

Extreme Heat in Summer 2010: A Window on the Future

NATIONAL WILDLIFE FEDERATION

2010



Many Americans in the eastern and southern United States have been sweltering during summer 2010.

As global temperature records have been set for the early summer months, states and cities are also setting hundreds of temperature records. More than 70 million Americans experienced extreme heat during June and July.

Unfortunately, climate models indicate that an average summer in 2050 will have even more days topping 90°F if global warming continues unabated. For example, Washington, DC is on track to have about 50 days of 90°F or hotter weather in summer 2010. By midcentury, an average summer could have 55 to 100 such days, depending on how much we curb global warming pollution.

This supplement to National Wildlife Federation's 2009 report *More Extreme Heat Waves: Global Warming's Wake-Up Call* examines just how hot summer 2010 is shaping up to be and the implications for air pollution, health, and the economy.



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CONFRONTING GLOBAL WARMING

RECORD SETTING GLOBAL TEMPERATURES

According to the National Oceanic and Atmospheric Administration (NOAA), 2010 brought the hottest June on record. Almost the entire global land surface experienced warmer-than-normal conditions, with especially high temperatures in the eastern and south-central United States. The warm summer continued the heat we already experienced through the first half of 2010, which is the hottest January through June on record.¹

2010 U.S. TEMPERATURES IN THE RECORD BOOKS

In 2010, New Jersey, Delaware, and North Carolina had their hottest June on record, while Rhode Island and Delaware had their hottest July. Sixteen other states had Junes or Julys that ranked in the top-five hottest.² That means upward of 70 million Americans experienced extreme heat these two months. Hundreds of daily temperature records were broken across the country.

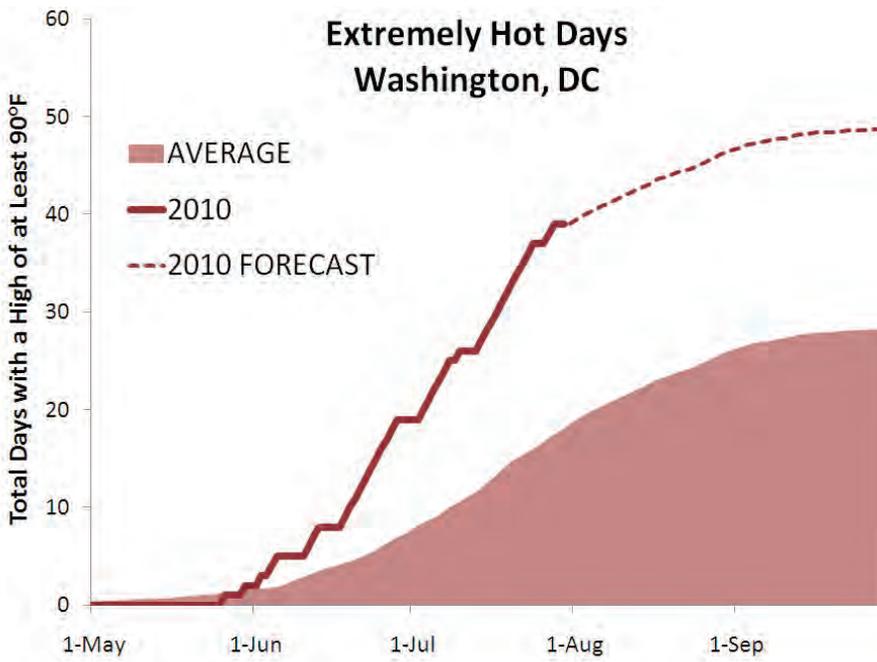
Not surprisingly, this hot spell has brought many days where the thermometer topped 90°F. Our analysis of large cities in the eastern United States shows that most locations have had about twice as many days with temperatures exceeding 90°F than they typically would by the end of July. For example, Washington, DC, had 39 days with temperatures in the 90s by July 31, 2010, compared to 18 days for the same period in an average year. If conditions continue to stay warm, or even if we return to more average conditions in August, Washington and several other cities are on track to meet or break records for the total number of days exceeding 90°F in a single year. Cities in the south-central United States are also running hot: many have had about 50 percent more days over 90°F than average.

