

Ready for Change

Preparing Public Health Agencies for the Impacts of Climate Change

A Climate Masters Guide
for the Public Health Sector

May 2010



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The Climate Leadership Initiative (CLI) is a social-science based global climate change research, education, and technical assistance consortium between The Resource Innovation Group, a 501(c)3 nonprofit, and the Institute for a Sustainable Environment at the University of Oregon. CLI is available to support your efforts with additional resources, case studies, trainings, and discussions. Please visit our public health webpage at <http://climlead.uoregon.edu>.

The Oregon Coalition of Local Health Officials (CLHO) represents the interests of local public health authorities and health officers in decision-making, accountability and leadership of Oregon's public health system. They consult with the Oregon Department of Human Services, Public Health Division on annual planning, funding and program decision making, minimum standards for personnel employed in local health departments, development and implementation of public health laws, and encourage accomplishments of public health standards across Oregon counties. CLHO strives to have representation from across the state and public health sector.

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Preparedness Manual and Program Training Goal

This project is a component of the Climate Master and Climate Preparedness programs of the Climate Leadership Initiative, a social-science based global climate change research, education, and technical assistance consortium between The Resource Innovation Group, a 501(c)3 nonprofit, and the Institute for a Sustainable Environment at the University of Oregon. The project seeks to identify effective methods of helping public and community health agencies reduce their greenhouse gas emissions and prepare for the impacts of global climate change. This manual and the training program are tailored specifically for the public health sector, including county public health departments and community based health organizations.

Contact Stacy Vynne, Oregon Preparedness Program Manager, with questions about the program at (541) 346-0467 or svynne@uoregon.edu or visit the Climate Leadership Initiative website at <http://climlead.uoregon.edu>.

EXECUTIVE SUMMARY

Global climate change poses a significant and emerging threat to public health.¹ Drought, heat waves, flooding, storm damage and disease are all exacerbated by climate change. Across the globe, hundreds of thousands of deaths annually have been directly linked to the changing climate. It is also indirectly affecting the health of a comparable number of people each year. With programs that reach across a variety of sectors and populations, the public health community can play a pivotal role in preparing communities to cope with the serious and urgent health consequences of climate change. For instance, increased instances of heat illness, spread of vector- and water-borne disease, and heightened mental health stresses. Public health agencies can also set an example for their community by actively reducing the greenhouse gas emissions generated by their facilities and operations that contribute to changes in the global climate.

In 2008, the University of Oregon's Climate Leadership Initiative and the Oregon Coalition of Local Health Officials surveyed Oregon public health departments on their knowledge of climate change, the impacts on public health, actions being taken to prepare for these impacts, and resource needs to take action. Many respondents expressed an interest in taking action to prepare their departments and communities for climate change, but felt they did not have the knowledge, tools, financial or staffing capacity, or organizational commitment to do so.

This manual is a response to those concerns. It provides guidance on how to prioritize and implement the operational changes that allow public agencies to prepare their employees and communities for climate change. Additionally, it provides guidance about how to demonstrate and communicate a commitment to reducing risks and building resilience. The following climate preparedness categories are discussed:

- ❑ Extreme heat
- ❑ Disease patterns
- ❑ Water
- ❑ Food
- ❑ Air quality
- ❑ Mental health

Many public health departments are stretched for human and financial resources. This handbook identifies actions that can be implemented immediately and at low cost, as well as those that may need long-term planning and budget allocations. Each health topic is examined to describe how it will be affected by climate change and the populations most vulnerable to the health risks. Recommendations are provided to prepare employees as well as communities for these changes. Methods are included for estimating needed capacity to implement the recommended action and the costs associated with such actions. The operations of many health departments are shaped by program and budgeting decisions made at the state level. When facilities are shared with other agencies, operations are also shaped by the interests of other building tenants. This document

¹ The World Health Organization. Climate and health. <http://www.who.int/mediacentre/factsheets/fs266/en/index.html> (accessed November 2009)

therefore identifies actions that can occur internally as well as steps that can be taken for influencing decision-makers at the higher level. Because effective framing and communication with co-workers and constituents is key to incorporating the actions described in this handbook, advice on how to talk about these issues internally and externally is also included. The concluding section provides a number of resources for the public health sector on climate change.

While this manual does not specifically identify policies to be implemented, public health professionals should be prominent stakeholders in climate preparedness planning at the local, state, and federal level to ensure that policies effectively integrate public health priorities. The Climate Leadership Initiative will continue to work with the public health sector to provide guidance and support for implementation of new policies on public health and climate change.

INTRODUCTION TO CLIMATE CHANGE & PUBLIC HEALTH

Climate change is a significant and emerging threat to public health.² Across the globe, hundreds of thousands of deaths annually have been directly linked to a changing climate, while these same occurrences have compromised the health of others.³ Drought, heat waves, flooding, and disease are some of the greatest health threats exacerbated by climate change. Public health agencies and organizations have an opportunity to play a direct role in helping communities prepare for climate impacts.

In 2007, the Intergovernmental Panel on Climate Change (IPCC)⁴ declared that the evidence is now “unequivocal” that the earth’s atmosphere and oceans are warming beyond natural variability.⁵ The IPCC concluded that human activities, including emissions of carbon dioxide, methane and other greenhouse gases, along with land clearing and development, are responsible for most of the earth’s warming. Left unchecked, rising global temperatures and the resulting changes in climatic patterns will affect ecological health and undermine economic and social prosperity as well as security locally and abroad.

Globally, many communities are already beginning to experience the public health impacts of climate change and these impacts are likely to increase in the near future.⁶ St. Louis and Hess (2008) reported that:

2 The World Health Organization. Climate and health. <http://www.who.int/mediacentre/factsheets/fs266/en/index.html> (accessed November 2009)

3 WHO. <http://www.washingtonpost.com/wp-dyn/content/article/2005/11/16/AR2005111602197.html>

4 The IPCC is a scientific intergovernmental body set up by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), consisting of member governments and hundreds of top scientists from around the world.

5 Intergovernmental Panel on Climate Change. 2007: Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge and New York.

6 WHO. 2005. Climate and Health: Fact Sheet. Available at: <http://www.who.int/globalchange/news/fsclimandhealth/en/index.html>

[Changes in climate] contribute to a wide array of health effects, including the direct effects of temperature and climatologic instability, such as heat waves, drought, and increased frequency and severity of extreme precipitation events. Secondary or “systems effects” are also included, such as those from positive or negative impacts on agriculture, clean water access, shifting geographic distributions of infectious diseases, migration, increased competition for scarce resources, and the potential for armed conflict...the health effects of climate change are increasingly manifest and may have a devastating effect on global health in the next several decades (527).⁷

In the United States, climate change is already having an adverse effect on public health, such as increases in heat-related illness and respiratory disease. These effects are expected to grow over the coming decades unless explicit efforts are made to prepare for and reduce the risks. In the future, extreme temperatures, increased ground ozone levels, droughts, floods, wildfire and severe weather events coupled with an aging population, changes in migration, and other socioeconomic factors will cause direct and indirect threats to health across the country.⁸ The 2009 report by the US Global Climate Research Program identified the following key threats to public health in the US:⁹

- Increases in the risk of illness and death related to extreme heat and heat waves are very likely.
- Warming is likely to make it more challenging to meet air quality standards necessary to protect public health.
- Extreme weather events cause physical and mental health problems. Events such as flooding and windstorms are projected to increase.
- Some diseases transmitted by food, water, and insects are likely to increase.
- Rising temperature and carbon dioxide concentration increase pollen production and prolong the pollen season in a number of plants with highly allergenic pollen, presenting a health risk to individuals with allergies and respiratory conditions.
- Certain groups, including children, the elderly, and the poor, are most vulnerable to the health impacts posed by climate change.

Even if worldwide emissions of carbon dioxide are rapidly reduced, temperatures are likely to rise in Oregon for the next 50 years.¹⁰ This increase will cause severe impacts on natural systems as well as direct and indirect impacts on public health such as increased instances of vector-borne disease, higher rates of asthma and other respiratory diseases, greater spread of communicable disease, reduced water quality, and increased heat stroke and mortality. Locally, these impacts will be expensive. An economic analysis produced by the University of Oregon's Climate Leadership

7 St. Louis, M.E., and J.J. Hess. 2008. "Climate Change Impacts on and Implications for Global Health." *American Journal of Preventative Medicine*, 35(5): 527-538.

8 Climate Change Science Program. 2008. *Analyses of the effects of global change on human health and welfare and human systems. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research*. [Gamble, J.L. (ed.), K.L. Ebi, F.G. Sussman, T.J. Wilbanks, (Authors)]. U.S. Environmental Protection Agency, Washington, DC, USA.

9 USGCRP 2009

10 (CIG 2007),

Initiative (CLI) and EcoNorthwest in 2009 found that lack of action to reduce greenhouse gas emissions is likely to result in additional public health costs in Oregon of \$900 million by 2020 and over \$1 billion by 2040 (these costs are already beginning to accrue).¹¹

While action is needed to reduce greenhouse gas emissions that are causing climate change, the public health sector must simultaneously begin to prepare their employees and communities for the inevitable impacts, making the most of their limited funding and staff. Despite the eminent need for preparation, the importance of preparing the public health sector for climate change is only beginning to emerge. In a study by the nonprofit Trust for America's Health, only five states (California, Washington, New Hampshire, Maryland and Virginia) have climate action plans that address public health.¹² Further, national studies have shown a concern of public health impacts from climate change, but lack the knowledge of how to address these issues.

A survey of Oregon's county public health departments by the Oregon Coalition of Local Health Officials (CLHO) and The Climate Leadership Initiative concluded similar findings: an awareness and concern for public health impacts associated with climate change, but a lack of knowledge, capacity or financial resources to pursue action. Respondents reported a general understanding of potential impacts from climate change in the region where they worked, but lack an understanding of specific actions they could take to prepare for these impacts. Additionally, the majority of respondents did not prioritize climate change health preparedness due to financial and staffing constraints.

Increasing public health employee's knowledge of climate change preparation can lead to prioritization and implementation of internal policy changes. By understanding the steps that can be taken with various levels of capacity and financial resources, as well as those that can be consolidated with existing initiatives, public health departments may be better equipped to take immediate action as well as start preparing for future extreme events.

This manual is a response to the needs identified by respondents of CLI's survey (referenced above) and provides guidance on prioritizing and implementing direct climate change preparedness action for public health agencies in Oregon and other states to carry out under different levels of capacity.

Recommended Uses and Users

To help address the need for climate preparedness among public health agencies, this manual provides a variety of tools and resources that can be implemented with different levels of capacity and different levels of financial commitment (e.g. incorporation of preparedness strategies into existing programs with no or limited additional expenses to new initiatives that must be budgeted for and require the appointment of new staff). Through proactive initiatives, this manual intends to provide opportunities for cost savings by reducing future risks or impacts that may have been more severe had action not been taken.

¹¹ Climate Leadership Initiative and EcoNorthwest. 2009. An Overview of Potential Economic Costs to Oregon of a Business-As-Usual Approach to Climate Change. <http://climlead.uoregon.edu/publications/climate-economics>

¹² Trust for America's Health, "Health Problems Heat Up: Climate Change and the Public's Health." Issue Report. October 2009

While this manual is directed towards state and county health departments as well as community based health organizations, the majority of the materials and resources can also be useful for any health practice or facility. With specific actions and resources identified in each chapter, this manual can be used as a stand-alone guide for climate preparedness. However, it is most effectively used to accompany in-person and online training workshops. Interaction with other agencies and organizations through the trainings increase an organization's opportunity to share lessons-learned, develop more innovative action plans for climate preparedness, and build an understanding of detailed information and strategies to address each of the topic areas accounting for the needs, capacity and financial resources of the agency.

Though this document uses specific case studies and research from Oregon and the Pacific Northwest, it is applicable to public health departments across the country.

The Need To Prepare for the Health Impacts of Climate Change

The public health sector plays a pivotal role in protecting communities from the health impacts of climate change. While, the role of the public health sector in climate change preparedness has not yet been clearly defined at the global, national or regional level, climate preparedness strategies complement health and nutritional goals, emergency response, and prevention of communicable diseases. Many preparedness strategies can also lower energy costs and air pollution, and reduce the likelihood for future expenses as a result of responding to extreme events.



