in mortality and mortality rates are perhaps due to increases in societies' collective adaptive capacities owing to a variety of interrelated factors—greater wealth, increases in technological options, and greater access to and availability of human and social capital.[30]

[29] Indur M. Goklany, "Death and Death Rates Due to Extreme Weather Events: Global and U.S. Trends, 1900-2004," presented at the Climate Change and Disaster Losses Workshop, Hohenkammer, Germany, May 25-26, 2006. Available at http://members.cox.net/goklany/Extreme%20Events%20Note%20Hohenkammer.pdf/ Access verified February 11, 2009.

[30] *Ibid*.

Is global warming affecting the severity of droughts in the U.S.?

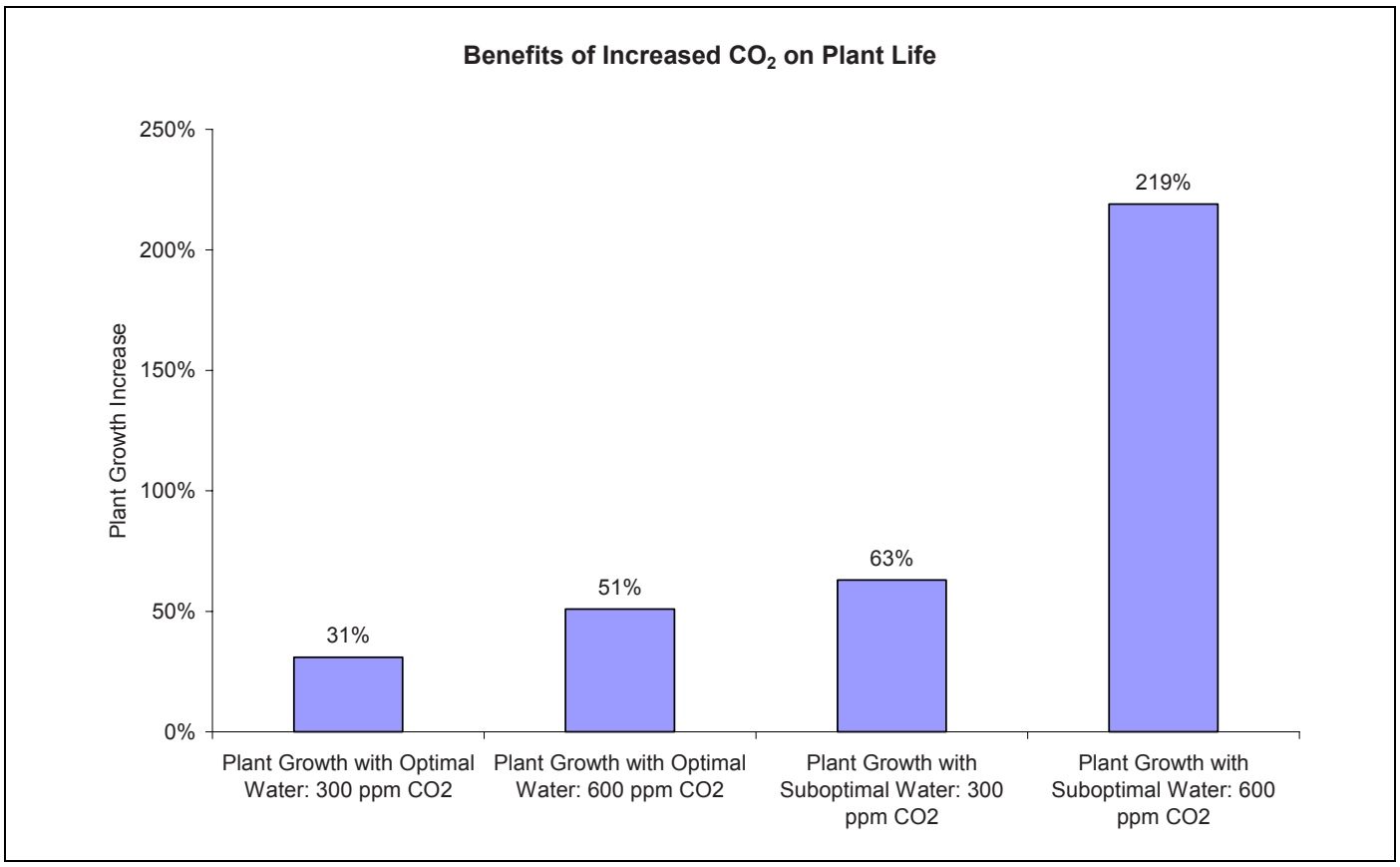


- The Palmer Hydrological Drought Index (PHDI) is a monthly measure of the severity of wet and dry spells. According to the National Climatic Data Center (NCDC), which is responsible for collecting the data, "the index is based on the principles of a balance between moisture supply and demand … but does not account for man-made changes such as irrigation, new reservoirs, and added industrial water use." The index ranges from -6 (extreme drought) to 6 (extreme wetness), with a few instances of higher levels of drought and wetness. Normal wetness is categorized as being between -.5 and zero; incipient drought, -0.5 to -1; mild drought, -1 to -2; moderate drought, -2 to -3; severe drought, -3 to -4; and extreme drought being any score lower than -4.[31]

- According to the index, there has been no meaningful increase or decrease in the frequency or severity of droughts in the U.S. since 1895.

[31] Palmer Hydrological Drought Index data from National Climatic Data Center, available at http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp. Access verified February 12, 2009.

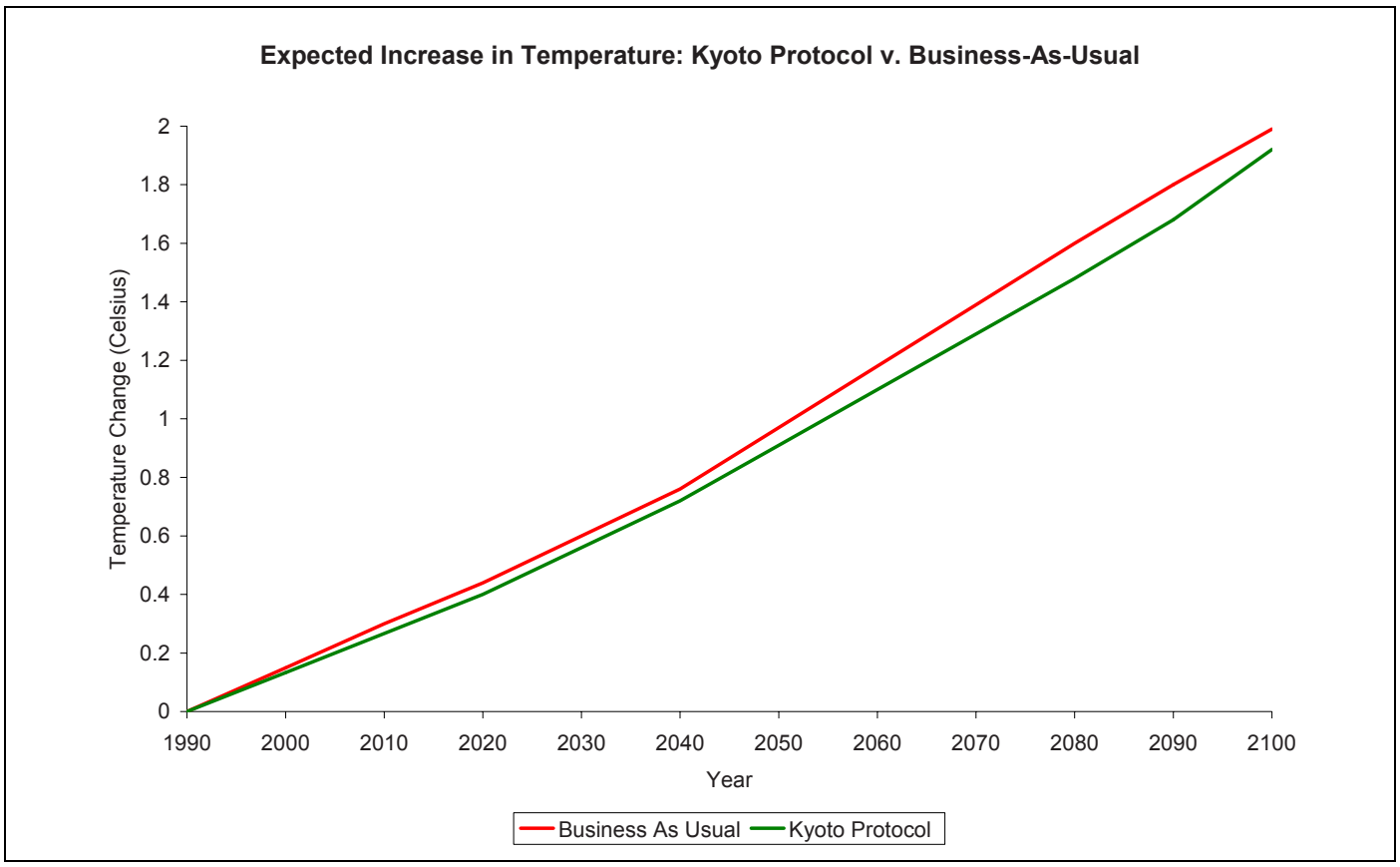
What are the potential benefits of increased atmospheric CO_2?



- In contrast to the idea that increased levels of CO_2 is a threat to life on Earth, Sherwood B. Idso—a research physicist at the U.S. Department of Agriculture—has found that increased CO_2 levels would create an environment in which plants would grow bigger and faster.[32]

[32] Sherwood B. Idso, "Carbon Dioxide and Global Change: End of Nature or Rebirth of the Biosphere?" in Jeff Lehr and Jay H. Lehr, *Rational Readings on Environmental Concerns* (New York: Van Nostrand Reinhold, 1992), pp. 414-433.

Can the Kyoto Protocol stop global warming?



- The Kyoto Protocol is an international environmental treaty produced by the United Nations to reduce greenhouse gas emissions from industrialized countries in an attempt to reduce global warming. The Protocol, which was adopted in 1997, aims to lower CO_2 and other greenhouse gas emissions to about 5 percent below what they were in 1990. The target year for these reductions is 2012.[33]

- Even if the limits of the Protocol were extended forever, the Earth would be only marginally cooler—approximately 0.13° F or 0.07° C cooler—by 2100, at a cost of about $1 trillion per year.[34]

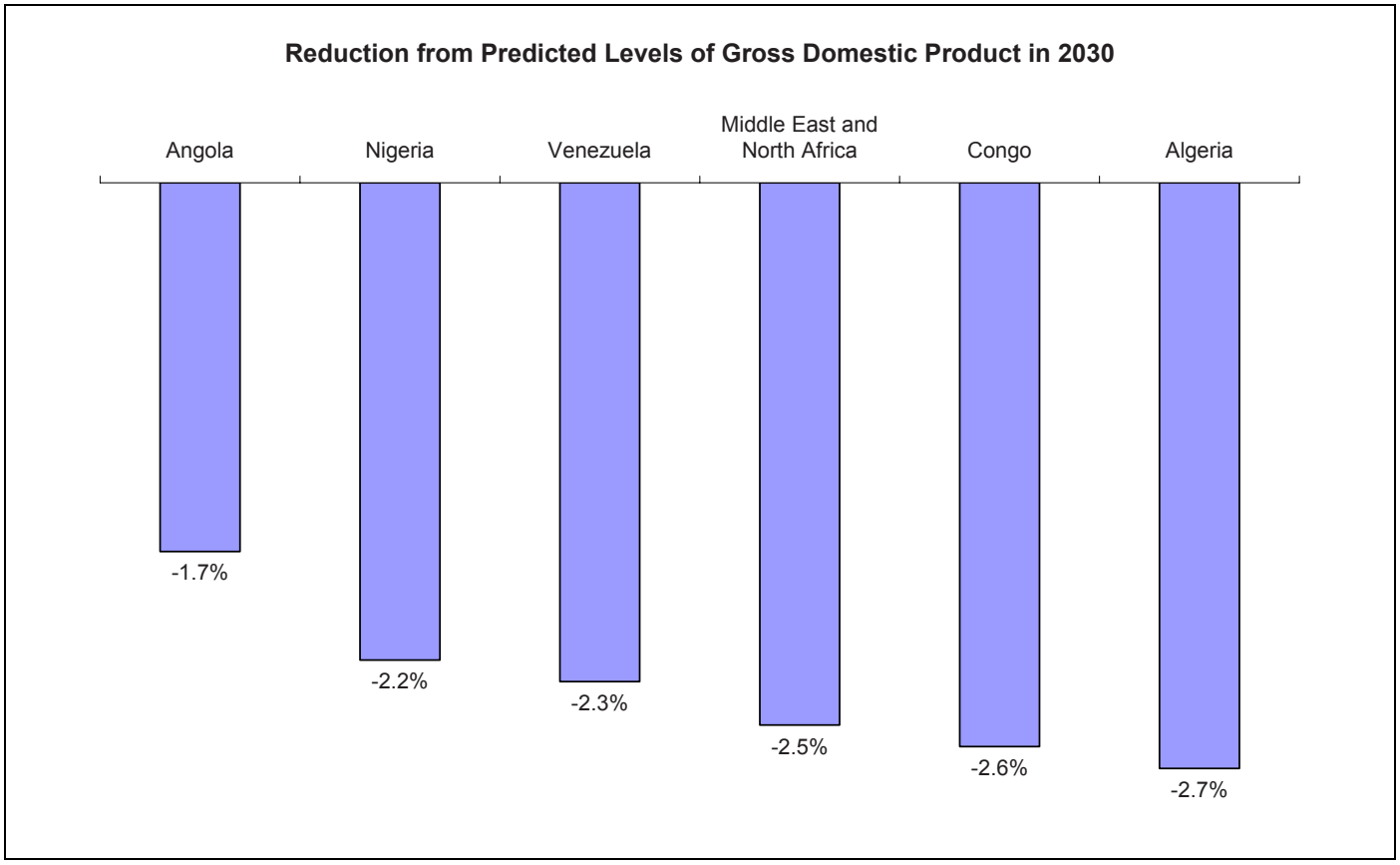
- One of the serious shortcomings of the Kyoto Protocol is that it only applies to *developed* nations; *developing* nations such as China, India, South Korea, Brazil, and Indonesia, are exempt. If these nations—which will account for as much as 85 percent of the projected increases in CO2 in the next 20 years—were included in a globally inclusive climate control protocol, the cost to the global economy could be an additional $4 trillion.[35]

[33] National Center for Policy Analysis, "A Global Warming Primer," 2007, p. 32.

[34] Bjørn Lomborg, "Global warming – are we doing the right thing?" *Guardian Unlimited* (United Kingdom), August 17, 2001. Available at http://image.guardian.co.uk/sys-files/Guardian/documents/2001/08/14/warming.pdf. Access verified February 12, 2009.

[35] *Ibid*. National Center for Policy Analysis, "A Global Warming Primer," 2007, p. 33.

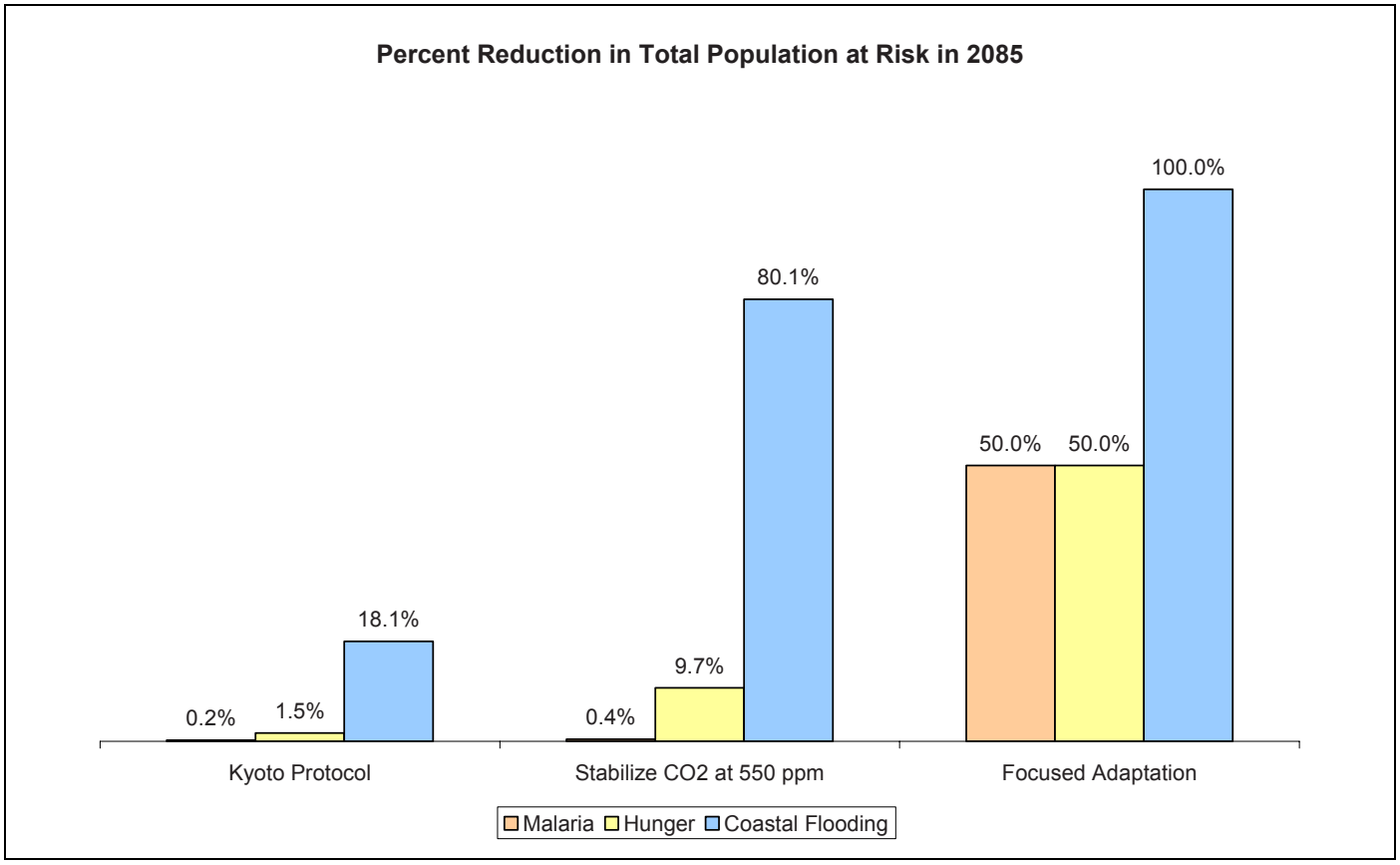
What effect would the Kyoto Protocol have on poorer nations?



- If the Kyoto Protocol were extended indefinitely, its emission limits would affect both developed and developing nations (which would not be required to reduce their levels of CO_2). The developed countries which would be affected the most are those with major oil-exporting industries; as demand for oil from these countries would fall, the cost of importing goods into countries adhering to the Kyoto Protocol would rise, stifling growth.[36]

[36] Paul M. Bernstein et al., "Effects of Restrictions on International Permit Trading: The MS-MRT Model," in "The Costs of the Kyoto Protocol: A Multi-Model Evaluation," *Energy Journal,* Special Issue, May 1999, pp. 221-56.

Which would reduce the risks of global warming more: Focused adaptation or the Kyoto Protocol?



- One alternative to adapting the Kyoto Protocol to reduce harm to the environment is *focused adaptation*, which involves taking steps to adapt to warmer conditions rather than attempting to halt any global warming. Such measures include using pesticides to kill malaria-carrying mosquitoes, improving farming practices, and ending subsidies to coastal development. If focused adaptation were adopted globally, the threat of coastal flooding would be all but eliminated, and the number of people at risk of hunger and malaria would be cut in half.[37]

- Best of all, focused adaptation costs only a few billion dollars per year, compared to the hundreds of billions—if not trillions—it would take to attempt to halt global warming.[38]

[37] National Center for Policy Analysis, "A Global Warming Primer," 2007, p. 33. Figure from Nigel W. Arnell et al., "The Consequences of CO_2 Stabilization for the Impacts of Climate Change," *Climate Change*, Vol. 53, No. 4, June 2002, pp. 413-46; Nigel W. Arnell, "Climate Change and Global Water Resources," *Global Environmental Change*, Vol. 9, Supplement 1, October 1999, pp. S31-S49; and Indur M. Goklany, "Relative Contributions of Global Warming to Various Climate Sensitive Risks, and Their Implications for Adaptation and Mitigation," *Energy and Environment*, Vol. 14, No. 6, November 1, 2003.

[38] Indur M. Goklany, "Living with Global Warming," National Center for Policy Analysis, *Policy Report* No. 278, September 2005. Available at http://www.ncpa.org/pub/st/st278/st278.pdf. Access verified February 12, 2009.

Is global warming the world's greatest challenge?

- In 2008, the Copenhagen Consensus, a panel of eight world-renowned economists (including five Nobel laureates) were asked "What would be the best ways of advancing global welfare, and particularly the welfare of the developing countries, illustrated by supposing that an additional $75 billion of resources were at their disposal over a four-year initial period?" Their answers:

1	Micronutrient supplements for children (vitamin A and zinc)	Malnutrition
2	Lower barriers to trade for developing nations	Trade
3	Micronutrient fortification (iron and salt iodization)	Malnutrition
4	Expanded immunization coverage for children	Diseases
5	Breeding crops to increase nutritional value	Malnutrition
6	De-worming and other nutrition programs at school	Malnutrition & Education
7	Lowering the price of schooling	Education
8	Increase and improve girls' schooling	Women
9	Community-based nutrition promotion	Malnutrition
10	Provide support for women's reproductive role	Women
11	Heart attack acute management	Diseases
12	Malaria prevention and treatment	Diseases
13	Tuberculosis case finding and treatment	Diseases
14	R&D in low-carbon energy technologies	Global Warming
15	Bio-sand filters for household water treatment	Water
16	Rural water supply	Water
17	Conditional cash transfers	Education
18	Peace-keeping in post-conflict situations	Conflicts
19	HIV combination prevention	Diseases
20	Total sanitation campaign	Water
21	Improving surgical capacity at district hospital level	Diseases
22	Microfinance	Women
23	Improved stove intervention	Air Pollution
24	Large, multipurpose dam in Africa	Water
25	Inspection and maintenance of diesel vehicles	Air Pollution
26	Low sulfur diesel for urban road vehicles	Air Pollution
27	Diesel vehicle particulate control technology	Air Pollution
28	Tobacco tax	Diseases
29	R&D and mitigation	Global Warming
30	Mitigation only	Global Warming

- While global warming made the list in three places, it did not rate as one of the top 10 concerns. Moreover, when asked which of these 30 concerns merited any of their hypothetical $75 billion, global warming initiatives received no funding.[39]

[39] "Copenhagen Consensus 2008," Copenhagen Consensus Center, May 2008. Available at www.copenhagenconsensus.com. Access verified February 12, 2009.

Air Quality: Criteria Pollutants

Air quality regulations target six "criteria" pollutants: carbon monoxide (CO), lead (Pb), nitrogen oxides (NOx), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), and sulfur dioxide (SO_2).

Carbon Monoxide. When fuel and other substances containing carbon burn without sufficient oxygen, they produce carbon monoxide (CO), a colorless, odorless, and at high levels, poisonous gas. Although trace amounts of CO occur naturally in the atmosphere, transportation sources account for about three-fourths of the nation's total emissions. In cities, automobile exhaust is responsible for as much as 95 percent of all CO emissions. Industrial processes, non-transportation fuel combustion (such as leaf blowers and lawn mowers), and natural sources such as wildfires are other sources of CO emissions.

Lead. The decline in ambient lead concentration is the greatest success story in the effort to reduce air pollution. Lead is a soft, dense, bluish-gray metal used in piping, batteries, weights, gunshot, and crystal. The highest concentrations of lead are found in areas surrounding smelters, battery manufacturers, and other stationary sources of lead emissions.

Nitrogen Oxides. Nitrogen oxides (NO_x) form naturally when nitrogen and oxygen combine through bacterial action in soil, lightning, volcanic activity, and forest fires. Nitrogen oxides also result from human activities including high-temperature combustion of fossil fuels by automobiles, power plants, industry, and the use of home heaters and gas stoves. Environmental agencies track the light brown gas, nitrogen dioxide (NO_2), because when it combines with volatile organic compounds (VOCs) in the presence of sunlight, it forms ground-level ozone.

Ozone. Ground-level ozone is the primary contributor to urban smog, although sulfur, nitrogen, carbon, and fine particulate matter contribute to smog's formation as well. Ozone is not emitted directly into the air but forms when volatile organic compounds (VOCs) combine in sunlight with various nitrogen oxides (NOx), dependent upon weather-related factors. This makes it difficult to predict changes in ozone levels accurately due to reductions in VOCs and NOx. VOCs evaporate into the atmosphere from motor vehicles, chemical plants, refineries, factories, consumer and commercial products such as lighter fluid, perfume, and other industrial sources. VOCs also occur naturally as a result of photosynthesis.

Particulate Matter. Particulate matter is the general term for a mixture of solid particles, including pieces of dust, soot, dirt, ash, smoke, and liquid droplets or vapor emitted directly into the air, where they are suspended for long periods of time. Particulates can affect breathing, damage paints, and reduce visibility. These particles come from a variety of sources, including forest fires and volcanic ash; emissions from power plants, motor vehicles, wood stoves and burning of waste or biomass; and dust from mining, paved and unpaved roads, and wind erosion.

Sulfur Dioxide. Sulfur dioxide (SO_2) is a colorless gas that forms from the burning of fuel containing sulfur, mainly coal and oil, as well as from industrial and manufacturing processes, particularly electrical power generation. Environmental factors such as temperature inversion, wind speed, and wind concentration also affect SO_2 levels.

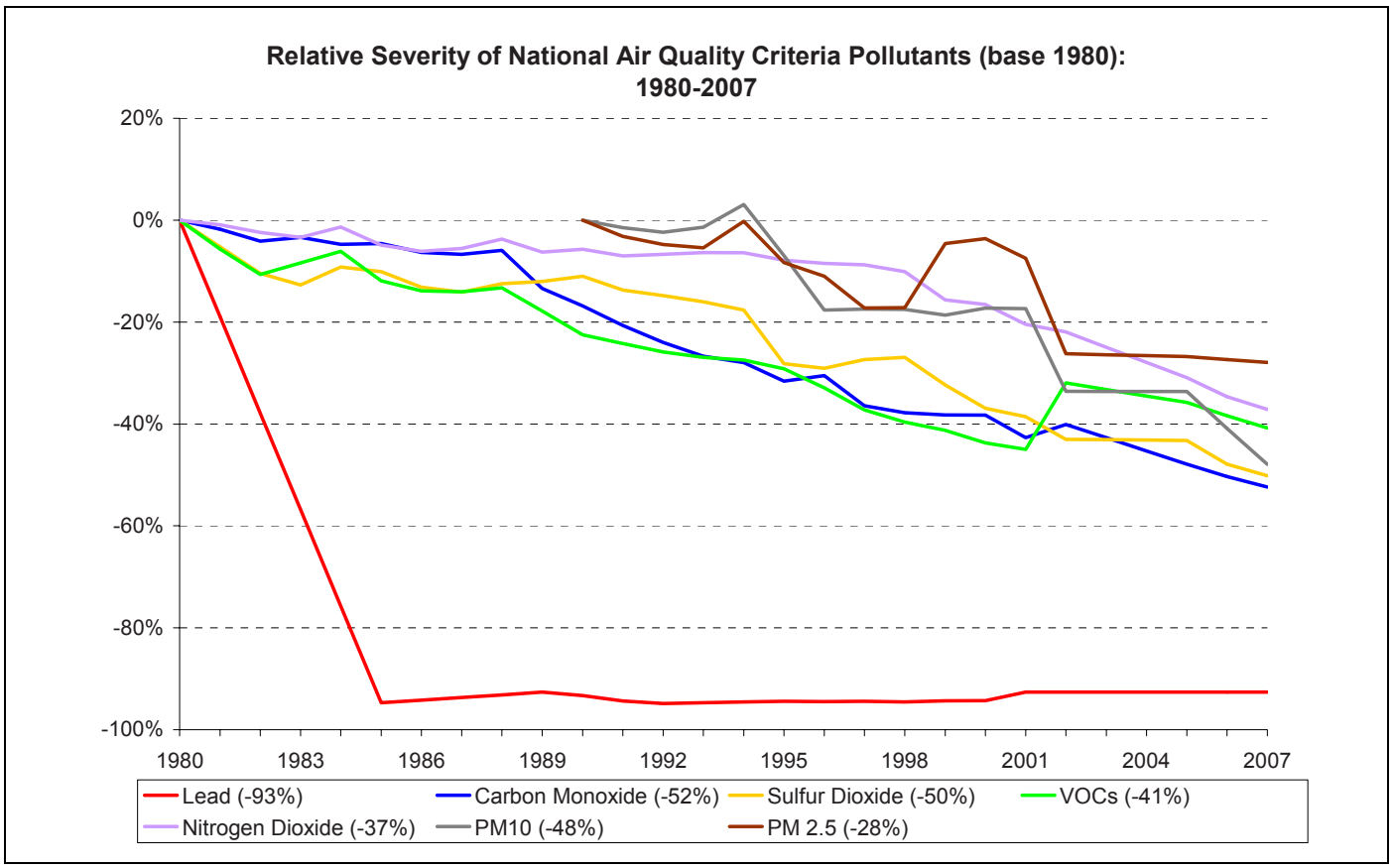
Air quality trends are measured in two ways: *emissions* and *ambient levels*. *Emissions* estimate the amount of material that comes out of a smokestack, automobile tailpipe, or other source. Emission estimates are typically measured in pounds or tons. *Ambient levels* refer to the actual concentration of a pollutant in the air, and are quantifiably measured through more than 600 U.S. sampling stations in parts-per-million or parts-per-billion. While both emissions and ambient levels show significant decline over the past quarter-century, this report focuses mainly on ambient levels. These measure the real exposure to

pollution, from which health experts and scientists can discern the actual threats posed to human health, and also quantify potential environmental hazards.

Ambient concentrations depend not only on the amount of anthropogenic emissions, but also on many meteorological factors such as temperature, sunlight, air pressure, humidity, wind, rain, and so forth. For example, hot summers such as 1983 and 1988 experienced higher ozone levels, while cool summers experienced lower air pollution levels.

It should be noted that some air pollutants, especially ozone-forming hydrocarbons and particulates, are naturally generated in substantial amounts by trees and other vegetation.

Is air quality in the U.S. better, worse, or about the same as it was in 1980?