STATES FEELING THE HEAT IN 2010

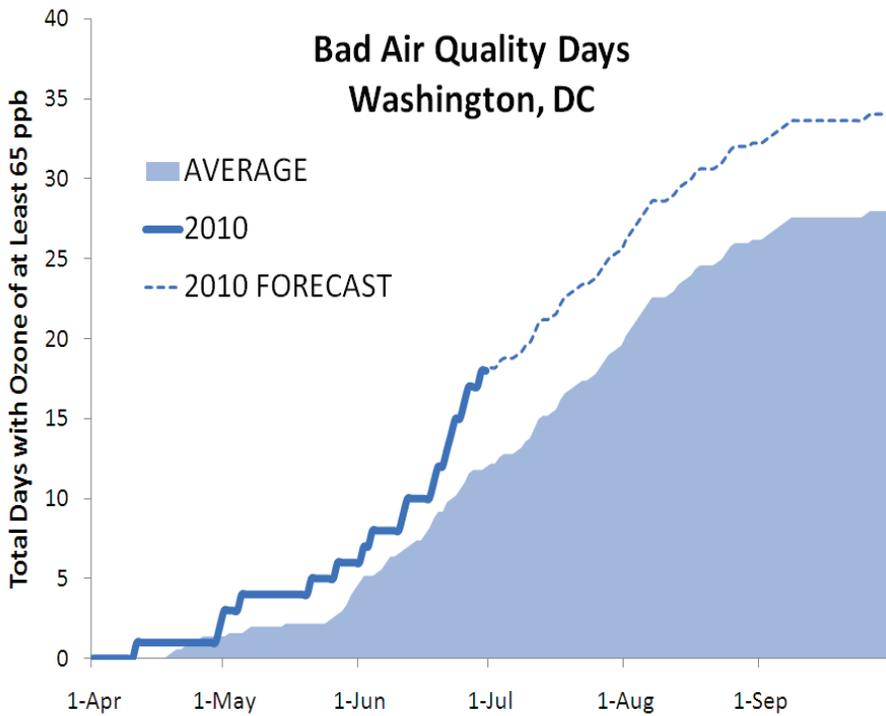
SOURCE: National Oceanic and Atmospheric Administration

| | June | July |
|---------------------------------|---|---|
| HOTTEST on Record | New Jersey Delaware N. Carolina | Rhode Island Delaware |
| SECOND HOTTEST on Record | Maryland Virginia S. Carolina Florida Louisiana | New Jersey |
| THIRD HOTTEST on Record | | New Hampshire Massachusetts Florida |
| FOURTH HOTTEST on Record | Rhode Island Kentucky Tennessee Alabama | Maine Connecticut N. Carolina |
| FIFTH HOTTEST on Record | W. Virginia Georgia Mississippi Arkansas | Virginia |





Number of days at Ronald Reagan National Airport, just outside Washington, DC, when temperature were 90°F or greater. Shaded area shows the average number for 1950-2009. Solid line shows the number for 2010. Dashed line is the number expected if August and September follow the past average. Data source: National Oceanic and Atmospheric Administration Global Historical Climatology Network (<http://lwf.ncdc.noaa.gov/oa/climate/ghcn-daily/>).



Number of days when average ozone measured at three locations in the Washington, DC, metropolitan area exceeded 65 parts per billion (ppb). Shaded area shows the average number for 2005-2009. Solid line shows the number for 2010. Dashed line is the number expected if August and September follow the past average. Data source: U.S. Environmental Protection Agency AirExplorer (<http://www.epa.gov/mxplorer/index.htm>).