In addition, public health agencies work across a variety of fields and populations such as housing, community planning, food quality and quantity, air and water quality, occupational hazards, low income, homeless, elderly, youth, and infirmed populations. By taking actions now in all of the areas where they currently work to prepare for the health impacts associated with climate change, the public health sector can help reduce the risks and costs of the likely health impacts of climate change.

Given the complexity and scope of projected climate impacts, cross-sector collaboration can ensure that preparedness activities are beneficial to (and not adversely affecting) other sectors. Public health workers, administrations, and departments can benefit from adopting climate change preparedness as a strategic goal and communicate strategies with other networks.¹³ The Climate Leadership Initiative (2008) has developed an integrated health preparedness planning framework, which looks across the systems that are most vulnerable to climate change in the Pacific Northwest (i.e. natural, human, built, cultural, and economic). The framework outlines key principles to assist different sectors in their preparation for climate change. The following are three general integrative preparedness principles to consider:

- I. Adopt a whole systems approach, looking at interactions between sectors (e.g. how changes in natural systems will impact human health)**

¹³ Climate Leadership Initiative and Oregon Coalition of Local Health Officials. "Preparedness in Oregon: An Assessment of Awareness, Preparation and Resource Needs for Potential Public Health Risks Associated with Climate Change." April 2009

2. Understand the limits and unintended consequences of human intervention.
3. Adopt an adaptive management strategy to address the need for flexibility in the face of future uncertainty.¹⁴

By communicating with, and providing education to, the public and local decision makers about the need for climate preparedness planning, public health departments can help communities understand the connections between climate and health. Health departments can also collaborate with research institutions, other agencies, and nonprofit organizations to better understand likely health impacts by modeling climate change projections and identify potential impacts to public health and vulnerable populations such as young children, the elderly, low-income communities, and people with disabilities or chronic medical conditions.

Prioritizing Climate Change Preparedness

While not specifically identified, climate change preparedness complements the Essential Public Health Services that provide the framework of the National Public Health Performance Standards Program.

- ❑ Monitor health status to identify and solve community health problems.
- ❑ Diagnose and investigate health problems and health hazards in the community.
- ❑ Inform, educate, and empower people about health issues.
- ❑ Mobilize community partnerships and action to identify and solve health problems.
- ❑ Develop policies and plans that support individual and community health efforts.
- ❑ Enforce laws and regulations that protect health and ensure safety.
- ❑ Link people to needed personal health services and assure the provision of health care when otherwise unavailable.
- ❑ Assure a competent public and personal health care workforce.
- ❑ Evaluate effectiveness, accessibility, and quality of personal and population-based health services.
- ❑ Research for new insights and innovative solutions to health problems.

Health departments have an opportunity to prepare for the health risks of climate change that are already adversely impacting human health around the world and will continue to pose a long-term challenge for public health departments and community health organizations. The past success of public health efforts to work on multi-decade timescales (e.g. polio, tobacco, etc.) provides a model for tackling climate change threats. As such, climate change health threats must be prioritized to ensure they are addressed given the already stretched capacity of resources of health departments to manage imminent emergencies. It is important to keep in mind that investing in climate change preparedness today will prevent increased costs in the future.¹⁵

¹⁴ Climate Leadership Initiative, University of Oregon. "Preparing the Pacific Northwest for Climate Change: A Framework for Integrative Preparation Planning for Natural, Human, Built and Economic Systems" 2008

¹⁵ Climate Leadership Initiative and Oregon Coalition of Local Health Officials. "Preparedness in Oregon: An Assessment of Awareness, Preparation and Resource Needs for Potential Public Health Risks Associated with Climate Change." April 2009

UNDERSTANDING LOCAL IMPACTS

The University of Washington's Climate Impacts Group (CIG) projects that climate change impacts in the Pacific Northwest will include changes in temperature, more extreme weather events, and variance in precipitation and snowpack.¹⁶ These changes will significantly impact ecosystems and biodiversity in the Northwest, which in turn will have considerable implications for all aspects of society, including human health.

CIG's projections of regional trends have been affirmed by assessments of the consequence of climate change in the Rogue, Klamath and Willamette Basins of Oregon done by the Climate Leadership Initiative (CLI) and partners, including the Oregon Climate Change Research Institute (OCCRI). The local studies found that these regions are already experiencing higher temperatures



and that climate change is likely to reduce snowpack, cause earlier spring runoff, increase wildfire, and dramatically alter vegetation patterns. Based on input by experts, resulting impacts include: increased instances of vector-borne disease from insects such as mosquitoes, due to more breeding grounds from flooding and warming; higher rates of asthma and other respiratory diseases from increased ground ozone, higher allergens, and smoke from wildfires; exemplified rates of communicable disease spread; and heightened heat stroke and mortality.¹⁷

Assessing Vulnerability & Capacity

Climate change is increasing the strength, frequency, and unpredictability of extreme weather events for which health professionals historically managed. By taking proactive steps, public health agencies and community health organizations can prepare for these changes and the associated health implications of climate change, especially among vulnerable populations who are at a higher risk of death, injury, disability and disease. Public health professionals can build public awareness about climate change in an effort to calm fears and educate citizens on how to stay healthy before, during, and after disaster events.

Consider your agency's existing activities and assess how current efforts could respond more directly to the specific challenges of climate change. What impacts are more likely to affect your community (e.g. heat waves, floods, and wildfires)? The Pacific Northwest, for example, is likely to experience increased insect outbreaks and declining springtime snowpack that could strain water supplies. The Southeast, on the other hand, will see more frequent heat-related illnesses and increased hurricane intensity. The U.S. Global Change Research Program provides region-specific information on climate impacts at www.globalchange.gov. Understanding the predicted local consequences of climate change will build the foundation for a strong preparedness strategy.

¹⁶ IPCC & CIG, 2006; Mote, 2008

¹⁷ PSR, 2002; WHO, 2008; CLI & NCCSP 2008

The following are threats to consider when developing a climate preparedness plan (addressed in further detail in the “Guidance on Specific Threats” section of this guide):

- ❑ **EXTREME HEAT** – heat waves and heat-related illnesses
- ❑ **DISEASE PATTERNS** – communicable and vector-borne diseases
- ❑ **WATER** – clean water access and water-borne diseases following floods and drought
- ❑ **FOOD** – agricultural impacts on food security, poisonings from seafood toxicity
- ❑ **AIR QUALITY** – allergies and respiratory diseases from pollution and wildfires
- ❑ **MENTAL HEALTH** – psychiatric risks in response to climate change impacts

Conducting a Vulnerability Study

An assessment of your agency’s emergency management and health response plans, and any related disaster response programs in your region (e.g. a county hazards mitigation plan) are important steps toward effective preparedness planning. A vulnerability assessment will provide a better understanding of where to focus your agency’s initiatives and education programs in response to these projected threats. The World Health Organization has developed a method to assess human health vulnerability and public health adaptation to climate change, which includes the following steps for conducting a vulnerability study:

- ❑ **Determine the scope of the assessment.**
Decide on the timeframe and region of focus.
- ❑ **Describe the current distribution and burden of climate-sensitive diseases.**
Consider the current incidence and prevalence, plus geographic distribution of vector-borne disease.
- ❑ **Identify and describe past and current strategies, policies and measures that reduce the burden of climate-sensitive diseases.**
Investigate the historic responses to similar threats and identify the strengths or weaknesses of these plans. Draw from successful adaptation plans currently being implemented in anticipation of climate change impacts.
- ❑ **Review the health implications of the potential impact of climate variability and change on other sectors.**
Look across scientific and non-health sectors.
- ❑ **Estimate the future potential health impacts using scenarios of future climate change, population growth and other factors.**
Look to climate scenarios that include health projections and describe uncertainty in the scenarios and projected impacts.

- ❑ **Synthesize the results and draft an assessment report.**
Use the results from the previous steps to identify links between sectors, vulnerable populations and key stakeholders.
- ❑ **Identify additional adaptation policies and measures to reduce potential negative health effects, including procedures for evaluation after implementation.**
Set priorities by evaluating strengths and weaknesses.

Source: WHO, "Methods of assessing human health vulnerability and public health adaptation to climate change" (2003)

A detailed vulnerability assessment tool is being developed by a number of public health organizations across the **country** through a Centers for Disease Control and Prevention program and will be available online with guidelines for moving through the suggested action steps: please see the public health resources page at <http://climlead.uoregon.edu> for more information.

Conducting a Capacity Assessment

There are a number of guidelines available to help public health departments assess capacity for implementing preparedness activities. For a comprehensive assessment, see the tools listed below. Capacity assessments generally involve an outside reviewer working with a number of staff to conduct thorough interviews to better understand everything from organizational structure to funding opportunities.

In general, addressing the following questions can provide a preliminary understanding of capacity for implementing climate change preparedness strategies. You can conduct an internal survey (online through a tool such as surveymonkey.com or paper-based), conduct interviews, or hold focus group sessions.

1. What is the staff's knowledge, training, or education on projected global and local climate change health impacts and appropriate preparedness measures?
2. What opportunities exist to improve employee proficiency on the issue?
3. Has the department engaged in strategic planning exercises that included climate change related contingencies?
4. What has been the department's historical response and ability to manage emergencies in the past?
5. Do current departmental goals and operational plans include climate change preparedness?
6. Are there long-term strategies and initiatives in place that are linked to preparing for the health impacts of climate change?
7. Is climate change preparedness reflected in the budget and long-range financial plans?
8. What are the funding opportunities and challenges of integrating climate preparedness into daily operations?
9. Does the department build and maintain collaborative relationships with other government agencies, nonprofits or businesses that can aid in climate preparedness?
10. Is the department perceived within the community as an expert on climate related health impacts?

Completing the vulnerability and capacity study will require dedicated staff, with an estimated time commitment of 40 hours to complete, depending on their knowledge of the department, access to resources on local impacts of climate change, and understanding of the connections between climate change and public health.

RESOURCES

Capacity Assessment Tools are available at:

http://www.caseygrants.org/pages/resources/resources_downloadassessment.asp

Simple Capacity Assessment Tool

<http://www.gdrc.org/ngo/bl-scat.htm>

Assessing Emergency Response and Public Health Preparedness

Brand, M. et. al. 2006. A Model for Assessing Public Health Emergency Preparedness Competencies and Evaluating Training Based on the Local Preparedness Plan. Journal of Homeland Security and Emergency Management. Vol 3, Issue 2.

<http://www.bepress.com/jhsem/vol3/iss2/3/>

McKinsey Effective Capacity Building in Nonprofit Organizations

<http://www.vpppartners.org/learning/reports/capacity/capacity.html>

Community Clinics Initiative Organizational Capacity Tool

<http://www.communityclinics.org/content/article/detail/531>

Overview on Public Health Concerns Related to Climate Change

Scientists predict that climate change will have a significant impact on the Earth's natural systems, which will in turn affect resources and infrastructure. These changes include a range of public health concerns like water-borne diseases and respiratory illness. This section explores six major threats to public health as they relate to climate change and provides guidance on implementing climate change preparedness actions for each of the following issues: extreme heat, disease patterns, water, food, air quality, and mental health.

EXTREME HEAT

One expected consequence of climate change is increased temperature variance, which includes the potential for more frequent heat waves and longer periods of hot weather. When combined with low precipitation levels, higher than average temperatures can result in drought conditions. Extreme heat is a direct threat to public health as high temperatures can cause serious heat-related illnesses and even death, especially among vulnerable populations such as the elderly and individuals who perform strenuous work outdoors.

DISEASE PATTERNS

The transmission of vector-borne disease is affected by changes in climate patterns like average temperature and precipitation rates. Global changes in travel, migration, and land use are expected to amplify these effects. Climate change is shifting the distribution of disease-causing microbes due to ecosystem changes and population migration. Communicable diseases spread quickly, especially in dense urban areas that are becoming more populated.

WATER

Climate change can impact both the availability and quality of drinking water resources. As average temperatures rise, precipitation patterns are more likely to shift, causing droughts and floods to occur more often and with increased severity. More frequent storm events combined with rising sea levels could heighten the incidence of flooding emergencies, especially in coastal communities. Conversely, a decrease in steady rainfall and earlier snowmelt in some regions can strain water supplies and significantly raise an area's vulnerability to wildfires.

FOOD

Higher temperatures and extreme weather events can negatively impact food yields and food security. The availability and nutritional value of food crops are vulnerable to climate impacts like droughts and uncommonly heavy rainfall. Crops and livestock can be harmed by the emergence of weeds, pests, and diseases that thrive in changing temperatures and precipitation patterns. Additionally, new diseases can be introduced through increased food importation, which could negatively impact domestic production.

