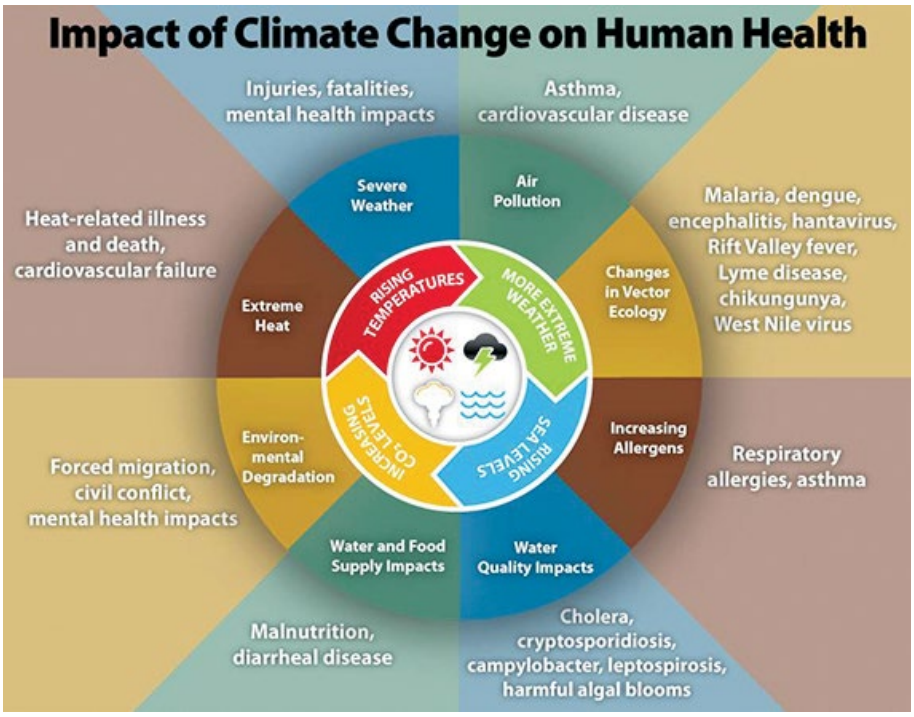
Health, Climate Change and Extreme Weather

Climate change and extreme weather events have health consequences in the United States.[749]

Shifts in temperatures, storms, sea level rise, flooding, droughts, air quality and pollution, insect control and other climate and weather changes can lead to:

- A rise in new insect and other vector-borne disease threats, ranging from Zika to dengue fever; [750,751]
- Increased heat-related deaths and sicknesses, particularly among the elderly and children; [752]
- Aggravating triggers for asthma; [753,754]
- Increased allergens and extended allergy seasons; [755]
- More injuries and difficulties accessing medical care during major storms;[756]
- Water shortages because of droughts and/or water contamination after heavy rainfall;[757]
- Mental health impacts such as depression and post-traumatic stress disorder (PTSD);[758] and
- Malnutrition due to extreme weather affecting agricultural yields and crop production.[759]

Experts estimate that ozone and particle health effects associated with climate change could contribute to 1,000 to 4,300 additional premature deaths nationally per year by 2050.[760,761,762] Climate change is expected to have a growing adverse economic impact. A recent study found between 2002 and 2009, climate change-related factors, such as flooding, vector-borne illnesses, and extreme weather events resulted in about $14.1 billion in health costs, including the value of lives lost prematurely.[763,764]



SOURCE: CDC Climate and Health Program[748]

Health departments have an important role to play in helping communities prepare for the adverse effects of climate change, given their role in building healthy communities. Public health workers are trained to develop communication campaigns that both inform and educate the public about health threats and can use these skills to educate the public about climate change-related disease prevention and preparedness. In addition, public health departments are also on the frontlines when there is an emergency, whether it is a natural disaster or an infectious disease outbreak. These types of emergency preparedness and response skills are essential as extreme weather events and other effects of climate change become more common.

RECOMMENDATIONS

- **Prevent and prepare for the adverse impact of climate change on infectious disease outbreaks, including Zika.** Every state should have a comprehensive climate change adaptation plan that includes a public health assessment and response, including developing sustainable state and local mosquito control programs. Public health and environmental agencies should work together to implement strategies that help track concerns, coordinate risk management and communications and prioritize key public health capabilities needed to address environmental health concerns. Climate change needs assessments should include an examination of what additional capacities are needed and identify vulnerable populations and communities.

- **Build resilience to climate-related health effects at the federal, state and local level.** Climate change preparedness should be a required element of Public Health Emergency Preparedness (PHEP) and Hospital Preparedness Program plans and grants. Funding should be significantly increased to expand CDC's Climate Ready States and Cities Initiative nationwide and to build capacity at the federal, state and local level to understand the impact of climate change and apply this to long-range health planning.