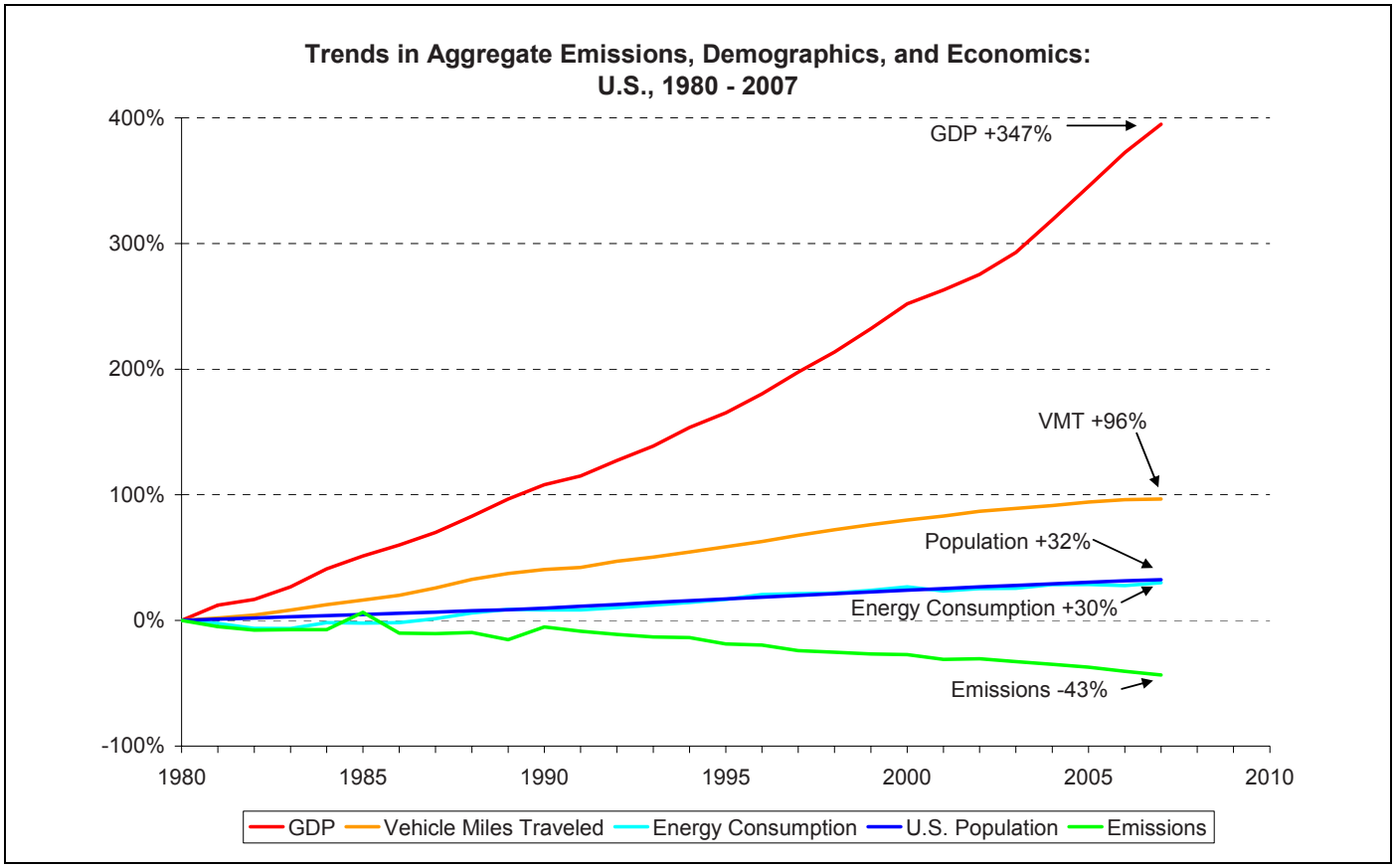


- The steady improvement in air quality in most American cities is one of the greatest environmental success stories of recent decades. Because this improvement has come in small increments, at any given moment it tends to go unnoticed and unappreciated.

- Polls consistently find that many Americans believe air quality has gotten worse and will continue to get worse. The most recent poll of this type, conducted in August 2004 by Wirthlin Worldwide for the Foundation for Clean Air Progress, found 38 percent of Americans believe air quality has gotten worse in the past 10 years, while only 29 percent believe air quality has improved.[40] It is only when the entire record of the last 30 years is surveyed that the dramatic progress in air quality becomes evident.

[40] Foundation for Clean Air Progress, *Clean Air National Survey Results: August, 2004*, 2005.

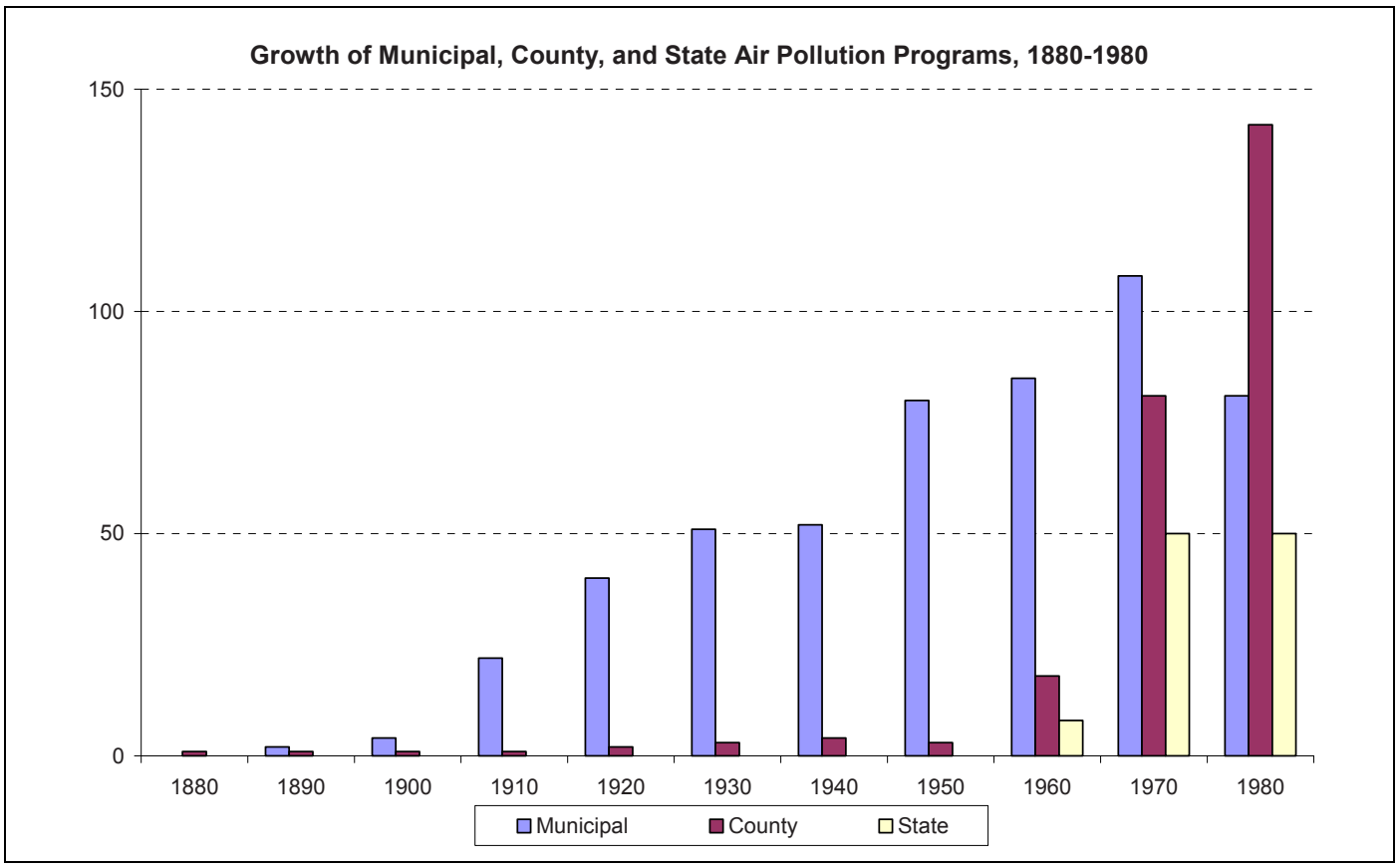
What progress are Americans making toward reduced air pollution?



- Despite significant increases in the United States' population, economy, travel habits, and energy consumption, there have been major decreases in ambient levels of the six criteria air pollutants since 1980. Between 1980 and 2007, the gross domestic product increased 347 percent, vehicle miles traveled increased 96 percent, energy consumption increased 30 percent, and the U.S. population increased 32 percent. At the same time, total emissions of the six criteria pollutants *decreased* an estimated 43 percent.[41]

[41] Criteria air pollutant data from Environmental Protection Agency (EPA), "National Emissions Inventory (NEI) Air Pollutant Emissions Trends Data," August 2008. Available at http://www.epa.gov/ttn/chief/trends/trends06/nationaltier1upto2007basedon2005v1.xls. Access verified August 28, 2008. Vehicle miles traveled data from U.S. Department of Transportation, Federal Highway Administration, Office of Highway Policy Information, "Traffic Volume Trends," August 14, 2008. Available at http://www.fhwa.dot.gov/ohim/tvtw/tvtpage.htm. Access verified August 29, 2008. National energy consumption data from the Energy Information Administration, "Frequently Asked Questions – General Energy," June 12, 2008. Available at http://www.eia.doe.gov/emeu/aer/txt/ptb0105.html. Access verified August 29, 2008. Population estimates from U.S. Census Bureau, American Fact Finder, "2007 Population Estimates (GCT-T1)." Available at http://factfinder.census.gov. Access verified August 29, 2008. GDP data from U.S. Department of Commerce, Bureau of Economic Analysis, "National Economic Accounts: Gross Domestic Product," August 28, 2008. Available at http://www.bea.gov/national/nipaweb. Access verified August 29, 2008.

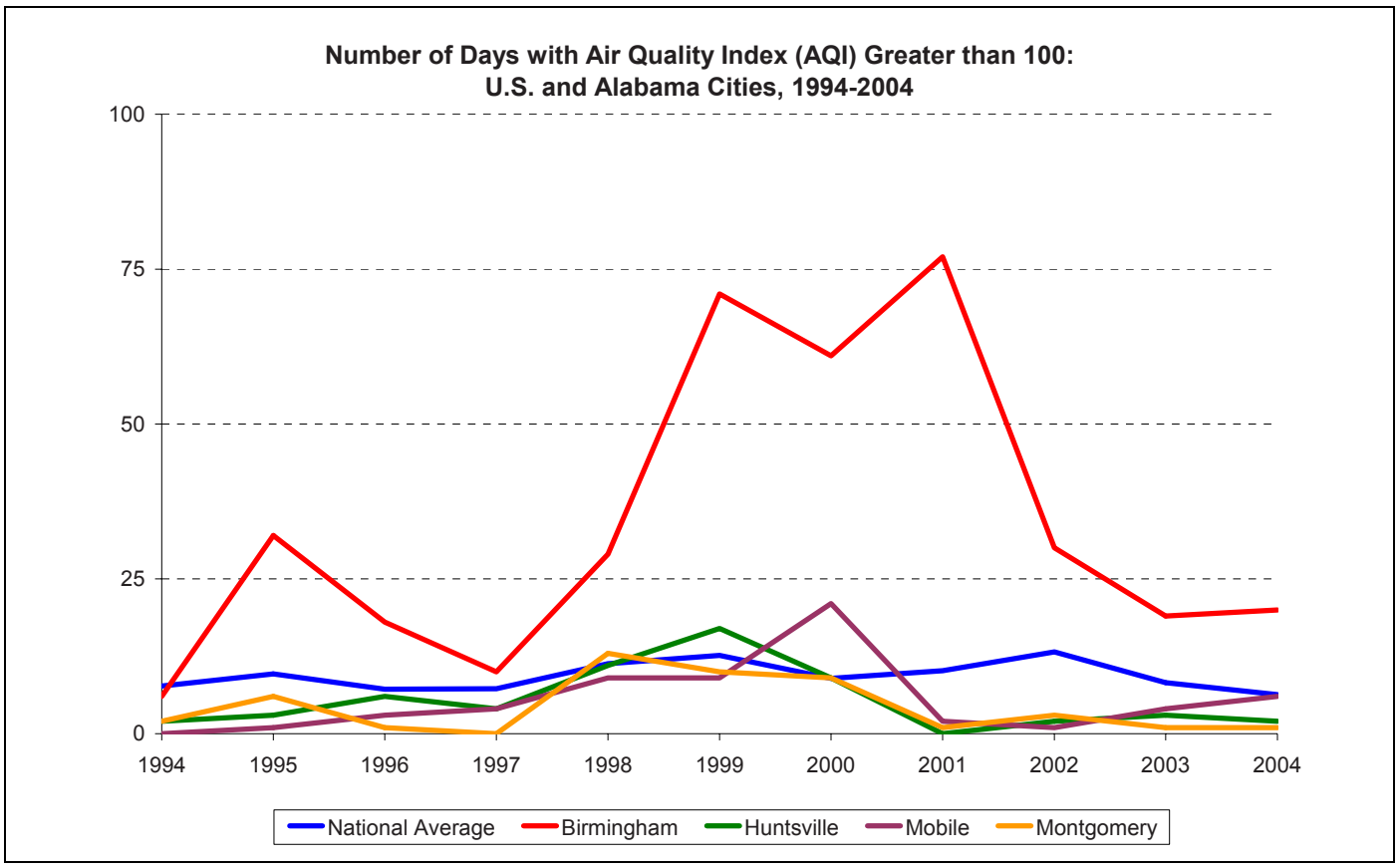
How long have air pollution control policies been in effect in the U.S.?



- Although the data for air pollution is not well quantified prior to 1970, studies indicate that air quality was improving rapidly before the passage of the 1970 Clean Air Act. For example, Paul Portney, an environmental economist with Resources for the Future, writes that it is "extremely difficult to isolate the effects of regulatory policies on air quality, as distinct from the effects of other potentially important factors," because "some measures of air quality were improving at an impressive rate before 1970."[42]

[42] Paul R. Portney, "Air Pollution Regulation," in Paul R. Portney, editor, *Public Policies for Environmental Protection* (Washington, DC: Resources for the Future, 1990), p. 40.

How healthy is the air in Alabama's largest cities?



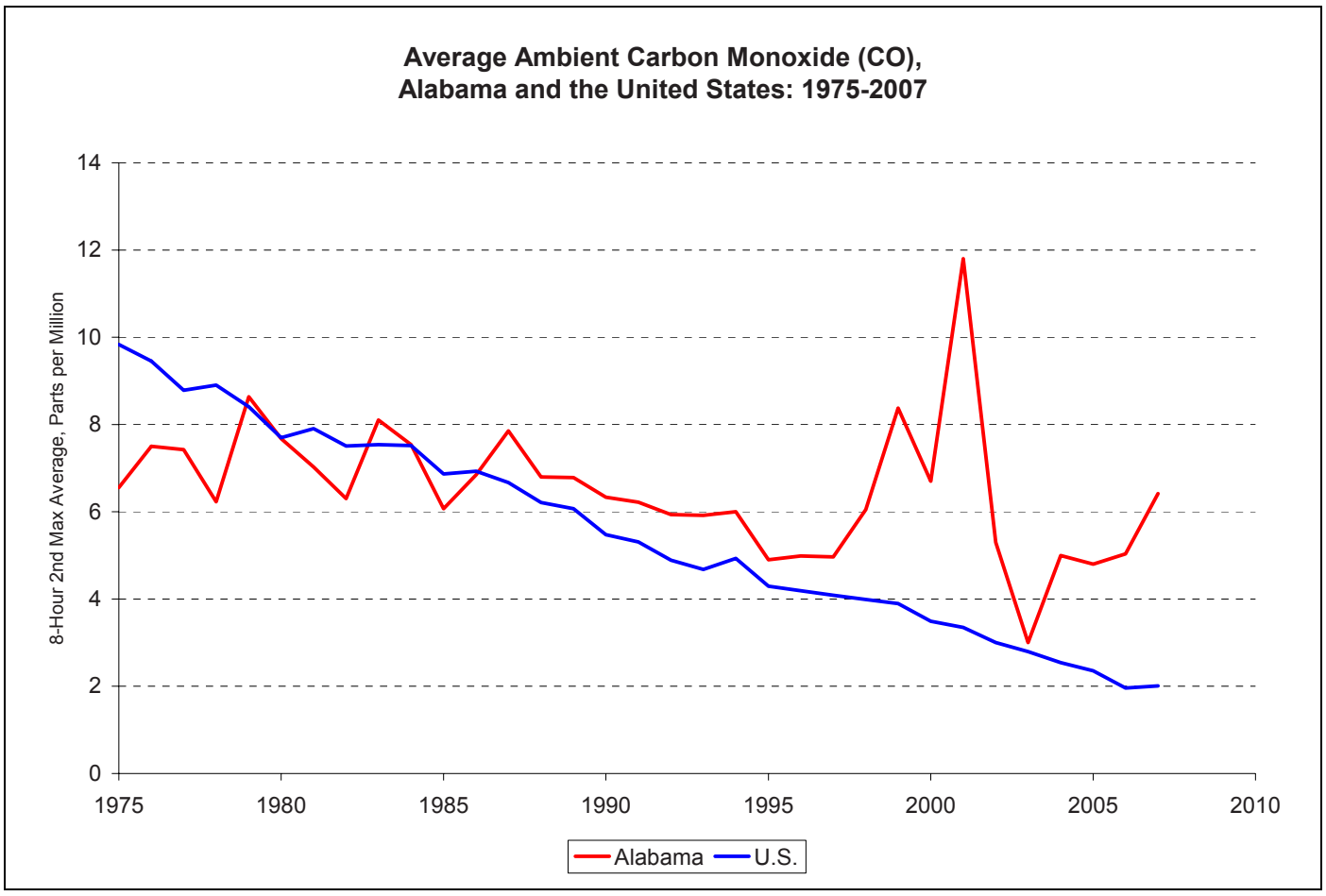
- In July 1999 the EPA replaced the Pollutant Standards Index (PSI) with the Air Quality Index (AQI).[43] The AQI is a composite measure of the criteria pollutants and it is used to give warnings about "unhealthful" air quality: an AQI value of 100 is the threshold of unhealthful air. The thresholds for each category are shown below:

Category	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy	Hazardous	
Index Value	0 - 50	51 - 100	101 - 150	151 - 200	201 - 300	301 - 400	401 - 500
Pollutant	Concentration Ranges						
CO	0 - 4.4	4.5 - 9.4	9.5 - 12.4	12.5 - 15.4	15.5 - 30.4	30.5 - 40.4	40.5 - 50.4
NO2	--	--	--	--	0.65 - 1.24	1.25 - 1.64	1.65 - 2.04
O3 1-hour	--	--	.125 - .164	.165 - .204	.205 - .404	.405 - .504	.505 - .604
O3 8-hour	0 - .064	.065 - .084	.085 - .104	.105 - .124	.125 - .374	--	--
PM 2.5	0 - 15.4	15.5 - 40.4	40.5 - 65.4	65.5 - 150.4	150.5 - 250.4	250.5 - 350.4	350.5 - 500.4
PM 10	0 - 54	55 - 154	155 - 254	255 - 354	355 - 424	425 - 504	505 - 604
SO2	0 - .034	.035 - .144	.145 - .224	.225 - .304	.305 - .604	.605 - .804	.805 - 1.004

Of the 305 MSAs surveyed nationwide, Montgomery ranked 139th in terms of AQI days of less than 100, Huntsville ranked 144th, Mobile ranked 236th, and Birmingham 283rd.

[43] "Air Quality Index (AQI) - A Guide to Air Quality and Your Health," http://airnow.gov /index.cfm?action =static.aqi.

How have ambient levels of carbon monoxide changed in recent years?

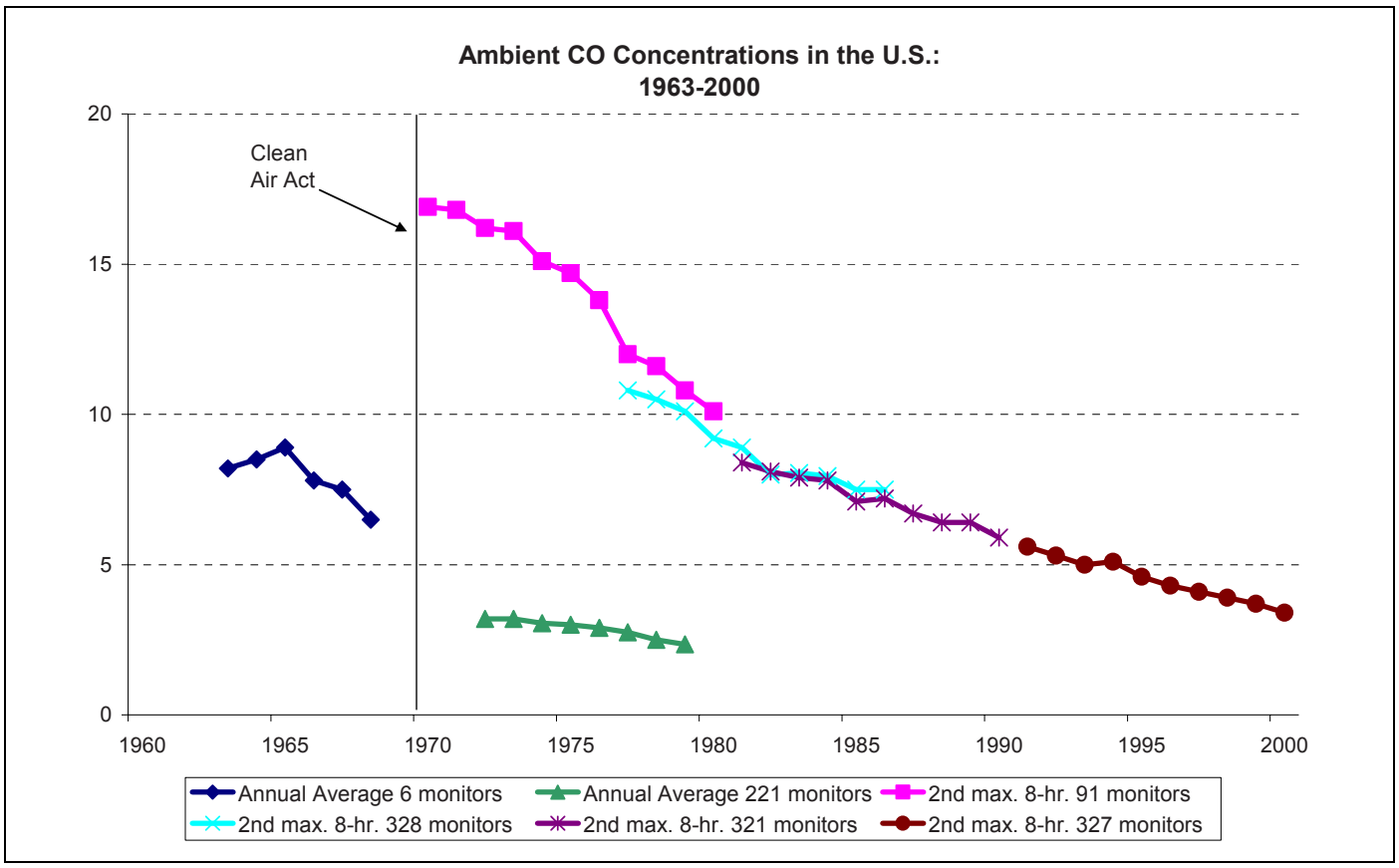


- The federal standard for carbon monoxide (CO) emissions is nine parts per million per eight-hour period. From 1975 to 2007, national ambient CO emissions fell 79 percent, and have declined 42 percent since 2000. Put another way, in 1975 one of every 64 readings for CO (1.6 percent) exceeded federal standards. By 2007, only one in every 172,000 readings (.001 percent) exceeded federal guidelines.[44]

- In Alabama, statewide CO levels fell 30 percent from 1975 to 2007, and have declined 31 percent since 2000. Except for 1975, 1987 and the years between 1998 and 2001, the number of exceedances for CO in Alabama has been 20 or fewer per year, with 15 of the past 33 years reporting no exceedances.

[44] EPA, AirData—Monitor Data Queries, Annual Summary Table Query, September 2, 2008. Available at http://oaspub.epa.gov/aqspub1/AQS_Annsum.AnnualSummary. Access verified September 2, 2008.

How have ambient levels of carbon monoxide changed since the Clean Air Act?

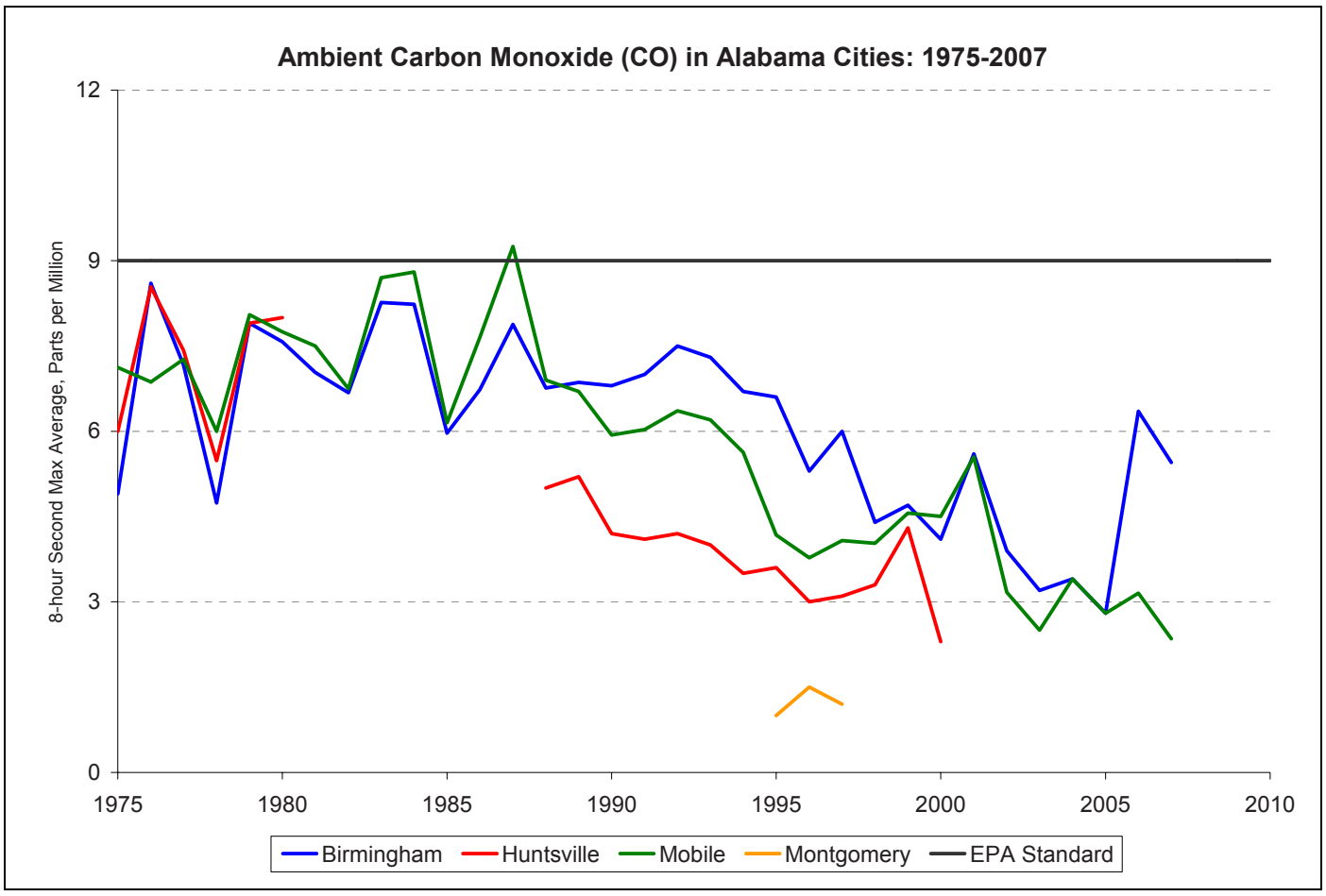


- Although there is little data on ambient CO concentrations until the 1970s, the available data suggest CO may have already begun improving in the mid-1960s, at least in urban areas.

- This data is from the federally-operated, six-city CAMP network, which includes Chicago, Cincinnati, Denver, Philadelphia, St. Louis, and Washington. Indur M. Goklany, author of *Clearing the Air: The Real Story of the War on Air Pollution*, notes: "The fact that declines apparently began before the Federal Motor Vehicle Control Program went into effect indicates that stationary (i.e., industrial) source reductions played a role in the initial turnaround; those improvements then gathered momentum as an increasing number of vehicles became subject to federal tailpipe controls starting with the 1968 model year."[45]

[45] Indur M. Goklany, *Clearing the Air: The Real Story of the War on Air Pollution* (Washington, DC: Cato Institute, 1999).

How have ambient levels of carbon monoxide changed in Alabama's largest cities?

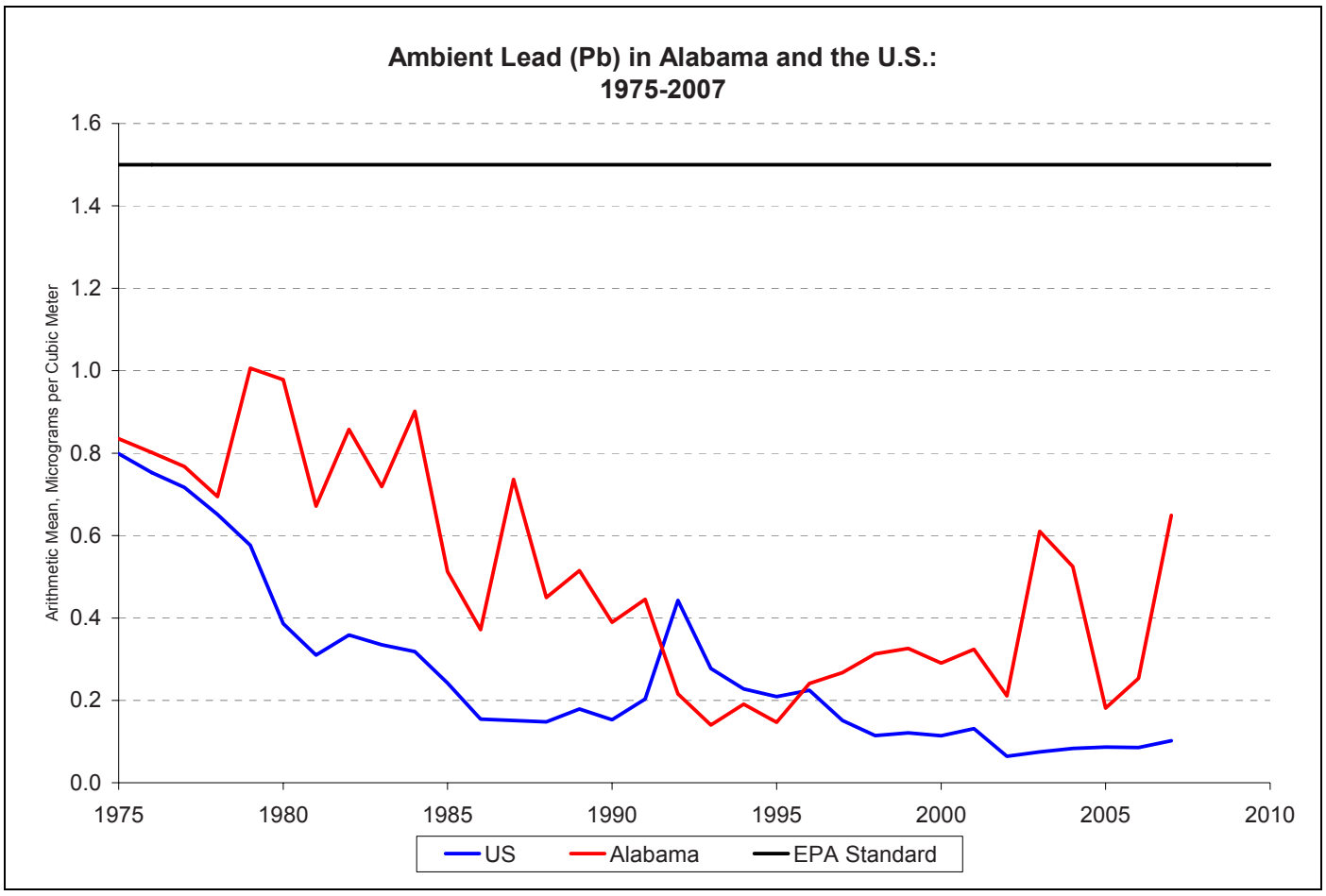


- Birmingham and Mobile are the only two large cities in Alabama in which CO levels are regularly monitored. From 1975 to 2007, ambient CO levels in Birmingham fell 29 percent, while levels in Mobile fell 55 percent during the same time period.[46]

- While only incomplete data exist for Huntsville and Montgomery, what data are available suggest both cities have been well below the federal CO threshold of an average of nine parts per million per eight hours.

