

Climate Change and Public Health Preparation Plan

An assessment of public health impacts of climate change
and actions to protect our health.



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Health Department

ACKNOWLEDGMENTS

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EXECUTIVE SUMMARY

Climate change has serious and far-reaching health implications for present and future generations. A team of international scientists recently described these challenges in *The Lancet* as “the biggest global health threat of the 21st century” (Lancet 2009).

Even if there is local and global action to immediately reduce greenhouse gas (GHG) emissions, we will likely feel the impacts from the current build up of emissions in the atmosphere for decades. These impacts, such as hotter summers and wetter, warmer winters for the Pacific Northwest, will likely affect our health, especially those most vulnerable. Communities must, therefore, begin to plan and prepare for the likely impacts that will be experienced because of the emissions already present in the atmosphere.

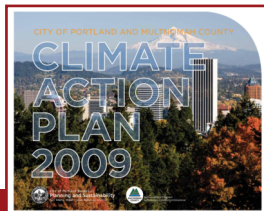
The Multnomah County/City of Portland Climate Action Plan identified “Climate Change Preparation” as one of its eight key action areas with the objective to “adapt successfully to a changing climate”. Adaptation means “to adjust to a new situation or environment” such as an increase in consecutive days over 95 degrees. This public health plan is a part of broader ongoing efforts by the City of Portland and Multnomah County to make our infrastructure, our natural environment, and our society more resilient to climate change. This plan communicates why we as a community, as policymakers and as public health professionals should care about climate change; what the local impacts may be; which populations and areas may be impacted; why equity and justice are key parts of this work; and what we can do to further prevent health issues and disparities.

Our key findings include:

- Some people and some neighborhoods will be more affected than others. Our efforts therefore must prioritize protecting the health of vulnerable populations. This includes the elderly, people with pre-existing health conditions, people who live in poverty, and people of color. Members of these communities and their advocates must be involved in the implementation of these actions and new efforts.
- Heat waves are becoming more common in our region and can be devastating, especially in urban areas like Portland that are not accustomed to extreme heat.
- Many air pollutants are known to be detrimental to our health and hotter weather will worsen their impacts.
- The geographical spread of mosquitoes and ticks is changing and this may bring new diseases to our region.

Thankfully, there is a broad range of actions that can be implemented to better understand and vastly reduce these risks. For example, we can plant trees in areas where we have lots on concrete to provide natural cooling and reduce the heat island effect. Improving air quality generates multiple immediate health benefits and reduces the long-term impacts of climate change. Overall, this plan takes into account current scientific understanding of the health impacts related to climate change in our region and provides a detailed and ambitious template of what can be done to reduce these risks.

BACKGROUND



The City of Portland and Multnomah County adopted a Climate Action Plan in October 2009 (CPMC 2009). This plan is a 40-year roadmap to transition us from a fossil-fuel economy to a way of life powered by clean, renewable energy. In addition to the typical reduction plans for greenhouse gases (walk more, drive less, etc.) the plan includes, but is not limited to, creating local jobs, improving social equity, creating healthier residents and protecting our natural systems. The action plan has eight content areas, one of which is "Preparation," and it tasks various county and city agencies to develop a plan to "adapt successfully" to changes in the climate.

Adaptation means "to adjust to a new situation or environment". This public health plan is a part of broader ongoing efforts by the City of Portland and Multnomah County to make our infrastructures, our natural environment, and our society more resilient to climate change. Creating an adaptation plan requires (1) knowing who in our community are the most vulnerable to the changes to our climate, (2) how community health will be impacted, (3) developing a plan to help communities and individuals be resilient to these changes, and (4) consistent monitoring and evaluation of efforts and identifying emerging issues.

Multnomah County Health Department was fortunate to be a part of a Centers for Disease Control and Prevention grant through the Oregon Health Authority to pilot a process for assessing vulnerabilities and to create a plan to help protect the public's health from potential health outcomes related to climate change. This plan communicates why we as a community, as policymakers and as public health professionals should care about climate change; what the local impacts may be; which populations and areas may be impacted; why equity and justice are key parts of this work; and what we can do to further prevent health issues and disparities.

WHAT IS CLIMATE CHANGE?

