Water, Heat, Drought, and Public Health in the Midwest USA - 2012

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ABSTRACT

The year 2012 was the hottest year on record in the United States and the second worst "extreme" weather year with respect to severe weather. Each of the contiguous 48 states had above-average temperatures, with 19 setting record high temperatures. This paper reviews these conditions and effects they had on the environment and people's health.
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Introduction

The year 2012 was the hottest year on record for the continental United States and the second-worst for "extreme" weather such as hurricanes, droughts or floods according to the U.S. government (reference needed) *(National Oceanic and Atmospheric Administration [NOAA], 2013)*. The year saw a mild winter give way to a balmier-than-normal spring, followed by a sweltering summer and high temperatures that lingered into the fall, all punctuated by extreme drought and intense storms.

The year's average temperature of 55.3 degrees Fahrenheit across the lower U.S. 48 states was more than 3.2 degrees warmer than the average for the 20th century, the National Oceanographic and Atmospheric Administration reported (NOAA, 2012). That topped the previous record, set in 1998, by a full degree.

Each of the contiguous 48 states showed above-average temperatures in 2012, with 19 of them setting annual records of their own, as registered by NOAA (Crouch, Heim, Hughes, & Fenimore, 2013). Meanwhile, the country faced 11 weather disasters that each topped $1 billion in losses, including a lingering drought that covered 61% of the country at one point (NOAA, 2012).

That drought shriveled crops across the American farm belt (Figure 1) leading to an expected rise in food prices in 2013, according to the U.S. Department of Agriculture (USDA) (2013). It also turned forests of the Mountain West into stands of timber that exploded into catastrophic wildfires over the summer, scorching millions of acres and destroying hundreds of homes (Accuweather, 2012).

Figure 1. A field of corn withers under temperatures over 100 degrees Fahrenheit north of Wichita, KS on July 16, 2012. (AP Photo/*The Wichita Eagle*, Mike Hutmacher)**.**

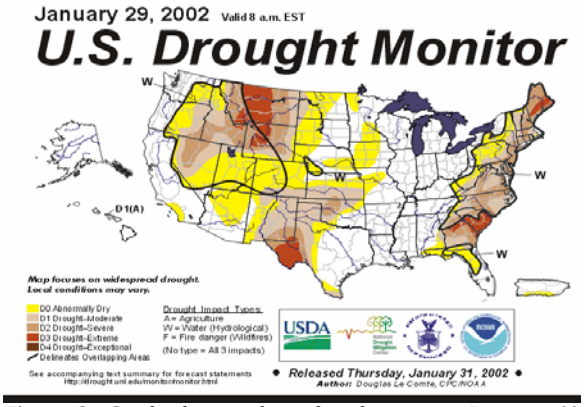

Figure 2. Graph showing how drought was in January 2002. Retrieved February 22, 2013 from http://droughtmonitor.unl.edu/.

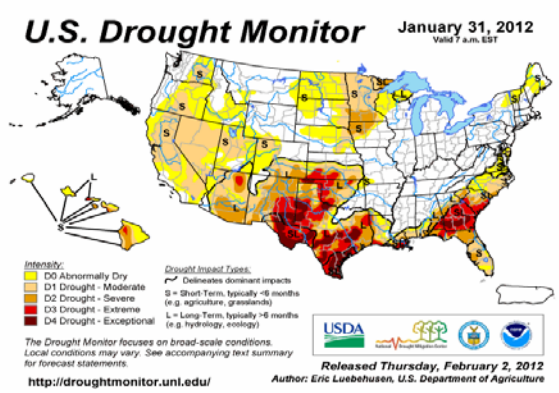

Figure 3. Graph showing how drought was in January 2012. Retrieved February 22, 2013 from http://droughtmonitor.unl.edu/.

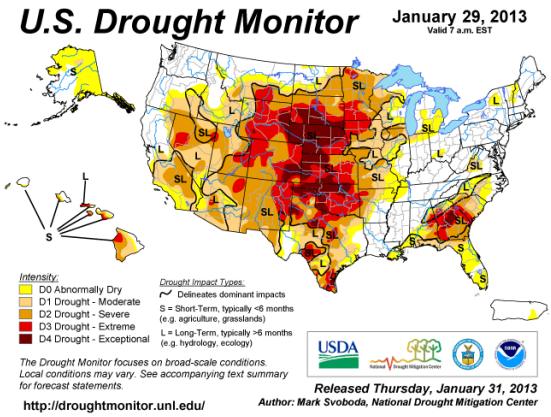

Figure 4. Graph showing how drought was in January 2013 after the drought year of 2012. Retrieved February 22, 2013 from http://droughtmonitor.unl.edu/archive/2013/drmon0129.gif.