AIR QUALITY

Respiratory and cardiovascular disease are likely to increase as a result of greenhouse gas concentrations and the air pollutant by-products of fossil fuel combustion. Climate change is also affecting the production of pollen producing plants, which can raise the risk of allergic asthma (asthma symptoms triggered by an allergic reaction). Changes in temperature, air movement, and precipitation patterns can reduce outdoor air quality by affecting the abundance and dispersion of pollutants that contribute to air pollution-related morbidity and mortality.

MENTAL HEALTH

Extreme weather events like hurricanes and floods that have clear devastating physical impacts to infrastructure also contribute to mental health issues for the affected community. Populations that struggle economically or suffer from pre-existing mental health conditions are more likely to experience psychological trauma following a climate related disaster. These events are often combined with displaced social networks and an interruption in regular psychiatric care, which may compound the problem. Even individuals who are not directly impacted by storm events may experience depression, emotional distress, and anxiety following an extreme weather event.

Climate change preparedness can benefit public health by protecting communities from the effects of climate-related impacts like diminished air quality, heat waves, or vector-borne disease outbreaks. Public health professionals should be prominent stakeholders in climate preparedness planning at the local, state, and federal level to ensure that policies effectively integrate public health priorities. While some preparedness strategies may require an investment of resources that requires formal policy authorization or implementation, other actions can easily be put into practice internally by a department.

Using this Manual

The climate preparedness strategies presented in each of the sections require different levels of capacity and financial resources. To support prioritization of actions for departments or organizations that might have limited means for carrying out preparedness strategies, we have provided symbols to indicate the estimated amount of human and financial resources needed.

\$ - \$ \$ \$ \$

Indicates estimated cost for implementation

👤 - 👤 👤 👤 👤

Indicates capacity (staff time) needed for implementation

⊖

Limited or no cost or capacity necessary

***Please note that some actions may have upfront costs, but the payback period is often less than a few years.**

GUIDANCE ON SPECIFIC THREATS

EXTREME HEAT

Extrême heat is marked by weather conditions that are significantly hotter and/or more humid than average in a given location during a given time of year. For the Pacific Northwest, a “heat wave” is an extreme weather event characterized by several consecutive days of temperatures of 90° F or higher, unusually warm minimum nighttime temperatures (in the upper 60s and lower 70s °F in the Pacific Northwest), and high atmospheric pressure that traps stagnant masses of warm, hazy air close to the ground. The World Meteorological Organization’s definition is when the daily maximum temperature of more than five consecutive days exceeds the average maximum temperature by 9° F, the normal period being 1961–1990.¹⁸ You can check with the National Weather Service Forecast Office in your area to find your local definition.¹⁹ Exposure to excessive heat is a serious public health problem and is the leading cause of weather-related fatalities.²⁰

How Will Climate Change Affect Extreme Heat Events?

The connection between climate change and more frequent and intense heat events is well established by the scientific community.²¹ According to the IPCC, higher mean temperatures and increased temperature variance are likely outcomes of climate change. This means higher average temperatures overall are expected, as well as an increase in the likelihood of record-setting temperatures and longer periods of hot weather. Northern cities in the U.S. that are unaccustomed to high temperatures will face additional challenges to prepare residents and equip buildings for increasingly frequent record-breaking days each year. Coupled with prolonged dry weather conditions, extreme heat may also result in dust storms and drought (see the Drought Section for more information on the health impacts of these conditions).



What Are The Potential Public Health Risks Of Extreme Heat?

Extrême heat accounts for more weather-related deaths in the U.S. than floods, hurricanes, earthquakes and tornadoes combined. At our current rate of carbon emissions, extreme heat-related deaths in the U.S. are projected to climb from 700 to between 3,000 and 5,000 annually by the year 2050.²²

Extreme heat is notable among climate change-related public health risks because it threatens human health directly, rather than indirectly. Permanent disability and even death can occur when high temperatures - combined with other environmental risk factors such as urban air pollution - cause dehydration and/or make it difficult for the body to properly cool itself. In order of increasing severity, the most common heat-related illnesses are listed in Table 1.

18 Frich, A.; L.V. Alexander; P. Della-Marta; B. Gleason; M. Haylock; A.M.G. Klein Tank; and T. Peterson (January 2002). “Observed coherent changes in climatic extremes during the second half of the twentieth century”. *Climate Research* 19: 193–212. doi:10.3354/cr019193. <http://cccma.seos.uvic.ca/ETCCDMI/docs/Frichetal02.pdf>.

19 US Environmental Protection Agency (USEPA). *Excessive Heat Events Guidebook*. US Environmental Protection Agency 2006.

20 Luber, George, MA, PhD, Michael McGeehin, PhD, MSPH “Climate Change and Extreme Heat Events” *Am Journal of Prev Med*. 2008;35(5)

21 Ibid.

22 “Climate Change and Public Health: Heat Waves”. Centers for Disease Control and Prevention (CDC). US Department of Health and Human Services. 29 July 2009. <http://www.cdc.gov/climatechange/effects/heat.htm>.

Table 1: Common Heat-Related Illness

Heat rash: A skin irritation, usually a cluster of small blisters, caused from excessive sweating.

Sunburn: The well-known symptoms of red, painful, and abnormally warm skin after sun exposure. In severe cases sunburn may cause swelling of the skin, blisters, fever, and headaches.

Heat cramps: Painful spasms, usually in the muscles of the legs and abdomen, caused by a depletion of the body's salt and moisture from heavy sweating.

Heat exhaustion: Excessive sweating, fast and weak pulse rate, fast and shallow breathing, and cold, pale and clammy skin.

Heat stroke: A rapid rise in body temperature (to 106°F and higher) and a failure of the sweating mechanism. Heat stroke is a severe medical emergency that can be fatal if not treated immediately.²³

IDEAS IN ACTION



On July 13th, 1995, the average temperatures in Chicago reached a 48 year high, with a heat index of 118° F and temperatures failing to fall below 84° F at night. The heat wave continued for six days with massive power outages and resulted in 525 heat-related fatalities, 208 deaths from health problems further complicated by heat exposure, and thousands of people hospitalized with heat-related symptoms. Following this tragedy, the city implemented an Extreme Weather Operations Plan to reduce the impact of future heat waves on human health. The plan instituted a National Weather Service public warning system that in turn mobilizes city service departments in the event of a “heat watch” to alert the public and monitor vulnerable populations at senior facilities and hospital emergency rooms. The Extreme Weather Operations Plan was put to the test soon after implementation, and more than 1,000 people were transported to Chicago’s cooling centers on the day of a National Weather Service’s “excessive heat warning.”

Thornbrugh, Casey. “Are America’s Cities Ready for the Hot Times Ahead?” University of New Mexico, SOARS® 2001

Who Is At Greatest Risk Of Suffering A Heat-Related Illness?

Heat-related illnesses are not limited to one segment of the population; anyone can suffer from the effects of overheating and dehydration. However, some people are at greater risk than others due to age, occupation or medical conditions, and may require special attention and monitoring. The elderly are at a high risk of heat-related mortality as they are more likely to live alone and/or have pre-existing health conditions that exacerbate heat-related illnesses. Young children and infants are dependent upon others to keep them hydrated and to regulate their environmental conditions. People who are obese or overweight tend to retain more body heat. People who perform strenuous work or exercise outdoors, as well as the homeless, run a heightened risk of dehydration and overexposure to heat. Additionally people who suffer from mental illness or chronic medical conditions, or who are taking certain medications (such as those for poor circulation or high blood pressure) have a higher risk for heat-related illness.

²³ “Extreme Heat: A Prevention Guide to Promote Your Personal Health and Safety” Centers for Disease Control and Prevention. 2009.

Steps to educate and prepare employees and the public on the risks of extreme heat
Heat-related illness can be dangerous, but it is also preventable.

This section highlights steps that health officials can take to minimize the risk of heat stress among employees and the public. Ideas include:

- ❑ Encourage employees to schedule any outdoor work activities or exercise during cooler parts of the day, especially during summer months. ☹
- ❑ Make cool liquids available in your office, avoiding beverages that can exacerbate the effects of dehydration (such as those containing caffeine, high amounts of sugar, or alcohol). \$
- ❑ Monitor employees, especially those who have higher risk of heat-related illness. † \$
- ❑ Inform employees of steps they can take to avoid heat-related illness, such as drinking plenty of fluids, wearing light and loose fitting clothing, and avoiding spicy foods. ☹
- ❑ Train employees to recognize and treat the signs of heat-related illness in themselves and others.²⁴ †

The following are suggested elements a public health agency might incorporate into a comprehensive heat-wave response plan. These steps can be used to educate and prepare your local community for extreme heat events:²⁵

- ❑ Assess existing heat-health action plans to identify effective education and response strategies and opportunities for improvement. †
Suggested principles for developing a heat-wave response plan include:
 - Identify a lead agency and participating organizations
 - Use standardized warning systems
 - Educate and communicate with the public
 - Implement response strategies that target high-risk populations
 - Collect and evaluate information and revise plans when needed²⁶
- ❑ Issue timely public warnings of extreme heat events and disseminate real-time information of impacts to city service departments. \$ †
- ❑ Raise public awareness of the dangers of extreme heat and ways to minimize the risk of heat-related illnesses (such as those listed in Table 1), especially at the start of summer. \$ †
- ❑ Ensure ability of health care and social service sectors to deliver services during heat waves, especially among facilities like senior centers that serve high-risk populations. \$ †
- ❑ Support greenhouse gas emissions reduction efforts, such as tree planting activities or painting roofs white in sunny climates. ☹
- ❑ Establish a cooling center with accessible transportation, especially for vulnerable populations, such as elderly, disabled and homebound individuals.²⁷ \$\$ (or ☹ if a center just needs to be appointed- e.g. the library, fairgrounds, etc.)

24 NIOSH 2009; CDC 2009

25 Analitis, Antonis et al. "Improving public health responses to extreme weather/heat-wave" EuroHEAT." World Health Organization Europe. 2009. www.euro.who.int/Document/E92474.pdf

26 Bernard, Susan M and Michael A McGeehim. "Municipal Heat Wave Response Plans," American Journal of Public Health 94, no 9. 2004

27 Analitis, Antonis et al. "Improving public health responses to extreme weather/heat-wave" EuroHEAT." World Health Organization Europe. 2009. www.euro.who.int/Document/E92474.pdf

-\$\$\$\$ Indicates estimated cost for implementation

† - † † † † Indicates capacity (staff time) needed for implementation

⊖ Limited or no cost or capacity necessary

RESOURCES

“Are You Ready for a Heat Wave?”

A preparedness tip sheet from the American Red Cross, FEMA, NOAA

<http://www.redcross.org/www-files/Documents/pdf/Preparedness/AreYouReady/AreYouReadyforaHeatwave.pdf>

“Learning about Urban Heat Islands” An overview from the Heat Island Group. <http://eetd.lbl.gov/HeatIsland/LEARN/>

“Extreme Heat: A Prevention Guide to Promote Your Personal Health and Safety”

CDC Extreme Heat web page. http://www.bt.cdc.gov/disasters/extremeheat/heat_guide.asp

“Extreme Heat” A Federal Emergency Management Agency (FEMA) fact sheet.

<http://www.tallyredcross.org/library/FS-ExtremeHeat.pdf>

DISEASE PATTERNS IN FLUX

As climate patterns shift, changes in the distribution and incidence of communicable disease transmission are highly likely.²⁸ Climatic factors like temperature and precipitation coinciding with shifts in trade, travel, land use, and demographics are likely to affect the occurrence of vector-borne disease in the United States and around the world.²⁹

Communicable diseases can spread quickly, especially in densely populated areas where people live and work in close physical proximity with one another. Urban areas are already experiencing population growth and may continue to expand if Americans (or climate refugees from other countries) relocate to avoid the harmful effects of climate change such as heat waves, sea level rise, fires, and floods. As extreme weather events become more common in the United States, northern cities in particular are preparing for an influx of “climate refugees.” This could impact local public health departments and their ability to respond to climate impacts as certain regions become more populated.³⁰

How Climate Change Affects Communicable Disease

Climate change is predicted to be most acute in far northern regions (i.e. away from the Equator); therefore, the shifts in distribution and incidence of communicable diseases may be more drastic in regions such as the northern United States and Canada, which are areas where

28 World Health Organization (WHO). Climate change and human health - risks and responses: Summary. 2003. ISBN 9241590815.

