



CLIMATE CHANGE AND THE HEALTH OF THE UNITED STATES

The Earth is warming from greenhouse gases (GHGs) emitted from burning fossil fuels and felling forests. The Intergovernmental Panel on Climate Change (IPCC), a collaboration among more than 2,500 scientists, predicts that average global temperatures will increase between 1.8 to 8.1°F by the end of this century. This warming, which fosters climate instability, will touch the lives and health of residents of the United States.

HEAT WAVES

The frequency and duration of heat waves are projected to increase with global warming.

- » By the end of this century, Chicago will likely experience 25% more heat waves per year, and Los Angeles up to 400% more annually.

Climate change alters the nature of heat waves, increasing their lethality.

- » GHGs elevate nighttime temperatures, more so than daytime, thus removing nighttime reprieve.
- » Increasing humidity with warmer atmosphere and oceans increases heat indices.
- » From 1979-2003, extreme heat exposure killed more people in the U.S. than hurricanes, tornadoes, floods, lightning and earthquakes combined.

Heat waves disproportionately affect children, the elderly, and those with chronic medical conditions.

- » 738 excess deaths occurred during the 10-day Chicago heat wave in 1995.
- » A recent study of 50 American cities showed that extremely hot days during summer may be especially lethal for those living in northern cities due to accelerated warming at higher latitudes and regional acclimatization.

The urban heat island effect, in which heat is retained by pavement and buildings, further elevates night time temperatures and heatwave mortality.

- » Ground-level ozone, elevated urban CO₂ and black carbon (soot) all amplify the urban heat island effect.
- » Approximately 75% of the United States population lives in urban areas.

AGRICULTURE AND NUTRITION

Crops face growing stresses, including more volatile weather, vanishing pollinators and the proliferation of pests, pathogens and weeds.¹

- » Warming favors the overwintering and extended range of insects.
- » Floods not only destroy crops, but also foster fungi the chief blight of food production.
- » Droughts favor aphids, locusts and whiteflies that consume or infect crops.
- » Agricultural weeds – like ragweed and poison ivy – are strengthened by rising CO₂ levels.
- » More pesticides, insecticides and herbicides will be needed with climate change. Farmers, their families and consumers will face increased financial burdens and amplified exposure to toxic chemicals.

Worldwide, 42% of growing and stored crops are lost annually due to pests, pathogens and weeds (equaling losses of ~\$300 billion/yr).

¹ Rosenzweig, C., Iglesias, A., Yang, X.B., Epstein, P.R., and E. Chivian. *Climate change and extreme weather events: Implications for food production, plant diseases, and pests. Global Change & Human Health 2, 90-104 (2001).*

AIR QUALITY

Burning fossil fuels emits CO₂, releases particulates, and increases ground level ozone (smog).

- » Elevated ozone exposure increases cardiovascular and respiratory mortality.
- » Elevated carbon dioxide boosts ragweed pollen, which diesel particles help deliver deep into the lungs, exacerbating asthma.
- » Climate change has extended the allergy and asthma seasons by 20 days, thus increasing healthcare costs.
- » Moderate warming projections for 50 U.S. cities east of the Mississippi will increase days with ground-level ozone above EPA standards by 68% by mid-century.

Forest fires are projected to be more common and widespread, therefore increasing health risks.

- » Fires emit carcinogens and particulates that worsen respiratory and heart disease.
- » Lands degraded by fire make nearby communities vulnerable to landslides.

A warming climate fosters wildfires by:

- » Extending the summer season, drying forests.
 - » Since 1980, wildfire season in the Western U.S. has increased by 78 days.
 - » Earlier snowmelt contributed to over ½ the fires and ¾ of the area burned.
- » Fostering the spread of insects, such as the spruce bark beetle in the Northwest and woolly adelgid in the Northeast, which provide dead stands for fire.

WATER SCARCITY AND QUALITY

Changing weather patterns, early snowmelt, and warming threaten vital water supplies.

- » Many U.S. aquifers are already overdrawn and underfed.
- » The 3.6°F warming projected for the 2040s would increase water demand in Portland, OR by 5.7 million m³/yr and decrease supply by 4.9 million m³/yr.
- » Modeling of the Ogallala Aquifer projects recharge decreases by 20%.
 - » This would affect drinking water and irrigation in eight states: South Dakota, Nebraska, Wyoming, Colorado, Kansas, Oklahoma, New Mexico and Texas.
- » Spring flows from the Edwards Aquifer in Texas, providing water to 2 million people, are projected to drop or cease.

Decreased groundwater in the Midwest may exacerbate non-compliance with water quality standards. Droughts, followed by heavy precipitation – sequences expected to be more common with climate change – increase phosphorous and sediment loads contaminating groundwater systems.

- » Heavy rainfall events have increased in the continental U.S. from the 1970s to the 1990s; 2"/day rains rose 14%; 4"/day rains rose 20%; and 6"/day events rose 27%.²
- » Heavy rains are associated with water-borne disease outbreaks from microbes such as *E. coli* and *cryptosporidium* in the U.S.

WINTER WEATHER ANOMALIES

- » More winter precipitation is falling as rain, increasing the potential for ice storms.
- » Greater weather variability creates hazardous walking and driving conditions.
- » Ice storms disrupt power grids that support public health and well-being.

Climate change-induced impacts on disease distribution, crop yields, forests, air and water quality can pose serious risks to the United States and to global security.

List of references can be found at: [HTTP://CHGE.MED.HARVARD.EDU](http://CHGE.MED.HARVARD.EDU)

² Groisman, P.Y., and R.W. Knight. Prolonged dry episodes over the conterminous United States: New tendencies emerging during the last 40 Years. BAMS 21,1850–1862 (2008).