[46] EPA, AirData—Monitor Data Queries, Annual Summary Table Query.

How have ambient levels of lead changed in recent years?



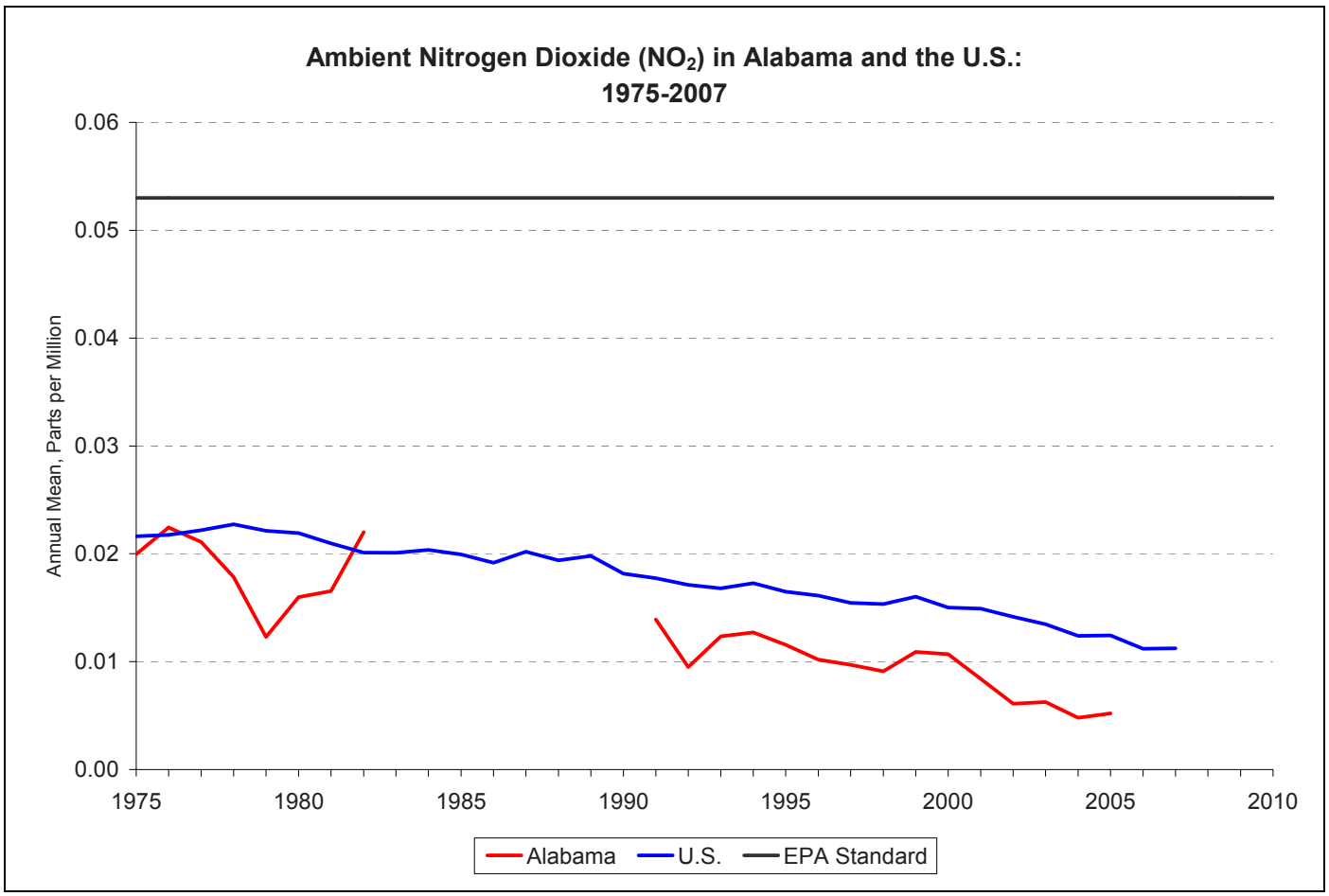
- Of the six criteria pollutants, lead is the most toxic. When ingested through food, water, soil, dust, or inhaled through the air, it accumulates in the body's tissues and is not readily excreted. Excessive exposure to lead can cause anemia, kidney disease, reproductive disorders, and neurological impairments such as seizures, mental retardation, and behavioral disorders. Young children are the most vulnerable to high levels of lead in the blood, which in small children retards brain and IQ development. Children who live in older housing with lead-based paint are still at risk for high blood-lead levels, but the pervasive threat of lead from poor urban air is a problem of the past.[47]

- Since 1975, ambient lead concentrations in Alabama and the United States decreased 22 percent and 87 percent, respectively. Both have remained well below the national standard of 1.5 micrograms per cubic meter of air for many years. Most of this reduction was achieved through the introduction of unleaded gasoline, and the elimination of lead compounds in paints, coatings, and from point sources such as smelters and battery plants.[48]

[47] EPA, "Lead in Paint, Dust, and Soil," February 6, 2007, Available at http://www.epa.gov /lead/.

[48] EPA, AirData—Monitor Data Queries, Annual Summary Table Query.

How have ambient levels of nitrogen dioxide changed in recent years?

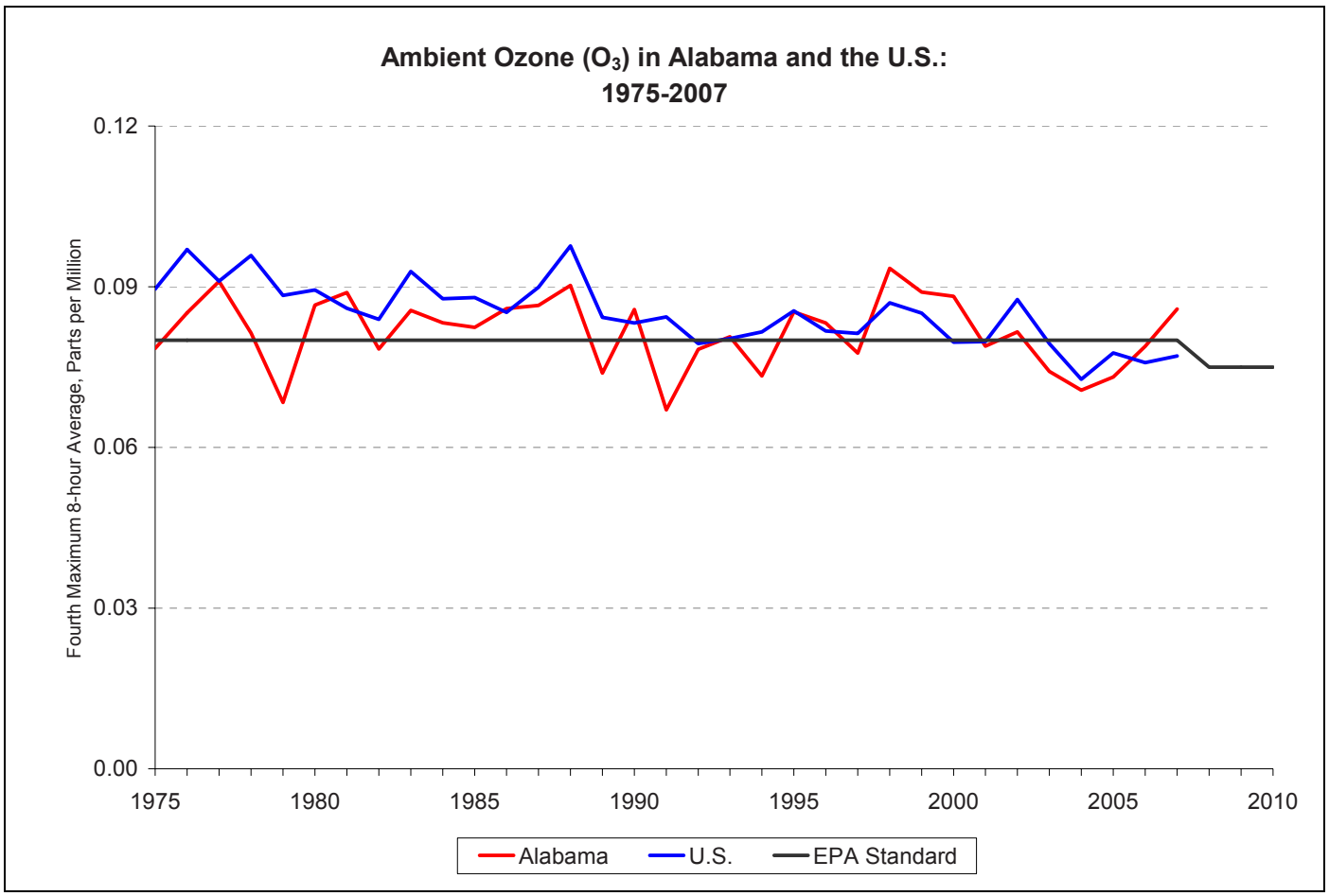


- Almost 40 percent of all nitrogen oxide emissions are from trucks and automobiles, with another 28 percent the result of electricity generation and industrial processes. By comparison, fires and residential wood burning account for only about 1 percent of all nitrogen oxide generation.[49]

- The national average for ambient levels of nitrogen dioxide decreased by 48 percent from 1976 to 2006. In Alabama, no data for ambient nitrogen levels are available from 1983 to 1990. Nevertheless, the available data suggest nitrogen dioxide levels declined by 74 percent from 1975 to 2005, well below the EPA standard of 0.053 parts per million.[50]

[49] EPA, "Air Emission Sources: Nitrogen Oxides," October 21st, 2008. Available at http://www.epa.gov/air/emissions/nox.htm. Access verified April 6, 2009.
[50] *Ibid*.

How have ambient levels of ozone changed in recent years?



- The December 1991 National Academy of Sciences report on ozone revealed that much of the variation in ozone comes from "natural fluctuations in the weather," not from "year-to-year changes in emissions." Therefore, it concluded that current ozone reduction strategies may be ineffective because they do not account for naturally-occurring VOCs.

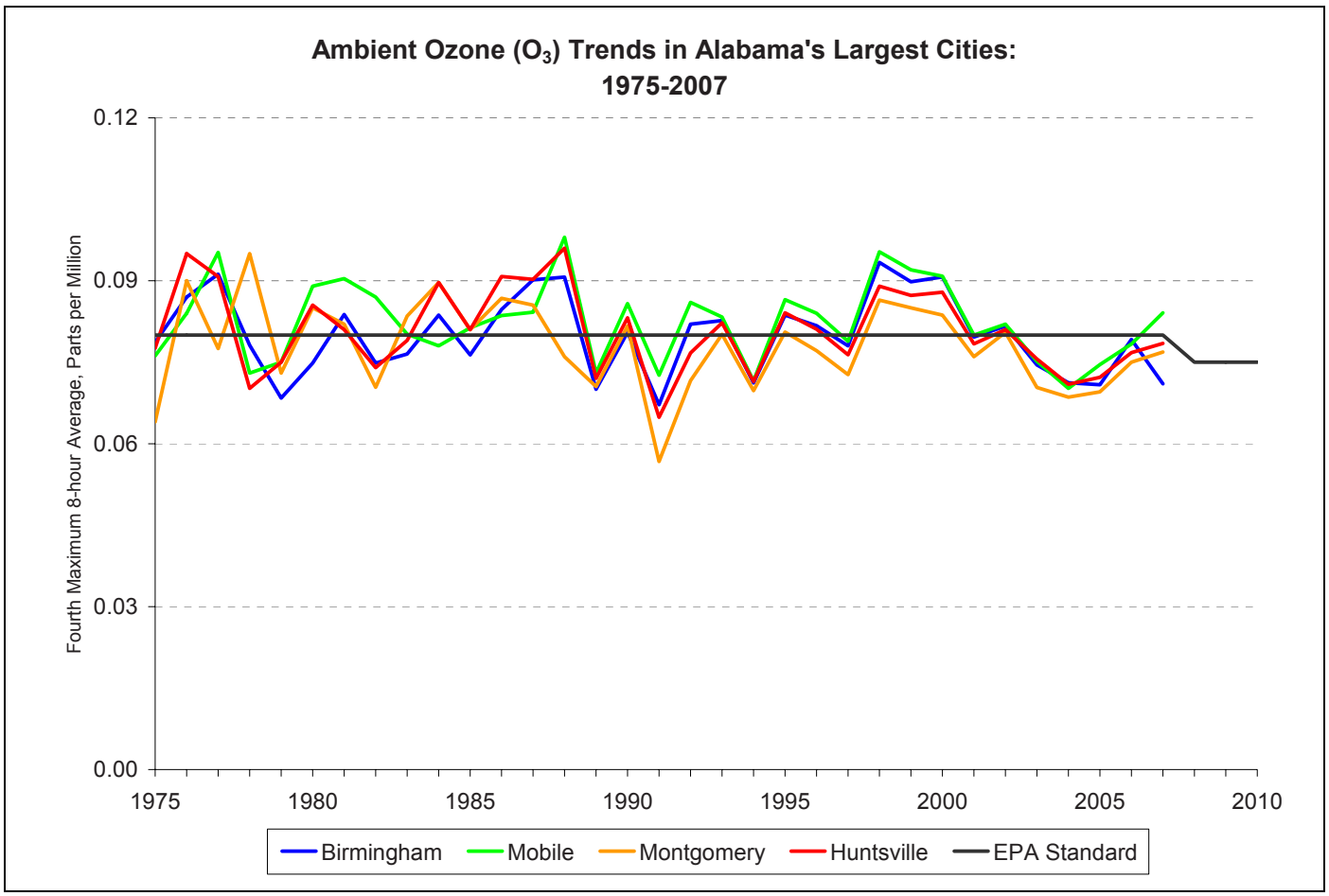
- Ozone is the most stubborn air quality problem for both Alabama and the nation as a whole. On average, national ambient levels of ozone decreased 13 percent from 1975 to 2007, while ozone levels in Alabama fell only 9 percent during the same period.[51]

- Effective May 27, 2008, the EPA's primary standard for ozone measurement tightened from .08 parts per million to .075 parts per million. A state is said to be in violation of this standard if the fourth-highest daily maximum value is above this threshold.[52]

[51] *Ibid*.

[52] EPA, "National Ambient Air Quality Standards (NAAQS)," March 28th, 2008. Available at http://www.epa.gov/air/criteria.html. Access verified September 2, 2008.

How have ambient levels of ozone changed in Alabama's largest cities?



- Alabama's four largest cities—Birmingham, Huntsville, Mobile, and Montgomery—measure ozone concentrations during the spring and summer months of each year.

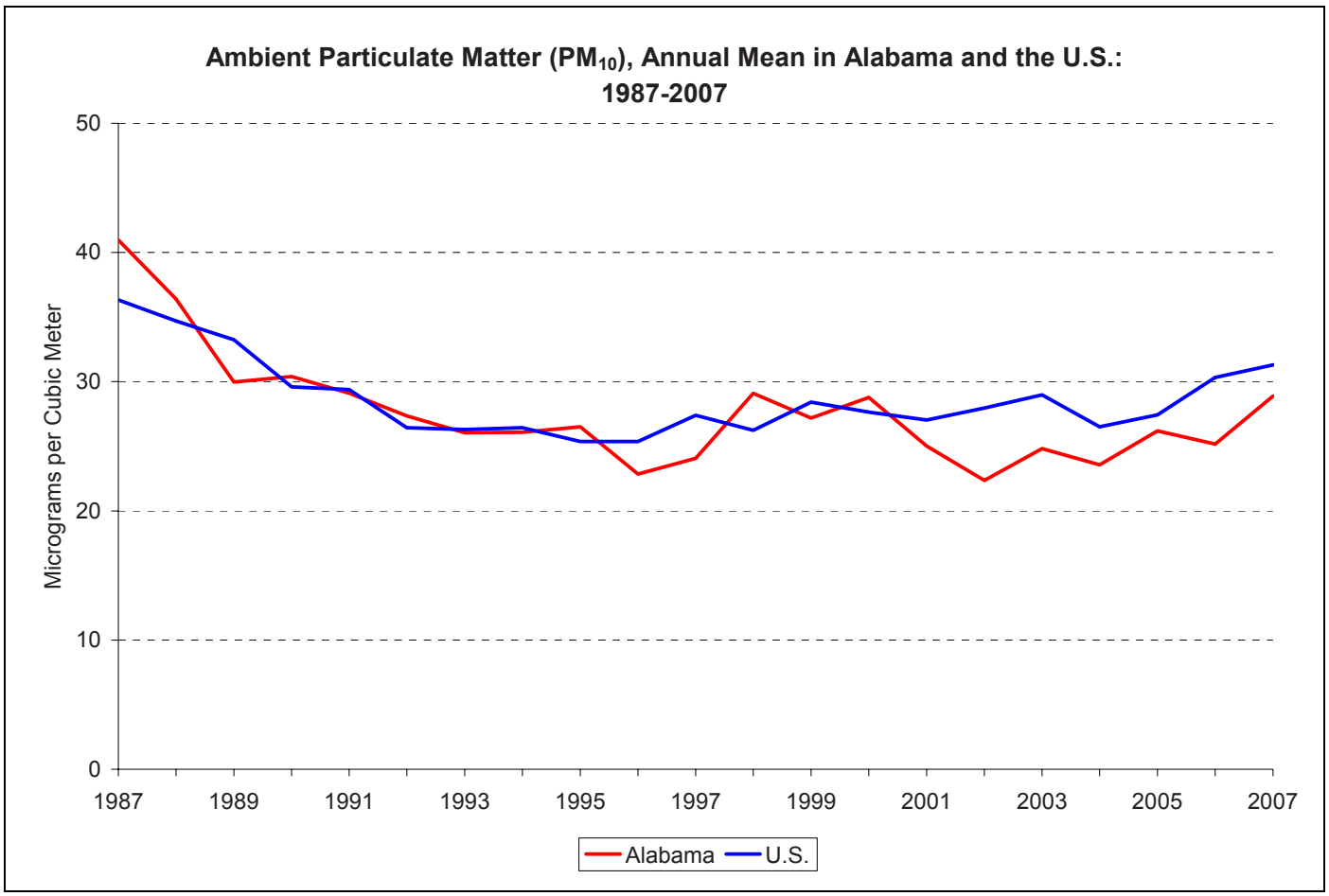
- Effective May 27, 2008, the EPA's primary standard for ozone measurement tightened from .08 parts per million to .075 parts per million. A state is said to be in violation of this standard if the fourth-highest daily maximum value is above this threshold.[53]

- From 1997 to 2002, Birmingham and Huntsville averaged at least 13 days per year in violation of federal ozone guidelines. Since 2003, however, the number of exceedances has dropped, to about 4.2 days per year for Birmingham and to about 8.4 days for Huntsville.[54]

[53] *Ibid*.

[54] EPA, AirData—Monitor Data Queries, Annual Summary Table Query.

How have ambient levels of particulate matter (PM_{10}) changed in recent years?



- Particle pollution (also called particulate matter or PM) is the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small that they can only be detected using an electron microscope. In 1987, the EPA began monitoring suspended particulates 10 microns in diameter or smaller (PM_{10}). To put this size in perspective, the average human hair is about 70 microns in diameter, and fine sand is about 90 microns across.[55]

- From 1987 to 2007, nationwide average concentrations of PM_{10} decreased 13 percent. In Alabama, overall measures of PM_{10} decreased 29 percent.[56]

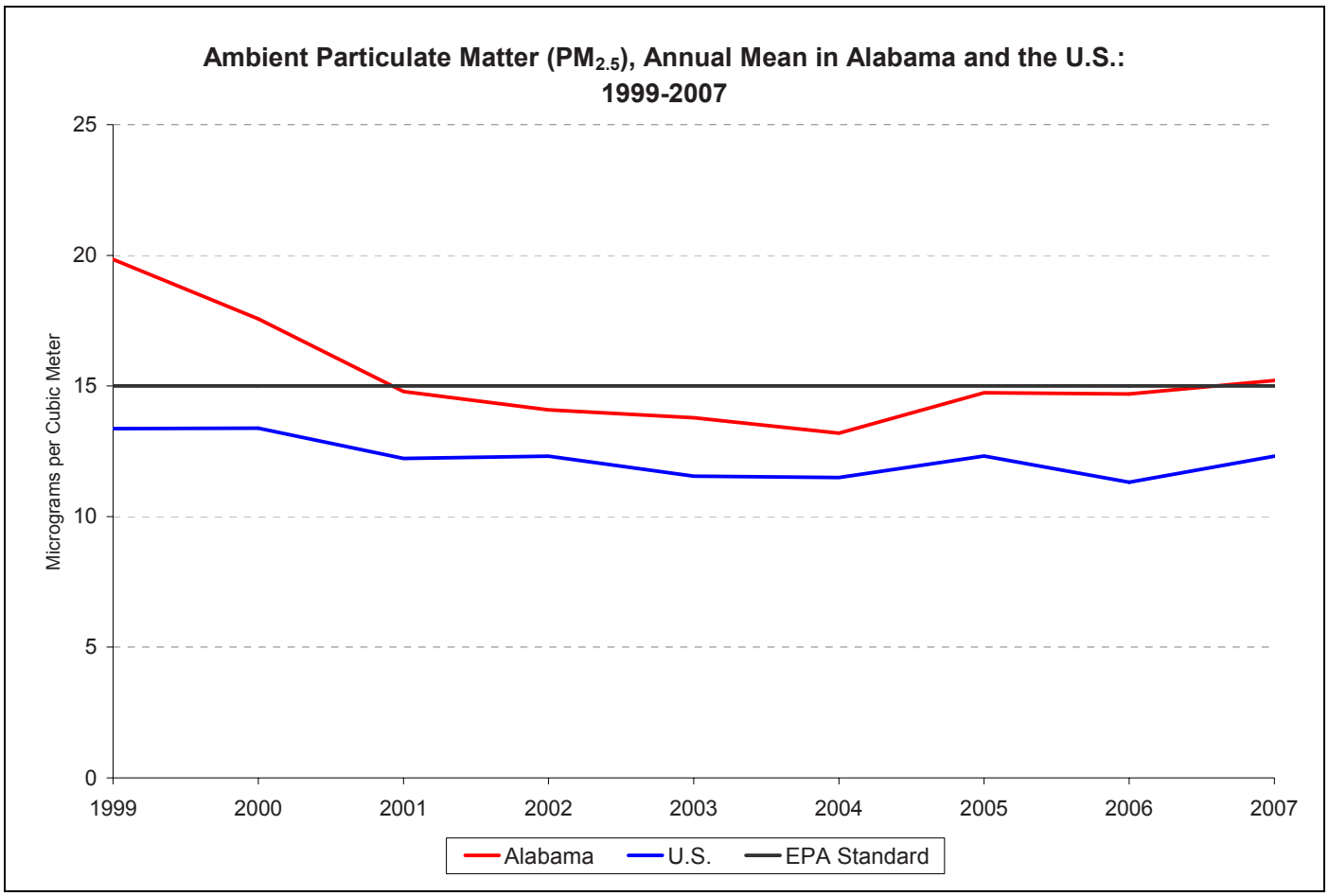
- Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the agency revoked the annual PM_{10} standard in December 2006, but retained the existing 24-hour standard of 150 micrograms per cubic meter ($\mu g/m^3$).[57]

[55] EPA, "Basic Information: Particulate Matter," May 9, 2008. Available at http://www.epa.gov/oar/particlepollution/basic.html. Access verified September 3, 2008.

[56] EPA, AirData—Monitor Data Queries, Annual Summary Table Query.

[57] EPA, "PM Standards," Available at http://www.epa.gov/air/particlepollution/standards.html. Access verified September 3, 2008.

How have ambient levels of particulate matter ($PM_{2.5}$) changed in recent years?



- In 1999, the EPA tightened its standards for particulate matter by monitoring particles 2.5 micrometers in size or smaller ($PM_{2.5}$). The EPA revised its standards based on a link to serious health problems ranging from increased symptoms, hospital admissions and emergency room visits for people with heart and lung disease, to premature death in people with heart or lung disease. Initially, these changes were challenged in court by several industry groups and state governments. However, in 2001 the U.S. Supreme Court upheld the EPA's authority under the Clean Air Act to set standards, and clarified that the EPA cannot consider cost in setting standards.[58]

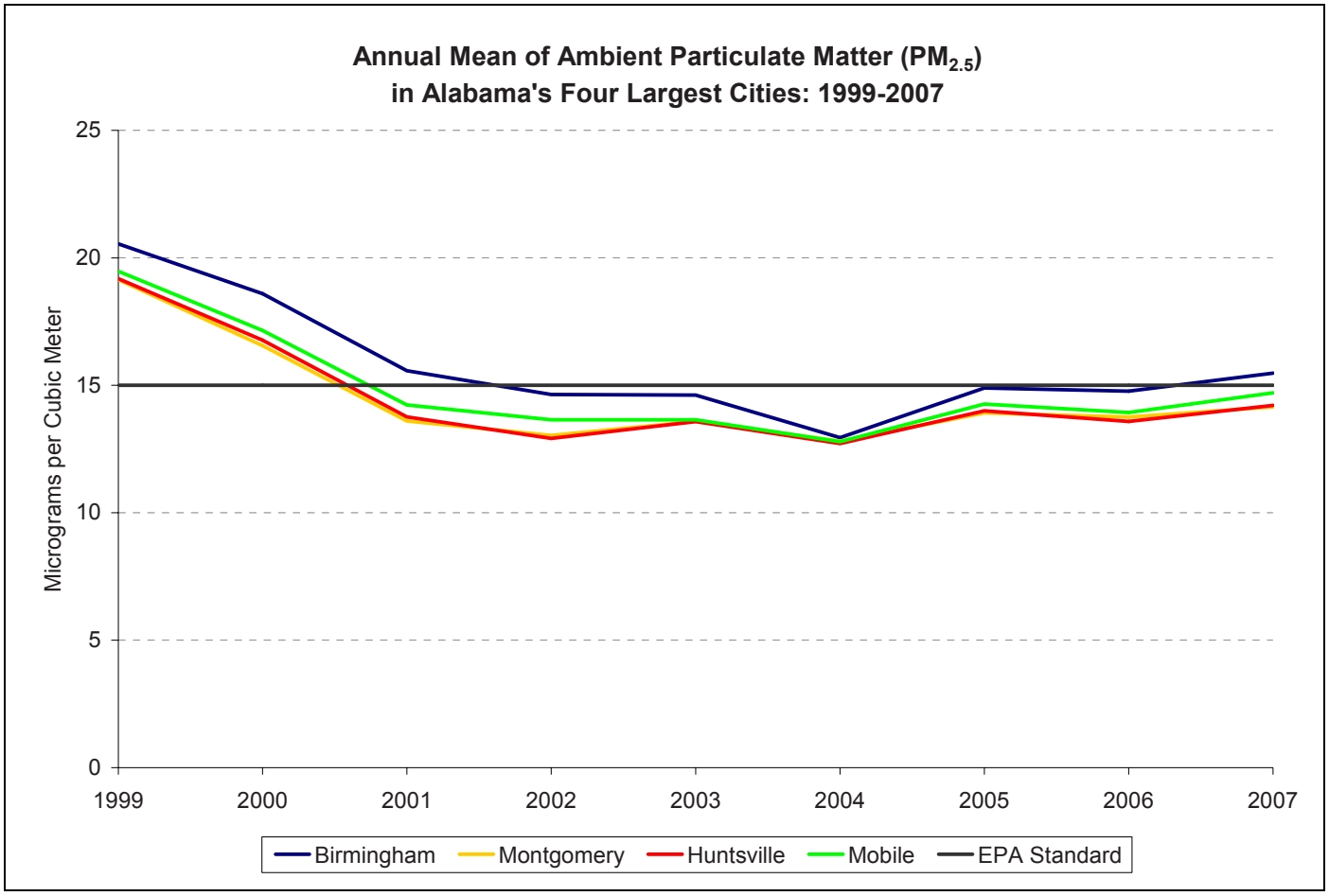
- From 1999 to 2007, ambient levels of $PM_{2.5}$ in the United States declined 15 percent. In Alabama, average $PM_{2.5}$ levels fell 23 percent during the same period of time. However, during the same period, the state's average level of $PM_{2.5}$ rose marginally above the federal standard of 15 $\mu g/m^3$ in 2007.[59]

- The EPA revised the air quality standards for particle pollution in 2006. The 2006 standards tighten the 24-hour fine particle standard from the current level of 65 micrograms per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$, and retain the current annual average fine particle standard at 15 $\mu g/m^3$.

[58] EPA, "History of PM Standards." Available at http://www.epa.gov/air/particlepollution/history.html. Access verified September 3, 2008.

[59] EPA, AirData—Monitor Data Queries, Annual Summary Table Query.

How have ambient levels of particulate matter ($PM_{2.5}$) changed in Alabama's largest cities?



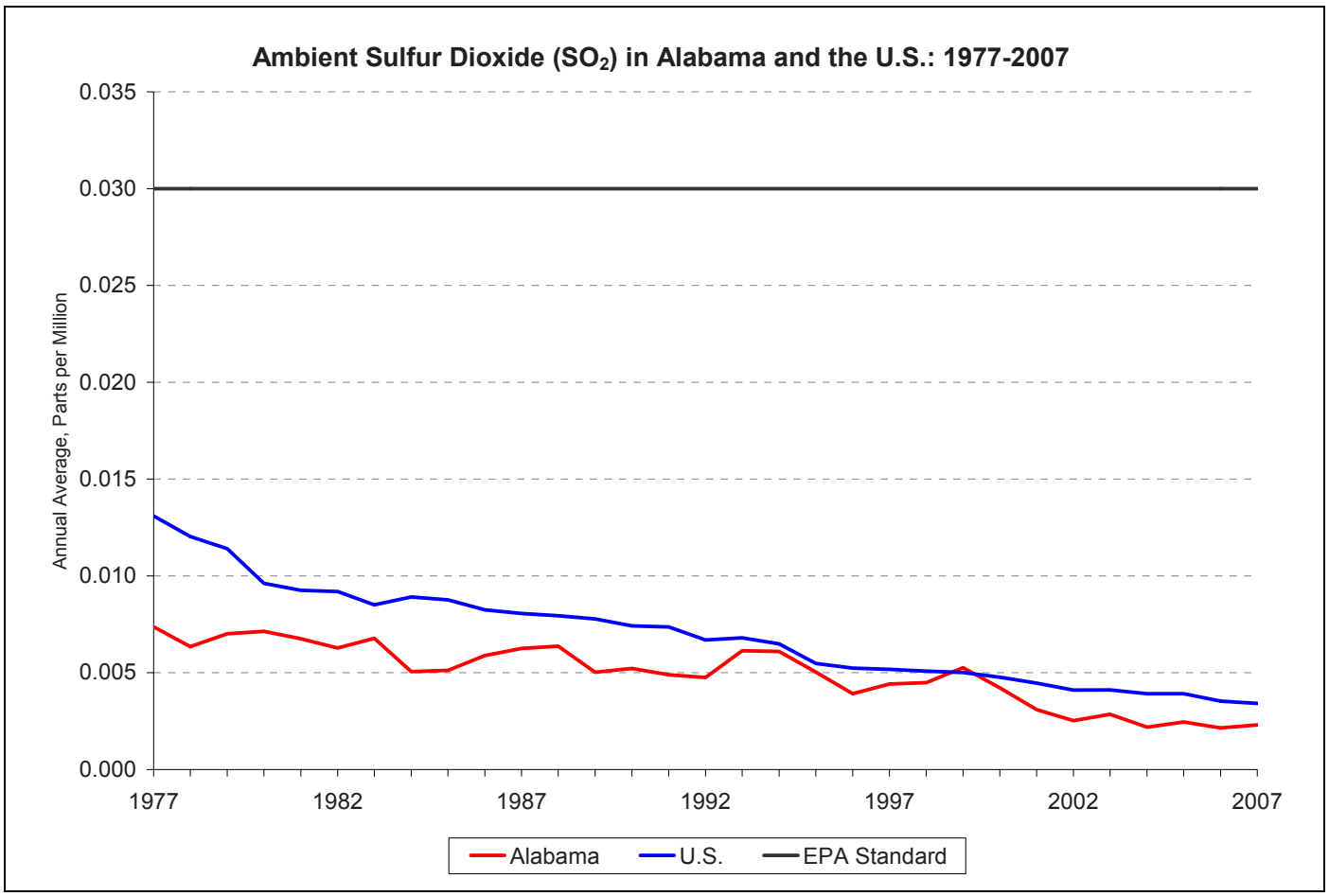
- Much of the improvements in $PM_{2.5}$ levels in Alabama have come from significant reductions in Alabama's largest cities. On average, $PM_{2.5}$ levels in Alabama's four largest cities—Birmingham, Huntsville, Mobile, and Montgomery—fell between 24 percent and 26 percent from 1999 to 2007.[60]

- During the same time, $PM_{2.5}$ levels in the state's eight other Metropolitan Statistical Areas (MSAs)—Anniston-Oxford, Auburn-Opelika, Columbus GA-AL, Decatur, Dothan, Florence-Muscle Shoals, Gadsden, and Tuscaloosa—declined an average of 25 percent from 1999 to 2007.[61]

[60] *Ibid*.