29 Gage, Kenneth et al., “Climate and Vectorborne Diseases,” American Journal of Preventive Medicine 35, no. 5 (11, 2008): 436-450.

30 Robert McClure, “State not ready for ‘climate refugees,’” Seattle P-I online, http://www.seattlepi.com/local/399958_climate13.html.

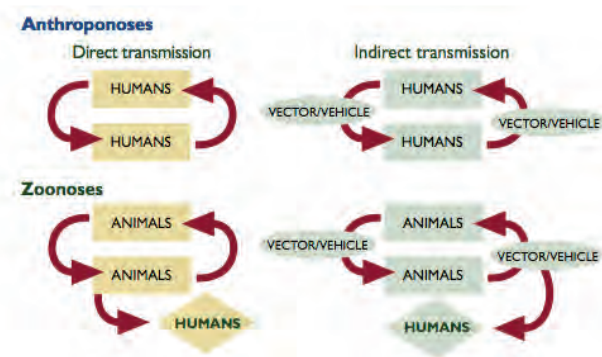
people are likely to relocate.³¹ Historically, periods of rapid urbanization have resulted in increased incidences of infectious disease through a combination of poverty, indoor crowding, and decreased environmental quality. Should climate change lead to rapid urbanization through human migrations, there is the potential to increase the mobility of infectious disease and even give rise to new diseases.³²



Diseases transmitted by mosquitoes, ticks, and other vectors are also projected to increase with warmer temperatures, and increased access to “still” water from flooding events. West Nile Virus, Dengue Fever, Lyme disease, and Malaria may become more apparent in certain parts of the United States.

Communicable diseases are subdivided into three categories based on the source of infection:

1. **“zoonoses”**- diseases transmissible from animals to people (e.g. either directly transmitted like rabies or through indirect, vector-borne transmission like Lyme disease)



Source: WHO 2003

2. **“saproponoses”**- diseases transmissible from abiotic environment such as water, soil, and decaying material to humans (e.g. botulism and tetanus)

3. **“anthroponoses”** - diseases transmissible from human to human (e.g. either directly transmitted like measles and tuberculosis or through vector-borne transmission, such as malaria and dengue fever)³³

Which Populations Are Most Vulnerable?

Directly transmitted anthroponoses include a number of diseases (e.g. influenza) that affect different populations differently. In general, however, these diseases pose the greatest risk to young children, the elderly, and to people with compromised immune systems. Some diseases are specific to a certain region or climate; for example, influenza is generally known as a “high latitude” disease. As climate change causes the distribution of disease-causing microbes to shift through ecosystem changes and human migration, entire populations may find themselves exposed to diseases for which they have developed no immunity.³⁴ People in low-income areas or crowded housing may be most at risk.

31 Greer, Amy, Victoria Ng and David Fisman. “Climate change and infectious diseases in North America: the road ahead.” Canadian Medical Association Journal. Mar 2008; 178: 715 - 722.

32 Committee on Climate, Ecosystems, Infectious Disease, and Human Health (CCEIDHH). Under the Weather: Climate, Ecosystems, and Infectious Disease. 2001. National Research Council, Washington, DC.

McMichael, Anthony J. “The urban environment and health in a world of increasing globalization: issues for developing countries.” Bulletin of the World Health Organization. 2000. Volume 98, issue 9. Pp. 1117-1126.

33 Hubálek, Zdenek. “Emerging Human Infectious Diseases: Anthroponoses, Zoonoses, and Saproponoses”. Emerging Infectious Diseases [serial online]. March 2003. Centers for Disease Control and Prevention. 20 August 2009. <http://www.cdc.gov/ncidod/EID/vol9no3/02-0208.htm>

34 CCEIDHH 2001

Influenza and climate change

Influenza (or “the flu”) is a highly contagious respiratory infection that can cause pneumonia and even death in vulnerable groups such as children, the elderly and the immunocompromised. The flu virus, which is spread from person to person through airborne saliva (from coughing and sneezing), has been responsible for at least three pandemics over the last century and infects millions of people worldwide each year.

Influenza, like other respiratory illnesses, exhibits seasonal increases during colder months (which are commonly called “cold and flu season”). Although the relationship between seasonality and increased incidence of cold and flu is poorly understood, two possible explanations are, 1) cold temperatures causing strained immune systems, and 2) more time spent in tight indoor quarters. Increased indoor crowding, whether due to unusually cold or unusually warm temperatures associated with climate change, could lead to increased incidence of cold, flu, and other directly transmitted illnesses. On the other hand, if cold weather itself is responsible for seasonal illnesses, a warmer climate has the potential to reduce the incidence of some these illnesses in some areas.

H1N1 (“swine flu”) is a new influenza virus that was first detected in the United States in April 2009. H1N1 is spread most commonly through coughing and sneezing and became widespread in 46 states in early fall 2009. Flu-related hospitalization and deaths are above the expected averages for regular flu seasons and there is some concern that these types of new viruses may become more common and spread faster with a changing climate. [Flu.gov](http://www.flu.gov) provides information on vaccination, prevention and treatment.

Steps To Reduce Risk Among Employees

Below are tips that public health agencies can share with employees in order to decrease the risk of spreading infectious among the staff. Precautions include:

- ❑ Washing hands frequently, especially before meals, after using the restroom, or after coming into contact with bodily fluids. ☉
- ❑ Covering a cough or sneeze to reduce risk of exposing others. ☉
- ❑ Staying home if illness is suspected and consulting a physician if symptoms do not improve. ☉
- ❑ Routinely disinfecting workspaces, restrooms, and eating areas. \$ †
- ❑ Vaccinating (both the employee and his/her family) as recommended by a doctor. \$
- ❑ Avoiding overuse of antibiotics and only using them as prescribed by a doctor (over-prescription of antibiotics may lead to new or resistant strains of bacteria or viruses). ☉
- ❑ Wear mosquito repellent and check for ticks when visiting areas that have experienced outbreaks. ☉

See www.cdc.gov/ounceofprevention for educational posters in English and Spanish.³⁵

35 Centers for Disease Control and Prevention (CDC). “The ‘An Ounce of Prevention’ Campaign.” 24 April 2008. Department of Health and Human Services. 25 August 2009. <http://www.cdc.gov/ounceofprevention/>.

Additionally, there are steps public health agencies can take to plan for and ensure continued operation during an infectious disease outbreak:

- ❑ Identifying the skill sets and key employees needed to remain in operation during a crisis, and creating redundancies in those areas. 🧑
- ❑ Creating agency-wide policies regarding absences, payroll and healthcare during an infectious disease outbreak, including a system for contacting employees outside of business hours. 🧑
- ❑ Developing relationships with the medical community and the public to collect and monitor infectious disease data in real time. ⓪
- ❑ Educating employees about infectious disease prevention and providing incentives to follow risk-reduction protocols (e.g. free or low-cost vaccination clinics).³⁶ \$

\$-\$\$\$\$ Indicates estimated cost for implementation

🧑 - 🧑 🧑 🧑 🧑 Indicates capacity (staff time) needed for implementation

⓪ Limited or no cost or capacity necessary

Steps To Reduce Public Risk

In addition to educating the public about the risk reduction steps outlined above, public health agencies may wish to foster a deeper understanding of the relationship between climate change and infectious disease in the following ways:

- ❑ Consider current research and models to predict patterns of disease transmission 🧑 🧑
 - Statistical-empirical models, first-principle mechanistic models, and integrated assessment models can help to improve our understanding of the relationship between climate and disease.
- ❑ Encourage interdisciplinary collaboration ⓪
 - Climate/disease linkages are affected by a wide range of human and natural systems, and will require the expertise and collaboration of practitioners and researchers from a variety of disciplines.
- ❑ When communicating with the public (through online or print materials), highlight the relationship between climate change and communicable disease. ⓪
 - The relationship between climate and disease is poorly understood, and a deeper understanding of the linkages will help public health officials prepare for future changes.³⁷

³⁶ Loukides, Cary et al. AON White Paper: Infectious Disease in the Workplace, "People at Risk" AON Risk Services. September 2008.

³⁷ Committee on Climate, Ecosystems, Infectious Disease, and Human Health (CCEIDHH). Under the Weather: Climate, Ecosystems, and Infectious Disease. 2001. National Research Council, Washington, DC.

The impact of climate change on disease transmission will require locally appropriate strategic response planning to prepare public health employees for shifting vector-borne disease outbreak patterns. The effects of climate change that lead to disease incidence stretch across a broad range of sectors—from water management to transportation systems—and require cooperation across agencies. Public health agencies can use current models and research to educate the public on risks and ways to prepare.

WATER

Water plays a fundamental role in protecting our environment and maintaining a healthy quality of life. As precipitation patterns shift (e.g. more snow falling as rain and more rain falling in a shorter amount of time) and average temperatures rise, droughts and floods are likely to occur more frequently and with greater intensity. The variations in rainfall due to climate change can impact water availability and quality, increasing the risk of water-borne disease. Both an excess (i.e. floods) and scarcity (i.e. droughts) of water can compromise the safety of drinking water supplies and threaten human health.³⁸

Under these changing conditions, seafood toxicity is becoming more common due to increasing surface water temperature in the ocean and agricultural pollutant runoff in rivers (to manage changes in pests and climatic conditions). This poses a greater risk to humans mercury poisoning from the consumption of these toxic fish and shellfish. Consuming contaminated fish can lead to neurological damage, respiratory irritation, skin irritation and gastrointestinal illness.³⁹

The Climate Leadership Initiative and Oregon Coalition of Local Health Officials conducted a survey of public health workers in county health departments around Oregon and found that the majority of respondents indicated that their health departments have some form of regulatory responsibility over drinking water quality. Considering the impact of public health in their county, respondents ranked drought as one of the most serious regional threats posed by climate change, followed by the increased frequency and severity of water-borne illnesses.

How Climate Change Affects Water Resources

STORMS AND FLOODING

Scientists predict that storm impacts from events like hurricanes and tropical storms will continue to grow in severity. At the same time, sea levels are rising from melting glaciers, making coastal and low-lying area residents especially vulnerable to floods. While coastal counties in the United States constitute only 17% of land area, they account for 53% of the population and it is estimated that

38 World Health Organization "Climate Change is Affecting our Health: Something should be done now" 2009 http://www.who.int/globalchange/publications/factsheets/climate_change_health_brochure/en/index.html

39 Physicians for Social Responsibility. "The Medical and Public Health Impacts of Global Warming" <http://www.psr.org/assets/pdfs/global-warming-fact-sheet.pdf>

close to 75% of Americans will live in coastal counties by 2025 as a result of population migration to these areas. Coastal cities offer employment and recreation opportunities, and are also a retirement destination for the large “baby boomer” generation.⁴⁰ This growth in coastal population is concurrent with increased storm severity and sea-level rise, which could intensify the number of people impacted by water-related emergencies.⁴¹



Climate change is disrupting marine ecosystems (through, for instance, ocean acidification) and contributing to rising sea levels that affect coastal areas, estuaries, and coastal freshwater resources. These changes are significantly impacting biodiversity, which in turn has serious implications for human health. Coastal flooding can result in disastrous human, environmental, and economic costs that include drowning and injuries, salt infiltration of fresh water tables, and infrastructure damage.⁴² Increased coastal and inland flooding will also lead to displacement of people and communities, resulting in increased stress to mental health - see Mental Health Section for more information.

Storm water runoff carrying pollutants like pesticides and fertilizer, erosion, and sewage overflows from heavy precipitation episodes, can contaminate water supplies and lead to water-borne disease outbreaks. Following Hurricane Katrina, public health officials reported respiratory and diarrheal disease common among rescue workers. Additionally, a primary health threat associated with the severe flooding was the exposure to molds in flood-damaged structures and toxic residue from flooded chemical factories and oil refineries between Baton Rouge and New Orleans.⁴³

There are more than 210 million reported cases (900,000 hospitalizations and 6,000 deaths) of water- and food-borne pathogens in the United States each year.⁴⁴ Disease outbreaks occur from water that is contaminated by bacteria (e.g. Salmonella, Shigella), viruses (e.g. rotavirus) and protozoa (e.g. Giardia lamblia, amoebas, Cryptosporidium, and Cyclospora). Water-borne disease replication, survival, persistence, and transmission are subject to environmental influences. As temperatures rise and precipitation patterns shift, pathogens are able to expand into different geographic areas.⁴⁵

WATER SCARCITY

In 2008 residents of the western and southeastern United States experienced the third worst fire season and period of persistent drought.⁴⁶ Given that climate change is melting glaciers, changing snowpack, and shifting the timing of snowmelt in many mountain regions, droughts and fire seasons

40 National Oceanic and Atmospheric Administration (NOAA). 2004. Population Trends Along the Coastal United States: 1980–2008.