Farmers and residents in 40 U.S. states know this all too well, as the 2012 summer's blend of low rainfall and extreme heat created a crisis for many. During a six-week period, the USDA (2013) designated 1,692 counties as disaster areas due to the drought. The USDA (2013) noted about 80% of agricultural land in the country was affected (40 out of 50 states), making the year's drought more far-reaching than any since the 1950s.

The drought also impacted wildlife, leading to the deaths of thousands of fish as lakes and rivers dried up. Water levels in several rivers and lakes dropped dangerously low. Climatologists noted that by the end of August 2012, about 63% of the nation was experiencing drought conditions. Research has shown that unusually warm temperatures can conspire with low precipitation to intensify droughts and worsen their impacts (Brewer & Love-Brotak, 2012; Weiss, Castro, & Overpeck, 2009). Corn and soybean crops had been devastated in places, and livestock farms were suffering. It affected 87% of the land dedicated to growing corn, 63% of the land for hay, and 72% of the land used for cattle (World Agricultural Outlook Board [WAOB], 2012).

The hot, dry weather was also harming parts of the nation's infrastructure. Highways in Texas, nuclear power plants in Illinois, runways and subway rails in Washington, and the concrete, steel and sophisticated engineering that undergird the nation's infrastructure were being taxed to worrisome degrees by heat, drought, and vicious storms (Lowrey & Nixon, 2012).

The NOAA (2012) reported that July 2012 was the hottest month in the lower 48 states since the U.S. began keeping temperature records in 1895. The average temperature in July 2012 was 77.6°F (25.3°C) — 3.3 degrees above the average 20th century temperature (NOAA, 2012). A hot July also contributed to the warmest 12-month period ever recorded in the U.S.

Higher-than-average temperatures occurred with the largest departures from the 20th century average reported across most of the Plains, in the Midwest and along the Eastern Seaboard with Virginia having its warmest July on record, with the average temperature 4° F above the norm.

The year 2012 was being compared for the heat and lack of rain with the 1930s Dust Bowl (Figure 5) in the U.S. During that historic health and environmental crisis, land and lives were devastated from the Midwest to the Atlantic Ocean by repeated, rolling dust clouds.

Figure 5. From the 1930s USA Prairie Lands Dust Bowl. Retrieved February 22, 2012 from http://kaidi-thinctank.blogspot.com/2012/01/dust-bowl-american-prairie-lands-1930s.html).

In the 2012 drought, while crops throughout the nation's farm belt were withering — driving up world food prices and making food less available — parched land and low water levels presented other health hazards. Drought impacted the economy as well.

Figure 6. A farmer sifts through arid topsoil under a ruined crop on the family farm on August 24, 2012 in Logan, KS. (Retrieved February 22, 2013 from http://timesofnews.co/2013/01/09/u-s-2012-was-hottest-year-on-record/).

Figure 7. President Obama inspects a drought-stricken area of Missouri Valley, IA on August 13, 2012. Since mid-June, corn prices rose 60% because of declining crop yields. (Retrieved February 22, 2013 from http://timesofnews.co/2013/01/09/u-s-2012-was-hottest-year-on-record/).

Figure 8. Boats in a dry cove at Morse Reservoir in Noblesville, IN on July 16, 2012. (AP Photo/Michael Conroy).

Figure 9. Boats on a dry, cracked bottom in a cove at Morse Reservoir in Noblesville, IN on July 16, 2012. The reservoir was down nearly 6 feet from normal levels and being lowered 1 foot every 5 days to provide water for Indianapolis. (AP Photo/Michael Conroy).

Figure 10. A farmer chops down his drought and heat stricken corn for feed July 11, 2012 in Nashville, IL. Farmers in parts of the Midwest dealt with the worst drought in nearly 25 years. (AP Photo/Seth Perlman).

Figure 11. A tractor cuts down corn in a field designated as zero-yield on a farm in Vigo County, IN on July 31, 2012. The U.S. Department of Agriculture has declared more than half the counties in the country natural disaster areas as drought sears millions of acres of pasture and cropland. (Retrieved February 22, 2013 from http://timesofnews.co/2013/01/09/u-s-2012-was-hottest-year-on-record/).

Figure 12. A ranch hand walks through a parched corn field on June 27, 2012, in wheat stubble that had not grown much in the dry heat in Menlo, KS. (AP Photo/Courtesy Coby Baalman).