[61] *Ibid*.

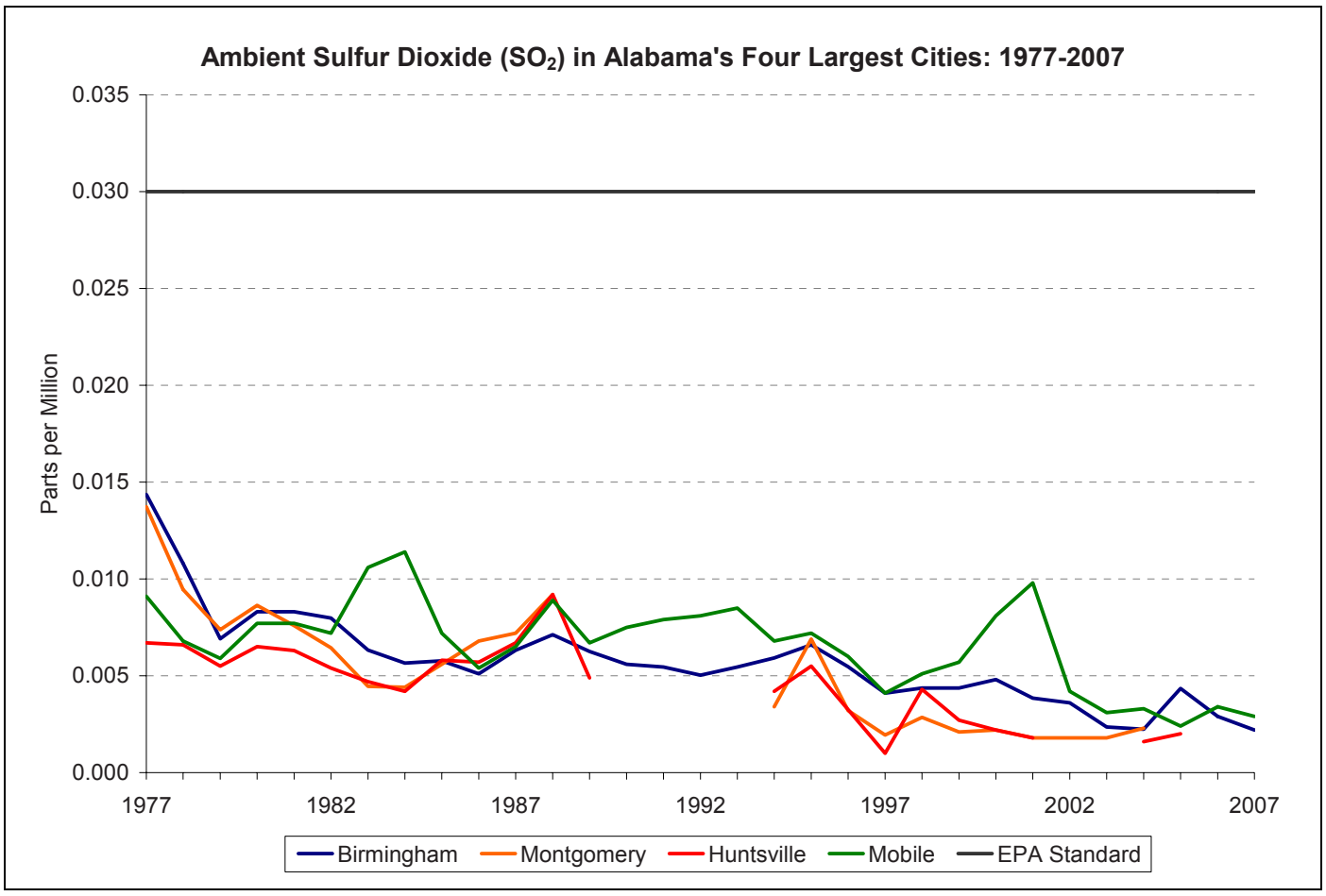
How have ambient levels of sulfur dioxide changed in recent years?



- Ambient levels of SO_2 decreased 74 percent nationwide between 1977 and 2007, and the United States has met the EPA's designated "good" category since 1981. In Alabama, ambient levels of SO_2 fell 68 percent from 1977 to 2007.[62]

[62] *Ibid*.

How have ambient levels of sulfur dioxide changed in Alabama's largest cities?



- Only Birmingham and Mobile have tracked sulfur dioxide (SO_2) levels without interruption since 1971. Nevertheless, the available data from Huntsville and Montgomery suggests a fairly uniform decline in ambient SO_2 levels for all of Alabama's largest cities over the past 30 years.

- Since 1977, ambient SO_2 levels in Birmingham and Mobile have fallen 78.7 percent and 55.9 percent, respectively. In Huntsville, the available data suggests a fall in ambient SO_2 levels of about 70 percent, while data from Montgomery suggests a decline of about 83 percent from 1977 to 2007.[63]

[63] *Ibid*.

Water Quality

As part of the EPA's *2008 Report on the Environment*, a chapter was devoted to examining 18 environmental indicators it considers helpful in assessing the quality of the nation's water resources. The goal of the EPA's report was to assess both the *extent* of water resources (their amount and distribution) and their *condition* (physical, chemical, and biological).[64]

The inland, coastal, and territorial waters examined in this chapter comprise less than seven percent of the surface of the United States, yet they cover 256,000 square miles, a surface area slightly smaller than Texas.[65] Because of this large size, the EPA relies on sampling, surveys, and monitoring stations that are considered representative of larger areas. They note:

> *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 combination of spatial and temporal domains. In general, there is an inherent tradeoff in representing trends in water resources. For example, a probabilistic survey may provide an accurate representation of national trends, but the resolution may be too low to definitively characterize the resource at a smaller scale. In some cases, results can be disaggregated to the scale of EPA Regions or ecoregions without losing precision. However, these indicators are generally not designed to inform the reader about the condition of his or her water bodies, for example, or the quality of locally harvested fish*.[66]

In the same way, the EPA notes that the sampling methods used can overlook "extreme events," such as the effect of pesticide application on a nearby water body. "Thus, representative extent or condition data cannot depict the full range of variations and extremes—some of which may be critical to ecosystems or to humans—that occur in smaller areas or on smaller time scales."[67]

Water Pollution: An Introduction

Water pollution stems from five types of sources: point, non-point, air deposition, invasive species, and natural factors:

- *Point source pollution* refers to large-scale industrial and municipal pollution, such as release pipes or sewer outlets that discharge pollutants directly into bodies of water.
- *Non-point source pollution* refers to such factors as agricultural runoff, mine drainage, soil erosion, urban storm runoff, recreational activities, and household disposal of pollutants "down the drain." These may vary more than point source pollution because of differences in land cover and land use, as well as the location and timing of pesticide application.
- *Air deposition* refers to acidic aerosols, heavy metals, and other airborne contaminants which may be deposited directly on water or may wash into water bodies after deposition on land.
- *Invasive species* refers to non-indigenous plant and animal species.
- *Natural factors* refer to influences by weather and climate, such as rain and temperature changes. It also refers to mineral and sediment deposits which may make a water body more susceptible to acidification.[68]

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[64] EPA, "Water Use," in *EPA's 2008 Report on the Environment*. National Center for Environmental Assessment, Washington, DC, 2008, p. 3-6. Available from the National Technical Information Service, Springfield, VA, and online at www.epa.gov/roe. Access verified September 3, 2008.

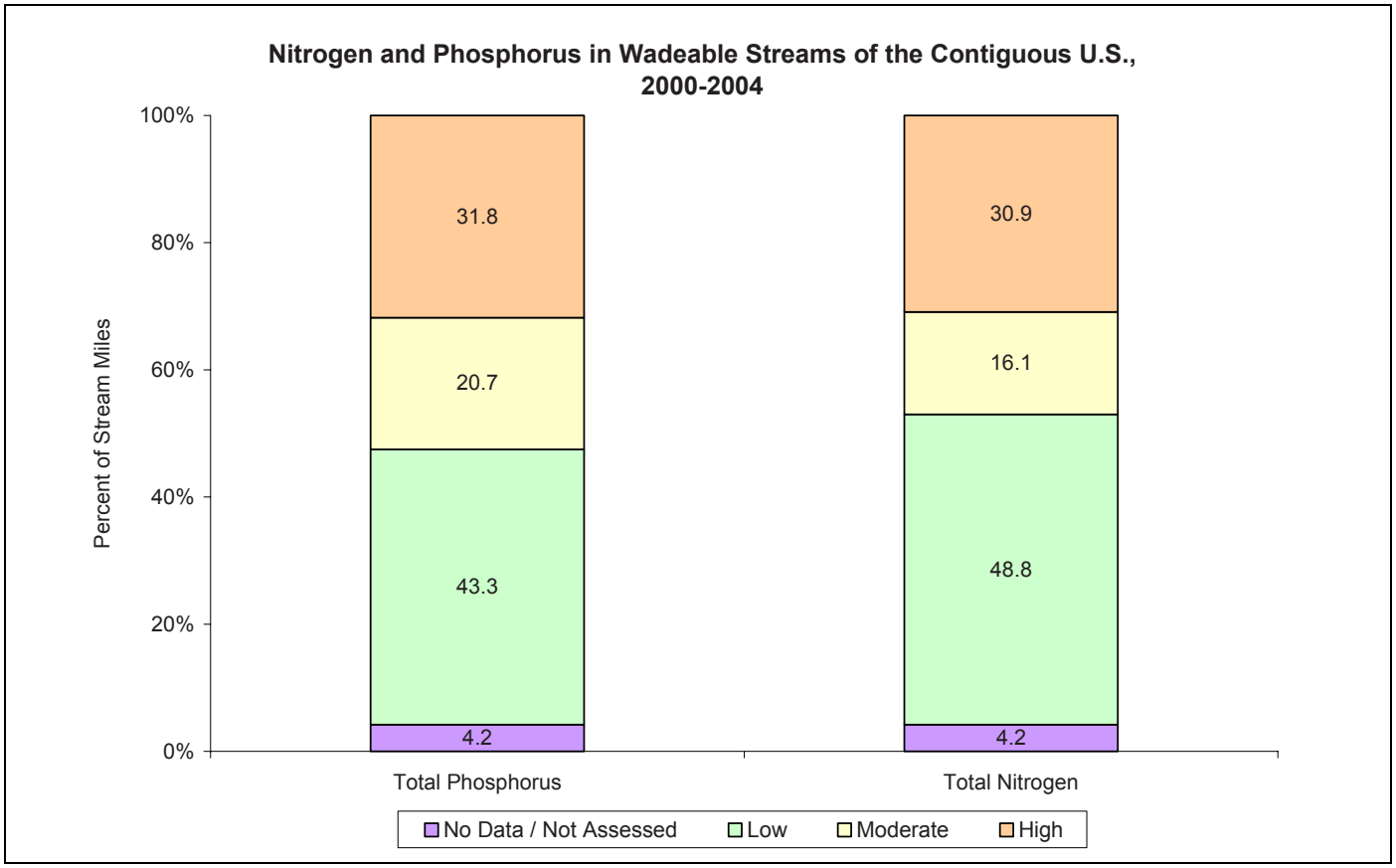
[65] U.S. Bureau of the Census, "Land and Water Area of States and Other Entities: 2000," in *Statistical Abstract of the United States: 2007* (126th Edition) Washington, DC, 2005. Available at www.census.gov/compendia/statab/tables/09s0344.pdf/.

[66] EPA, "Water Use," in *EPA's 2008 Report on the Environment*, p. 3-6.

[67] *Ibid*.

[68] *Ibid*.

How much nitrogen and phosphorus is present in wadeable streams in the U.S.?

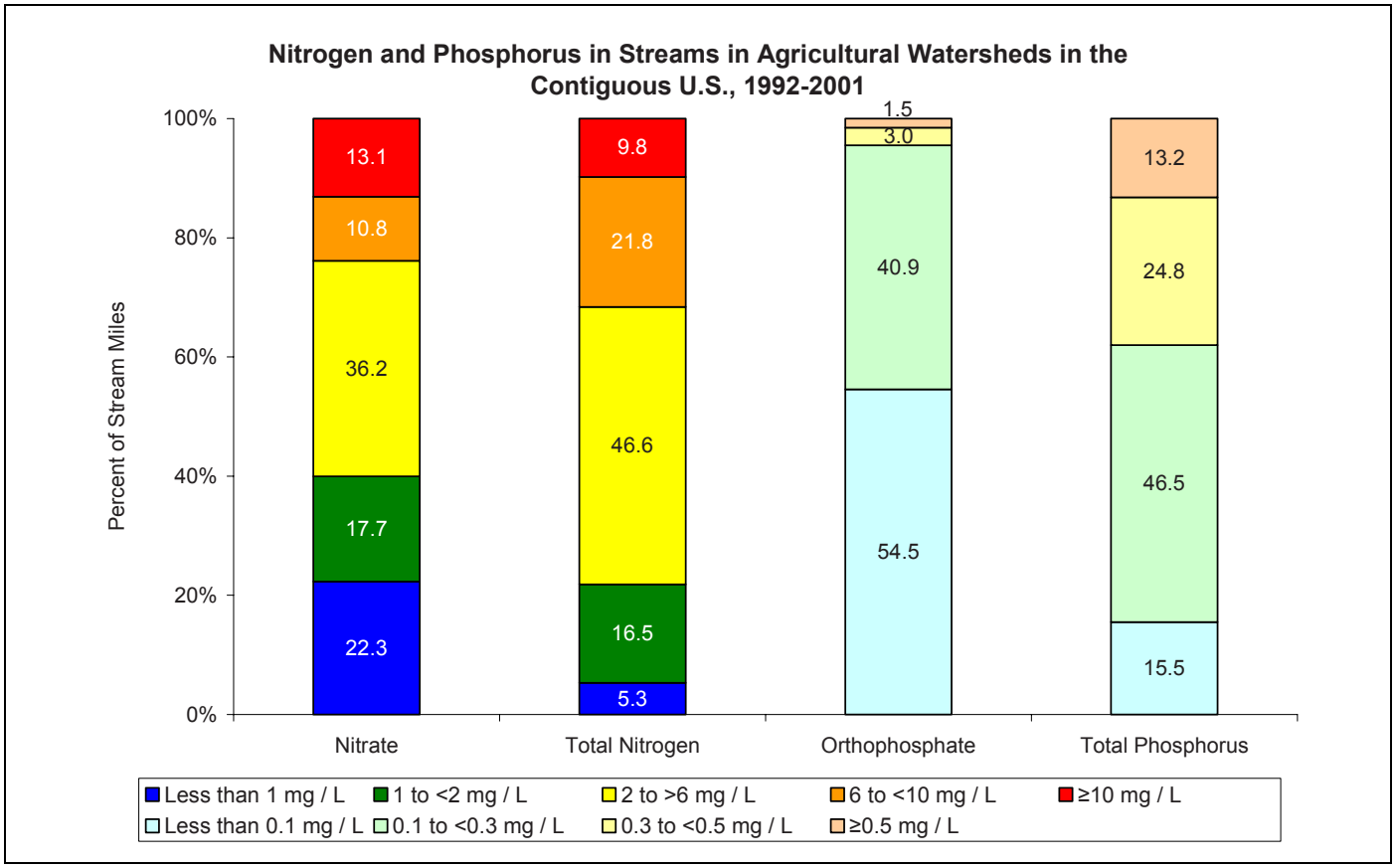


- Nitrogen and phosphorus are essential elements in aquatic ecosystems, as both are used by plants and algae for growth. Excess nutrients, however, can lead to increased algae production, and excess nutrients in streams can also affect lakes, larger rivers, and coastal waters downstream. In addition to being visually unappealing, excess algae growth can contribute to the loss of oxygen needed by fish and other animals, which in turn can lead to altered ecosystems. Sources of excess nutrients include sewage and septic tank drain fields, agricultural runoff, excess fertilizer application, and atmospheric deposition of nitrogen.[69]

- From 2000 to 2004, crews sampled 1,392 randomized sites in streams, creeks, and small rivers across the contiguous United States. Total nitrogen levels were low for 43.3 percent of all water bodies sampled, but were high—that is, above the 95th percentile of the region's reference distribution—in 31.8 percent of the samples. Similar results were found for phosphorus, with 48.8 percent of samples possessing low levels, while 30.9 percent had high levels of phosphorus.

[69] *Ibid*, p. 3-13.

How much nitrogen and phosphorus are present in agricultural watersheds in the U.S.?



- From 1992 to 2001, nitrogen concentrations in 129 streams connected to major agricultural areas were collected by the U.S. Geological Survey's (USGS) National Water-Quality Assessment (NAWQA) program. Each site was sampled 12-25 times per year over a 1- to 3-year period. These samples represent 36 of 51 major river basins examined by NAWQA.[70]

- Naturally-occurring levels of nitrogen and nitrate vary widely across the country, so "normal" levels range from 0.12 to 2.2 mg / L.[71] In 60 percent of the streams tested, nitrate levels were 2 mg / L or higher. Of these, 13.1 percent had nitrate levels at or above 10 mg / L. Nitrogen levels were worse, with 78.2 percent of streams tested showing levels at or above 2 mg / L.

- No national water quality standard has been established for orthophosphate or phosphate because "the effects of phosphorus vary by region and are dependent upon such physical factors as the size, hydrology, and depth of rivers and lakes." Nevertheless, some statistical analyses suggest a reference point for both substances at 0.75 mg / L or less, indicating that some of the streams reporting the lowest concentrations of phosphorus and orthophosphates may have still exceeded these recommendations.[72]

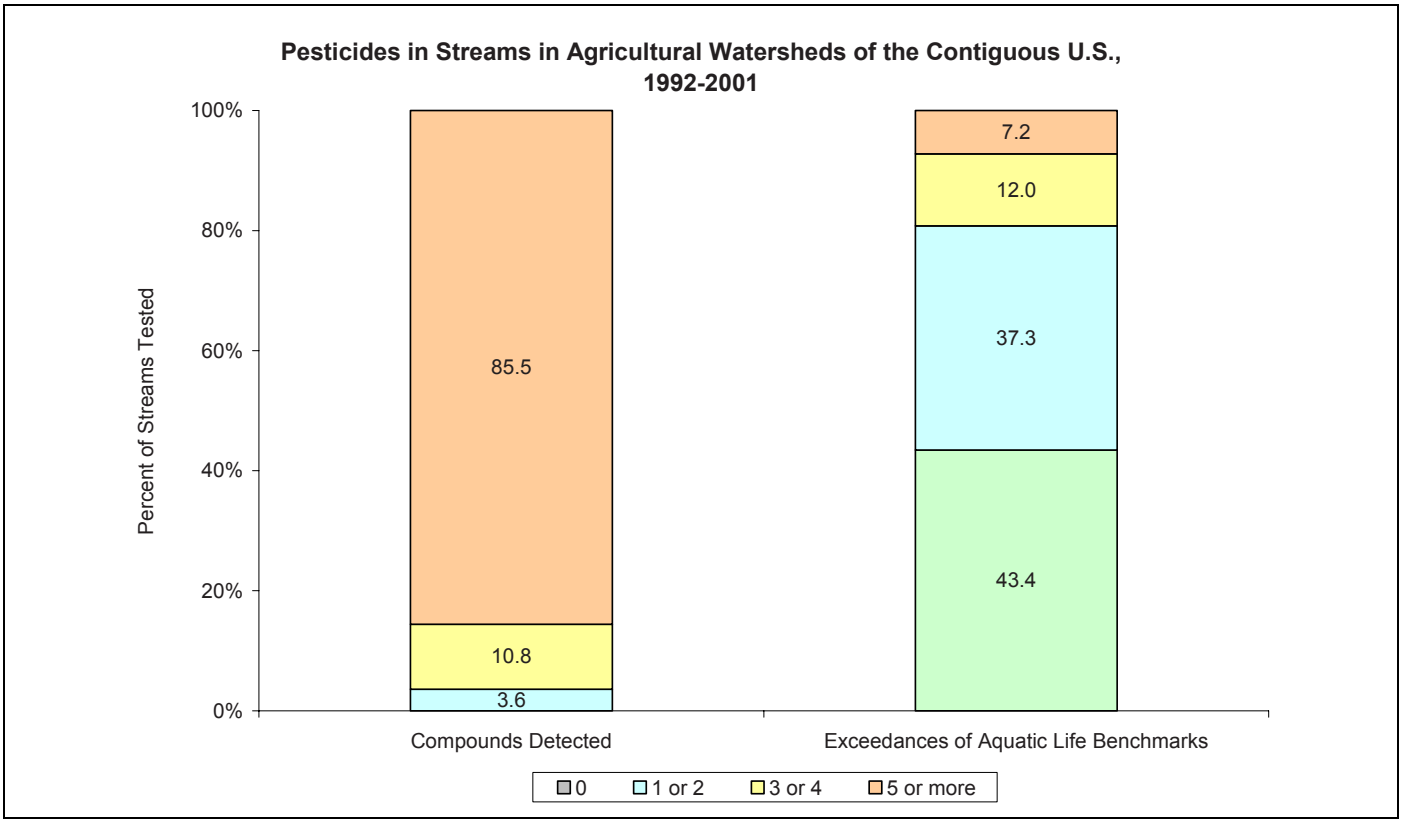
- About 45 percent of all streams tested indicated levels of orthophosphate at or above 0.1 mg / L, while about 85 percent indicated similar levels of phosphate.

[70] *Ibid*, p. 3-15.

[71] *Ibid*.

[72] *Ibid*, p. 3-16.

What levels of pesticides are present in streams that are part of agricultural watersheds?



- More than a billion pounds of pesticides (measured as pounds of active ingredient) are used in the United States each year.[73] About 80 percent of this total is used for agricultural purposes. While pesticide use has resulted in increased crop production and other benefits, pesticide contamination of streams, rivers, lakes, reservoirs, coastal areas, and ground water can cause adverse effects on aquatic life, drinking water, irrigation, and other uses.[74]
- This indicator uses data from the same stream water samples collected between 1992 and 2001 as part of the U.S. Geological Survey's National Water-Quality Assessment (NAWQA) program. NAWQA collected 10-49 water samples per year from each site over a 1-to-3-year period to analyze for 75 different pesticides and eight pesticide degradation products, which account for approximately 78 percent of the total agricultural pesticide application in the U.S. by weight during the study period.[75]
- Of the streams sampled, all had at least one pesticide detected and 86 percent had five or more compounds present. In 57 percent of the streams sampled, at least one pesticide was detected at a concentration that exceeded one or more aquatic life benchmarks. About 7 percent of streams (6 of the 83 streams sampled) had five or more pesticides at concentrations above aquatic life benchmarks.[76]

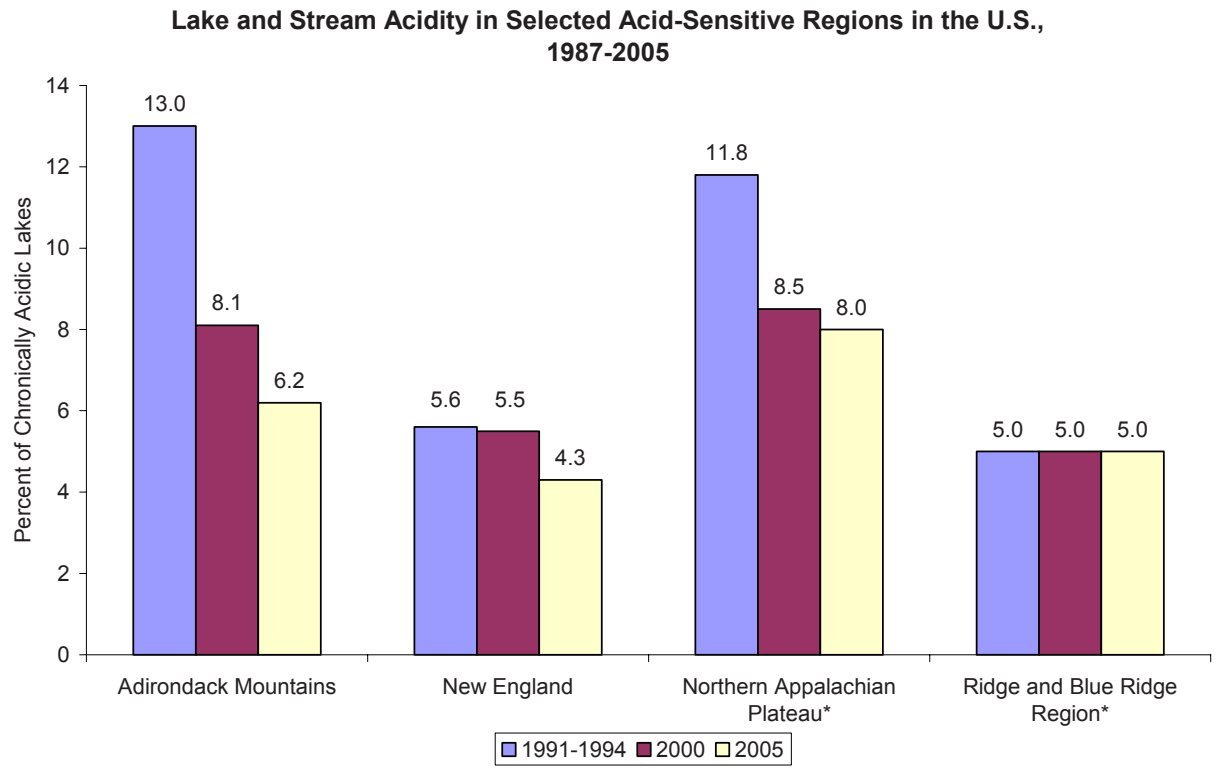
[73] Arnold L. Aspelin, *Pesticide Usage in the United States: Trends during the 20th Century* (Raleigh, NC: Center for Integrated Pest Management, North Carolina State University, 2003). Available at www.pestmanagement.info/pesticide_history/index.pdf. Cited by EPA, "Water Use," in *EPA's 2008 Report on the Environment*. p. 3-19.

[74] United States Geological Survey (USGS), "Pesticides in stream sediment and aquatic biota," 2000. Available at http://water.usgs.gov/nawqa/pnsp/pubs/fs09200/. Cited by EPA, "Water Use," in *EPA's 2008 Report on the Environment*, p. 3-19. Access verified September 3, 2008.

[75] R. J. Gilliom et al., "Pesticides in the nation's streams and ground water, 1992-2001," U.S. Geological Survey circular 1291, February 15, 2007. Available at http://water.usgs.gov/nawqa/pnsp/pubs/circ1291/ (document); http://water.usgs.gov/nawqa/pnsp/pubs/circ1291/supporting_info.php (supporting technical information). Access verified September 12, 2008. Cited by EPA, "Water Use," in *EPA's 2008 Report on the Environment*, pp. 3-19, 3-20.

[76] EPA, "Water Use," in *EPA's 2008 Report on the Environment*, p. 3-20.

How acidic are lakes and streams in the U.S. becoming?



- Acid deposition can seriously affect aquatic ecosystems. For example, aquatic organisms in acidified waters can develop calcium deficiencies that weaken bones and exoskeletons and cause eggs to be weak or brittle. Acidic waters can impair the ability of fish gills to extract oxygen from water and change the mobility of certain trace metals, which in turn can place fish and other species sensitive to these metals at risk.[77]

- The best measure of the capacity of a water body to neutralize the acid deposition it receives depends upon its acid neutralizing capacity (ANC), which is the amount of dissolved compounds that will counteract acidity. ANC ratings depend upon the watershed's physical characteristics such as geology, soils, and size. The higher the ANC, the more acid a water body can neutralize.[78]

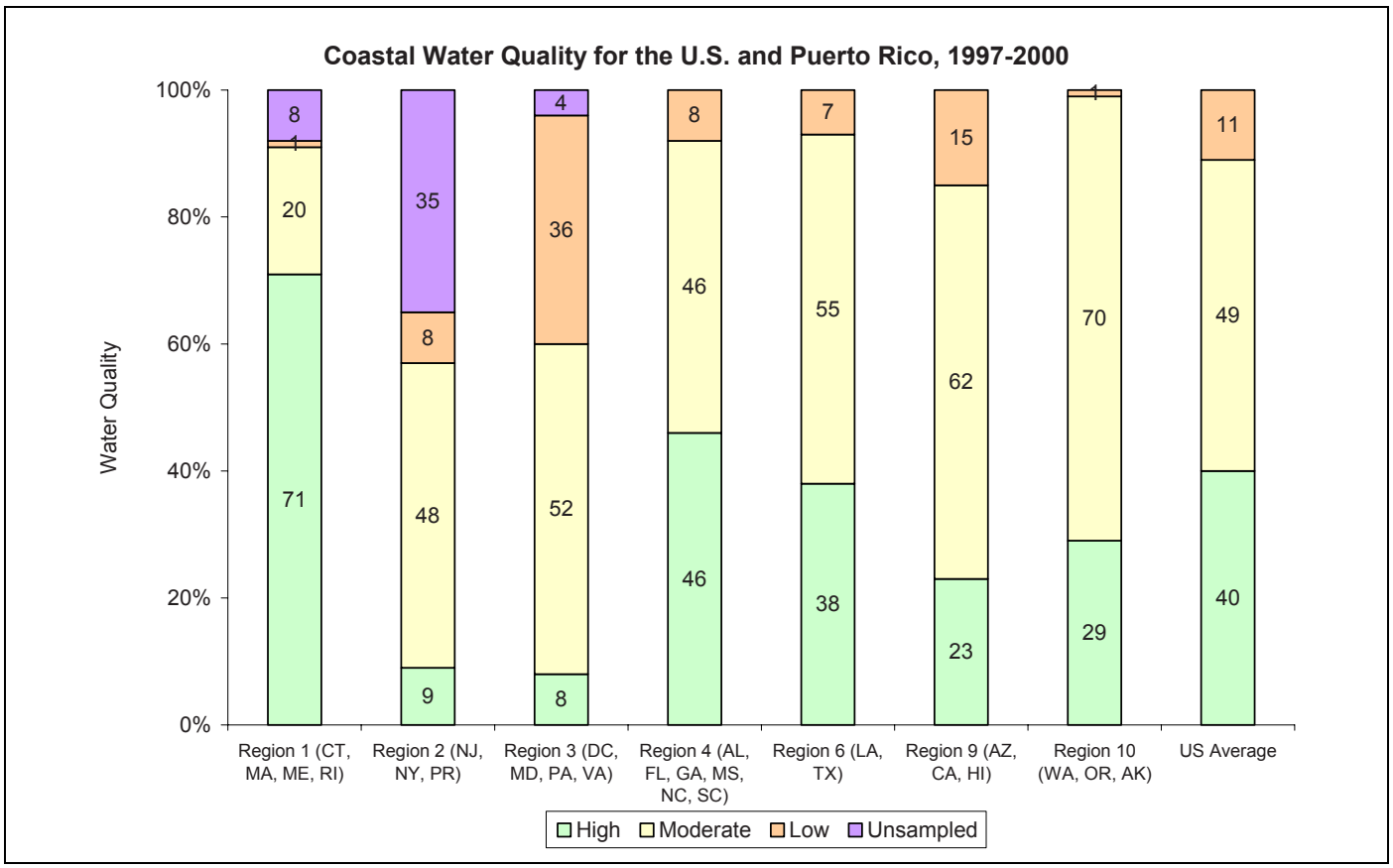
- This indicator focuses only on survey samples in the northeastern U.S. because trend data for other parts of the nation are not available. It represents samples from 8,664 lakes and 46,673 miles of streams.

