Americans' Perspectives on the Link between Extreme Events and Climate Change

By Sarah White and Zack Guido

Extreme weather doled out damage with punishing efficiency in 2011. Torrential rains swelled the Mississippi and Ohio rivers in June, destroying roads and bridges; spring and summer drought in the southern tier of the U.S. desiccated thousands of acres of crops; and the remnant of Hurricane Irene pummeled the East Coast.

When all was said and done, 14 separate billion-dollar weather and climate disasters thrashed the United States, shattering the previous record of nine set in 2008. The hefty $53 billion disaster price tag exceeds the gross domestic product of about 60 percent of the world's countries. Outside the U.S., heat waves and drought affected millions of people living in Europe and China, fires torched Mexico, and Thailand and Australia suffered record floods.

The high number of extreme events last year reinvigorated conversation about the link between rapid and catastrophic events and the slow drift of human-caused climate change. While the causes of those disasters cannot be attributed unequivocally to human-caused climate change, the events were likely influenced by it. The public also has made this link, and their perceptions are in line with scientific evidence connecting human actions and extreme events.

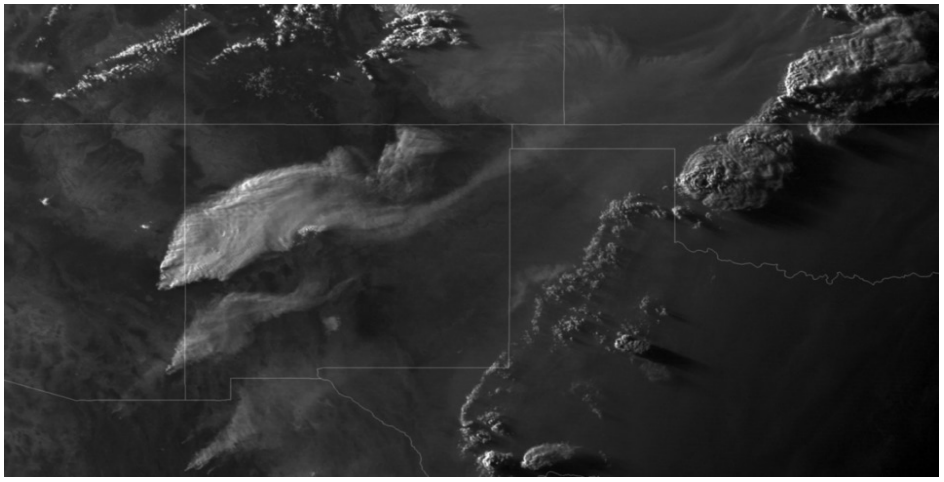

Figure 1. An extremely dry 2010-2011 winter teamed with windy spring weather to prime the landscape for an epic fire season. In recent polls, people in the U.S. are linking extreme weather and its impacts like fire with human-caused climate change. In this satellite image, smoke plumes waft into New Mexico from the Wallow (east-central Arizona) and Horseshoe Two (southeastern Arizona) fires that raged in June 2011. The Wallow Fire burned more than 500,000 acres and is Arizona's largest recorded wildland fire. Image source: National Oceanic and Atmospheric Administration

Scientific evidence mounting

Many studies on climate extremes have been published recently, including the report, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*, by the Intergovernmental Panel on Climate Change (IPCC). In general, "single extreme events cannot be simply and directly attributed to anthropogenic [human-caused] climate change," according to the report, because natural climate variability also causes anomalous conditions. Only when extreme events repeatedly venture outside the range of natural patterns is a strong link with climate change implied. The report also states, however, that anthropogenic climate change likely has increased the probability of occurrence for some events, particularly those related to temperature and precipitation.

In "A Decade of Weather Extremes", a recent peer-review article in *Nature Climate Change*, scientists analyzed the occurrence of extreme events in the past decade. The authors state that in a stationary climate, one in which human actions do not increase temperatures, there should be an equal number of record highs and lows. In the past decade, the U.S. has experienced twice as many record highs as record lows. The ratio also has been higher in recent years. In the summer of 2011, for example, record highs were eight times more frequent than record lows. These statistical analyses, along with climate modeling exercises, led the authors to argue there is strong evidence linking at least some extreme events to human influence on climate.