41 Collini, Kimberly and the Coastal States Organization Coastal Resilience Steering Committee “Coastal Community Resilience: An evaluation of resilience as a potential performance measure of the Coastal Management Act” 2008 http://www.coastalstates.org/uploads/PDFs/final_resilience%20white%20paper_25july08.pdf

42 Frumkin et al. “Climate Change: The Public Health Response” Framing Health Matters, American Journal of Public Health March 2008, Vol 98, No. 3

43 Physicians for Social Responsibility. “The Medical and Public Health Impacts of Global Warming” <http://www.psr.org/assets/pdfs/global-warming-fact-sheet.pdf>

44 Centers for Disease Control and Prevention, Environmental Health, Water- and Food-borne Diseases <http://www.cdc.gov/climatechange/effects/waterborne.htm>

45 Trust for America’s Health “Health Problems Heat up: Climate Change and the Public’s Health” 2009 <http://healthyamericans.org/reports/environment/>

46 United Nations Environment Programme. “Climate Change Science Compendium” 2009 http://www.unep.org/pdf/ccScienceCompendium2009/cc_ScienceCompendium2009_full_en.pdf

such as those experienced in 2008 may become more common. These shifting conditions can have a serious impact on the populations that depend on freshwater runoff for their water supply. The western United States in particular could face perpetually strained water supplies and heightened wild fire vulnerability from depleted snowpack and declining precipitation.⁴⁷

While some regions are experiencing increased precipitation, other areas will see a decline in annual rainfall, often combined with short periods of deluge rather than steady rain. During periods of drought, water quality becomes a significant concern as water supplies decline, stagnant waters become breeding ground for insects, and concentrations of waste and pollutants increase.⁴⁸ In addition, drought years may lead to reduced irrigation allocations, potentially resulting in less local crop availability or reduced nutritional value of foods.

Who Is At Greatest Risk?

Coastal populations and people who reside in floodplains are most vulnerable to potential injury and water-borne disease from sea level rise, earlier snow melt and flashier stream events, or extreme weather events. Individuals with compromised immune systems have a higher risk of contracting a water-borne disease. Additionally, children are particularly vulnerable to water-borne diseases like rotavirus as they drink more water relative to their body mass than adults and have less developed immune systems.⁴⁹

Preparing Employees And Communities For Extreme Weather Events And Ensuring Safe And Healthy Water

Extreme weather events, such as heavy rainfall and flooding, can have serious impacts on deteriorating water, wastewater, and storm water infrastructure systems. Additionally, shifting population centers due to climate change may put new stresses on existing water infrastructure.⁵⁰ Public health professionals can encourage local governments and utilities to update aging infrastructure and consider climate change during infrastructure planning and design in order to avoid the risks of system failures and subsequent public health threats from service interruptions and sewer backups.

Trust for America's Health recommends the following strategies for climate change preparedness for flooding and drought conditions:

- Develop scientific and technical guidance and decision support tools for development of early warning systems and emergency response plans, including appropriate individual behavior. \$ ♀
- Implement early warning systems and response plans in anticipation of events. \$ ♀
- Conduct education and outreach on emergency preparedness. \$ ♀ ♀
- Ensure that emergency preparedness plans include medical services. ⊕
- Improve programs to monitor the air, water, and soil for hazardous exposures. \$-\$\$\$
♀ - ♀ ♀ ♀

47 Frumkin et al. "Climate Change: The Public Health Response" Framing Health Matters, American Journal of Public Health March '08, Vol 98, No. 3
48 Physicians for Social Responsibility. "The Medical and Public Health Impacts of Global Warming" <http://www.psr.org/assets/pdfs/global-warming-fact-sheet.pdf>

49 TFAH 2009

50 American Water Works Association Research Foundation. "Climate Change and Drinking Water" Drinking Water Research, Special Issue, Vol 18, No 2, 2008 <http://www.waterresearchfoundation.org/newsAndEvents/pressRoom/DWRvol18no2.pdf>

- ❑ Improve surveillance programs to collect, analyze, and disseminate data on the health consequences of flooding and droughts. \$-\$\$\$ ♣ - ♣ ♣ ♣
- ❑ Monitor and evaluate the effectiveness of systems. \$ \$ ♣ ♣
- ❑ Improve surveillance and control programs for the detection of disease outbreaks \$-\$\$ ♣ - ♣ ♣
- ❑ Develop methods to ensure watershed protection and safe water and food handling \$-\$\$\$ ♣ - ♣ ♣ ♣
- ❑ Sponsor research and development on rapid diagnostic tools for food- and water-borne pathogens \$-\$\$ ♣ - ♣ ♣
- ❑ Sponsor research on treatment options \$-\$\$ ♣ - ♣ ♣
- ❑ Develop and disseminate information on signs and symptoms of disease to guide individuals on when to seek treatment. \$ ♣


\$-\$\$\$ Indicates estimated cost for implementation

♣ - ♣ ♣ ♣ ♣ Indicates capacity (staff time) needed for implementation

⊙ Limited or no cost or capacity necessary

Health departments can prepare for increased flooding in low-lying and coastal regions that are most susceptible to extreme weather events like hurricanes and tropical storms. Preparedness for water-related emergencies includes developing evacuation plans and augmenting current water-borne disease monitoring.⁵¹ Early warning systems can be strengthened by including vector-borne, water-borne and climate data, possibly through partnerships with the departments of environmental quality and water resources. The Centers for Disease Control and Prevention recommends that long-term disease surveillance that includes weather and climate data is needed to identify historical relationships between storms and disease outbreaks in order to project future impacts of climate change.⁵² In areas susceptible to such events, partnerships should be formed (if not already in existence) with emergency preparedness and response services. Planning for and managing the health impacts of climate change on water resources can benefit from regional data and the local expertise of public health officials and health care providers.⁵³

IDEAS IN ACTION



The Washington State Department of Public Health Office of Drinking Water has joined the Climate Ready Water Utilities Working Group. This working group includes representation from other public health departments, tribal and public utilities, state water and sewage boards, water resource boards, EPA, and water protection environmental organizations. The goal of this multi-sector working group is to “prepare a report containing findings and recommendations on the development of an effective program that will enable water and wastewater utilities to develop and implement long-range plans that account for climate change impacts.” (CRWUWG Project Roadmap 11/2/09) Representation from public health departments will ensure that long-term preparedness decisions made by the working group consider impacts on the public’s health.

51 Trust for America’s Health “Health Problems Heat up: Climate Change and the Public’s Health” 2009
 52 Centers for Disease Control and Prevention, Environmental Health, Water- and Food-borne Diseases <http://www.cdc.gov/climatechange/effects/waterborne.htm>
 53 Frumkin et al. “Climate Change: The Public Health Response” Framing Health Matters, American Journal of Public Health March 2008, Vol 98, No. 3

RESOURCES

Centers for Disease Control and Prevention - Healthy Water
<http://www.cdc.gov/healthywater/>

World Health Organization – Water, Sanitation and Hygiene
http://www.who.int/water_sanitation_health/en/

Monterey Bay Aquarium - Seafood Watch Program
http://www.montereybayaquarium.org/cr/cr_seafoodwatch/download.aspx

FOOD

Climate change has significant implications for food security and human health: higher temperatures and extreme weather events negatively impact the fundamental components of food production such as soil, water and biodiversity.⁵⁴ The United States produces \$200 billion in food commodities annually, however relies on about 15% (by volume) or \$78 billion in imported foods.⁵⁵ Agriculture is not only a source of greenhouse gas emissions (mainly methane and nitrous oxide), representing 8.6% of greenhouse gas emissions in the US, but is vulnerable to climate change as well.⁵⁶ Steps that the public health sector takes to build a food system that is resistant to the negative affects of climate change is also a food system that can help lower issues of concern to public health: rates of heart disease, diabetes, obesity, and outbreaks of food-borne illness.

How Will Climate Change Affect Food Systems?

While a warmer climate can be beneficial to some plants, extreme weather events associated with climate change, such as uncommonly heavy rains and prolonged droughts, have a negative impact on crop growth, nutritional content and yields (see figure below).⁵⁷



In the spring of 2008, severe rainfall caused the Mississippi river to rise and flood thousands of acres of cropland, impacting the region's wheat, corn and soybean crops and costing farmers \$8 billion.⁵⁸

Livestock production simultaneously is affected by climate change. The consumption of animal products poses a threat to the environment as well as human health as livestock production is a major source of greenhouse gas emissions and contributes to heart disease.⁵⁹ Severe weather events and rising temperatures are likely to cause a decline in livestock productivity. Higher heat

54 FAO Profile for Climate Change, <http://www.fao.org/docrep/012/i1323e/i1323e00.htm>

55 USDA Economic Research Service. 2009. US Food Import Patterns 1998-2007. www.ers.usda.gov

56 US Global Change Research Program (USGCRP) "Global Change Impacts in the United States" June 2009 <http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts>

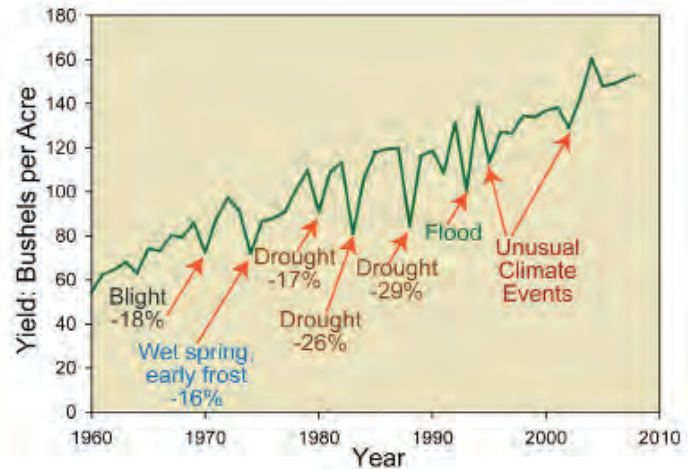
57 Food and Agricultural Organization of the United Nations (FAO) "Addressing climate change and food security together" <http://www.fao.org/news/story/en/item/37840/icode/>

58 USGCRP 2009

59 Anthony J McMichael et al., "Food, livestock production, energy, climate change, and health," *The Lancet* 370, no. 9594 (10, 2007): 1253-1263.

places stress on animals, which reduces dairy production and slows growth and conception rates.⁶⁰

The waning quantity and quality of crop and livestock yields as well as rising food prices could threaten the stability of the supply, availability, accessibility, safety, and nutrition of food.⁶¹ In addition, given the United States' increasing trend in importation of food, extreme weather events may make current transportation systems for food unreliable.

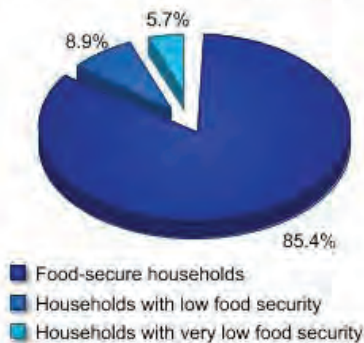


Source: USGCRP 2009

What Are The Potential Public Health Risks From These Impacts?

Climate change poses challenges for the efficient production of food and waning crop and livestock yields can influence availability, price, and nutrition. Additional threats to food yields are the emergence of weeds, pests, and diseases that benefit from higher temperatures or experience a shift in distribution patterns based on climatic changes, thus harming crops and

Food security status of U.S. households, 2008



Note: Food-insecure households include those with low food security and very low food security.

Source: Calculated by ERS using data from the December 2008 Current Population Survey Food Security Supplement.

livestock. Reduced domestic food yields may also increase food importation, which can introduce additional diseases.⁶² The emergence of new disease may increase use of herbicides and pesticides, which are harmful for the health of farm workers and their families, the environment, and food safety, and also raises costs for farmers.⁶³ Organic agriculture, on the other hand, allows ecosystems to better adjust to climate change, and is more resistant to disease strains compared to genetically identical monocultures.⁶⁴ Additionally, organic farms that are part of a local food system will reduce carbon emissions from transportation, and ensure access to locally produced food when transportation is disrupted during extreme weather events.