- Between the early 1990s and 2005, the percentage of lakes and streams in the Adirondack Mountains and in the Northern Appalachians with chronically acidic water declined 52 percent and 32 percent, respectively. The decline in New England was significant, yet less dramatic (25 percent decline). No change was found in the Ridge /Blue Ridge Region.

[77] National Acid Precipitation Assessment Program (NAPAP), *Acid deposition: State of science and technology, volume II, aquatic processes and effects*. Washington, DC, 1991.

[78] EPA, "Air Quality," in *EPA's 2008 Report on the Environment*, p. 2-43.

How polluted are the nation's coastal waters?



- When nitrogen and phosphorus are present in high amounts in coastal waters, they can create algae blooms, decreasing water transparency and lowering oxygen levels to the point that fish and other aquatic life can be harmed.[79] The EPA measures these "trophic states" using five factors—dissolved inorganic nitrogen, dissolved inorganic phosphorus, chlorophyll-*a*, daytime dissolved oxygen in bottom or near-bottom waters, and water clarity—to create an overall water quality index.

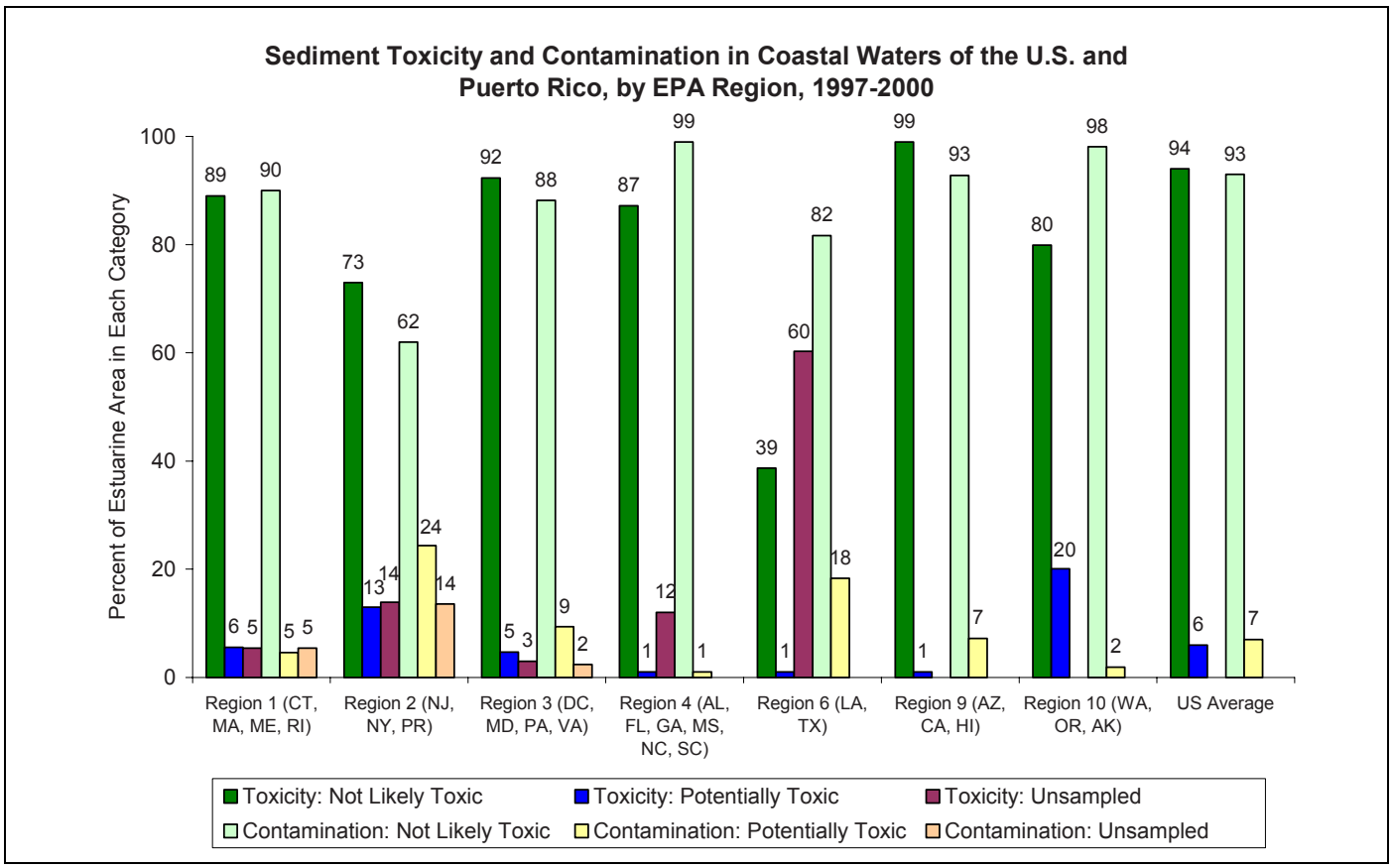
- According to the index, 46 percent of estuarine surface area in Region 4—the region containing Alabama's coastal area—reported high water quality during the 1997-2000 period. Another 46 percent reported moderate quality, and 8 percent had low water quality. Only Region 1 (Connecticut, Maine, Massachusetts, and Rhode Island) had a higher level of high quality estuarine water.

- By comparison, 40 percent of the nation as whole reported good water quality, 49 percent had moderate water quality, and 11 percent was of low quality.

- It should be noted that these areas do not include the Great Lakes or the oxygen-depleted zone in offshore Gulf Coast waters.

[79] *Ibid*, "Water Use," p. 3-38.

How clean are the sediments in the coastal waters of the U.S.?



- Contaminated sediments can pose an immediate threat to bottom-dwelling water organisms and an eventual threat to entire estuarine ecosystems. Sediments can be stirred up by anthropogenic activities, storms, or other natural events; as a result, organisms can be exposed to contaminants, which may eventually pose health risks to humans.[80]

- Sediment quality can be measured two ways: their toxicity to specific organisms, or in the level of toxins present. The data for this report are from probabilistic surveys conducted as part of EPA's National Coastal Assessment (NCA) and presented in EPA's second National Coastal Condition Report.[81]

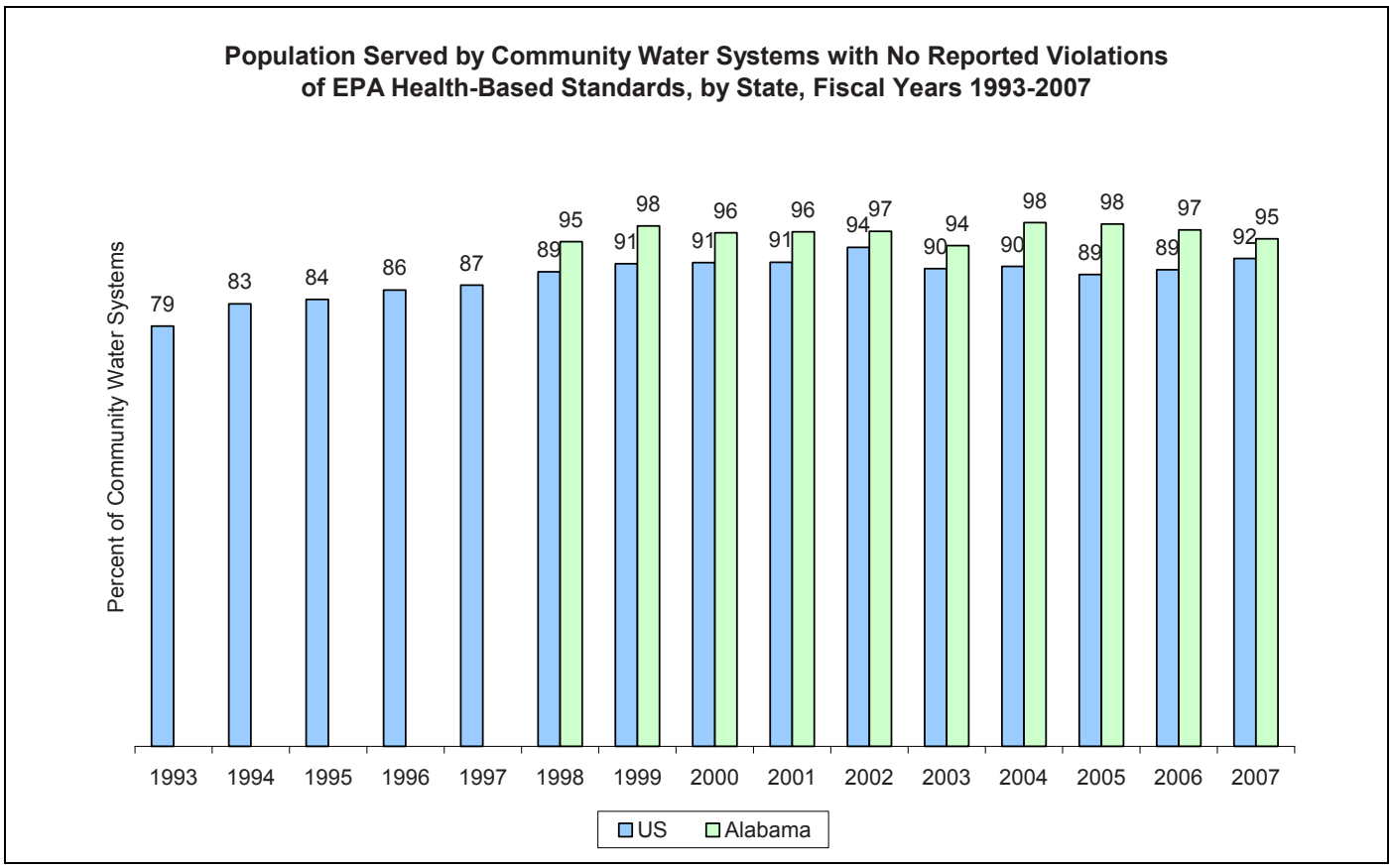
- Nationally, 6 percent of coastal sediments were rated "potentially toxic" based on their toxicity to bottom-dwelling organisms, and contaminants were present at potentially toxic levels in 7 percent of all samples.

- In Region 4—the region including Alabama's coastline—only about 1 percent of sediments were rated potentially toxic using both measures, giving the Gulf Coast one of the best ratings of the seven regions examined.

[80] EPA, "Contaminated sediment in water," 2004. Available at http://www.epa.gov/emap/nca/html/data.index.html.

[81] *Ibid*.

How clean are the nation's community water systems?



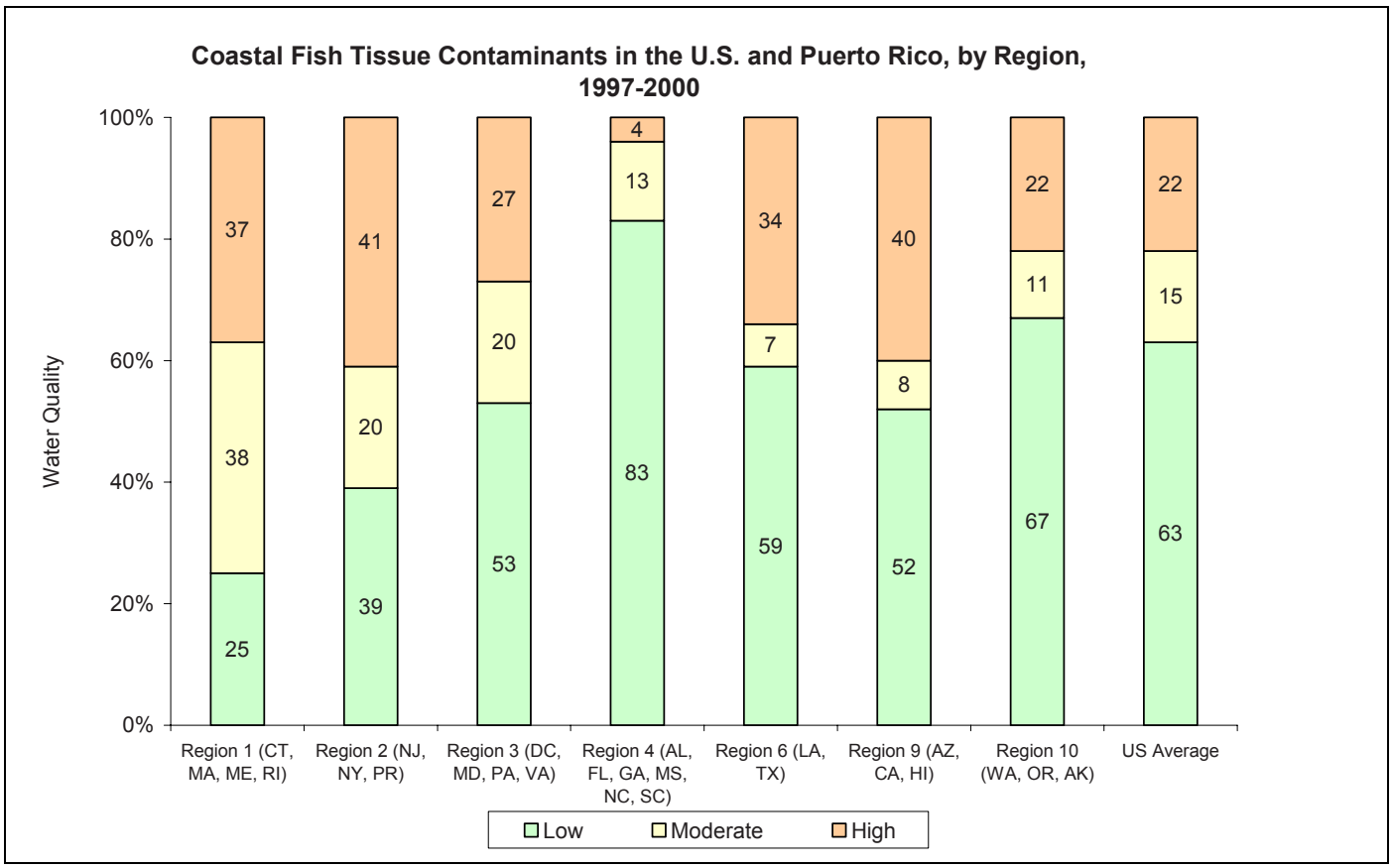
- There are approximately 52,000 community water systems in the United States serving 286 million persons, but just eight percent of those systems (4,048) serve 82 percent of the people. In 2007, Alabama was served by 539 community water services, most of which came from surface water sources.[82]

- From 1993 to 2007, the percentage of the national population served by community water systems which reported no health-based violations rose from 79 percent to 92 percent. For the years in which data is available for Alabama, the same percentages have remained between 94 percent and 98 percent.

- Of the 106,000 community water system violations reported in 2007, two-thirds (70,200) were for failure to monitor for a particular contaminant or report a violation, while another 22 percent (23,300) were for failure to provide public notice of a violation, or for failure to produce a Consumer Confidence Report. Only 9 percent (9,500) were for violations of one or more Maximum Contaminant Levels, and 3 percent (3,056) were for violations of water treatment techniques.

[82] EPA, "Factoids: Drinking Water and Ground Water Statistics for 2007," March 2008. Available at http://www.epa.gov/safewater/data/pdfs/data_factoids_2007.pdf. Access verified September 14, 2008.

Are fish caught along the nation's coast safe to eat?



- Contaminants in fish not only affect the fish's own health and ability to reproduce, but also affect the many species that feed on them. Contaminants may also make fish unsuitable for human consumption.[83]

- The data for this indicator came from the EPA's second *National Coastal Condition Report*, which was released in 2004. To gather data, five to 10 whole-body fish and shellfish samples were collected from 653 estuary sites across the United States from 1997 to 2000. Each fish was then tested for 90 contaminants. A site scored "high" if one or more contaminants were present at a concentration above the guideline ranges; "moderate" if one or more contaminants were within guideline ranges but none was in exceedance; and "low" if all contaminants were below guideline ranges.[84]

- Nationwide, 63 percent of sites showed low fish tissue contamination, 15 percent had moderate contamination, and 22 percent had high contamination. In Region 4—which includes Alabama—83 percent of sites showed low fish tissue contamination, 13 percent had moderate contamination, and 4 percent exhibited high contamination.

- The most common contaminants found nationwide were PCBs (19 percent of sites exceeding guideline ranges), mercury in fish muscle tissue (18 percent), and DDT (8 percent).[85]

[83] EPA, "Water Use," in *EPA's 2008 Report on the Environment*, p. 3-61.

[84] *Ibid*, p. 3-62.

[85] *Ibid*.

Water Quality: Alabama

Alabama has about 77,272 miles of rivers and streams in 14 different major river basins. Its ponds, lakes, and reservoirs cover more than 490,000 acres, and freshwater wetlands occupy an estimated 3.6 million acres.[86] According to the National Wetland Inventory, Alabama's coastal wetlands are estimated at 27,600 acres. Coastal Alabama also contains 610 square miles of estuaries and a coastal shoreline that is 337 miles long (including Mobile Bay and island shorelines).[87]

According to data released in 2006 by the Alabama Department of Environmental Management (ADEM), 96.7 percent of the state's rivers and streams support their designated uses.

Approximately 83.7 percent of all publicly accessible lakes in Alabama fully support their designated uses. In 2004-2005, ADEM examined 32 of the 41 publicly-owned Alabama lakes for eutrophic (oxygen-depleting) conditions that make it difficult for fish to survive. They found that 16 of them (representing 168,000 acres of a sampled 285,000 acres) had eutrophic conditions, and one—the Lake Purdy reservoir (1,050 acres)—manifested hypereutrophic conditions.[88] According to ADEM, "much of the non-support acreage is related to historic PCB contamination and eutrophic [oxygen-depleting] conditions in the Coosa River Basin reservoirs," and "naturally higher nutrients in the soils of the Coosa River Basin, to a large extent, dictate its reservoirs' eutrophic conditions."[89] In order to manage these conditions more directly, ADEM has developed nutrient criteria for 29 reservoirs in the state.[90]

According to ADEM, Alabamians draw approximately 850 million gallons of drinking water from ground and surface sources each day. Before reaching household taps, it passes through 607 community treatment plants and 104 non-community plants. Approximately 65 percent of the water used is obtained from surface sources such as lakes, rivers, and streams and provided with full treatment to include coagulation, sedimentation, filtration, and disinfection. In 2006, 97 percent met trihalomethane standards, and 100 percent of these systems met standards for turbidity, haloacetic acid, inorganic, and radiological drinking water standards.[91]

All community and non-transient, non-community water system sources continued to be monitored for volatile organic compounds (VOCs) and synthetic organic chemicals (SOCs). More than 98 percent of the community systems and 100 percent of the non-transient, non-community systems required to monitor in 2006 were in full compliance with VOC and SOC monitoring requirements.[92]

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[86] Alabama Department of Environmental Management (ADEM), *2006 Alabama Integrated Water Quality Monitoring and Assessment Report*, p. ix, April 1, 2006. Available at http://www.adem.state.al.us/WaterDivision/WQuality/305b/2006/2006%20AL%20IWQMAR%20(TOC-LT-LF-ES-Acr).pdf. Access verified September 4, 2008.

[87] *Ibid*.

[88] *Ibid*, p. 41.

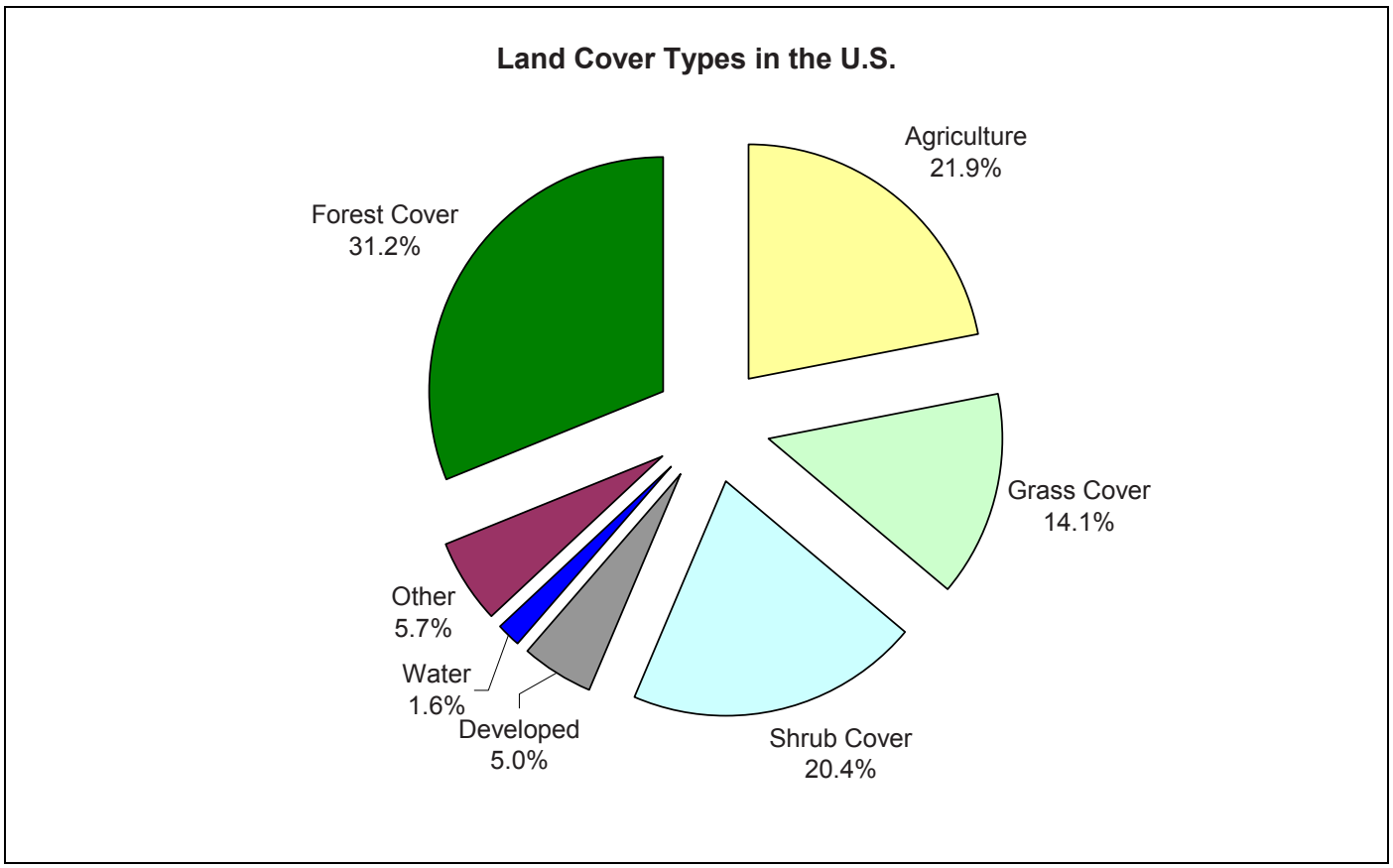
[89] *Ibid*, p. x.

[90] *Ibid*.

[91] *Ibid*, p. xi.

[92] *Ibid*, p. 116.

Is the U.S. in danger of losing its undeveloped areas to urban sprawl?



- In 2007, a group of federal agencies known as the Multi-Resolution Land Characteristics Consortium (MRLC) published the 2001 National Land Cover Database (NLCD), which cataloged over 27 billion surface images taken from Landsat satellites from 1999 to 2002. These data do not include land use for Alaska or Hawaii, thereby providing information for only 1.92 billion acres out of 2.3 billion acres.[93]

- According to the NLCD, forests cover approximately 641.1 million acres of the United States, agricultural land covers 448.9 million acres, shrublands cover 419.2 million acres, grasslands cover 290.5 million acres, and other lands—including ice and snow, barren areas, deserts, and wetlands—constitute 117.7 million acres. By comparison, only five percent of the nation's land cover is classified as "developed," which the NLCD defines as having "a high percentage (30 percent or greater) of constructed materials (e.g., asphalt, concrete, and buildings)."[94]

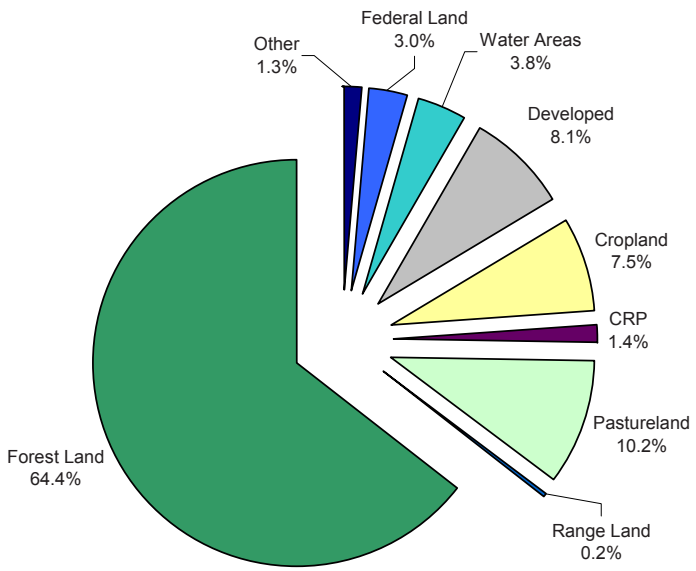
- Land use varies considerably across the country. For example, Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee) has the largest portion of timberland in the nation (27 percent of total U.S. timberland).[95]

[93] EPA, "Land Use," in *EPA's 2008 Report on the Environment*, pp. 4-7, pp. 4-8.

[94] *Ibid*, p. 4-8.

[95] *Ibid*.

Is Alabama in danger of losing its undeveloped areas to urban sprawl?



- Even though the rate of urbanization in Alabama has exceeded the national average, the state is in no danger of losing its forests or undeveloped areas. From 1982 to 2003, the number of acres developed for urban use increased from 1.6 million acres to 2.7 million acres. This represents an increase of 68.8 percent, yet this developed land makes up only 8.1 percent of the state's overall surface area.

- To put these numbers in perspective, forest land covers 64.4 percent of the state, while land used for crops, pasture, rangeland, and agricultural land set aside for conservation constitutes 19.3 percent of Alabama's total surface area.[96]

[96] U.S. Department of Agriculture (USDA), "National Resources Inventory: 2003." Available at http://www.nrcs.usda.gov/technical/NRI/. Access verified September 3, 2008.

Forests: Introduction

Some of the most heated controversies surrounding the environmental movement involve America's forests. Unlike other environmental indicators, these concerns date back to the turn of the 20th century. In 1905, President Theodore Roosevelt warned that "a timber famine is inevitable," and the *New York Times* ran headlines in 1908 proclaiming "The End of the Lumber Supply" and "Supply of Wood Nears End—Much Wasted and There's No Substitute." During the 18th and 19th centuries, Americans did indeed cut down a large percentage of the nation's forests. A full two-thirds of the deforestation that has occurred in the U.S. took place between 1850 and 1910. Yet commercial logging was not the primary cause of this deforestation. Rather, trees were cut in order to clear land for agriculture. Since this time, however, America's forests have made a rapid comeback.

Today, forests cover nearly 30 percent of the United States' total land area. American forests contain more than 130 diverse species of trees and sustain a wide variety of plants and animals. They provide habitat, purify air, prevent run-off, and inhibit erosion by anchoring topsoil. Forests also release water vapor into the air and play a critical role in the carbon cycle, as they absorb and break down carbon dioxide, store carbon, and release oxygen. In addition to ecological and biodiversity values, American forests play a significant role in world timber markets. In 2005, U.S. timber markets produced 29 percent of global softwood logs, 25 percent of all softwood lumber, 37 percent of hardwood logs, and 54 percent of all hardwood lumber.[97]

Despite such production, the United States planted 25 percent more trees than it harvested in 1991, and since the 1950s, net growth has exceeded net harvest every year. According to the Society of American Foresters, about 1.7 billion tree seedlings are planted each year, or about four million a day. If naturally regenerated trees are included, net forest growth exceeds harvesting by about 33 percent.[98]

While most Americans are pleased to hear that forests are making a comeback, many are also surprised to learn it is not due to government protection. In fact, just the opposite is true. During the first half of the 20th century, the amount of land used for agriculture declined significantly. As less land was harvested for crops, forests took over that land. In some cases, forests naturally regenerated, yet in most cases, foresters planted trees for commercial harvesting.

This trend has continued into the 21st century. Of the 21.6 billion cubic feet of timber grown in 1991, public forests accounted for less than 25 percent of that growth. The forest industry, farmers, and private foresters were responsible for more than three-quarters (16.4 billion cubic feet) of the timber grown that year.[99]

Most trees are grown in the United States for future harvesting. These second-growth forests support a diverse population of wildlife and trees of various ages, sizes and species. Many small animals and most game prefer younger forests, which allow more sunlight to reach the forest floor, thereby supporting a greater variety of trees and plant life than older forests.[100]

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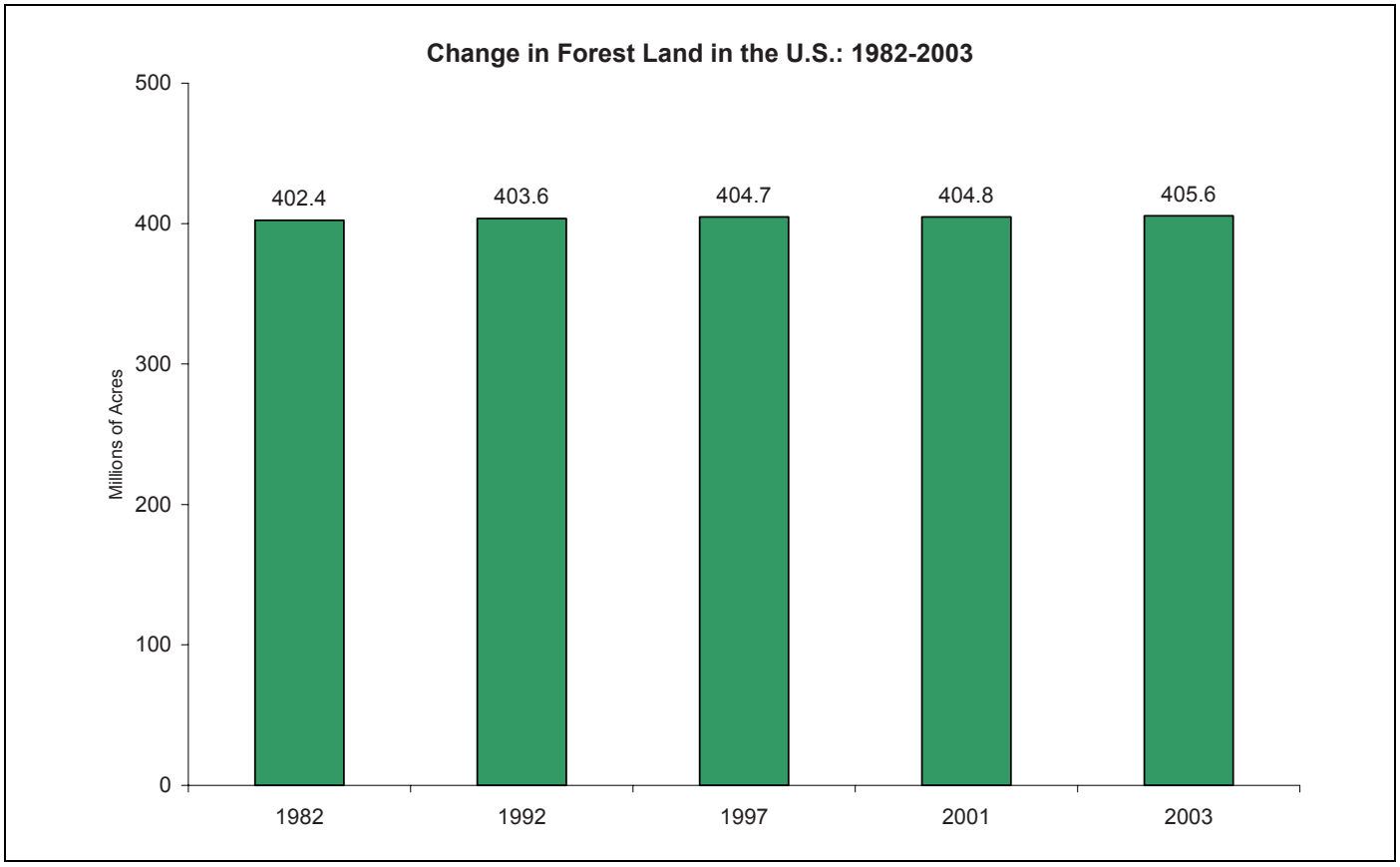
[97] U.S. Bureau of the Census, "Wood Products—Production, Exports, and Consumption for Selected Countries: 2000 to 2005," in *Statistical Abstract of the United States: 2007* (126th Edition) Washington, DC, 2005. Available at www.census.gov/compendia/statab/comparative_international_statistics/natural_resources_and _energy/. Access verified September 3, 2008.