- **Increase funding for prevention and preparedness measures that promote health equity and help protect vulnerable populations from adverse climate effects.** Initiatives addressing the underlying causes of climate change can simultaneously provide important health equity benefits to vulnerable populations. Projects aimed at reducing greenhouse gas emissions through city planning initiatives promoting active transportation options, for example, can play an important role in reducing existing health inequities by increasing resilience, physical activity levels and social cohesion in communities most at-risk.[765] Urban planning policies can also help vulnerable populations adapt to the predicted impacts of climate change. Policies ensuring buildings are constructed to resist extreme weather events, for example, could help mitigate the negative impacts for vulnerable populations located in areas heavily impacted by hurricanes or heavy rain.[766]

- **Restore funding for the CDC's Climate and Health Program at the National Center for Environmental Health.** The program was created in 2009 to translate climate change science to inform states and communities, create tools to build state and local capacity to handle extreme events happening today and in the future and lead efforts to mitigate the public health impacts of climate change and extreme weather. For each additional $1 million in funds, CDC would be able to fund approximately three additional states or cities under their Climate Ready States and Cities Initiative.[767] A larger, long-term investment will be critical to building nationwide resilience.

- **Implement the Clean Air Act (CAA) in an effective and timely manner.** The CAA protects American health against dangerous levels of air pollutants, and investments to comply with the CAA have provided $4 to $8 of economic benefits for every $1 spent on compliance.[768] Four major rules of the CAA alone would yield more than $82 billion in Medicare, Medicaid and other healthcare savings for America through 2021.[769]

- **Develop sustainable state and local mosquito and other vector control programs.** A review by ASTHO found that many states and local communities are challenged to develop and maintain vector control programs, especially in tight budgetary times and when emergency situations have quieted, but that these programs are a vital public health strategy to help control vector-borne diseases.[770]

- **Increase funding for the National Environmental Public Health Tracking Program at the National Center for Environmental Health at the CDC.** Health tracking is important to identify the link between environmental factors and their impact on health. The program should be expanded and fully funded to cover every state.

- **Improve coordination and move to integration across medical care, public health and environmental agencies.** Public health agencies at all levels must work with environmental, homeland security and other agencies to undertake initiatives to reduce known health threats from extreme weather, food, water and air and educate the public about ways to avoid potential risks.

Investing in a Robust Environmental Health System

PARTNERS:

Background and Need for Action

Environmental Health is the branch of public health that focuses on the interrelationships between people and their environment, promotes human health and well-being, and fosters healthy and safe communities. As a fundamental component of a comprehensive public health system, environmental health works to advance policies and programs to reduce chemical and other environmental exposures in air, water, soil and food to protect residents and provide communities with healthier environments.

Environmental health protects the public by tracking environmental exposures in communities across the United States and potential links with disease outcomes. To achieve a healthy community, homes should be safe, affordable, and healthy places for families to gather. Workplaces, schools, and child care centers should be free of exposures that negatively impact the health of workers or children. Nutritious, affordable foods should be safe for all community members. Access to safe and affordable multimodal transportation options, including biking and public transit, improves the environment and drives down obesity and other chronic illnesses. Outdoor and indoor air quality in all communities should be healthy and safe to breathe for everyone. Children and adults alike should have access to safe and clean public spaces such as parks. When a disaster strikes, a community needs to be prepared and should have the tools and resources to be resilient against physical (infrastructure and human) and emotional damage. All these activities require the participation of federal, state, local, and tribal governments.

Building a Robust Environmental Health System

Investing in essential governmental environmental health services through dedicated resources will create an effective environmental health system that proactively protects communities and helps everyone attain good health. Federal, state, local, and tribal governments should adopt standard approaches to ensuring environmental health equity, protections and access for all, particularly vulnerable and at-risk populations.

The federal government can help build an effective and strong environmental health system by:

- Creating an integrated infrastructure to collect and track crucial information.
- Developing a well-trained and highly skilled workforce.
- Providing ample and sustainable funding from diverse sources.
- Ensuring that policy and programs are grounded in existing and up-to-date evidence-based research.
- Encouraging/incentivizing cross-sectoral partnerships to support consideration of health impacts.
- Assuring environmental health services are equitably accessible.

A cohesive environmental health system monitors and measures diseases, hazards, exposures, and health outcomes; can collect data over time; and can present real-time data to quickly respond to emergencies and to identify problems for program planning. All government agencies should assess the environmental health impacts of their programs and policies across all sectors to improve health of all communities and people.