Climate change is happening and humans are largely responsible for recent changes to our climate. Over the past century, human activities, such as burning fossil fuels to produce energy, have released large amounts of carbon dioxide and other gases into the atmosphere. These gases trap energy in the atmosphere, and cause it to warm. The buildup of greenhouse gases is changing our climate and resulting in dangerous effects to human health and welfare and to ecosystems.

Climate change refers to any significant change in measures of climate, such as temperature, precipitation, wind, and other weather patterns, that lasts for decades or longer. The world's climate is showing signs of shifting, which is "evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level" (IPCC, 2007). Potential effects of this shift nationwide include more variable weather, stronger and longer heat waves, more frequent intense precipitation events, and extreme weather events such as flooding.

WHAT ARE THE POTENTIAL IMPACTS

TO MULTNOMAH COUNTY?

Oregon is already experiencing climate change, with a temperature increase of about 1.5 degrees Fahrenheit over the last century (Karl, 2009). Researchers, scientists and analysts use a variety of climate change models to project what may happen in our climate in the next fifty to one hundred years. By providing us with projections for our region – drier, hotter summers and warmer, wetter winters – we can plan for potential impacts on the public's health.

The climate pattern of the Portland metropolitan region is one of considerable variability, both annually and over the historic record. Several factors influence climate, including proximity to the ocean, latitude, the existence of mountains, and the geographic position of the area. These factors dictate the major aspects of weather including

temperature, wind, precipitation, humidity, clouds and air pressure. In our case, the Coast Range Mountains, the Columbia River Valley, the Willamette Valley and the proximity to the Pacific Ocean mean that weather patterns in the Portland area are complex and often difficult to forecast.

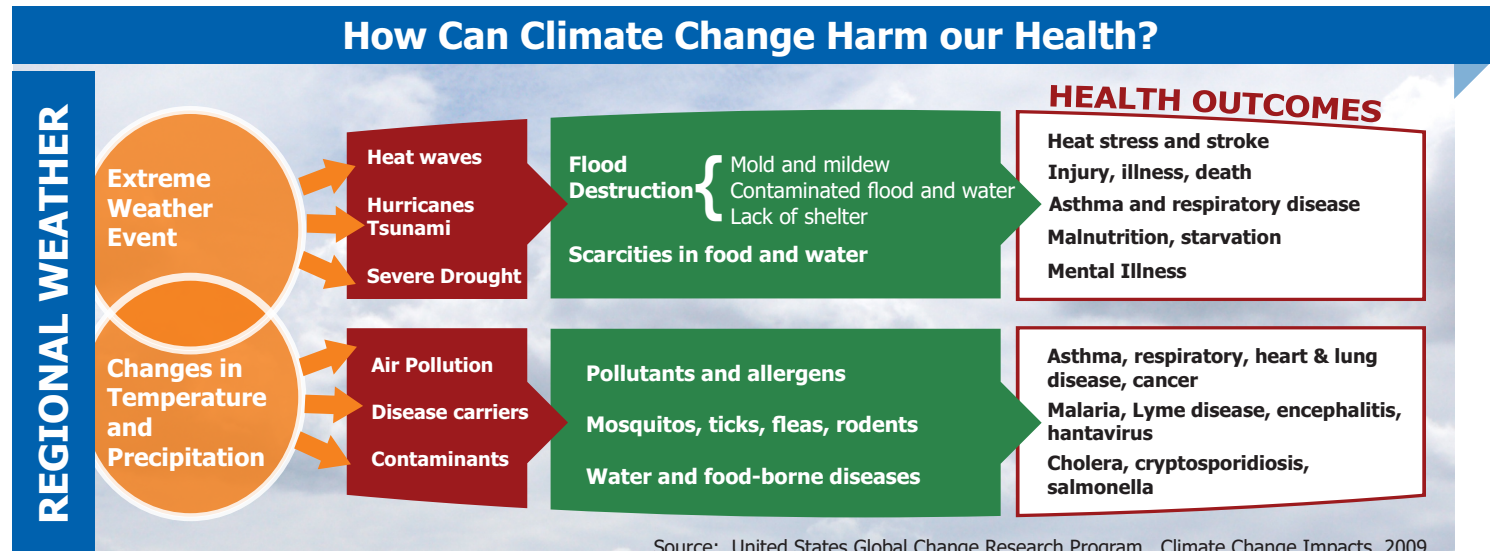
Portland experiences a temperate climate with most precipitation falling in October through May, and relatively dry, warm summers. The average annual precipitation amount in Portland is approximately 37 inches, and localized precipitation patterns can vary due to elevation changes of a few hundred feet across the metropolitan region. Snow does occasionally occur, typically in the higher elevations (e.g. West Hills), however it usually melts within days, if not hours.