[98] Society of American Foresters, "Forest Facts," 2007. Available at http://forestry.msu.edu/testmsaf/PDF/Facts-SAF1.PDF.

[99] For more information, see http://svinet2.fs.fed.us:80/pl/rpa/93rpa/ powell.htm. Access verified October 6, 2008.

[100] Michael Sanera and Jane Shaw, *Facts Not Fear*, rev. ed. (Washington, DC: Regnery, 1999), p. 67.

How much land is covered by forests in the U.S.?



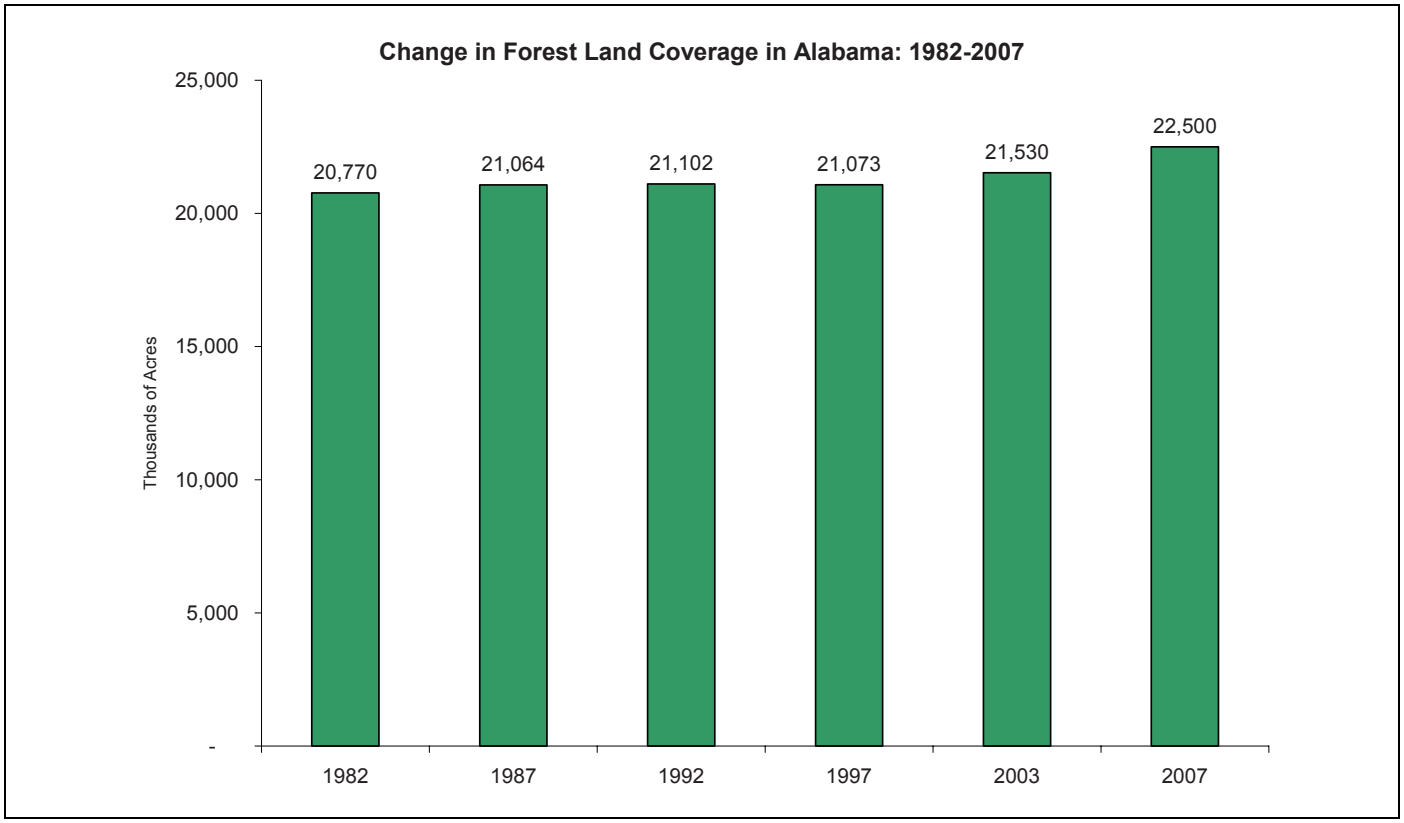
- Since 1982, the amount of surface area in the U.S. that is forested has remained relatively stable at between 402.4 million acres and 405.6 million acres. About 20.1 percent of all land in the U.S. is forest.[101]

- Because of these resources, the U.S. is the world's largest producer of temperate-climate hardwood lumber and the second-largest producer of softwood lumber. In 2005, the U.S. produced 25 percent of the world's softwood lumber (66 million cubic meters) and 54 percent of its temperate-climate hardwood lumber (23 million cubic meters).[102]

[101] USDA, "Total Surface Area by Land Cover/Use by Year in Millions of Acres, with Margins of Error," in *National Resources Inventory: 2003 Annual NRI*, February 2007, p. 5. Available at http://www.nrcs.usda.gov/technical/NRI/2003/Landuse-mrb.pdf. Access verified September 5, 2008.

[102] U.S. Bureau of the Census, "Wood Products—Production, Exports, and Consumption for Selected Countries: 2000 to 2005," in *Statistical Abstract of the United States: 2007* (126th Edition) Washington, DC, 2005, www.census.gov /compendia/statab/comparative_international_statistics/natural_resources_and_energy/.

How much land is covered by forests in Alabama?



- Approximately 22.5 million acres in Alabama are forested, and they account for 69.3 percent of Alabama's total surface area.[103] Between 1982 and 2007, forest land increased by 1.7 acres. Excluding Alaska, Alabama ranks second in the nation in acres of forest.[104]
- The "Loblolly Pine-Shortleaf Pine" forest type is the predominant forest type, occupying about 35.7 percent of the total timberland area. The "Oak-Hickory" forest type is the second most predominant forest type in Alabama, accounting for approximately 32.3 percent of the timberland acreage.[105]
- Some 28 percent of Alabama's timberland is plantations while 72 percent is naturally-regenerated.[106]
- There are twice as many trees in Alabama today as there were 50 years ago. For every tree harvested in the state of Alabama, five are planted.[107]
- In Alabama, forestry produces more than $15 billion worth of products a year. The forest industry directly employs approximately 70,000 Alabamians with an annual payroll of $2.2 billion. Another 100,000 workers are indirectly employed by forestry. In all, forestry employs about 12 percent of Alabama's total work force, either directly or indirectly.[108]

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[103] Alabama Forestry Commission, "Alabama Forest Facts." Available at www.forestry.state.al.us/forest_facts.aspx. Access verified September 5, 2008.

[104] USDA, "2003 Total Surface Area by Land Cover/Use by State, in Thousands of Acres, with Margins of Error," in *2003 National Resources Inventory: Summary Report for All States*.

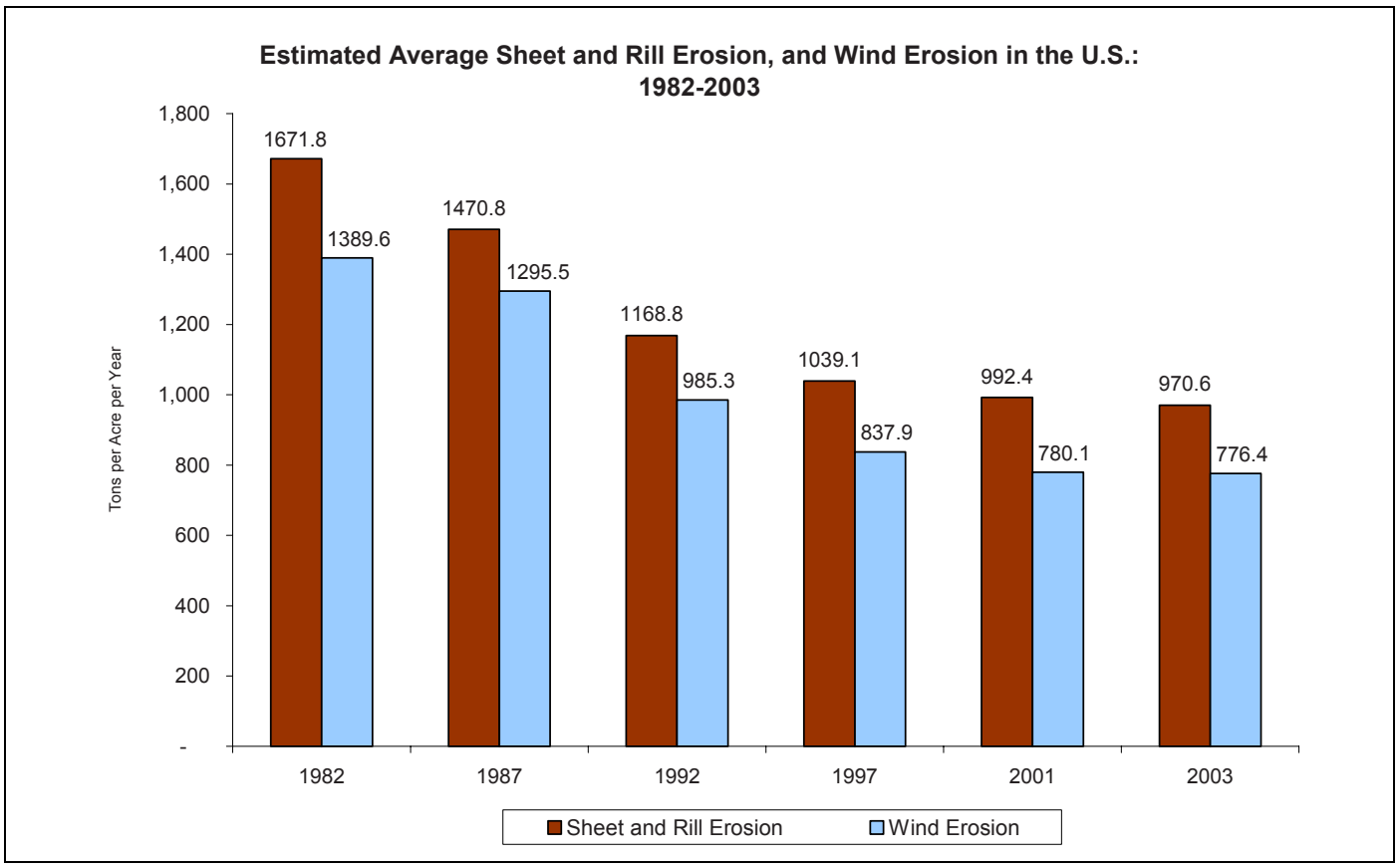
[105] *Ibid*.

[106] Alabama Forestry Association, "Forestry Facts 2008," p. 3. Available at www.alaforestry.org/ftp/Website/Resources/News%20and%20Publications/Special%20Reports/FINALforestryfacts08.pdf. Access verified September 5, 2008.

[107] Alabama Forestry Association, "Forestry Facts 2007." Available at www.alaforestry.org/. Access verified February 26, 2008.

[108] Alabama Forestry Association, "Forestry Facts 2008."

How much soil is lost to erosion in the U.S. each year?



- Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity. Soil erosion on cropland is of particular interest because of its on-site impacts on soil quality and crop productivity, and its off-site impacts on water quantity and quality, air quality, and biological activity.[109]

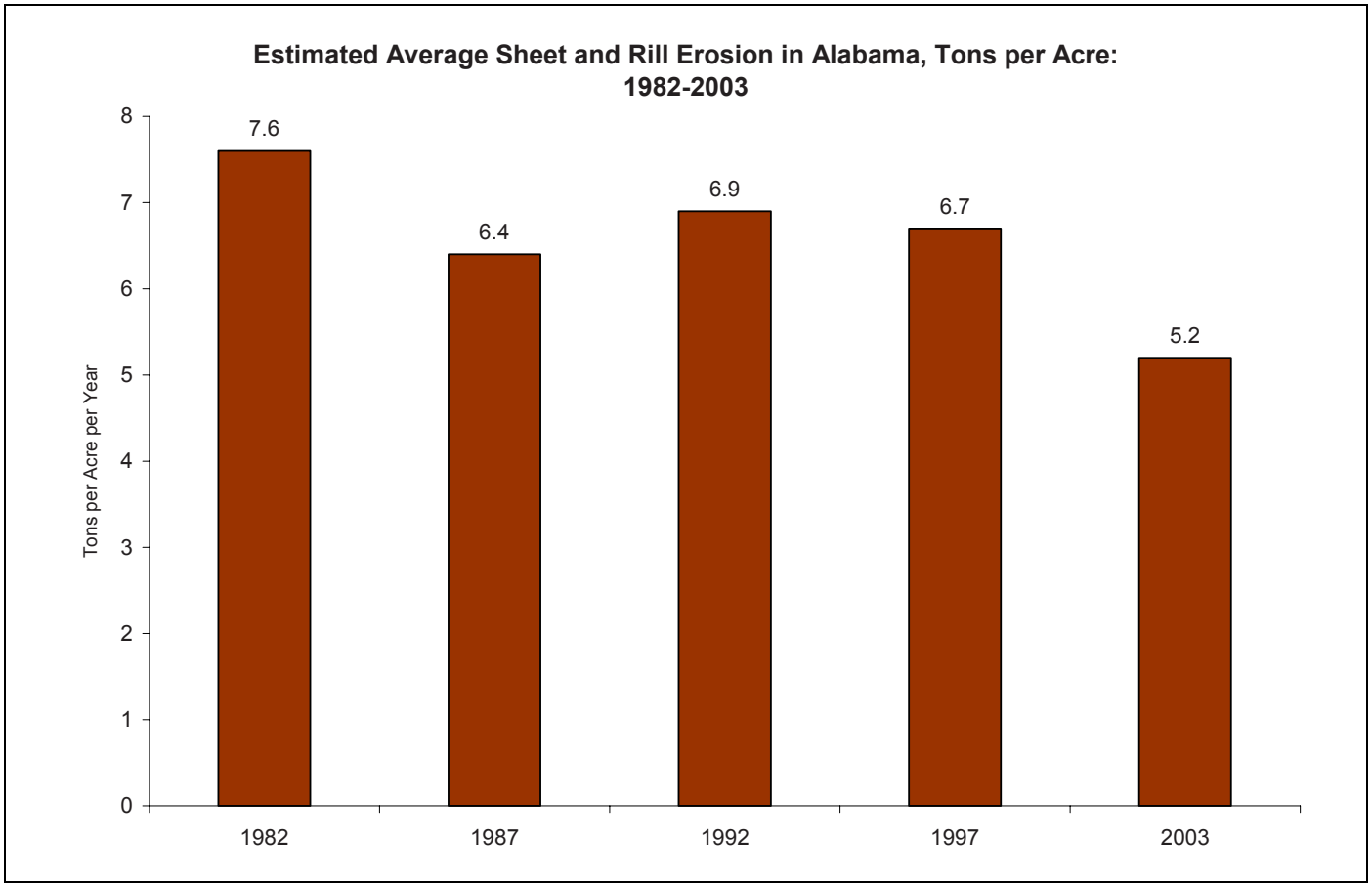
- The USDA measures two kinds of soil erosion: wind erosion, and what is called "sheet and rill" erosion. Wind erosion is self-explanatory. It is prevalent in arid western states which have dryer soil and less natural ground cover, while many eastern and southern states experience no measurable wind erosion at all. Sheet erosion is the removal of thin layers of soil over the whole surface chiefly through raindrop splash and surface water flow. Rills are channels small enough to be obliterated by normal tillage operations.

- According to the 2003 National Resources Inventory, erosion rates on a per-acre basis declined significantly between 1982 and 2003. Sheet and rill erosion on cropland dropped from 4.0 tons per acre per year in 1982 to 2.6 tons per acre per year in 2003; wind erosion rates dropped from 3.3 to 2.1 tons per acre per year.[110]

[109] USDA, "Soil Erosion," in *National Resources Inventory: 2003 Annual NRI*, February 2007, p. 1.

[110] *Ibid*.

How much soil is lost to erosion in Alabama each year?



- From 1982 to 2003, the amount of sheet and rill erosion in Alabama fell from 7.6 tons per acre to 5.2 tons per acre, a decline of 31.5 percent.[111]

- To put these numbers in perspective, the loss of one ton of topsoil per acre is approximately equal to the loss of .007 inches of soil. Thus, in 2003 about .0364 inches of soil was lost per acre in Alabama. At this rate, it would take 27 years for one inch of topsoil to be lost. Note that these rates do not include the formation of new topsoil, which is about the rate of one ton per acre per year.

- While the USDA has previously noted that, "loss of farmland poses no threat to U.S. food and fiber production,"[112] a 2003 report by the same organization stated the following:

> Erosion is a concern because of its potential offsite effects, for example, in contributing dust to the atmosphere, or delivering sediment, nutrients, and chemicals to water resources. Soil loss from farm fields at excessive rates can also be a concern as it diminishes soil productivity over time. Some productivity loss can be mitigated through the addition of external inputs, but at an economic cost.[113]

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[111] *Ibid*.

[112] Marlow Vesterby, Ralph E. Heimlich, and Kenneth E. Krupa, "Urbanization of Rural Land in America," USDA, Economic Research Service, Agricultural Economic Report 673, March 1994. No table is provided for the effects of wind erosion in Alabama because National Resource Inventory data shows no loss of soil due to wind erosion.

[113] USDA, Natural Resources Conservation Service, "Soil Erosion." In *2001 National Resources Inventory*, July 2003. Available at http://www.nrcs.usda.gov/technical/land/nri01/nri01eros.html#ertables.

Waste and Waste Management

The amount of waste produced is influenced by economic activity, consumption, and population growth. In affluent nations like the U.S., we "generally produce large amounts of municipal solid waste (e.g., food wastes, packaged goods, disposable goods, and used electronics) and commercial and industrial wastes (e.g., demolition debris, incineration residues, and refinery sludges)." In fact, the EPA's *2008 Report* notes that, "among industrialized nations, the U.S. is the largest producer of municipal solid waste per person on a daily basis."[114]

Toxics Release Inventory

According to the EPA, "Hazardous wastes are either specifically listed as hazardous by the EPA or a state, or exhibit one or more of the following characteristics: ignitability, corrosivity, reactivity, or toxicity. Generation and management of hazardous wastes have the potential to contaminate land, air, and water and negatively affect human health and environmental conditions."[115]

The principle source of trend data for toxic chemicals is the EPA's Toxics Release Inventory (TRI), a reporting system for more than 650 chemicals (up from 300 when the TRI began in 1988) used in most major industries, mining operations, and, more recently, federal facilities.[116]

The EPA emphasizes several important caveats about interpreting TRI data, including gaps in the data and the lack of straight-line applicability of human health risk. The 2001 TRI, for example, emphasizes:

> *TRI reports reflect releases and waste management activities of chemicals, not exposures of the public to those chemicals. Release estimates alone are not sufficient to determine exposure or to calculate potential adverse effects on human health and the environment.*

In addition, "toxic" chemicals are not all created equal, which is why a crude measure of mere "pounds" of toxins "released" is not an especially helpful measure of health or environmental risk. As the EPA notes:

> *Some high-volume releases of less toxic chemicals may appear to be a more serious problem than lower-volume releases of more toxic chemicals, when just the opposite may be true. For example, phosgene is toxic in smaller quantities than methanol. A comparison between these two chemicals for setting hazard priorities or estimating potential health concerns, solely on the basis of volumes released, may be misleading.*[117]

With all of these caveats and limitations, what does the TRI tell us? While the TRI is limited as a tool for judging environmental or health risks, it is indicative of another trend: reductions in the use of chemicals, even as total industrial output and economic activity grow, is a sign of the increasing efficiency of our industrial plants, and a measure of what has been called the "dematerialization" of the economy. As such, the TRI can be viewed as a proxy for measuring "sustainable development" or industrial ecology.

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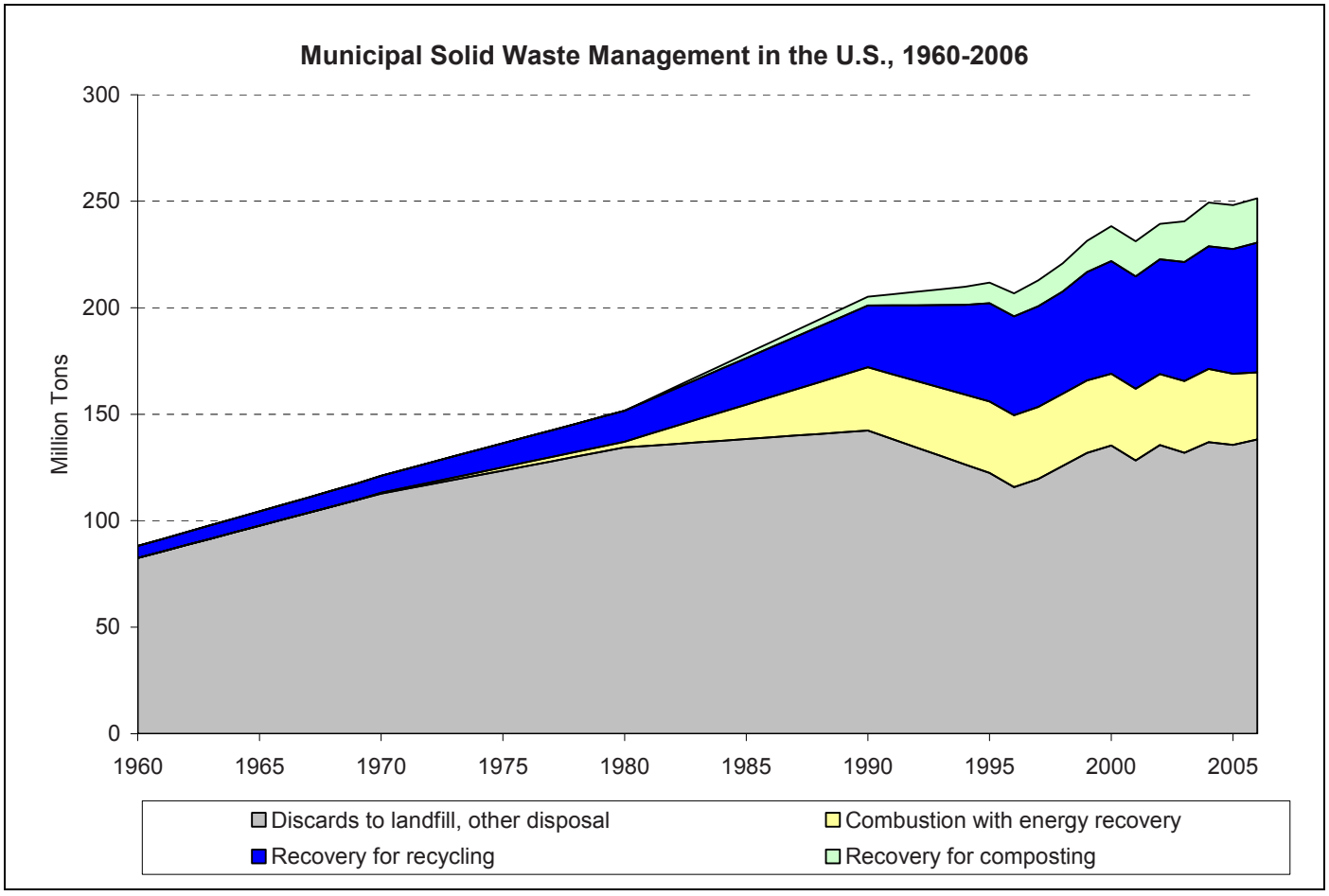
[114] EPA, "What are the Trends in Wastes and Their Effects on Human Health and the Environment?" in *EPA's 2008 Report on the Environment*, p. 4-23.

[115] *Ibid*.

[116] The TRI for the entire nation as well as individual states can be downloaded from the EPA website at http://www.epa.gov/tri/.

[117] EPA, 2001, TRI, pp. 1-9.

What happens to all of the trash we produce each year?



- The amount of municipal solid waste (MSW) generated in the United States grew steadily from 88 million tons in 1960 to over 251 million tons in 2006, an increase of 185 percent. During this time, the U.S. population increased 66 percent. On a per-capita basis, MSW generation increased from 2.7 pounds per person per day in 1960 to 4.6 pounds per person per day in 2006.[118]

- Of the 88 million tons of MSW generated in 1960, 6 percent was recovered through recycling and 94 percent was placed in landfills. MSW quantities sent to landfills or other disposal sites peaked in 1990 at 142 million tons and then began to decline as recycling and combustion for energy recovery increased. The quantity of MSW disposed in landfills has averaged about 135 million tons per year since 2000, a 4.9 percent decrease from 1990.[119]

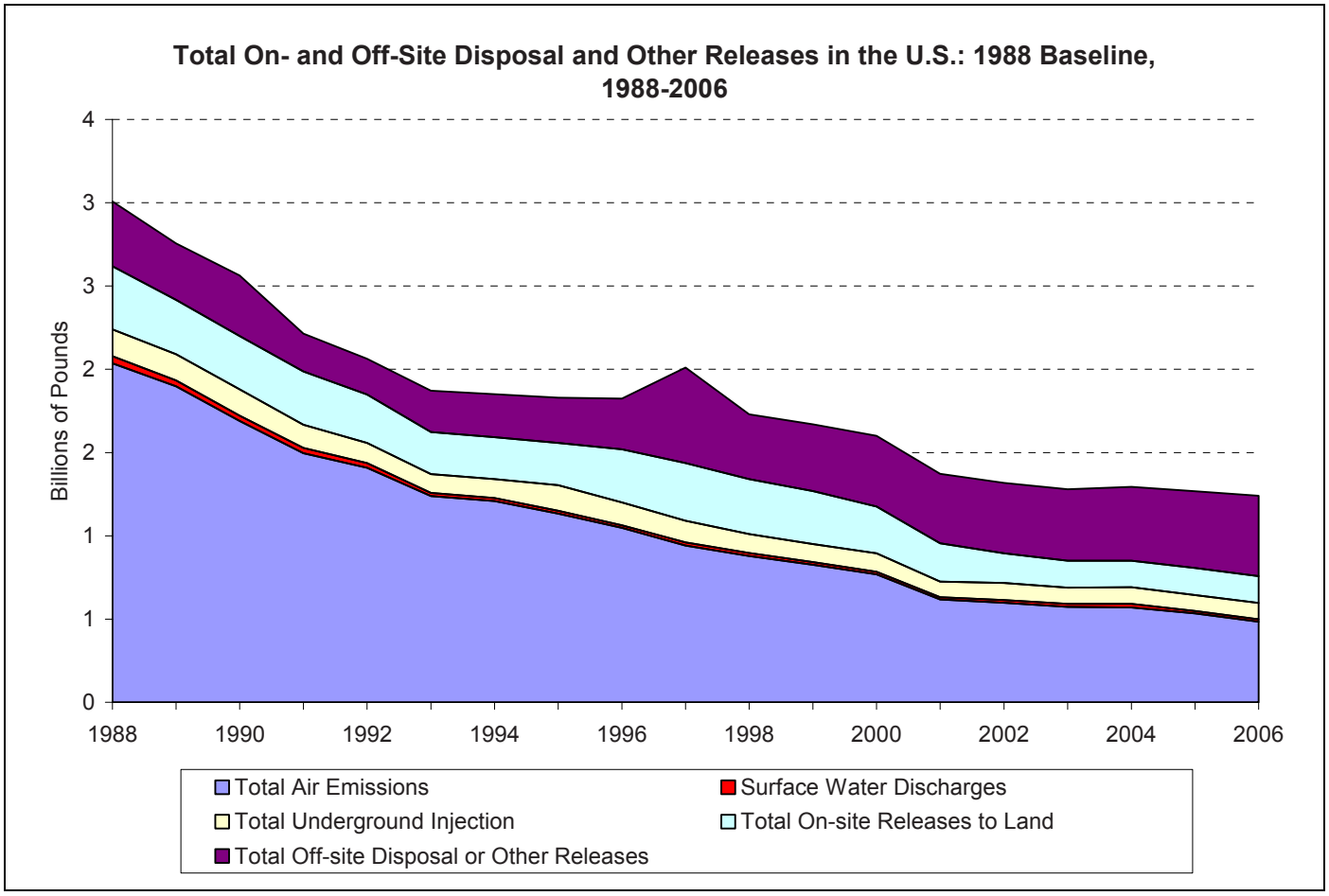
- Of the 251 million tons generated in 2006, 32.5 percent was recycled (including composting), 13 percent was combusted for energy recovery, and 55 percent was sent to landfills. Since 1990, the amount of MSW placed in landfills has dropped from 69 percent to 55 percent, the percentage recycled rose from 14 percent to 24 percent, the percentage composted rose from 2 percent to 8 percent, and the percentage combusted for energy recovery ranged from 13 percent to 15 percent.[120]

[118] EPA. "Quantity of Municipal Solid Waste Generated and Managed," in *EPA's 2008 Report on the Environment*, p. 4-25.

[119] *Ibid*.

[120] *Ibid*.