Top 10 Focus Areas

Safe Drinking Water
Clean Air
Vector Control
Food Safety
Chemical Safety
Healthy Community Design
Healthy Housing
Climate Effects
Emergency Preparedness
Environmental Equity

Recommendations

Governmental environmental health services are not a luxury; they are essential to providing basic needs to the public such as safe drinking water, clean air, lead poisoning prevention, climate change adaptation, and more. Everyone should have the opportunity to achieve the highest possible level of health at all stages of life, which encompasses physical, mental, and social well-being and extends beyond the absence of disease. As such, the following recommendations support the uncomplicated right to environmental health:

PREVENTION: Enable federal, state, local, and tribal governments to promote resilient, equitable, and healthy communities for all Americans, especially those who are most vulnerable and most at risk.

RESPONSE: Build and support the governmental environmental health system, including workforce needs as well as tracking disease outcomes and environmental exposures.

REAL-LIFE SOLUTIONS: Strengthen environmental health protections and support peer-reviewed research to inform environmental health decision making and practice.

Case Examples that Demonstrate the Need for a Strong and Equitable System

Environmental health professionals work every day to ensure that the air we breathe, the water we drink, and the food we eat are safe and secure. No one would want a person without a medical degree performing surgery, nor should anyone want the safety of their food or water being determined by a person who is not a highly skilled professional. Offering collaboration early on, enhancing their capabilities to detect and respond to threats, grounding policy and actions in evidence-based research, and ensuring that their services reach everyone are critical tenets of a system that can create resilient communities after a disaster.

Recent major emergencies demonstrate the need for a strong governmental nationwide environmental health system. The Zika virus outbreak, Flint water crisis, and Hurricane Katrina are three examples with stark environmental health implications. These emergencies will not be the last, so we must prepare by investing in a robust environmental health system.

Zika Virus Outbreak

Mosquito-borne diseases have and continue to threaten the public's health with such illnesses as Encephalitis, West Nile Virus Disease, Dengue, Chikungunya, and now Zika Virus Disease. Zika infection - passed from an infected pregnant woman to her fetus and capable of causing devastating birth defects - also can have significant economic consequences on affected communities. There is no vaccine to prevent Zika. The best way to prevent disease-carrying mosquitoes is through community-based mosquito control and public education programs. **Environmental health actions are mobilized through Integrated Mosquito Management Programs that provide mosquito monitoring and surveillance, remove places where mosquitos lay eggs, and carefully apply pesticides to significantly reduce mosquito populations while protecting water systems and minimizing undue human and animal exposure.** These actions, coupled with public education and promoting healthy housing, will undoubtedly result in reduced illness and suffering.

Flint Water Crisis

Due to recent, highly visible events, the safety of, and trust in our nation's drinking water systems have been called into question. The drinking water crisis associated with lead contamination in Flint, MI, sheds a national spotlight on an issue that is occurring across the country. In Flint, due to a change in the source of the city's drinking water without taking the necessary corrosion control steps, the safety of approximately 100,000 people's drinking water was threatened. This resulted in the leaching of lead from the plumbing causing an increase in the blood lead levels in children consuming the water. This was a preventable situation. **Strong policy with sufficient oversight and accountability supported by a skilled and resourced environmental health system is essential to monitor drinking water systems.** The presence of chemical and microbial contaminants must be detected, source waters must be protected, regulations must be enforced, and surveillance systems must be in place that monitor and link water quality to human health data for rapid detection of potential public health problems.

Hurricane Katrina & Super Storm Sandy

Unforgettably, Hurricane Katrina flooded the city of New Orleans in 2005, damaging more than 100,000 homes and Super Storm Sandy hit New York, New Jersey and other neighboring states in 2012, also causing devastating damage to homes and businesses, power supply systems, and other critical infrastructures such as roads. Storms like these have both acute and longer term environmental health impacts capable of causing physical, emotional, and economic harm. Understandably, the victims' focus was on mere survival and not necessarily whether the water coming from their kitchen sink was safe to drink, whether residual mold growth in their home would impact the health of their children, or whether the reconstruction of their home would cause harmful exposures to lead or other building materials or contaminants. **A strong environmental health system provides the necessary safeguards to measure, track, and respond to such concerns and mitigate the adverse health consequences.**

This document was made possible through cooperative agreement 1U38OT000131 between the Centers for Disease Control and Prevention and the American Public Health Association. The contents of this document are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention.

Endnotes

749 U.S. Global Change Research Program. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, Washington, DC, 2016. http://dx.doi.org/10.7930/J0R49NQX (accessed September 2016).