60 USGCRP 2009

61 FAO Profile for Climate Change, <http://www.fao.org/docrep/012/i1323e/i1323e00.htm>

62 Climate Change Science Program. 2008. Analyses of the effects of global change on human health and welfare and human systems. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Gamble, J.L. (ed.), K.L. Ebi, F.G. Sussman, T.J. Wilbanks, (Authors)]. U.S. Environmental Protection Agency, Washington, DC, USA.

63 USGCRP 2009

64 FAO "Organic Agriculture and Climate Change" <http://www.fao.org/DOCREP/005/Y4137E/y4137e02b.htm>

In 2008, 14.6% of US households (49.1 million people, including 16.7 children) were food insecure during the year, the highest recorded rate of food insecurity since the national food security survey began. "Food insecurity" is defined by the USDA as: "[households that were] uncertain of having, or unable to acquire, enough food to meet the needs of all their members because they had insufficient money or other resources for food."⁶⁵ Future food security may depend on the agriculture sector's ability to prepare for the challenges of climate change.

In 2009, the American Medical Association (AMA) passed a sustainable food policy "in support of practices and policies within health care systems that promote and model a healthy and ecologically sustainable food system. The resolution also calls on the AMA to work with health care and public health organizations to educate the health care community and the public about the importance of healthy and ecologically sustainable food systems that 'provide food and beverages of naturally high nutritional quality.'"⁶⁶ The policy encourages the health sector to promote local foods, higher nutritional value and sustainable food options in cafeterias, support of federal policy for healthier and ecologically sound foods, and educational campaigns for the public. The recommendations by the AMA are in line with the goals of achieving healthier populations, reducing greenhouse gas emissions, and building communities that are more resistant to the impacts of climate change.

⁶⁵Healthcare With No Harm. 2009. American Medical Association Passes Resolution Supporting Sustainable Food System. http://www.noharm.org/us_canada/news_hcwh/2009/jul/hcwh2009-07-17.php

Who Is At Greatest Risk?

Youth, infants, the elderly, and the infirmed are the most vulnerable to contracting food-borne illnesses as their immune systems are either still developing or weakened. The homeless and low-income families may also have less choice in the type of food they consume, or they may lack access to more nutritious or locally grown foods. Populations that rely on imported foods, such as minority populations that favor foods grown in other parts of the country or world, may see their food supply impacted by interruptions to transportation systems.

Steps to educate and prepare employees and the public on the risks to our food systems. The Environmental Protection Agency (EPA) affirms that the impact of climate change on agriculture depends on the sector's "ability to adapt through future changes in technology, changes in demand for food, and environmental conditions, such as water availability and soil quality."⁶⁶ Preparing for the effects of climate change on agriculture also benefits human health. Agricultural preparedness strategies include shifting crop selection and timing to limit exposure to high temperatures and either excessive or insufficient rainfall.⁶⁷ The Food and Agricultural Organization of the United Nations (FAO) asserts that agricultural practices that reduce emissions can also improve food security by enabling agricultural systems to be more resilient to climate impacts.⁶⁸

⁶⁵ USDA Economic Research Service, "Food Security in the United States" 2009 <http://www.ers.usda.gov/briefing/Foodsecurity/>

⁶⁶ Environmental Protection Agency (EPA) "Agriculture and Food Supply" <http://www.epa.gov/climatechange/effects/agriculture.html>

⁶⁷ USGCRP 2009

⁶⁸ FAO 2009

A survey of Oregon public health workers, conducted by the Climate Leadership Initiative and the Oregon Coalition of Local Health Officials, found that 82% of respondents indicated their health departments have some form of regulatory responsibility over food safety and security. However, when asked if their health departments use information on changes in climatic patterns in planning or implementing programmatic activities, only 12% indicated that they were using information related to food security.⁶⁹ A 2006 Association of State and Territorial Health Officials (ASTHO) survey of state environmental health directors found that while programs that included food protection often existed at the state level, less than half (and in many states less than 10%) of county public health departments have programs that include food protection.⁷⁰

Preparing food systems for the likely impacts of climate change can conserve biodiversity and natural resources, protect food yields, and increase food security and safety. Preparing for the impacts of climate change can include supporting local, resilient food systems that provide healthy and affordable organic foods to our communities. A food system that is resistant to the negative affects of climate change is also a food system that can help lower rates of heart disease, diabetes, obesity, and outbreaks of food-borne illness: all of which the public health sector is working to combat within their communities. A public health education campaign, highlighting the benefits of eating right, can also illustrate the connections between climate change, agriculture, and a healthy diet.⁷¹ **Ideas include:**

- Provide pamphlets on how to prevent and recognize food-borne illness. \$ ♀
- Encourage support for building a local food economy to increase food availability when transportation is disrupted or food-borne illness is detected in imported foods. ⊙
- Encourage employees and the public to start their own vegetable gardens or join a community garden. ♀
- Work with social services, churches and food banks to ensure food banks are stocked in case of extreme events, which could affect crop yield and transportation of food. ♀ - ♀ ♀
- Work with University Extension programs or agricultural services to encourage farmers to plant crops that are more tolerable to the impacts of climate change. ♀ - ♀ ♀
- Work with community gardens to develop plots dedicated to culturally important crops. ♀ - ♀ ♀
- Work with partners to encourage restaurants and food suppliers to support expansion of the local food economy. ♀ - ♀ ♀

\$-\$\$\$\$ Indicates estimated cost for implementation

♀ - ♀ ♀ ♀ ♀ Indicates capacity (staff time) needed for implementation

⊙ Limited or no cost or capacity necessary

69 Institute for a Sustainable Environment, Climate Leadership Initiative and Coalition of Local Health Officials. "Climate Change Health Preparedness in Oregon" April 2009

70 IMDB

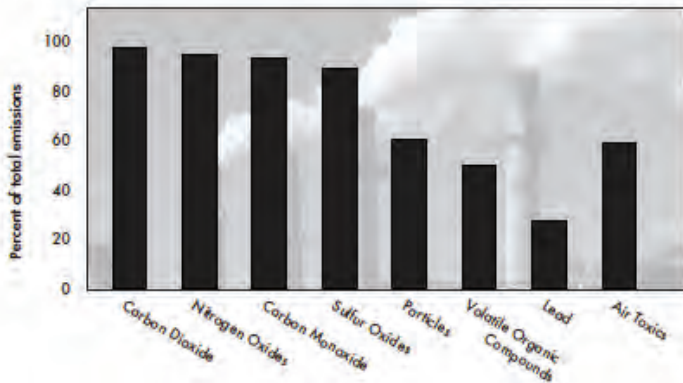
71 Public Health Law and Policy, "An Action Plan for Public Health: Initial Recommendations for Involving Public Health in Climate Change Policy" 2009 http://www.phlpnet.org/sites/phlpnet.org/files/ClimateChangeReport_web_090318_0.pdf

AIR QUALITY

Climate change is a key determinant of air quality and will likely increase the prevalence of respiratory and cardiovascular disease in the United States and around the world. In December of 2009, the U.S. Environmental Protection Agency (EPA) made a public declaration that greenhouse gases pose a threat to public health.⁷² Additionally, the climatic shifts that result from fossil fuel combustion weaken the natural systems that reduce air pollution.⁷³ Therefore, reducing carbon emissions can have immediate health benefits by decreasing particulate matter and ground-level ozone and subsequently preventing air pollution-related morbidity (e.g. asthma and chronic bronchitis) and mortality.⁷⁴

How Will Climate Change Affect Air Quality?

Air pollutants, such as particulate matter and sulfur dioxide, are byproducts of fossil fuel combustion and are harmful to human health. While taking immediate steps to reduce



Emissions of Air Pollutants Associated with Fossil Fuel Combustion
Source: PSR 2002, data from US EPA

emissions is essential to protecting human health, a reduction in air quality is still likely with climate change, as these pollutants may increase in concentration and dispersion due to climatic shifts in temperature, wind, and precipitation.⁷⁵ Therefore it is important that steps are taken not only to improve air quality, but also to prepare employees and communities for reduced air quality.

What Are The Potential Public Health Risks From Air Pollution?

Decreased air quality can result from the following: increased concentrations of ground-level ozone; emissions of nitrogen dioxide, sulfur dioxide, and particulate matter; smoke from wildfires; and pollen levels.

GROUND-LEVEL OZONE

Stagnant weather with decreased air movement and precipitation can allow air pollutants to accumulate and increase smog in urban areas.⁷⁶ Ground-level ozone concentration is a component of urban smog that results from a reaction between nitrogen dioxide and volatile

72 US Environmental Protection Agency (EPA), Climate Change – Regulatory Initiatives “Endangerment and Cause or Contribute Findings for Greenhouse Gases under the Clean Air Act” <http://www.epa.gov/climatechange/endangerment.html>

73 Physicians for Social Responsibility (PSR). 2002. Degrees of Danger: Health Effects of Climate Change and Energy in Oregon. <http://www.psr.org/site/DocServer/DegreesDangerOrgeon.pdf?docID=4242>

74 Frumkin et al. “Climate Change: The Public Health Response” Framing Health Matters, American Journal of Public Health March 2008, Vol 98, No. 3


75 Physicians for Social Responsibility (PSR). 2002. Degrees of Danger: Health Effects of Climate Change and Energy in Oregon. <http://www.psr.org/site/DocServer/DegreesDangerOrgeon.pdf?docID=4242>

76 The World Health Organization. Climate and Health. <http://www.who.int/mediacentre/factsheets/fs266/en/index.html>

organic compounds (VOCs), which are emitted by cars, power plants and factories.⁷⁷ The most prevalent outdoor air pollutant in the United States, ground-level ozone is highest on hot sunny days, which are likely to be more frequent due to climate change. Studies have linked ground ozone to hundreds of deaths per year in the United Kingdom, with studies in the US and other countries showing similar results. Ground ozone is formed by reactions between other gases - including greenhouse gases methane and nitrogen oxides - in the presence of sunlight, and leads to exacerbation of respiratory diseases. While direct emissions cause ground ozone, it is also worsened by a changing climate, with levels expected to increase with higher temperatures and changes in precipitation patterns.⁷⁸ Ground-level ozone is harmful to breathe and can cause coughing, shortness of breath, eye irritation, and can increase risk of chronic obstructive pulmonary disease, asthma, allergic rhinitis, and premature mortality.⁷⁹

NITROGEN DIOXIDE, SULFUR DIOXIDE, AND PARTICULATE MATTER

Nitrogen dioxide and sulfur dioxide are produced by the combustion of fossil fuels in automobiles and industrial processes. Together, they combine to form particles that irritate the respiratory system, and are also the main components of acid rain. This particulate matter (i.e. "soot") is emitted into the atmosphere by cars, trucks, power plants and industry. Breathing these particles can damage lung tissue, exacerbate asthma, and lead to respiratory infections, lung cancer, cardiovascular disease, and premature death.⁸⁰ Exposure to particulate matter may become more common as a result of climate change and increase asthma risks.⁸¹ Approximately 34 million Americans have been diagnosed with asthma (which is triggered by indoor air quality as well as outdoor exposure), and that number is estimated to grow to more than 100 million by 2025.⁸²

 *Note: awareness campaigns need to be appropriate for the community that you serve. The EPA has developed asthma awareness radio campaigns in a number of languages, including Navajo and Lakota. www.epapsa.com/campaigns/nativeamerican/*

SMOKE FROM WILDFIRES

With warming temperatures and increased drought, wildfires are expected to become more frequent and severe in many parts of Oregon and around the country. The increased incidence of wildfires is both a result of, and contributor to, climate change. Smoke inhalation from fires can cause acute and chronic respiratory and cardiovascular disease.⁸³ Winds can carry air pollutants from wildfires over long distances and can even affect individuals who are far from the event.⁸⁴ Communities that are not in direct danger of wildfires may still be at risk of smoke inhalation depending upon wind direction.