What happens to hazardous wastes produced by businesses and industries in the U.S.? (1988 Baseline)



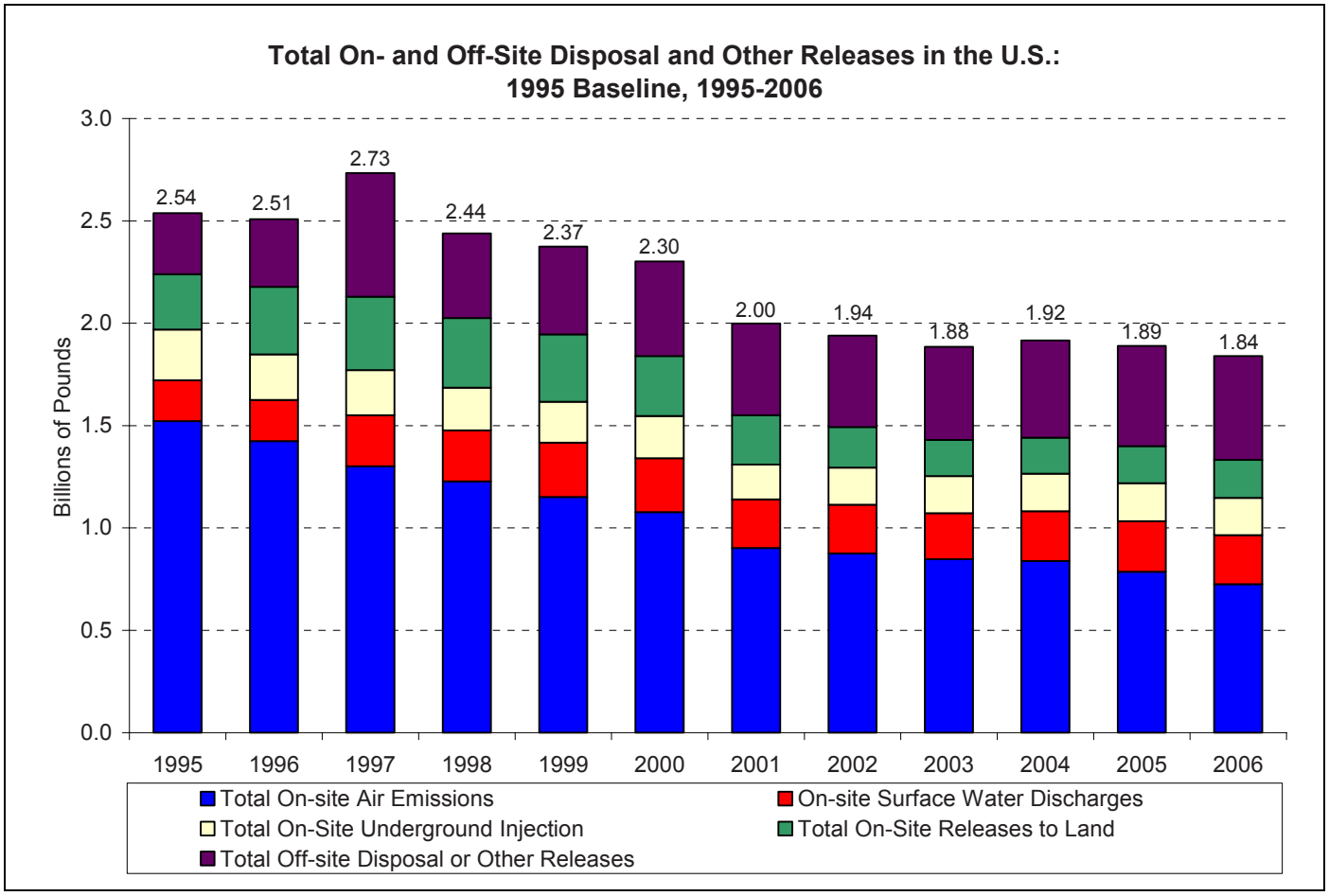
- The constant expansion of the number of chemicals and number of facilities included in the TRI data net makes tracking trends difficult. Fortunately, the EPA helpfully breaks out the data against a 1988 baseline that includes only the 300 chemicals included in the original inventory.

- From 1988 to 2006, the release of toxins in the United States has fallen from just over three billion pounds to 1.24 billion pounds in 2006. The largest reduction has come from air emissions, which have fallen 1.55 billion pounds (76.3 percent) since 1988.[121]

- As a group, on-site releases—that is, toxins released or disposed of at the point of their generation—fell 57.2 percent since 1988, while off-site releases rose from 388 million pounds in 1988 to 462 million pounds in 2006, a 24.2 percent increase.

[121] EPA, "TRI Explorer," version 4.7, July 23, 2008. Available at http://www.epa.gov/triexplorer/. Access verified September 8, 2008.

What happens to hazardous wastes produced by businesses and industries in the U.S.? (1995 Baseline)



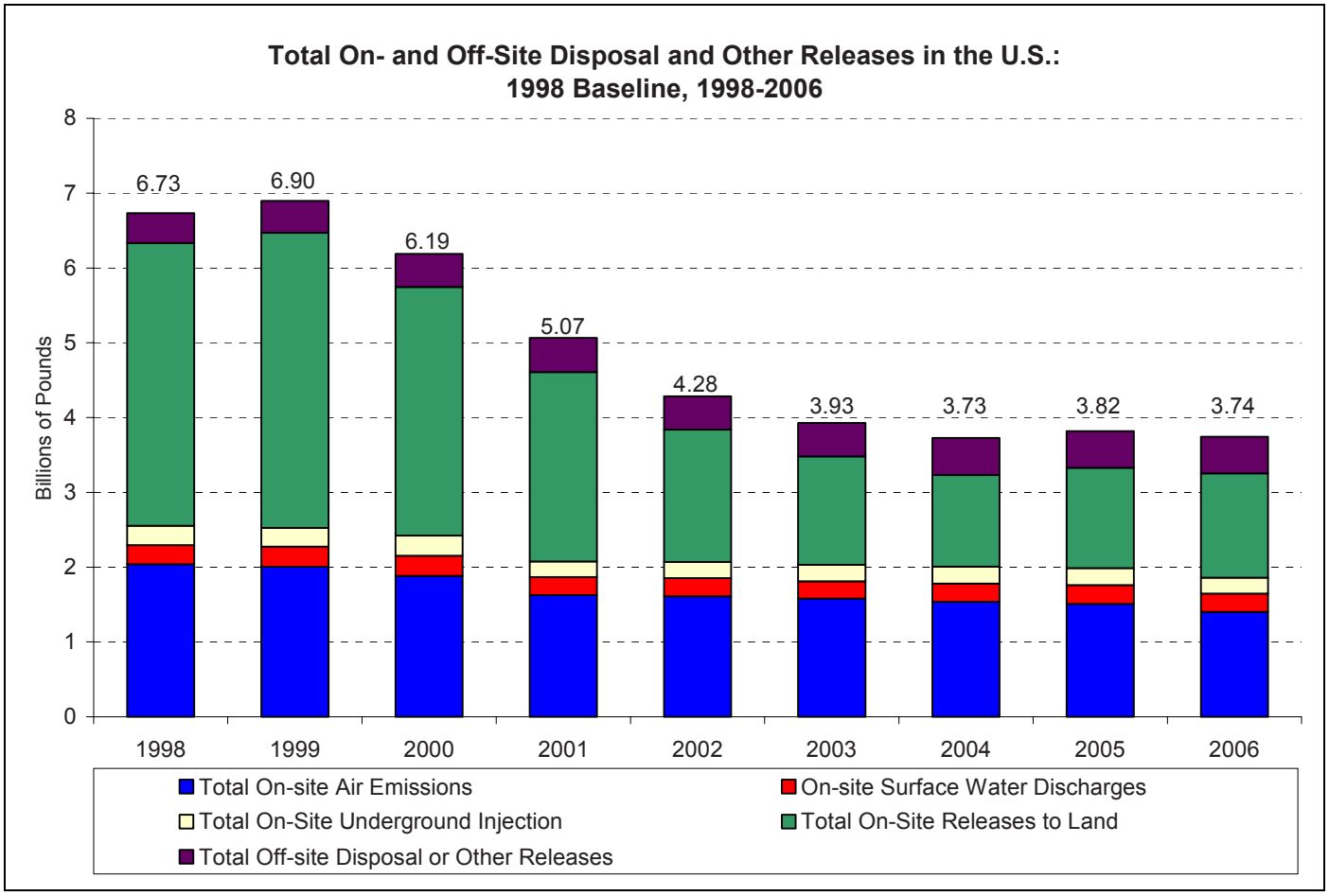
- Throughout the 1990s, the EPA added chemicals to the TRI. In 1995, a new baseline was established.[122]

- From 1995 to 2006, the release of toxins in the United States has fallen from just over 2.54 billion pounds to 1.84 billion pounds in 2006, a decline of almost 25 percent. As with the 1988 baseline, the largest reduction has come from air emissions, which fell 797 million pounds (45 percent) since 1995.

- As a group, on-site releases—that is, toxins released or disposed of at the point of their generation—fell 35.7 percent since 1995, while off-site releases rose from 298 million pounds in 1995 to 507.9 million pounds in 2006, a 59 percent increase.

[122] *Ibid*.

What happens to hazardous wastes produced by businesses and industries in the U.S.? (1998 Baseline)



- In 1997, the EPA revised the TRI again by including seven industries not previously required to report toxic emissions: electrical utilities, coal mining, metal mining, chemical wholesalers, petroleum bulk plants and terminals, solvent recovery, and hazardous waste management facilities. By including these seven facilities, the EPA almost tripled the amount of reported toxins released in 1988 from 2.5 billion pounds to 6.7 billion pounds in 1998.[123]

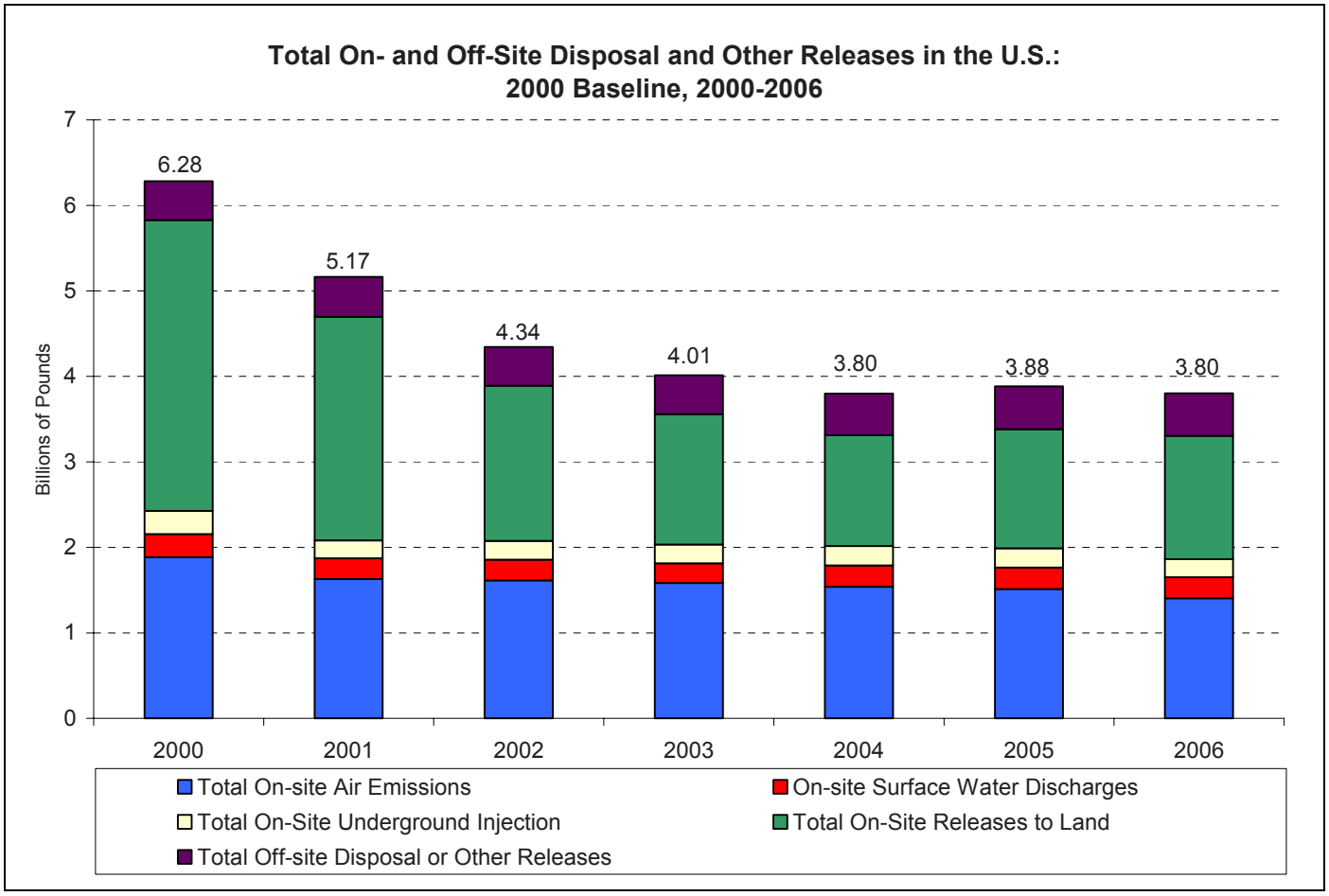
- Nevertheless, total releases by both old and new industries fell from 6.73 billion pounds in 1998 to 3.74 billion pounds in 2006, a 44 percent reduction.

- The greatest reductions in toxic releases in the U.S. have been in releases to land (63 percent decrease), followed by air emissions (31 percent decrease).

- The disposal of toxic releases off-site increased by 23 percent since 1998; off-site releases, however, only comprise 13 percent of all recorded releases.

[123] *Ibid*.

What happens to hazardous wastes produced by businesses and industries in the U.S.? (2000 Baseline)



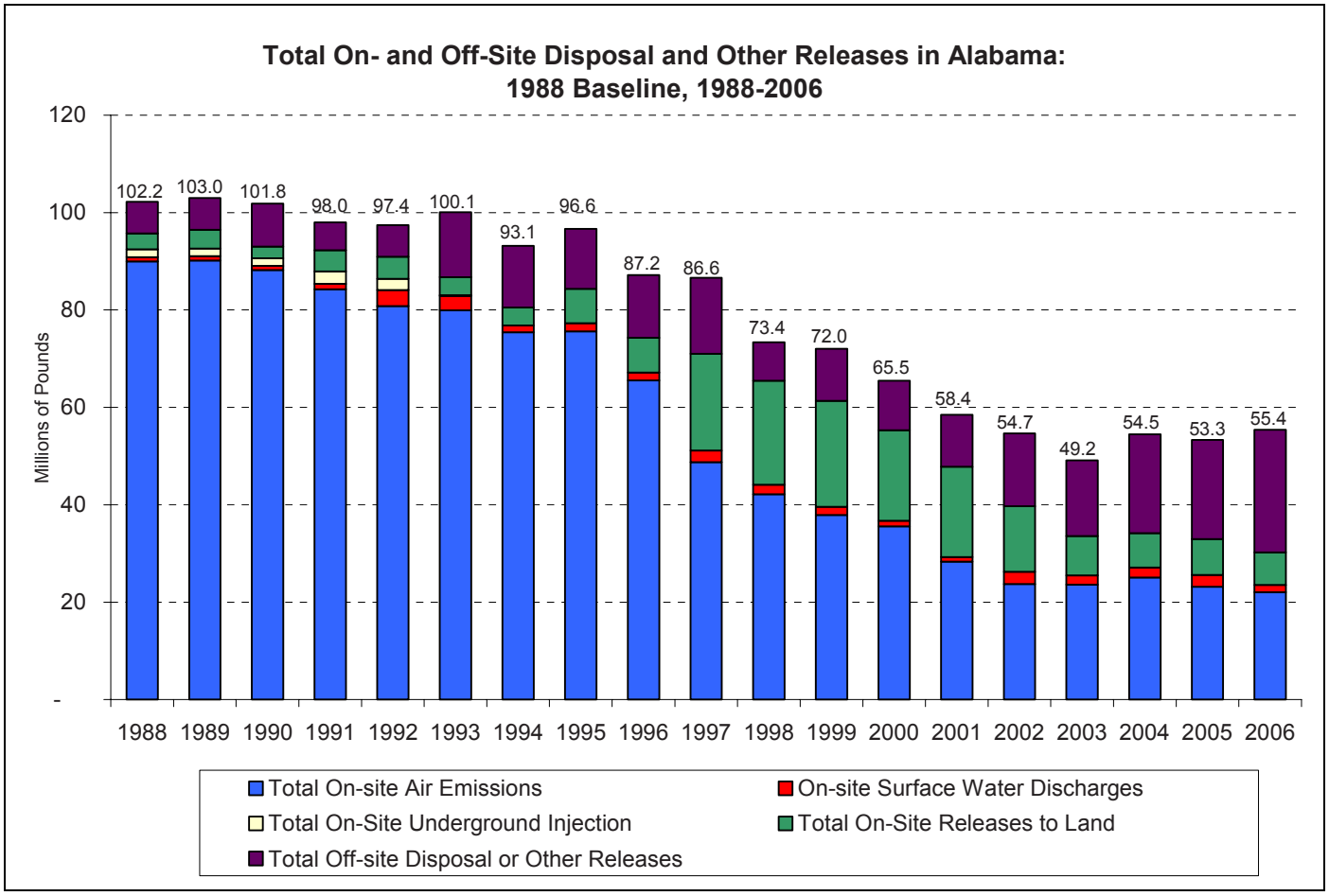
- In 2000, the EPA added six persistent bioaccumulative toxic chemicals (PBTs) and one PBT category to the TRI list. Because PBTs persist and bioaccumulate in the environment, the EPA lowered the threshold for reporting them from a minimum of 10,000 to 25,000 pounds to as little as 0.1 gram. The total tonnage of PBTs released in 2000 was extremely small, compared to total releases (12.1 million pounds of 6.2 billion pounds).[124]

- From 2000 to 2006, the total amount of toxins released that are included in the 2000 baseline dropped from 6.28 billion pounds to 3.8 billion pounds, a 39.5 percent reduction.

- The greatest reductions in toxic releases have been in releases to land (57.6 percent decrease), followed by air emissions (25.5 percent decrease) and underground injection (21.4 percent).

[124] *Ibid*.

What happens to hazardous wastes produced by businesses and industries in Alabama? (1988 Baseline)



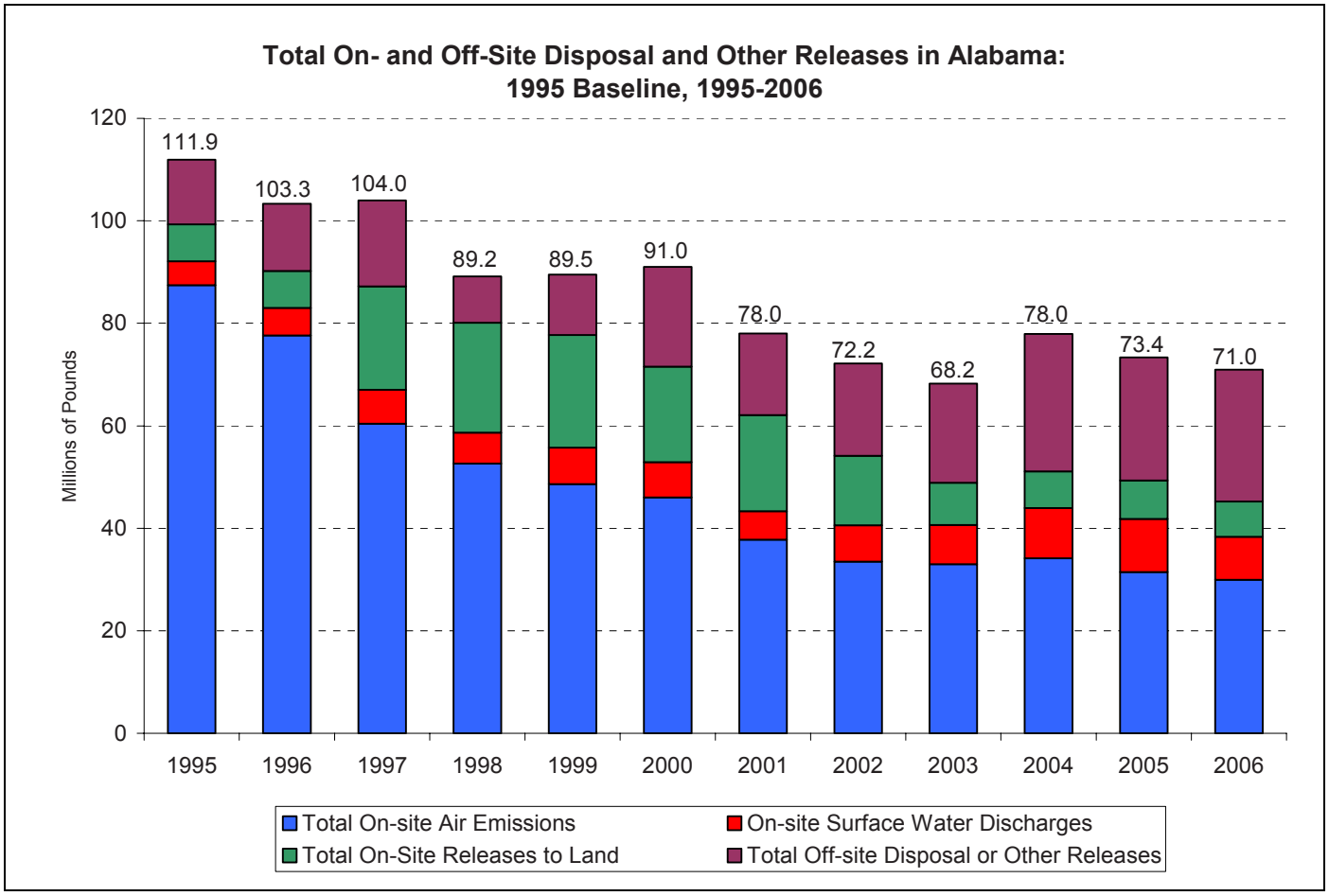
- In 1988, facilities in Alabama released 102.2 million pounds of toxins. In 2006, this amount was only 55.4 million pounds, a reduction of 45.8 percent.[125]

- In 1988, almost 90 percent of the toxins released in Alabama were air emissions (89.9 million pounds). By 2006, the amount of air emissions had dropped to only 22 million pounds, a 75.5 percent decline. Moreover, there have been no on-site underground injections of toxins in Alabama since 1997.

- While air emissions and underground injections in Alabama have decreased, some other types of emissions have risen. For example, on-site surface water discharges have grown from 860,000 pounds in 1988 to 1.5 million pounds in 2006, a 73 percent increase. Likewise, land releases of toxins have climbed from 3.2 million pounds in 1988 to 6.7 million pounds in 2006, an increase of more than 107 percent. These increases need to be kept in perspective, though; in 2006, surface water discharges and land releases of toxins in Alabama accounted for only 3.7 percent and 12.1 percent of all releases, respectively.

[125] *Ibid.*

What happens to hazardous wastes produced by businesses and industries in Alabama? (1995 Baseline)



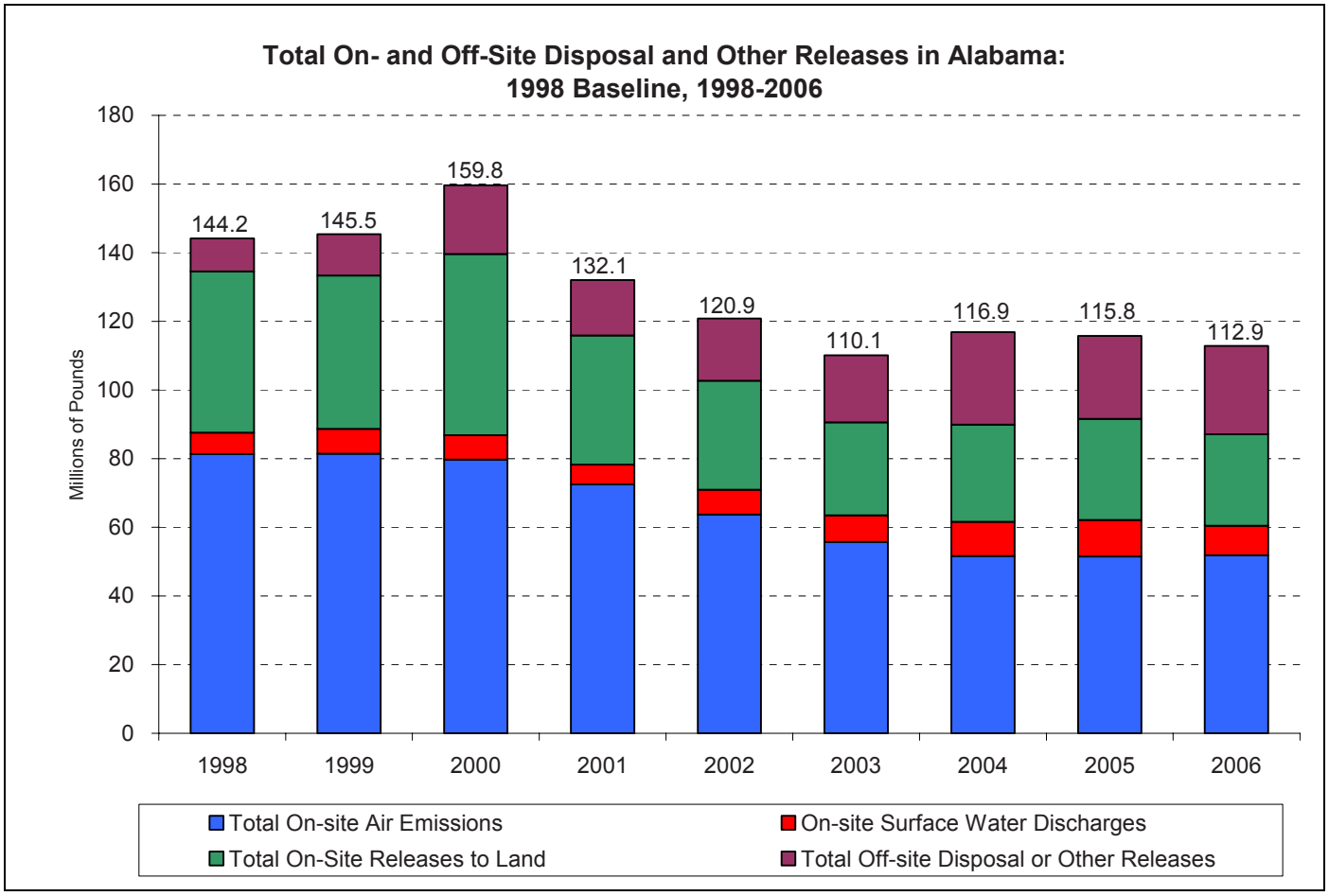
- From 1995 to 2006, the amount of toxins released from facilities in Alabama dropped from 111.9 million pounds to 71 million pounds, a decline of 36.5 percent.

- As with the 1988 baseline, the largest contributor to Alabama's 1995 baseline TRI is on-site air emissions (30 million pounds in 2006). Nevertheless, air emissions in Alabama have fallen from 87.4 million pounds in 1995 to 30 million pounds in 2006, a 65 percent decline.

- Since 1995, on-site surface water discharges tracked by the 1995 baseline TRI have risen from 4.7 million pounds to 8.4 million pounds in 2006, an increase of about 80 percent. In 2006, water discharges constituted 12 percent of all toxins released in Alabama.

- In the same way, off-site disposal of toxins in Alabama has also increased, from 12.6 million pounds in 1995 to 25.7 million pounds in 2006, an increase of approximately 104 percent. In 2006, toxins in Alabama that were disposed of off-site made up 36 percent of all toxic releases.

What happens to hazardous wastes produced by businesses and industries in Alabama? (1998 Baseline)



- From 1998 to 2006, the amount of toxins released from facilities in Alabama using the 1998 baseline fell from 143.3 million pounds to 113 million pounds, a decline of 21.7 percent.[126]

- As with earlier baselines, the largest contributor to Alabama's 1998 baseline TRI is on-site air emissions. Nevertheless, air emissions in Alabama have fallen from 81.3 million pounds in 1998 to 51.8 million pounds in 2006, a 36.2 percent decline.

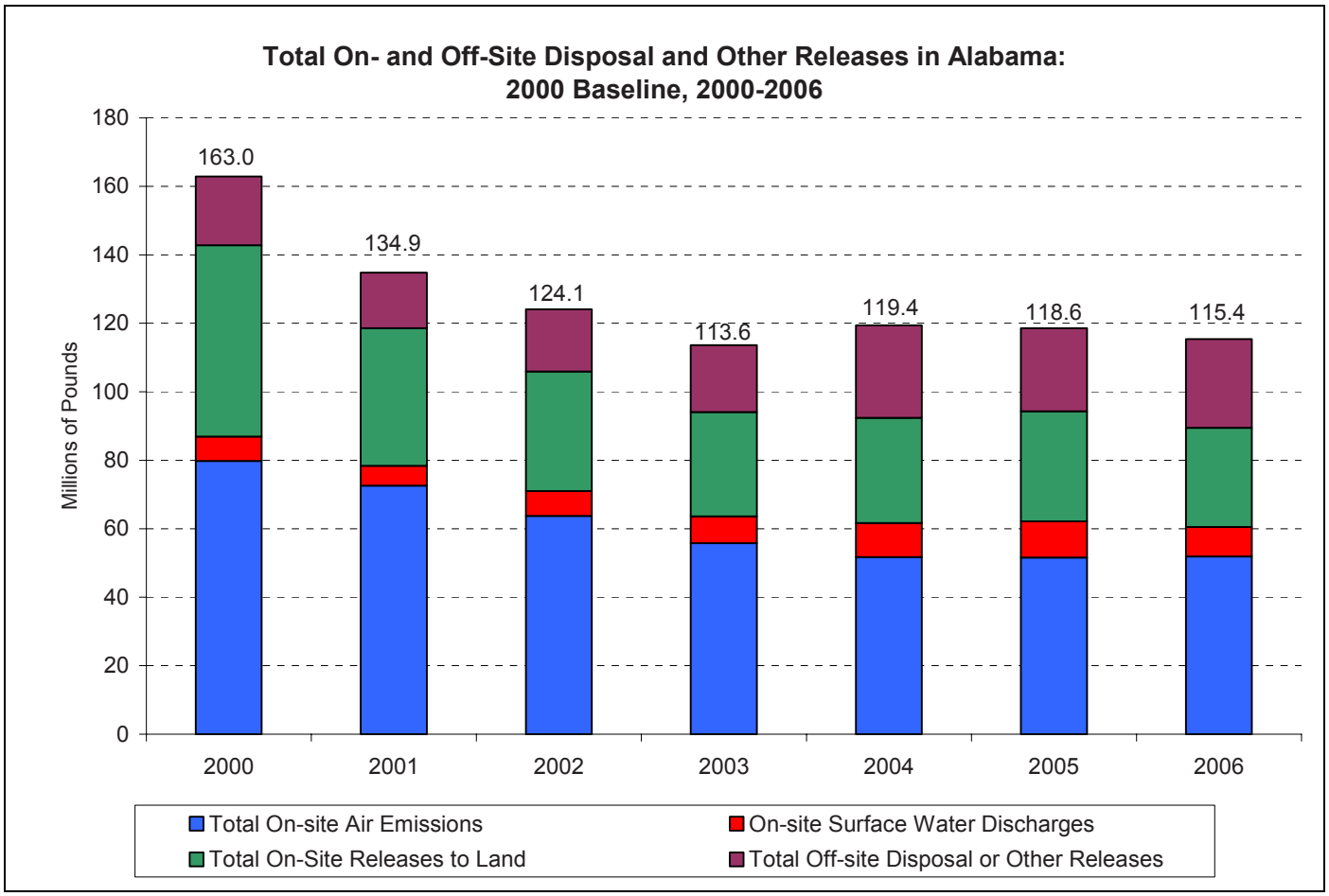
- Likewise, total on-site releases to land fell from 47 million pounds in 1998 to 26.6 million pounds in 2006, a decline of 43.4 percent. From 1998 to 2006, the share of toxins released to on-site land facilities in Alabama declined from 32.8 percent to 23.5 percent.

- On-site surface water discharges using the 1998 baseline TRI rose from 6.2 million pounds in 1998 to 8.6 million pounds in 2006, an increase of 38 percent. From 1998 to 2006, the share of toxins released into Alabama's surface water rose from 4.3 percent to 7.6 percent.

- In the same way, off-site disposal of toxins in Alabama has tripled, from 9.6 million pounds in 1998 to 25.7 million pounds in 2006. From 1998 to 2006, the share of toxins disposed of off-site rose from 6.7 percent to 22.8 percent of all toxins released.

[126] *Ibid*.

What happens to hazardous wastes produced by businesses and industries in Alabama? (2000 Baseline)



- Using the EPA's latest baseline, the amount of toxins released from facilities in Alabama fell from 163 million pounds to 115.4 million pounds, a decline of approximately 26.7 percent.[127]

- From 2000 to 2006, on-site air emissions in Alabama fell from 79.8 million pounds in 2000 to 51.9 million pounds in 2006, a decline of 35 percent. From 2000 to 2006, the share of toxins released into the air from on-site facilities decreased from 48.9 percent to 45 percent.