Figure 13. A corn plant struggles to survive in a drought-stricken field in Illinois. The sweeping drought in Midwest this summer killed crops. Photo by Scott Olson/Getty Images, July 2012.

Public Health Implications of Drought

The following information has been adopted in part from the Centers for Disease Control and Prevention (CDC) National Center for Environmental Health document "When every drop counts: Protecting public health during drought conditions - A guide for public health professionals" (2010).

The public health implications of drought include: compromised quantity and quality of drinking water; increased recreational risks; effects on air quality; diminished living conditions related to energy, air quality, and sanitation and hygiene; compromised food and nutrition; and increased incidence of illness and disease.

We will now discuss the major public health impacts which drought can cause and in most cases did cause during 2012 in the USA using the CDC document mentioned above as the framework of our discussion.

Drought and Air Quality

When rainfall is scarce, airborne dust, pollen, and contaminants — such as fluorocarbons and even animal feces from livestock — remain in the air longer. This not only exacerbates allergies and irritates eyes and ears, but it also worsens symptoms in people with chronic respiratory illnesses, such as asthma and chronic obstructive pulmonary disease (COPD). Smoke from drought-induced wildfires further increases problems, including the risk of developing bronchitis and pneumonia. Drought conditions increase the amount of airborne *Coccidioides immitis* fungus, which causes Valley Fever, a potentially fatal respiratory infection. Found mostly in the Southwest and California, the fungus lodges in the lungs after a person breathes in spore-saturated dust (CDC, 2010).

Figure 14. A car kicks up dust as it drives by corn fields on dry dirt road in State Center, IA. (Adopted on 22 February 2013 from http://timesofnews.co/2013/01/09/u-s-2012-was-hottest-year-on-record/)

Drought and Increased Water Temperature

The impacts of warmer water include the following: changes in fish populations and a potential increase in mercury concentrations in fish; harmful algal blooms; reduced dissolved oxygen, which is harmful to aquatic animals and may more readily mobilize persistent pollutants and mercury; incomplete water mixing of lakes, which can have harmful effects on fish populations and the biological activities that maintain the health of water systems; and potential habitat for mosquitoes that may carry harmful diseases such as West Nile virus (CDC, 2010).

Drought and Mosquito-Borne Illness

It may seem like common sense to think this summer's drought means fewer mosquitoes, as they typically breed in wet conditions. But throughout the country, record high temperatures provided ideal conditions for mosquitoes carrying the West Nile virus (CDC, 2010). What water there is in parched areas is generally standing water in low-lying areas or in storm drains, which is exactly where the *Culex pipiens* mosquito that carries the virus likes to breed. Forty-two states have reported human, bird, and mosquito cases of West Nile, and cases have been found as far north as Ontario. The best way to protect yourself against West Nile is to wear insect repellent, and avoid

going outside at dawn and dusk, when mosquitoes are most active (CDC, 2010).

Drought and Hygiene

Water conservation is high priority in drought-stricken areas. However, when people make an effort to save water, hygienic practices like hand-washing and dish-washing suffer, which can increase the spread of germs. Bacteria such as *E. coli* and salmonella, and viruses like the rotavirus and norovirus, lead to negative health consequences like nausea, vomiting, abdominal cramping, diarrhea, and respiratory problems (CDC, 2010).

Decreased hand- and dish-washing increases spread of bacteria and viruses. The CDC reminds people that "conservation efforts should not get in the way of proper sanitation and hygiene." To ensure hands are properly disinfected, those with limited water can supplement washing with an alcohol-based hand sanitizer. The New Mexico Department of Health recommends soaking dishes for five minutes in a bleach-and-water solution to kill foodborne disease-causing bacteria (CDC, 2010).

Drought and Critical Care

Because water is crucial to power generation — from hydroelectric dams to cooling of nuclear- and fossil fuel-powered plants — heat and drought are key concerns for hospitals, senior care facilities, and clinics that require a constant supply of power to keep patients healthy. In addition, hospitals simply use a lot of water — for drinking, sanitation, equipment sterilization, and other essential functions (CDC, 2010).

In July 2012, the Braidwood nuclear plant in Illinois had to seek special permission to keep operating because the water used to cool its reactors had reached 102 degrees, two degrees above the plant's upper allowable limit. Nuclear meltdown is unlikely, but if plants go offline, the lower energy production can lead to problems with air conditioning and smooth running of technological equipment needed to deliver the highest standard of health care (CDC, 2010).