77 Physicians for Social Responsibility (PSR). 2002. Degrees of Danger: Health Effects of Climate Change and Energy in Oregon. <http://www.psr.org/site/DocServer/DegreesDangerOrgeon.pdf?docID=4242>

78 "Ground level ozone to increase." October 2008. <http://www.independent.co.uk/environment/climate-change/groundlevel-ozone-pollution-to-increase-952823.html> [Accessed December 2009]

79 Jenny Griffiths, Mala Rao, Fiona Adshead and Allison Thorpe The Health Practitioner's Guide to Climate Change: Diagnosis and Cure Earthscan Publishing September 2009

80 Physicians for Social Responsibility (PSR). 2002. Degrees of Danger: Health Effects of Climate Change and Energy in Oregon. <http://www.psr.org/site/DocServer/DegreesDangerOrgeon.pdf?docID=4242>

81 Jim Efstathiou Jr "Study links ailments to global climate change" Bloomberg News Nov 2009 http://seattletimes.nwsourc.com/html/nation-world/2010321328_climatedisease21.html?syndication=rss

82 American Academy of Allergy, Asthma, and Immunology "Asthma Statistics" <http://www.aaaai.org/media/statistics/asthma-statistics.asp>

83 Jim Efstathiou Jr "Study links ailments to global climate change" Bloomberg News Nov 2009 http://seattletimes.nwsourc.com/html/nation-world/2010321328_climatedisease21.html?syndication=rss

84 Jenny Griffiths, Mala Rao, Fiona Adshead and Allison Thorpe The Health Practitioner's Guide to Climate Change: Diagnosis and Cure Earthscan Publishing September 2009

POLLEN LEVELS

Rising temperatures, carbon emissions, and shifts in precipitation patterns can also influence the timing, **productivity**, and distribution of fungal spores and pollen producing plants.⁸⁵ Earlier and longer pollen seasons have increased the concentration of some aeroallergens and contributed to shifts in the burden of pollen-induced allergic diseases like allergic asthma and allergic rhinitis. Allergic rhinitis is a common allergic disease that is becoming more prevalent in the United States.⁸⁶

Who Is At Greatest Risk?

Children are particularly vulnerable to air pollution as their lungs are still developing, and they also tend to participate in higher levels of outdoor activity than adults. The elderly, people with chronic heart and lung disease, and those who work or exercise outdoors are also vulnerable to the health risks of air pollution.⁸⁷ Current asthma sufferers are also likely to experience more extreme or frequent attacks, and allergy sufferers may experience prolonged or more intense allergy seasons.

Steps to prepare employees and the public on the risks to air quality

This section highlights steps that health officials can take to minimize the risk of climate-change induced public health impacts associated with poor air quality among employees and the public.

Outdoor air quality standards are primarily set and enforced at the federal and state level, however local health departments can assist in the implementation of activities that meet air quality goals, such as pollution prevention and community planning. The National Association of Local Boards of Health (NALBOH) suggests that local health departments assist in the implementation of state plans to meet federal air quality standards to “proactively identify and address specific concerns within their jurisdictions, including issues that fall outside of any formal regulatory programs.”⁸⁸

Many people are aware of the connection between motor vehicles and air pollution, but the connections between flipping a light switch and electric power generation is less apparent. Public health departments can increase public awareness of the adverse effects of climate change on respiratory health by highlighting the connections between fossil fuel combustion and air quality.

The following no-cost actions can be recommended to employees and community members to protect themselves from hazardous air quality:

- ❑ Check daily air quality levels in your area. ☹
- ❑ Stay inside during high ozone and pollen days or if there’s a wildfire burning in your area. ☹
- ❑ If you go outside, avoid strenuous exercise or activity, especially in high traffic areas and in the late afternoons and early evenings on high-ozone days. If possible, exercise on a machine at home or at a gym. ☹

85 United States Environmental Protection Agency. 2008. A Review of the Impacts of Climate Variability and Change on Aeroallergens and Their Associated Effects. Global Change Research Program. National Center for Environmental Assessment. Office of Research and Development

86 Jenny Griffiths, Mala Rao, Fiona Adshead and Allison Thorpe The Health Practitioner’s Guide to Climate Change: Diagnosis and Cure Earthscan Publishing September 2009

87 Samet, Jonathan M. “Adapting to Climate Change - Public Health” Adaptation, An Initiative of the Climate Policy Program at Resources for the Future. June 2009

88 The National Association of Local Boards of Health (NALBOH) “Local Board of Health Environmental Health Primer” http://www.cdc.gov/nceh/ehs/NALBOH/NALBOH_EH_Primer.htm

- ❑ Consider wearing a fine dust mask, which can be found at home improvement stores. ⓪
- ❑ Keep your windows and doors closed. ⓪
- ❑ Avoid running your bathroom or kitchen exhaust fan, as this circulates polluted air into your home. ⓪
- ❑ Drink plenty of fluids to moisten the respiratory tract. ⓪
- ❑ Do not ignore respiratory symptoms, as they could indicate a reaction to ozone or particle pollution. ⓪ Visit a doctor if symptoms are persistent.⁸⁹

\$-\$\$\$\$ Indicates estimated cost for implementation

♣ - ♣ ♣ ♣ ♣ Indicates capacity (staff time) needed for implementation

⓪ Limited or no cost or capacity necessary

The recommendations above can be included in outreach materials to employees and the public (e.g. integrated into air quality resource pages online or local air quality health advisories). Departments can develop online, TV, or radio alerts to warn the public of hazardous air quality days and the proper steps they should take to protect themselves and their families. Depending on your intended investment in this type of project, costs and capacity needs can range from minimal to high.



The EPA's Air Quality Index (www.airzone.gov) offers daily air quality reports and associated health effects one may experience within a few hours or days after breathing polluted air. EPA calculates the AQI based on ground-level ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide. A range of colored zones inform the public of potential health hazards: green zones indicate satisfactory air quality, orange zones indicate air is unhealthy for sensitive groups like children or older adults; and red zones indicate hazardous air quality that could pose health threats to the entire population.

RESOURCES

The National Allergy Bureau provides a map of regional pollen and mold levels
<http://www.aaaai.org/nab/index.cfm?p=pollen>

The EPA's Air Quality Index offers daily air quality reports
www.airzone.gov

National Association of Local Boards of Health (NALBOAH) Environmental Health Primer
http://www.cdc.gov/nceh/ehs/NALBOH/NALBOH_EH_Primer.htm

World Health Organization – Air Quality Guidelines
http://www.who.int/phe/health_topics/outdoorair_agq/en/

⁸⁹ The Clear Air Campaign. "How to Protect your Health." <http://www.cleanaircampaign.org/>


Mental Health

Major weather events such as hurricanes and heat waves are occurring with greater intensity and frequency, serving as concrete reminders of the ways in which climate change can impact our daily lives. These direct, physical impacts of climate change also induce mental health issues, as affected communities struggle with the environmental, social, and economic disruptions and interruptions of psychiatric care that result from extreme weather events. Major disasters – such as Hurricanes Katrina and Rita and the 2004 Asian Tsunami – demonstrate how extreme weather events affect the mental health of an impacted community. Climate change is also having mental health impacts on individuals who are not directly involved in disasters, who are reporting depression, emotional distress, and anxiety over the threat of future catastrophic impacts.⁹⁰

What Are The Potential Public Health Risks Of Climate Change On Our Mental Health?

Those who directly experience extreme weather events such as hurricanes, tornadoes, heat waves, droughts, and floods may face some degree of displacement, loss, housing and employment instability, physical injury, and/or general disruption of daily life. Proximity to a disaster has been shown to provoke short-term psychiatric reactions at six times the rate of the general population.⁹¹ Depending upon the severity, duration, and frequency of exposure, the resultant mental health impacts on affected communities may include:

- ❑ Posttraumatic stress disorder (PTSD)
- ❑ Other stress-related disorders such as grief, depression, aggression, anxiety, and drug and alcohol abuse
- ❑ Reduced worker productivity
- ❑ Increase rates of suicide and attempted suicide
- ❑ Increased risk of crime, domestic violence and child abuse
- ❑ Increased risk for people with preexisting mental health conditions
- ❑ Long-term psychiatric problems may also lead to or exacerbate physical ailments
- ❑ Climate change delusion (psychosis or anxiety disorders focused on climate change or future additional disasters)

 *In the aftermath of Hurricane Katrina, rates of severe mental illness (depression, post-traumatic stress disorder, anxiety disorder, panic disorder, and a variety of phobias) rose from 6.1% to 11.3% among residents of affected areas. Rates of mild-to-moderate mental illness doubled from 9.7% to 19.9%.⁹² Affected communities also exhibited high rates of depression, domestic violence, and suicide rates tripled.⁹³*

⁹⁰ <http://www.cdc.gov/climatechange/effects/mentalhealth.htm>

⁹¹ Hall, Richard C.W. and Ryan C.W. Hall. "Establishing Liaison Before Disaster Strikes." Disaster Psychiatry Handbook. American Psychiatric Association Committee on Psychiatric Dimensions of Disaster: 2004: 12-19.

⁹² Anthes, Emily "Climate change takes a mental toll" The Boston Globe, February 9, 2009 http://www.boston.com/lifestyle/green/articles/2009/02/09/climate_change_takes_a_mental_toll/.

⁹³ Fritze, Jessica G et al. "Hope, despair and transformation: climate change and the promotion of mental health and wellbeing." International Journal of Mental Health Systems, September 2008 <http://www.ijmhs.com/content/2/1/13>; <http://newvoicesforresearch.blogspot.com/2009/05/climate-change-and-health-mental-health.html>

Not all psychiatric reactions are pathological; some are to be expected as a normal and temporary reaction to a high-stress situation. More severe psychiatric symptoms tend to manifest between 6 and 12 months following a disaster after short-term responses such as shock, anxiety, and insomnia recede. Individuals (particularly young children) who do not receive early psychiatric interventions are especially vulnerable to long-term symptoms. These mental health impacts may last for months or even years and may shift or worsen as the long-term impacts of the event or threat of additional events become clear. Fear and distress following extreme weather events may also lead to a sense of powerlessness that can inhibit affected communities from taking actions toward recovery.⁹⁴

Who Is At Greatest Risk?

Vulnerability to the mental health impacts of climate change depends upon proximity and ability to adapt to a disaster, such as having the resources to reestablish social networks following displacement. Major weather events have been shown to disproportionately affect the elderly, rural, poor, and communities of color. Communities without access to social and economic resources such as employment opportunities, education, and housing may also lack the knowledge and resources that would allow them to adequately respond to a disaster. In addition, these vulnerable populations are often already under economic or other stress. As a result, these groups, along with people who suffer from pre-existing mental health conditions, are likely to be more impacted by psychological stress following an extreme weather event or other climate change-related disaster. Other vulnerable groups include single parents, children between the ages of 8 and 15, bereaved and injured individuals, and rescue workers⁹⁵.

Steps To Prepare The Public On The Risks To Mental Health

Minimize disruption by planning ahead for staffing, transportation and supplies to keep your agency functioning in case of a disaster. Steps include:

- ❑ Prior to a disaster, establish tracking and early warning systems and plans for ensuring that accurate information reaches the media and the public in a way that avoids unnecessary panic. ♀ - ♀ ♀ \$-\$
- ❑ Establish relationships with community organizations, faith-based groups, and healthcare and mental health departments to facilitate distribution of disaster preparedness literature and training. These relationships can also be a first point of contact into the community in the case of an emergency. ♀ - ♀ ♀ \$-\$
- ❑ Following a disaster, help alleviate stress in the community by ensuring that all basic needs are met through connections with other organizations and agencies in the region, and ensure a plan is established for doing so prior to the disaster: food, water, shelter, clothing, safety. ♀ ♀
- ❑ Provide psychiatric intervention for stress experienced by employees and the public (especially high risk groups). ♀ ♀
- ❑ Reduce feeling of helplessness following a disaster by putting people to work on specific, supervised tasks. ♀
- ❑ Aid communities in the development of victims' families' organizations.⁹⁶ ♀ ♀

94 Swim, Janet et al. 2009. Psychology and Global Climate Change: Addressing a Multi-faceted Phenomenon and Set of Challenges. A report of the Task Force on the Interface Between Psychology and Global Climate Change. American Psychological Association.