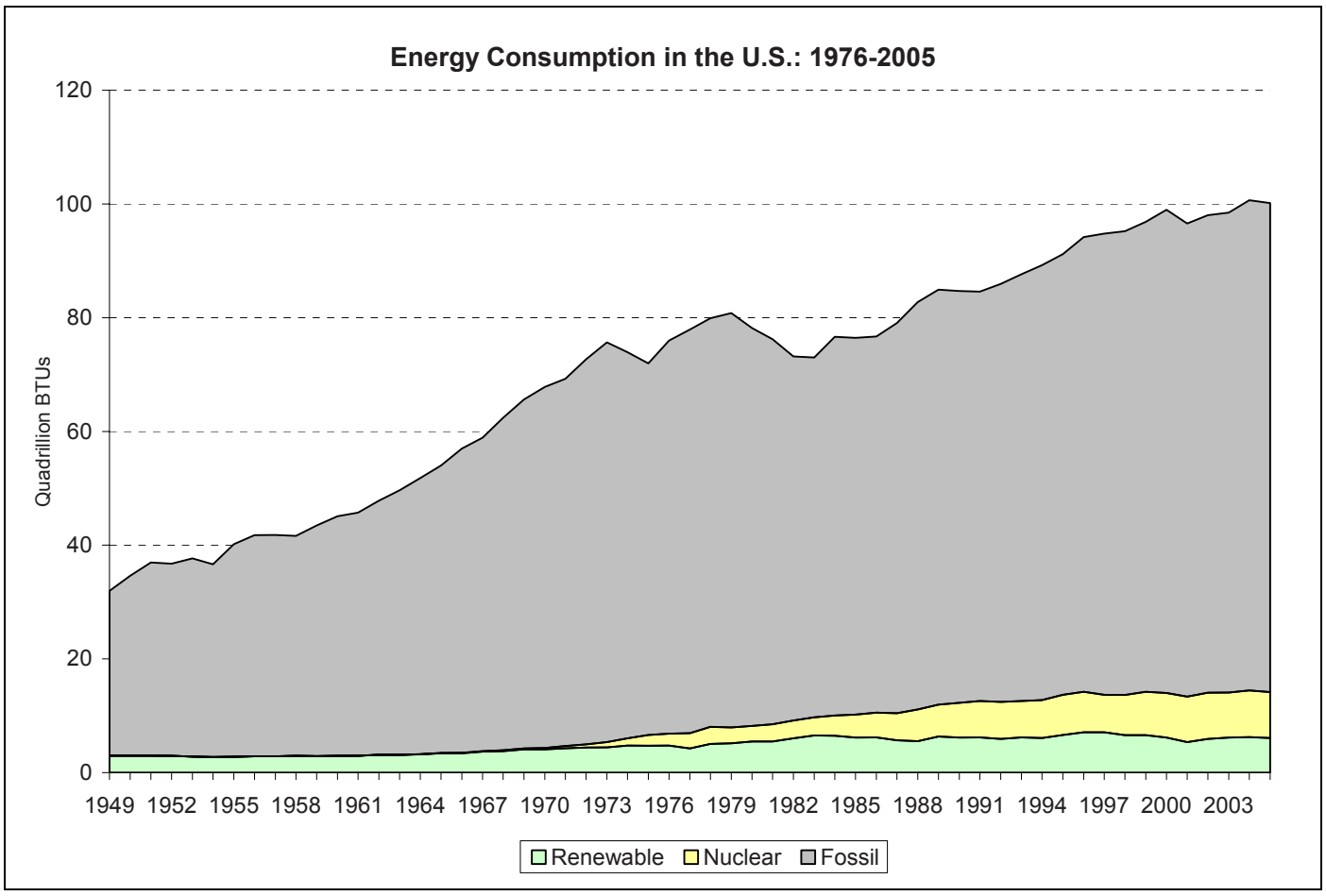
- Likewise, total on-site releases to land fell from 55.9 million pounds in 2000 to 29 million pounds in 2006, a decline of 45 percent. From 2000 to 2006, the share of toxins released to on-site land facilities in Alabama dropped from 34.3 percent to 25.5 percent.

- On-site surface water discharges using the 2000 baseline rose from 7.1 million pounds in 2000 to 8.6 million pounds in 2006, a 40 percent increase. From 2000 to 2006, the share of toxins released into Alabama's surface water rose by about 40 percent, from 4.4 percent to 7.5 percent.

- Off-site disposal of toxins in Alabama has increased about 35 percent, from 20.1 million pounds in 2000 to 25.8 million pounds in 2006. From 2000 to 2006, the share of toxins disposed of off-site nearly doubled, from 12.3 percent of all toxins released to 22.4 percent.

[127] *Ibid*.

How much energy does the U.S. consume each year?



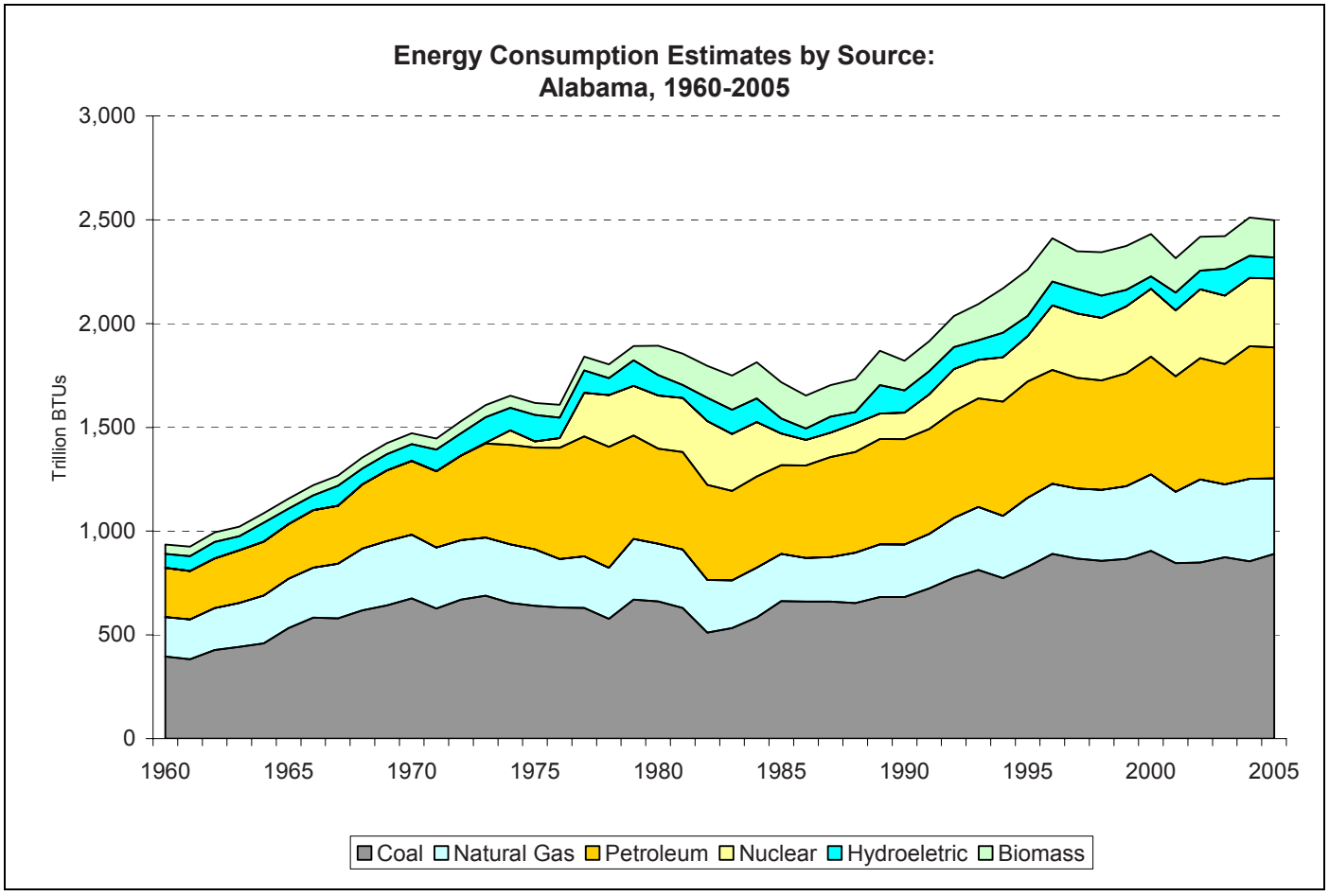
- From 1976 to 2007, the amount of energy consumed in the U.S. increased 33.6 percent. Most of this growth was from increased consumption of fossil fuels such as petroleum and coal (24.8 percent).[128]

- Nuclear power consumption increased almost 300 percent during the same time period, yet it accounted for only 8.3 percent of all the power consumed in 2007. Despite the complete halt on reactor construction in the U.S. since the partial meltdown of the Three Mile Island reactor in 1979, reactor operators have been able to increase their production of power from 2.78 quadrillion BTUs in 1979 to 8.42 quadrillion BTUs in 2007.

- During the same time, renewable energy consumption such as biomass and hydroelectric power increased 43.3 percent. As with nuclear power, its contribution to overall power consumption (6.7 percent) pales by comparison to that of fossil fuels (84.9 percent).

[128] Energy Information Administration (EIA), "Primary Energy Consumption, by Source," in *Monthly Energy Review*, August 2008. Available at http://www.eia.doe.gov/emeu/mer/pdf/pages/sec1_7.pdf. Access verified August 26, 2008.

How much energy does Alabama consume each year?



- From 1976 to 2005, Alabama's overall energy production increased 36.2 percent. During this time period, nuclear power production increased 609 percent, energy from biomass increased 181 percent, natural gas consumption increased 56.4 percent, and coal consumption increased 40 percent.[129]

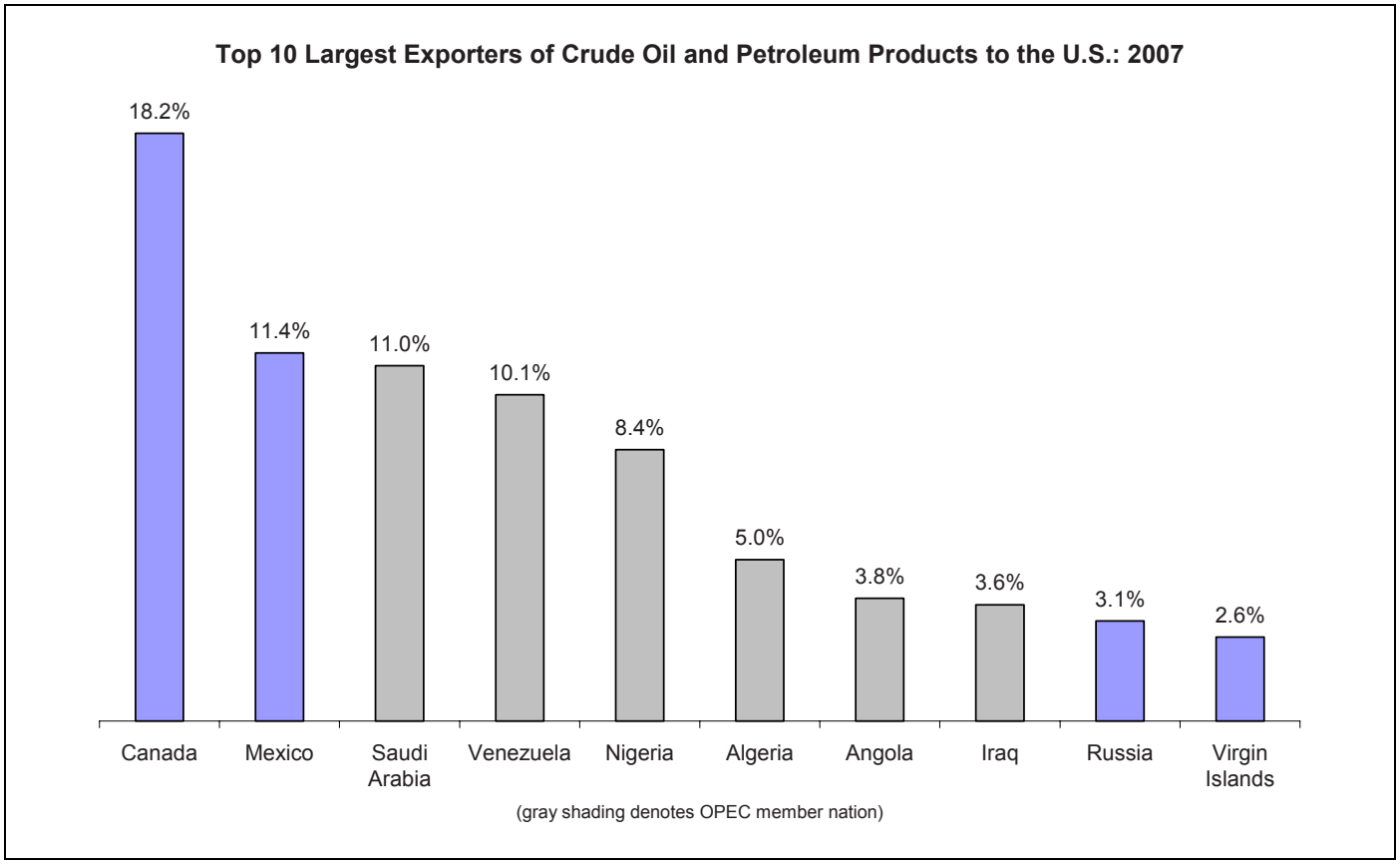
- In 2005, the lion's share of power consumed in Alabama came from coal (42 percent), followed by oil (29.6 percent), natural gas (17.2 percent), nuclear power (15.6 percent), biomass (8.4 percent), and hydroelectric sources (4.8 percent).

- About 18 percent of all the power generated in Alabama is exported to other states. In terms of raw power (371.1 trillion BTUs), Alabama is the fourth largest exporter of energy in the nation. This is almost as much as Alabama consumes in natural gas (364.1 trillion BTUs). To put this amount in perspective, it is more than enough to meet all the energy needs of any one of six other states – Delaware, Hawaii, New Hampshire, Rhode Island, South Dakota, or Vermont – or the District of Columbia.[130]

[129] EIA, "Energy Consumption Estimates by Source, Selected Years, 1960-2005, Alabama," February 29, 2008. Available at http://www.eia.doe.gov/emeu/states/hf.jsp?incfile=sep_use/total/use_tot_al.html&mstate=ALABAMA. Access verified August 26, 2008.

[130] EIA, "Energy Consumption Estimates by Source, 2005." Available at http://www.eia.doe.gov/emeu/states/sep_sum/html/sum_btu_tot.html. Access verified August 26, 2008.

Where does the U.S. get its crude oil and petroleum products from?



- In 1973, the U.S. imported 34.8 percent of the petroleum it needed to operate. By 2007, this number had grown to 58.2 percent.[131]

- The United States imports its petroleum from dozens of countries across the world, from Australia to Guatemala. In 2007, the two largest exporters of crude oil and petroleum products to the U.S. were Canada (18.2 percent of all imports) and Mexico (11.4 percent).[132]

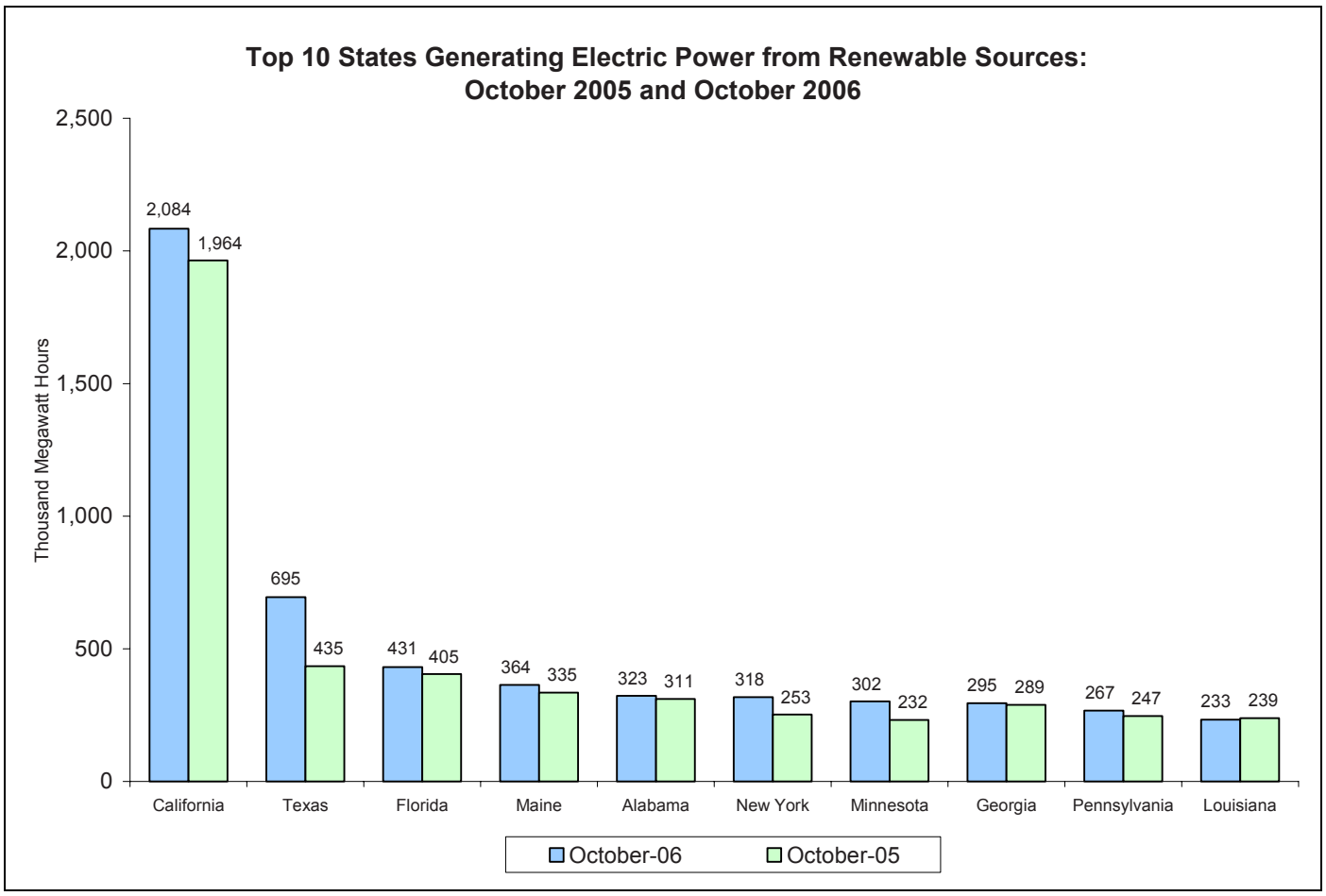
- Eleven of the nations the U.S. depends on for oil are members of OPEC (Organization of Petroleum Exporting Countries), and together they account for 44.4 percent of all U.S. imports of crude oil and petroleum products.[133]

[131] EIA, "Petroleum Trade: Overview," in *Monthly Energy Review*, August 2008. Available at http://www.eia.doe.gov/emeu/mer/pdf/pages/sec3_7.pdf. Access verified August 25, 2008.

[132] EIA, "U.S. Imports by Country of Origin," July 28, 2008. Available at http://tonto.eia.doe.gov/dnav/pet/pet_move_impcus_a2_nus_epc0_im0_mbblpd_a.htm. Access verified August 25, 2008.

[133] EIA, "Petroleum Trade: Overview."

Which states generate the most energy from renewable sources?



- Approximately 7.9 percent of all the power generated in Alabama comes from renewable sources, such as hydroelectric power (5.1 percent) and the burning of biomass (2.8 percent).[134]

- Together, Alabama's 12 major hydroelectric power plants produce, on average, 849 thousand megawatt hours of electricity per month. This makes Alabama the fifth largest producer of hydroelectric power in the nation.[135]

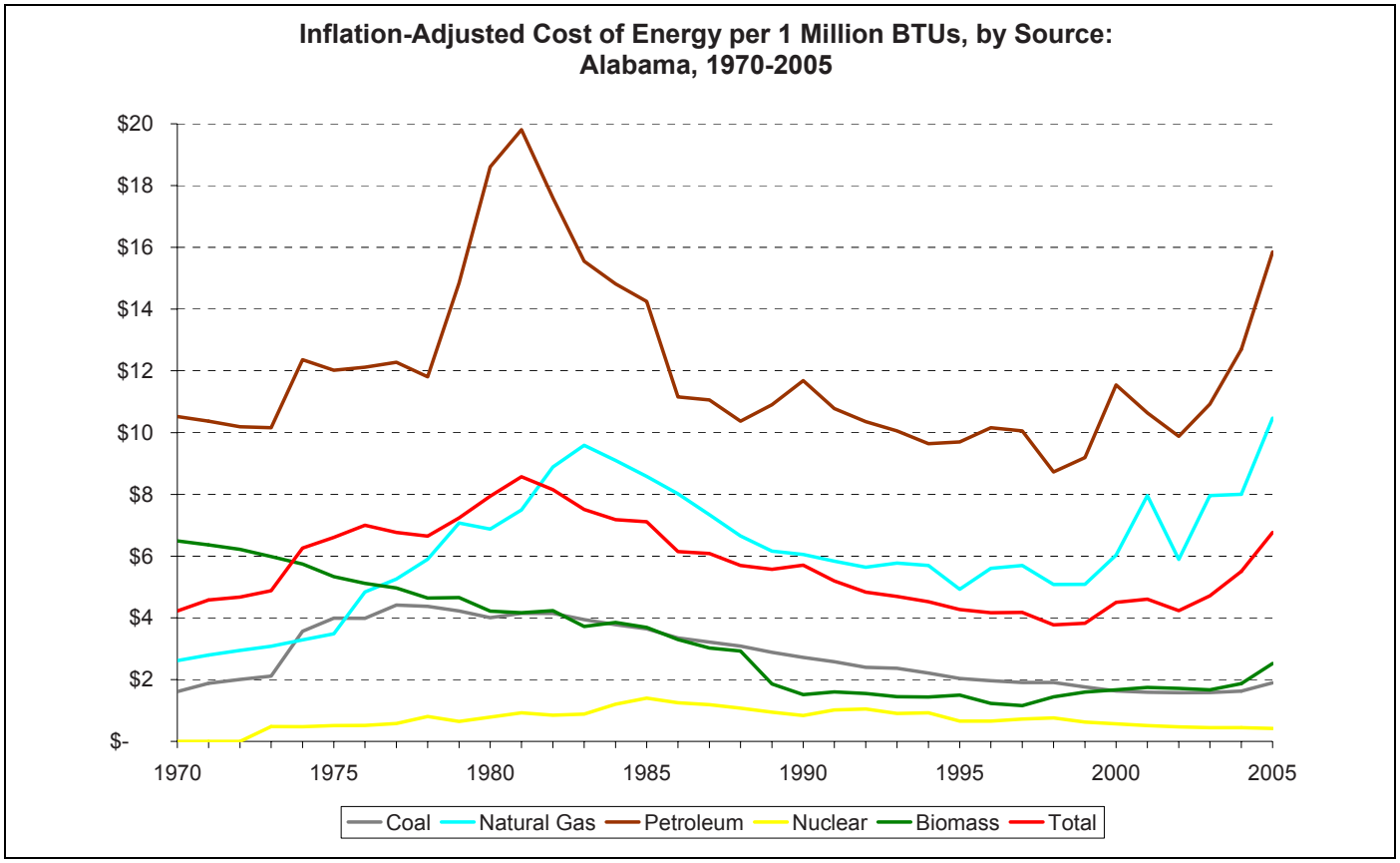
- Of the 328 thousand megawatt hours of energy produced in March 2008 by renewable energy in the state, 95 percent was produced in Alabama's industrial sector. Alabama produces more energy from renewable sources from industry—an average of 313 thousand megawatt hours per month—than any other state.[136]

[134] EIA, "Alabama Renewable Electricity Profile: 2006 Edition," May 2008. Available at http://www.eia.doe.gov/cneaf/solar.renewables/page/state_profiles/alabama.html. Access verified August 26, 2008.

[135] EIA, "State Energy Profiles: Alabama," August 21, 2008. Available at http://www.eia.doe.gov/cneaf/electricity/epm/epmxlfile1_13_a.xls. Access verified August 26, 2008.

[136] EIA, "Net Generation from Other Renewables by State by Sector," August 5, 2008, available at http://www.eia.doe.gov/cneaf/electricity/epm/table1_14_a.html. Access verified August 25, 2008.

How much does it cost to use different types of energy?



- Since 1970, the inflation-adjusted average cost for 1 million BTUs of energy from all sources in Alabama has risen 60 percent. In 1970, the average cost of 1 million BTUs was $4.23; in 2005, it was $6.77.[137]

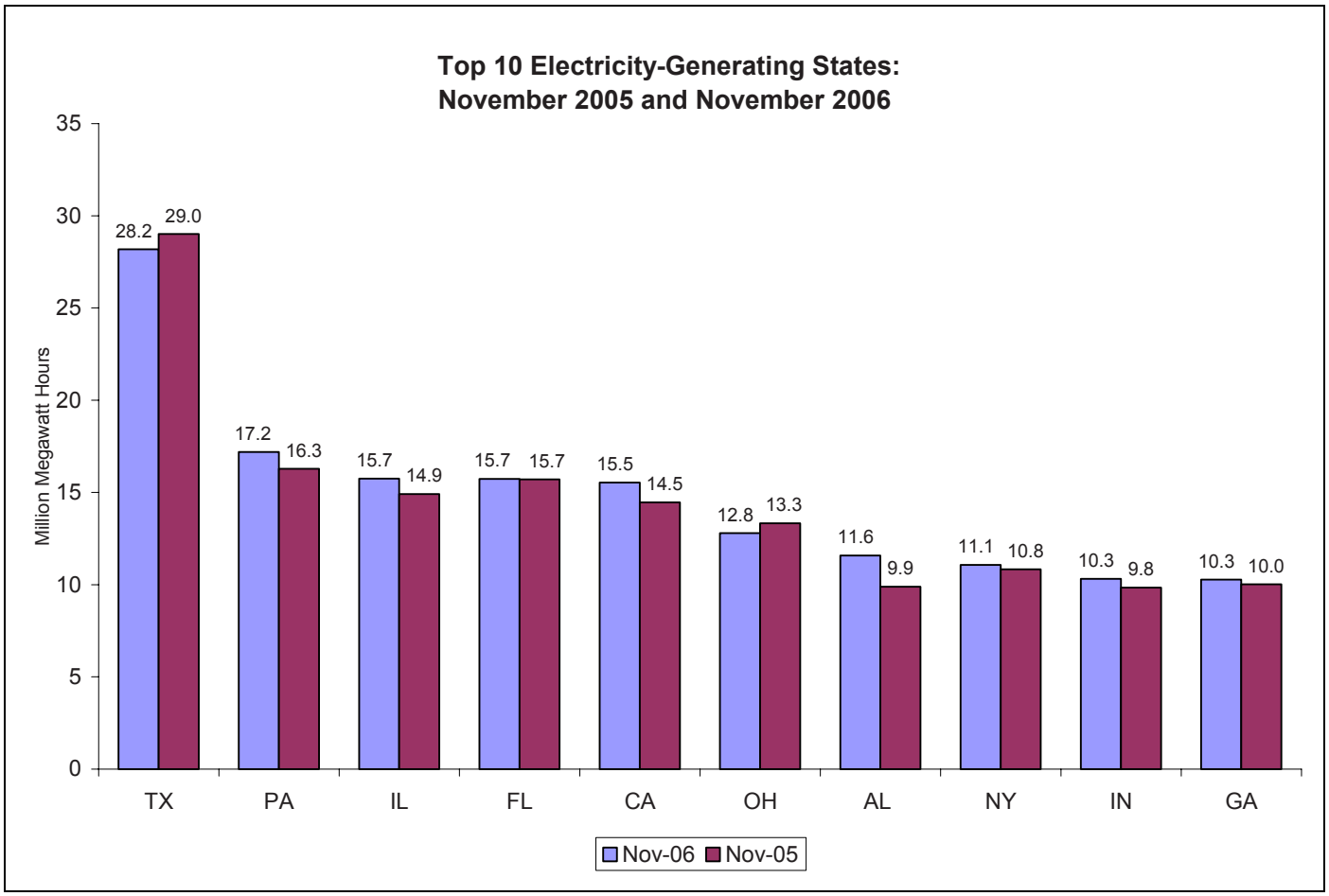
- During the late 1970s and early 1980s, the inflation-adjusted average cost of 1 million BTUs of energy from petroleum products approached $20. After steadily declining from a high of $19.81 in 1981 to a low of $8.72 in 1998, the cost of petroleum-based energy has risen to about $15.85 per million BTUs in 2005.

- The cost of energy from natural gas has followed a similar pattern as that of petroleum. Since 1970, the inflation-adjusted cost of 1 million BTUs of natural gas-based energy has quadrupled, from $2.62 to $10.47 in 2005.

- Two bright spots in the energy market are nuclear power and biomass. Since 1970, the cost of 1 million BTUs of energy from biomass has fallen 61 percent, from $6.49 to $2.52 in 2005, making it cheaper than natural gas and petroleum, but more expensive than coal ($1.89 per million BTUs in 2005). Nuclear power has also remained cheap; the inflation-adjusted cost for 1 million BTUs of nuclear energy actually fell from 48 cents in 1973 to 42 cents in 2005.

[137] EIA, "Electric Power Sector Price and Expenditure Estimates by Source, 1970-2005, Alabama," February 29, 2008. Available at www.eia.doe.gov/emeu/states/hf.jsp?incfile=sep_prices/total/pr_tot_al.html&mstate=ALABAMA. Access verified August 27, 2008. Inflation-adjusted estimates from the U.S. Department of Labor, Bureau of Labor Statistics, Consumer Price Index—All Urban Consumers (CPI-U), August 18, 2008. Available at ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt. Access verified August 27, 2008.

Which states produce the most electricity?



- Alabama is the seventh largest producer of electricity in the nation. From April 2007 to April 2008, Alabama's electricity production rose from 10.4 million megawatt hours to 10.8 million megawatt hours, an increase of 4.3 percent.[138]
- In 2006, coal-fired power plants produced 55 percent of all of the electricity generated in Alabama.[139] Although it produces large amounts of coal, Alabama relies on deliveries of coal with lower amounts of sulfur from other states to meet roughly half of its demand.[140]
- Nuclear power produces about 23 percent of Alabama's electricity.[141]
- About 14 percent of Alabama's electrical power comes from natural gas-fired plants. Alabama produces natural gas from wells offshore in the Gulf of Mexico and from coalbed methane deposits, found primarily in the Black Warrior Basin and the Cahaba Coal Field.[142]
- Alabama is one of the largest hydroelectric power-producing states east of the Rocky Mountains. In 2006, 5.1 percent of the state's electricity came from hydroelectric sources.[143]

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[138] EIA, "Net Generation by State by Sector, April 2008 and 2007," August 25, 2008. Available at http://www.eia.doe.gov/cneaf/electricity/epm/table1 _6_a.html. Access verified August 27, 2008.

[139] EIA, "1990–2006 Net Generation by State by Type of Producer by Energy Source," October 26, 2007. Available at http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html. Access verified August 27, 2008.

[140] EIA, "Alabama Quick Facts," last update August 21, 2008. Available at http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=AL. Access verified August 27, 2008.

[141] EIA, "1990–2006 Net Generation by State by Type of Producer by Energy Source."

[142] *Ibid*. EIA, "Alabama Quick Facts."

[143] *Ibid*. EIA, "1990–2006 Net Generation by State by Type of Producer by Energy Source."

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