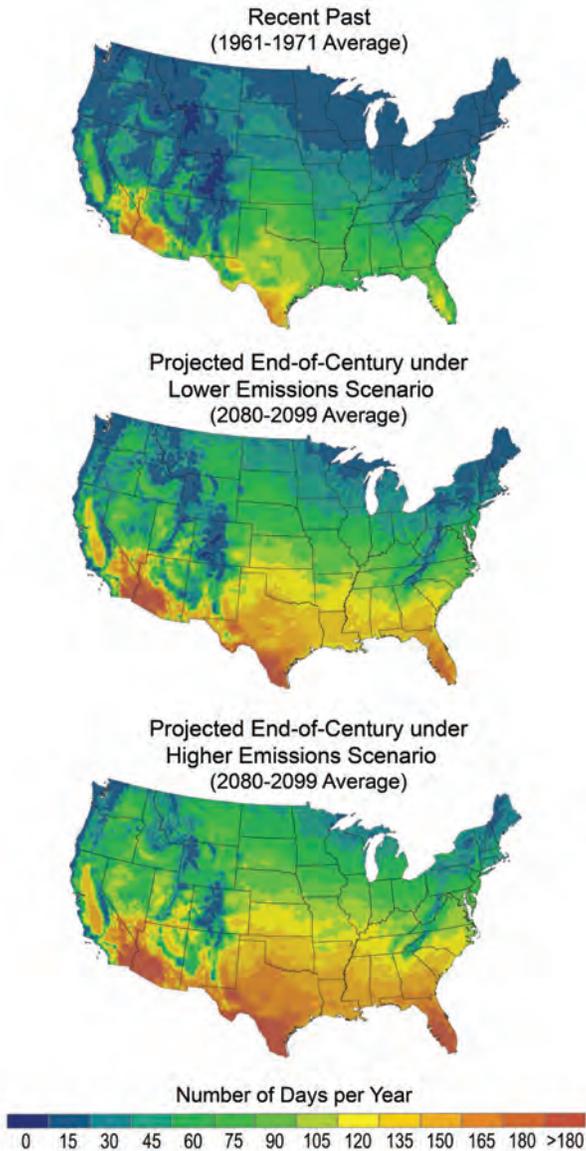
EXTREME SUMMER 2010 HEAT COULD BE TYPICAL BY MIDCENTURY

Summers like the current one, or even worse, will become the norm by 2050 if global warming pollution continues to increase unabated. Alternatively, taking steps to reduce emissions can help avoid some of this increase in extremely hot days.³ For example:

- Washington, DC, is projected to have about 55 days over 90°F by midcentury under a lower-emissions scenario and about 100 such days if emissions are higher. For comparison, the city will likely have about 50 days above 90°F in 2010 if August and September have an average number of very hot days.
- Philadelphia, PA, is projected to have about 40 days over 90°F by midcentury under a lower-emissions scenario and about 60 such days if emissions are higher.⁴ Through the end of July, the city had 25 days exceeding 90°F in 2010 and is on track to have about 30 or more such days for the year.
- St. Louis, MO, is projected to have about 60 days over 90°F by midcentury under a lower-emissions scenario and about 80 such days if emissions are higher.⁵ This year, the city is on track to have 45 extremely hot days, about 10 more than average.

The take away message is that, for each of these cities and for countless others that have been sweltering the last couple months, summer 2010 could be considered mild compared to the typical summers of the future.

The climate projections for the end of the century are even more dramatic (see maps). Much of the country will have twice as many days over 90°F if emissions are not curbed. That means much of the southern United States will have at least three or four months each year with temperatures in the 90s or above.³



The number of days in which the temperature exceeds 90°F for (top) the 1960s and 1970s, (middle) the 2080s and 2090s under a lower emissions scenario, and (bottom) the 2080s and 2090s under a higher emissions scenario.³

SOURCE: U.S. Global Change Research Program



EXTREME HEAT CONDUCTIVE TO BAD AIR QUALITY

Hot and sunny days with relatively stagnant winds provide textbook conditions for building up unhealthy levels of ground-level ozone pollution. The steamy summer of 2010 has brought many such days, despite continued efforts by the U.S. Environmental Protection Agency and individual states to restrict emissions from tailpipes, power plants, and industry.

For example, by the end of June 2010, the Washington, DC, metropolitan area had 18 days when maximum 8-hour average ozone met or exceeded 65 ppb, about 50 percent more than the region typically has by that time based on the previous 5 years of data.