Drought and Wildfires

The summer of 2012 also saw devastating wildfires in Colorado, Nebraska, Oklahoma, and elsewhere which scorched tens of thousands of acres. In addition to personal injury, death, and the destruction of hundreds of homes, smoke from these vast blazes was dangerous not only to asthmatics and others with respiratory problems. Wildfire smoke contains gases such as carbon dioxide and small particles from burnt trees and other plants. The smoke can lead to lung and sinus problems and headaches, as well as chest pain and rapid heartbeat in people with heart disease. Those with congestive heart failure, angina, COPD, and emphysema may also experience shortness of breath and bouts of severe coughing. Smoke irritates the eyes and reduces visibility, creating hazards to drivers and airline pilots (CDC, 2010).

Drought and Injury

Filling swimming pools was banned in several drought-hit areas during the summer of 2012, including Indianapolis. Warm, stagnant water in lakes, ponds, and even rivers can result in increased pollutant levels and lower levels of oxygen, contributing to higher concentrations of illness-causing bacteria and protozoa, as well as toxic blue-green algae blooms. An Oklahoma boy died from a rare disease after being infected by an amoeba at the end of July while swimming in the state's Red River. In Canada, experts worried about the health quality of recreational waters in seasonal "cottage country" (CDC, 2010).

Lower water levels are dangerous in another way: They create an increased risk of head- and spinal-cord injuries from diving into shallow or more shallow water than divers expect. Boating accidents are a problem around sand bars and other debris that in normal conditions are submerged (CDC, 2010).

Drought and Mental Health

Drought can cause stress, anxiety, and depression. The financial impact of drought can be devastating, especially to farmers and other workers who earn their living off the land. What's more, stress and anxiety from drought is different than that from other natural disasters. Drought anxiety builds over time and becomes chronic, making it less noticeable to ourselves and those around us. Drought-driven stress and depression lead to higher rates of suicide in rural communities (CDC, 2010).

Drought and Heat Stress

The NOAA (2012, 2013) announced that July was the hottest month ever on record for the nation. By mid-July, St. Louis authorities had recorded 23 heat-related deaths for the year; and in Maryland the total was 31 deaths through the end of July. The young and the elderly are at greatest risk of heat stress, including heat exhaustion, and heat stroke. Older people are particularly affected because their bodies do not adjust as well to changes in temperature, and they're more likely to take medication that interferes with the body's temperature regulation system. Symptoms of heat

stress include hot, red, dry skin; rapid pulse; dizziness; muscle cramps; nausea; and fainting (CDC, 2010).

Research on Health Impacts on Intense Heat Wave

The California Department of Public Health published a study of the health impacts of an intense, two-week long 2006 heat wave in California (Palmer, 2012). That study was one of the first comprehensive examinations of statewide data concerning heat-related deaths and illnesses. During the record-breaking heat wave:

- more than 600 people died;
- hospital emergency departments had 16,000 more visits than usual; and
- 1,200 extra hospitalizations occurred.

Costs from that heat wave are estimated at $5.3 billion.

Drought and Food and Nutrition

Drought can limit the growing season and create conditions that encourage insect and disease infestation in certain crops. Low crop yields can result in rising food prices and shortages, potentially leading to malnutrition particularly with the poor and unemployed. Drought can also affect the health of livestock raised for food. During drought, livestock can become malnourished, diseased, and die (CDC, 2010).

Epilog

As of 22 November 2012, the worst U.S. drought in decades had deepened again after more than a month of encouraging reports of slowly improving conditions. The report showed that 60.1 percent of the lower 48 states were in some form of drought, up from 58.8% the previous week. The amount of land in extreme or exceptional drought — the two worst classifications — increased from 18.3% to 19.04%. Virtually all of Nebraska was in a deep drought, with more than three-fourths in the worst stage. But Nebraska, along with the Dakotas to the north, could still see things get worse in the near future. On 23 November 2012 the Army Corps of Engineers reduced the flow from a Missouri River reservoir which will lead to worsen low-water conditions on the Mississippi River. This reduction in water flow already caused barges to carry lighter loads (coal and grain mostly). Concern was a pivotal 180-mile stretch of the Mississippi from St. Louis to the confluence with the Ohio River at Cairo, Ill., where heavy two-way traffic includes shipments going south to the Gulf of Mexico, as well as transports from the Illinois and Ohio rivers headed north to Chicago and Minneapolis. There, the Mississippi was 15 to 20 feet below normal due to months of drought, and rock pinnacles at two southern Illinois sites could make it difficult, if not impossible, for barges to pass if the river drops much lower (Suhr, 2012).

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