Regionally, climate change projections indicate an increase in average annual temperature of 3.3 °F to 9.7 °F by the end of this century (depending on future carbon emission scenarios), with greater warming happening in the summers. We expect to see decreases in summer precipitation (by as much as 30 percent), and increases in winter precipitation over the coming century. In the future, we can expect hotter, drier summers, and warmer, wetter winters and an increased frequency of high heat days (Vynne 2010, OCCRI 2010).

What are the Public Health impacts?

Changes in the area’s climate are likely to have substantial consequences for the health of Multnomah County residents and the way that the County and City governments serve the public. People’s health will be impacted by the immediate consequences of events like hotter summers as well as the indirect effects spurred by changing populations of plants, animals, and microorganisms. Hotter summers, warmer, wetter winters and shifts in ground-level ozone can contribute to an increase in many health issues, such as:


- Heat related morbidity and mortality, particularly among vulnerable populations such as the elderly, low income, homeless, pregnant women, and individuals with outdoor occupations;
- Increased threat of vector-borne and emerging diseases (due to longer breeding seasons), particularly West Nile virus; and
- Breathing air containing ozone is associated with diminished lung function, increased asthma, and increases in premature mortality.



Protecting the public welfare is at the heart of planning for climate change. It is “part of a basic, preventive approach to public health, not a separate or competing demand” (World Health Organization 2009). Some of the first effects of reduced greenhouse gas emissions will be improved human health and decreased healthcare costs, and those that most benefit from planning for changes in our climate are often those most vulnerable, for example, communities in poverty and people of color.

The World Health Organization calls for health professionals at all levels to take a leadership role in climate action planning, because of their social status and the health sector’s economic importance. Public health has the expertise to guide many key components of climate action planning, such as emergency response, disease surveillance, vector control, and assessment of health disparities. Local health jurisdictions are charged with Ten Essential Services, many of which can make a direct contribution to planning for, adapting to, and mitigating the effects of climate change. The adjacent table lists these services and provides an example of how each one might be relevant to climate change issues.

The Ten Essential Services are a great way to approach the overwhelming task of climate planning. Many of the services of the framework are easy to relate to, whether you are a health professional, policy maker or community member. Using this framework helped us better understand which services we currently provide that might be impacted by hotter summers, and warmer, wetter winters. For example, we perform vector control and surveillance and an increase in precipitation could affect mosquito breeding seasons. We currently do not have a heat-wave preparedness plan, a gap identified by using this framework. We also identified the need to empower and mobilize community members in our adaptation planning process, which forced us to look deeper into how we can address equity and justice in our climate work, moving forward.

 Essential public health services and climate change applications	
SERVICES	APPLICATIONS
1. Monitor health status to identify and solve community health problems.	▶ Track diseases and trends related to climate change (e.g.,: heat-related events).
2. Diagnose and investigate health problems and health hazards in the community.	▶ Investigate infectious water-, food-, and vector-borne disease outbreaks (e.g., west Nile virus).
3. Inform, educate, and empower people about health issues.	▶ Inform the public and policymakers about health impacts of climate change.
4. Mobilize community partnerships and action to identify and solve health problems.	▶ Form partnerships with faith community, civil society, and others to design and implement solutions.
5. Develop policies and plans that support individual and community health efforts.	▶ Design heat-wave preparedness plans.
6. Enforce laws and regulations that protect health and ensure safety.	▶ Enforce public health and other codes related to vector control, food and water safety.
7. Link people to health services and ensure the provision of health care when otherwise unavailable.	▶ Provide health care service following disasters.
8. Ensure competent public and personal health care workforce.	▶ Train health care providers on health conditions related to climate change such as heat stress.
9. Evaluate effectiveness, accessibility, and quality of personal and population-based health services.	▶ Assess preparedness efforts such as heat-wave plans.
10. Research for new insights and innovative solutions to health problems.	▶ Research health effects of climate change and optimal adaptation strategies.