Their argument also applies to extreme rainfall, which has increased by about 33 percent in the U.S. during the past 100 years, according to the paper. Models show that for more than approximately two-thirds of the Northern Hemisphere land area, greenhouse gases (GHG) have intensified the largest one-day annual precipitation event and five-day total during the second half of the 20th century. These results conform to well-established physical relationships. As the atmosphere warms—average U.S. temperatures have increased by about 2 degrees F in the last 50 years—the air can hold more water vapor, and the expectation is that the added moisture will cause the most intense events to strengthen and be more frequent.

The signals are not all clear. Tropical storms prove more difficult to analyze; their record keeping does not span long time periods and scientists do not yet

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have a complete understanding of the driving forces. Even though the intensity of tropical storms has significantly increased since satellite records began in the 1970s, the authors note that scientists are still unsure if this increase is outside what occurs as a result of natural variability.

Public Perceptions

As observations increasingly suggest extreme events are influenced by climate change, the connection also appears to be strengthening in the perceptions of the public.

A nationally representative poll of 1,008 Americans conducted in March by researchers at Yale and George Mason universities reported that 82 percent of the respondents personally experienced at least one extreme weather event or natural disaster during the past year, and 35 percent stated experiencing at least a moderate amount of personal harm from one or more extreme events in that time. Americans also say the weather in the U.S. over the past several years has been getting worse, rather than better, by a margin of more than two to one (52 percent to 22 percent).

Many people believe that extreme events have become more common during the past two decades, according to the poll. This includes 53 percent of the respondents who believe that heat waves occur more often now than in the past, while 46 and 43 percent think drought and heavy rainstorms, respectively, are on the rise. Many Americans also say that extreme weather has increased the occurrence of other problems in their local areas, including harm to crops (46 percent), floods (39 percent), forest fires (34 percent), and water quality issues (31 percent).

The poll also suggests that a majority of people believe global warming helped fuel several high-profile extreme events last year. For example, 72 and 70 percent of the respondents stated that global warming added to the unusual warmth last winter and summer, respectively. Another 69 percent said global warming intensified the drought in the southern tier of the U.S., while 63 and 59 percent said global warming exacerbated the flooding on the Mississippi and strengthened Hurricane Irene, respectively.

Although these numbers suggest the public connects extreme weather with climate change, the poll did not address whether people believe human actions contribute to climate change.

Jon Krosnick, professor in the departments of communication, political science and psychology at Stanford University, addressed this question in a 2011 survey. Krosnick and his colleagues found that 72 percent of Americans polled believe that global warming is at least in part caused by humans.

Krosnick and his colleagues also sought the public's perceptions about decreasing GHG emissions—the principal driver of human-caused climate change. A 2010 survey reported that 76 percent of Americans think the government should limit GHGs emitted by businesses, and 84 percent think the government should give companies tax breaks to produce more electricity from water, wind, and solar power. Even more surprising, 65 percent of Americans support cap and trade, one of several market-based strategies to curtail GHG emissions; cap and trade sets a limit on the total GHG emissions and fosters the exchange of GHG permits.

Several years ago, an article in the journal *Eos, Transactions, American Geophysical Union* stated that while about 97 percent of climatologists actively publishing believed that humans influence the climate, only about 57 percent of the general public held this belief. The challenge, as the authors saw it, was finding ways to communicate the link between human actions and climate changes to policy makers and the public. It seems that nature's force in recent years has been a costly but effective communication tool.

Related Resources

1. IPCC report on extremes: http://ipcc-wg2.gov/SREX/

2. A Decade of Weather Extremes (Subscription Required): http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1452.html

3. Yale and George Mason Poll: http://environment.yale.edu/climate/files/Extreme-Weather-Climate-Preparedness.pdf

4. 2011 survey by Krosnick and others: http://woods.stanford.edu/docs/surveys/Global-Warming-Survey-Stanford-Reuters-September-2011.pdf

5. 2010 survey by Krosnick and others: http://woods.stanford.edu/docs/surveys/Global-Warming-Survey-Selected-Results-June2010.pdf