750 Centers for Disease Control and Prevention. Climate Effects on Health. Atlanta, GA: Centers for Disease Control and Prevention, 2014. Available at http://www.cdc.gov/climateandhealth/effects/default.htm

751 U.S. Global Change Research Program. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, Washington, DC, 2016. http://dx.doi.org/10.7930/J0R49NQX (accessed September 2016).

752 U.S. Global Change Research Program. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, Washington, DC, 2016. http://dx.doi.org/10.7930/J0R49NQX (accessed September 2016). Rey, G., E. Jougla, A. Fouillet, G. Pavillon, P. Bessemoulin, P. Frayssinet, J. Clavel, and D. Hémon, 2007: The impact of major heat waves on all-cause and cause-specific mortality in France from 1971 to 2003. *International Archives of Occupational and Environmental Health,* 80, 615-626, doi:10.1007/s00420-007-0173-4.

753 Centers for Disease Control and Prevention. Climate Effects on Health. Atlanta, GA: Centers for Disease Control and Prevention, 2014. Available at http://www.cdc.gov/climateandhealth/effects/default.htm

754 U.S. Global Change Research Program. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, Washington, DC, 2016. http://dx.doi.org/10.7930/J0R49NQX (accessed September 2016).

755 Ibid.

756 Ibid.

757 Ibid.

758 U.S. Global Change Research Program. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, Washington, DC, 2016. http://dx.doi.org/10.7930/J0R49NQX (accessed September 2016). United States Environmental Protection Agency. Climate Impacts on Human Health. 2013

759 Brown ME, Antle JM, Backlund P et al. *Climate Change, Global Food Security, and the U.S. Food System.* U.S. Department of Agriculture, 2015. http://www.usda.gov/oce/climate_change/FoodSecurity2015Assessment/FullAssessment.pdf (accessed September 2016). Wheeling Jesuit University / Center for Educational Technologies. Climate Change and Health Effects. http://ete.cet.edu/gcc/?/humanhealth_effects

760 Tagaris, E., K. J. Liao, A. J. DeLucia, L. Deck, P. Amar, and A. G. Russell, 2009: Potential impact of climate change on air pollutionrelated human health effects. *Environmental Science & Technology,* 43, 4979-4988, doi:10.1021/es803650w.

761 Liao, K. J., E. Tagaris, K. Manomaiphiboon, C. Wang, J. H. Woo, P. Amar, S. He, and A. Russell, 2009: Quantification of the impact of climate uncertainty on regional air quality. *Atmospheric Chemistry and Physics,* 9, 865-878, doi:10.5194/acp-9-865-2009.

762 Jacobson, M. Z. On the causal link between carbon dioxide and air pollution mortality. *Geophysical Research Letters,*35, L03809, 2008, doi:10.1029/2007GL031101.

763 National Resources Defense Council. *Health and Climate Change: Accounting for Costs.* Washington, DC: National Resource Defense Council, 2011.

764 Knowlton K, Rotkin-Ellman M, Geballe L, et al. Six climate change–related events in the United States accounted for about $14 billion in lost lives and health costs. *Health Affairs,* 30(11):2167-76, 2011. National Resources Defense Council. *Health and Climate Change: Accounting for Costs.* Washington, DC: National Resource Defense Council, 2011.

765 Melillo JM, Richmond TC, Yohe GW, eds. *Climate Change Impacts in the United States: Third National Climate Assessment.* Washington, DC: US Global Change Research Program; 2014.

766 Bambrick, H. J., A. G. Capon, G. B. Barnett, R. M. Beaty, and A. J. Burton, 2011: Climate change and health in the urban environment: Adaptation opportunities in Australian cities. *Asia-Pacific Journal of Public Health,* 23, 67S-79S, doi:10.1177/1010539510391774

767 Building Resilience Against Climate Effects (BRACE). In *Federal Grants.* http://www.federalgrants.com/Building-Resilience-Against-Climate-Effects-BRACE-41116.html (accessed September 2016).

768 Heintz J, Garrett-Peltier H and Zipperer B. New Jobs – Cleaner Air: Employment Effects Under Planned Changes to the EPA's Air Pollution Rules. Ceres, 2011. http://www.ceres.org/resources/reports/new-jobs-cleaner-air (accessed September 2016).

769 Trust for America's Health and the Environmental Defense Fund. *Saving Lives and Reducing Health Care Costs: How Clean Air Act Rules Benefit The Nation.* 2011.

770 Association of State and Territorial Health Officials. *Public Health Confronts the Mosquito – Developing Sustainable State and Local Mosquito Control Programs.* Association of State and Territorial Health Officials: Washington, DC, 2005. http://www.astho.org/programs/environmental-health/natural-environment/confrontsmosquito/ (accessed September 2016).