Continued global warming could make it even more difficult to meet the ground-level ozone standards in the future. Warmer conditions and more periods with clear, sunny weather patterns would be conducive to ozone formation. At the same time, some emissions of ozone precursors are expected to increase as the demand for air conditioning and the risk of wildfires increase.

One study found that global warming could increase the ground-level ozone by 10 ppb or more during heat waves by 2050 in the Midwest and Northeast.⁶ For a city like Washington, DC, that means about 42 excess deaths for each day that there is elevated ozone.⁷ These would be in addition to any deaths caused primarily by exposure to extreme heat.

In January 2010, the Obama Administration announced its intention to lower the ozone standard from 75 parts per billion (ppb) to something in the range of 60 to 70 ppb.⁷ EPA estimates that lowering the standard to 65 ppb would save 1740 to 5100 lives annually, prevent nearly a million missed school days each year, and provide a total benefit to the economy of \$15 to \$43 billion by 2020.⁸ Stricter controls on ozone precursors likely would have co-benefits of reducing emissions of carbon dioxide and other greenhouse gases.



SOURCES

1. National Oceanic and Atmospheric Administration (NOAA), 2010: June, April to June, and Year-to-Date Global Temperatures are Warmest on Record. Available at: http://www.noanews.noaa.gov/stories2010/20100715_globalstats.html (Accessed July 20, 2010).
2. NOAA, 2010: June and July 2010 Statewide Ranks. Available at: <http://www.ncdc.noaa.gov/sotc/get-file.php?report=national&image=Stawidetrnk&year=2010&month=06&ext=gif> (Accessed July 20, 2010).
3. U.S. Global Change Research Program (USGCRP), 2009. *Global Climate Change Impacts in the United States*, T.R. Karl, J.M. Melillo, and T.C. Peterson, (eds.). Cambridge University Press, 191 pp.
4. Union of Concerned Scientists, 2006: *The Changing Northeast Climate: Our Choices, Our Legacy*. Available at: <http://www.climatechoices.org/ne/index.html> (Accessed August 4, 2010).
5. Wu, S., L.J. Mickley, E.M. Leibensperger, D.J. Jacob, D. Rind, and D.G. Streets, 2008. Effects of 2000–2050 global change on ozone air quality in the United States, *Journal of Geophysical Research* 113: D06302.
6. Calculation of about 42 excess deaths in Washington, DC based on an increase in mortality of 0.87% for every 10 ppb enhancement in ozone (National Research Council, 2008: *Estimating Mortality Risk Reduction and Economic Benefits from Controlling Ozone Air Pollution*. National Academies Press, p. 89.), an average mortality rate of 803.6 per 100,000 (Centers for Disease Control, FastStats, available at: <http://www.cdc.gov/nchs/fastats/deaths.htm>), and a district population of 599,600 (US Census Bureau, 2010: *Annual Estimates of the Population of Metropolitan and Micropolitan Statistical Areas: April 1, 2000 to July 1, 2009*. Available at: <http://www.census.gov/popest/metro/tables/2009/CBSA-EST2009-01.xls>).
7. The standard applies to the 4th highest 8-hour average, which must not exceed the designated value. Environmental Protection Agency (EPA), 2010: National Ambient Air Quality Standards for Ozone. *Federal Register* 75(11), 40 CFR Parts 50 and 58: p. 2938. Available at: <http://www.epa.gov/glo/fr/20100119.pdf> (Accessed July 20, 2010)
8. EPA, 2010: *Regulatory Impact Analysis: Re-analysis of the Benefits of Attaining Alternative Ozone Standards to Incorporate Current Methods*. Available at: http://www.epa.gov/ttn/ecas/regdata/RIAs/s3-supplemental_analysis-updated_benefits11-5.09.pdf (Accessed July 20, 2010)

Report prepared by:

Amanda Staudt, Ph.D., Climate Scientist
Renee Curry, Climate Science Assistant

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Report design by:

Max Greenberg

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