95 Swim, Janet et al. 2009.

96 Hall, Richard C.W. and Ryan C.W. Hall, 2004

\$-\$\$\$\$ Indicates estimated cost for implementation

♣ - ♣ ♣ ♣ ♣ Indicates capacity (staff time) needed for implementation

⊖ Limited or no cost or capacity necessary

Reducing the mental health risks of climate change-related disasters among your employees
Promoting psychiatric health among public health employees following a disaster will help keep essential services available throughout an emergency. **Public health agencies can encourage and facilitate the following coping and resiliency activities among their employees:**

IDEAS IN ACTION



Following the Midwest Flood of 1993, mental health professionals trained in disaster response saw that individuals under

stress from the event often turned to community leaders like clergy members and teachers, rather than seeking the treatment of mental health professionals. Project CREST (Community Resources for Education, Support, and Training) was developed to equip community leaders with the tools to provide supplementary emotional support and crisis counseling services following a disaster. Additionally, the American Red Cross and the American Psychiatric Association established a joint disaster intervention plan to facilitate cooperative relationships between mental health disciplines during disaster events.

North, Carol S. M.D., John D. Weaver, M.S.W., A.C.S.W. and Barry A. Hong, Ph.D., "Roles of Psychiatrists on Multidisciplinary Mental Health Disaster Teams," *Psychiatric Services, American Psychiatric Association* 52:536-537 (2001).

- ❑ **Social networking:** Gatherings with family, friends and colleagues can help victims feel less isolated. ⊖
- ❑ **Healing rituals:** Healing rituals such as memorial services and spiritual gatherings can help with the mourning process. ⊖
- ❑ **Recreation:** Distracting and enjoyable activities such as sports, art, and other hobbies can take victims' minds off their troubles. ⊖
- ❑ **Reframing disaster:** Disasters can be viewed for the positive impacts they can bring about, such as people helping one another and a strengthened sense of community. ⊖
- ❑ **Clear and identified tasks:** When ready, put employees back to work to give them a sense of purpose and a distraction from their own stress.⁹⁷ ⊖

Communities, especially those in disaster-prone regions, can also benefit from pre-event interventions to educate individuals about climate change and prepare individuals for potential impacts. Residents of these areas often face ongoing anxiety about future events, particularly as hurricane or fire seasons approach.⁹⁸ The Centers for Disease Control and Prevention promotes public health communication that "inspires action rather than stress and despair," in an effort to alleviate climate change distress.⁹⁹

97 Tucker, Phebe and Anthony T. Ng. "Helping Adults After Disaster Strikes." *Disaster Psychiatry Handbook*. American Psychiatric Association Committee on Psychiatric Dimensions of Disaster. 2004: 20-27.

98 Fritze, Jessica G et al., 2008

99 Centers for Disease Control and Prevention (CDC). "Climate Change and Public Health; Health Effects: Mental Health." <http://www.cdc.gov/climatechange/effects/mentalhealth.htm>

IDEAS IN ACTION



In Victoria, Australia, Deakin University released a manual “Countering Drought” on how to support farmers during periods of drought and keep them mentally healthy. The manual includes information such as: noticing who is not attending community events as these are often the people most in need; creating networks via email or telephone; tips on how to apply for funding to support community grants; and some low cost activities to bring people together. Other efforts included: the ‘Drought Postcard Project’ where children at primary schools send personal messages to farmers on postcards; Mental Health First Aid courses for community members, kindergarten teachers, stock agents, bank staff and anyone coming into contact with people who may be feeling the pressure of the drought; the FarmGate project which involves a partnership of people providing emergency relief, emotional support and service information directly through farm visiting; and the Regional Youth Network who are working to support young people at risk for drought through their Local Learning and Employment Networks.

http://www.dpc.vic.gov.au/domino/Web_Notes/newmedia.nsf/955cbeae7df9460dca256c8c00152d2b16722baf930e5b12eca2572a200789606!OpenDocument

RESOURCES

Coping with a disaster or traumatic event (CDC):
Information in English, Spanish and Vietnamese
<http://www.bt.cdc.gov/mentalhealth/>

Health, Safety and Resilience for Disaster Responders Pamphlet (OSHA):
www.osha.gov/SLTC/emergencypreparedness/.../cdc_pamphlet.pdf

When Disaster Strikes: Managing Mental Health in the Workplace Pamphlet (National Partnership for Workplace Mental Health):
www.workplacementalhealth.org/pdf/disasterbrochure.pdf

Case studies highlighting ideas from Victoria, Australia's “State Government's Sustaining community wellbeing in drought” program:
www.health.vic.gov.au/pcps/downloads/.../overview_case_studies.pdf

CONCLUSIONS

COMMUNICATION

Communication about climate change tends to focus on actions that individuals can take to reduce emissions, such as replacing light bulbs and turning down the thermostat. While mitigation activities are essential for limiting unsafe levels of CO₂ in the atmosphere, climatic changes are already occurring and will likely continue to negatively affect human health for many decades to come. Emissions must be reduced to slow global warming, but preparing for the expected impacts is also essential. Public health leaders are in a unique position to inform, educate, and empower the public, as well as to elevate the prominence of health issues in climate preparedness planning. When communicating with the public, clients, colleagues, and policymakers about the potential health consequences of climate change, it is important to express how both emissions reductions and preparedness can create healthy communities:

- 1. The Public.** The potential health implications of climate change are severe and can leave people feeling helpless or overwhelmed. Rather than focusing on the negative impacts of climate change, emphasize the benefits that will come from thoughtful preparedness efforts. Convey that while climate change will likely have significant impacts on natural systems and infrastructure, we can act now and prepare for the resulting health implications.

Sample language: In addition to doing everything we can to prevent the worst effects of global warming, we must also prepare for the effects we are already experiencing. Just like a responsible homeowner wouldn't wait for a rainstorm to fix the hole in the roof, we can't wait for the worst effects of climate change to reach us before we take action.¹⁰⁰

State and local health departments can develop messages and public education campaigns that convey the health risks of climate change and benefits from preparedness. Public health leaders can encourage the public to get involved in preparedness planning efforts and support strong climate policies. A public health climate preparedness advisory council, for example, could focus on climate change preparedness and serve as a liaison with nonprofit networks and citizen groups to show how the health of communities can be improved through climate preparedness.

- 2. Clients.** When interacting with clients and visitors, public health practitioners have the opportunity to share information about the health implications of climate change. The following resources can help you talk with your clients about climate change preparedness and protecting one's health in response to potential events like heat waves:

- o Environmental Protection Agency's daily Air Quality Index reports
www.airzone.gov

¹⁰⁰ Climate Crossroads: A Research-Based Framing Guide. 2009. <http://www.thesocialcapitalproject.org/The-Social-Capital-Project/publications>

- “Are You Ready for a Heat Wave?” Red Cross guide to heat wave preparedness <http://www.redcross.org/www-files/Documents/pdf/Preparedness/AreYouReady/AreYouReadyforaHeatwave.pdf>
- Seafood Watch guide to safe and sustainable seafood choices http://www.montereybayaquarium.org/cr/cr_seafoodwatch/download.aspx
- Information on coping with a disaster or traumatic event from the CDC <http://www.bt.cdc.gov/mentalhealth/>

3. Colleagues. When talking with coworkers, a supervisor, or staff, describe how climate change is linked with existing public health concerns like air and water quality. Understanding these connections will allow public health **departments to be** prepared for future events. Since climate change often seems abstract and distant, it is helpful to consider the health risks that are specific to your particular region in order to make the issue relevant to people’s lives. Consider how climate change will affect the health of your community. For example, is your area urban and especially prone to air pollution or are you in a coastal town that is concerned with potential flooding or sea level rise?

Public health professionals should be vocal stakeholders in climate change preparedness policy decisions. The expertise of public health leaders can be augmented with climate-specific trainings and guidance. The Trust for America’s Health suggests the following strategy for developing a climate change knowledge base among practitioners:

“In order to enhance knowledge about climate change among state and local public health workers, agencies should cross-train their workforce. Epidemiologists, who specialize in infectious disease surveillance, can be trained to research heat-related morbidity and mortality. Emergency preparedness planners, who specialize in pandemic and all-hazards preparedness, can be educated about the increased risk of extreme weather events as a result of climate change. In addition to cross-training, health agencies should emphasize best practices and education.”¹⁰¹

4. Policymakers. Public health practitioners have a unique opportunity to talk to local decision and policymakers about the need for proactive climate change health preparedness. By providing a critical health perspective, public health professionals can communicate the significant health impacts that are likely to occur should adequate preparedness measures not be adopted. For many people, climate change is an abstract concept that is not connected to their daily lives. Incorporating public health objectives into climate change planning processes will highlight the fact that rising temperatures directly affect people, as well as animals. For example, instituting policies that make bicycle commuting more accessible and convenient will help reduce carbon emissions, improve air quality, and decrease obesity rates by facilitating

¹⁰¹ Trust for America’s Health “Health Problems Heat up: Climate Change and the Public’s Health” 2009 <http://healthyamericans.org/reports/environment/>

physical activity. Public health professionals can educate policymakers in the health benefits that will result from sound climate preparedness planning.

Public health departments and agencies should keep in mind that communication tools and actions tailored to the community, and population they are working with, will have greater impact for community members. **Consider the following:**

- ❑ Use variety of media outreach strategies that would be effective for different age groups (on public radio, local news, popular radio stations, social media sites, etc.)
- ❑ Have brochures and media outreach in multiple languages
- ❑ Door to door outreach may be more effective for some communities
- ❑ Use non-traditional outlets for education and outreach (Meals on Wheels, YMCAs, local celebrities, sporting events, etc)

A series of communications trainings and tools will accompany this handbook to help the public health sector develop messages and strategies to foster awareness of the health benefits from climate preparedness. The trainings and accompanying materials will assist public health leaders motivate colleagues, policymakers, and the public to support climate preparedness efforts.

COLLABORATION

Public health agencies are already collaborating with huge network of organizations and agencies in their communities. In Oregon alone, county public health departments work with a diverse array of government, nonprofit, and institutional entities including Department of Environmental Quality, Economic and Community Development, Watershed Councils, Emergency Management, US Forest Service, University Extension Office, Department of Energy, Health Care Systems, Environmental Protection Agency, Department of Agriculture, Public Works, State Drinking Water, Water Resources, Sheriff's Office, etc. This range of partnerships provides extended opportunities for both reducing harmful carbon emissions and preparing for the impacts of climate change, allowing public health departments to think outside the box and develop innovative strategies for improving the health of the staff and community, as well as preparing for the health impacts of climate change.

The 2008 survey of Oregon public health departments by the CLI and CLHO identified the need for preparedness efforts to be conducted collaboratively across the county, region, state, and between sectors. Public health respondents identified the groups in the community with which they could collaborate on climate issues, including: watershed groups, universities, county offices of sustainability, clean air coalitions, healthy homes coalitions, Department of Environmental Quality, and housing departments. Cross-sector cooperation can help ensure that one sector's actions do not unintentionally produce negative affects for another sector (e.g. if removing a mosquito breeding ground based on disease concerns, officials should consult natural systems managers to ensure no species are threatened).

TAKING ADVANTAGE OF EXISTING RESOURCES AND INTEGRATING EFFORTS INTO EXISTING SYSTEMS

While additional funding and staff will provide support for taking your climate preparedness initiative further, departments and agencies should start first with their existing resources. Evaluate your current planning process and activities: Where can preparedness be built in? What upcoming reports or awareness brochures would benefit from the addition of a section on climate preparedness?

After you've made as many changes as possible within your current operations and available resources, additional grants and partnerships can support acquisition of additional funding, research, tools and projects.

As discussed throughout this document, many health departments and agencies are strained for financial and human resources, and often do not have the ability to initiate large-scale change without support or mandates from decision-makers. **However, there are many operations and communication strategies that you may be able to change or adapt internally (depending on your department/agencies policies) including:**

- ❑ Revising community specific brochures
- ❑ Strengthening local partnerships
- ❑ Developing internal trainings, awareness building mechanisms for staff
- ❑ Conducting preliminary assessments of populations in your community that are most at risk to climate related health impacts
- ❑ Providing climate and preparedness related information on your website
- ❑ Reducing indoor air pollution exposure by closing windows, doors, reducing activities outside, etc.

For actions or strategies that require approval or authorization at the state level or from headquarters, departments can document the work they are doing on preparedness; demonstrate the changes they are seeing in terms of awareness, energy savings, improved health, etc.; and prepare recommendations for operations or policies that should be considered for adoption by all departments or agencies across the state. Share these with other departments or agencies and develop a strategy for enacting greater change at the highest level. Forming partnerships with other agencies or departments (e.g. Department of Environmental Quality, Water Resources, Department of Energy, etc) may provide a greater voice for encouraging policy adoption of climate preparedness across departments and agencies at the state level.