Adapted from Frumkin 2008.



CLIMATE EQUITY AND JUSTICE

“All populations are vulnerable to changes in our climate – but some are more vulnerable than others” (World Health Organization, 2009). In the United States, the interplay of racial, social and economic inequality may have a stark effect on communities’ exposure and ability to respond to climate change-related hazards. For example, a study in North Carolina showed that schools in low-income areas, the majority of whose students were Black, had twice the risk of being flooded after Hurricane Floyd than did non-low-income schools with a majority of non-Black students (Guidry, 2005). Sadly, the same groups over-represented at these vulnerable schools are also already known to be already overburdened with respiratory illness.

Vulnerable populations that do not have the physical or economic ability to adapt to extreme weather conditions face greater health risks. These communities also tend to experience greater burdens from the cumulative impacts of existing poor health conditions, lack of adequate health care, restricted housing choice and mobility, high rates of un- and under-employment, and limited access to healthy food, among other examples. Some examples of vulnerable populations in Multnomah County include:

- People with physical disabilities (5.5% of Multnomah County residents) may lack the mobility required to evacuate their place of residence under emergency conditions such as extreme heat or flooding (U.S. Census Bureau, 2010).
 - People who are homeless - 0.6% of Multnomah County population (Smock, 2011) - are among the most vulnerable as they include people suffering from high rates of untreated chronic disease, substance abuse, extreme poverty, smoking, respiratory conditions and mental illness (Ramin 2009).
 - People living in assisted living nursing facilities, residential facilities and in-home care, and adult foster homes - 0.9% of Multnomah County population (OHHS 2009) - are limited in their ability to take emergency action on their own during extreme weather related emergencies.
 - Individuals who live in areas with urban heat island effect– areas in urban communities that retain heat due to a higher quantity of buildings and paved surfaces versus vegetation – may experience warmer temperatures than other areas of the county and city that have less concrete and more tree canopy. For example, community members in outer Southeast Portland along the I-205 corridor are more vulnerable when summer temperatures increase because of large swaths of impervious surface. This means they are more vulnerable to heat-related illnesses.
- As our region moves forward with plans to adapt to the impacts of our changing climate, it is critical that we recognize the communities least resilient to such changes. Vulnerable communities are also often communities that are the least responsible for escalating carbon emissions per capita and the laws, policies and regulations that allow such emissions. The root causes of our current climate change concerns are the underlying racial and socioeconomic inequalities in our society and the externalized costs of our environmental decision-making. The risks to our health and environment are increasing, with more serious consequences than ever before.

Achieving the greenhouse gas emission reductions necessary to maintain a healthy climate and livable environment requires more equitable distribution of the costs and benefits of our decision-making. Programmatic approaches that simultaneously address climate change while protecting the public health, creating green jobs and reducing racial and income disparities reflects both Environmental Justice and Equity principles and an operational paradigm shift.

Pursuing an environmental justice approach within our climate adaptation plans requires adherence to specific core principles:

- Reducing and eliminating cumulative impacts of environmental health risks;
- Protecting overburdened communities from additional permitted activities and potentially harmful projects without their prior and informed consent;
- Meaningfully engage communities most impacted by potential harms in the development of policies and projects to mitigate the hazards of climate change;
- Acknowledging the responsibilities of present generations to future ones in all environmental decision-making; and
- Using a precautionary approach in environmental decision-making to prevent harm in the face of scientific uncertainty

We can use key environmental justice principles in implementing our plan and developing new efforts. These principles seek to ensure that the benefits and burdens of our preparations for climate change are equitably distributed throughout our community, regardless of race, ethnicity, income, physical or mental ability, age, language or privilege.

Putting this into practice requires taking a hard look at the root causes and data of historical racial disparities. Research indicates that equity and inequity are driven by a set of interrelated factors. Examining these

interconnections between people, place, process and power is an accessible way to deeply understand our organization’s impact on communities.

The following questions can be used by decision-makers in climate planning:

1. Who stands to benefit most from a climate adaptation action? Who will benefit the least?
2. Does the climate adaptation action address root causes of current and historical racial and socioeconomic disparities?
3. How are those most impacted engaged and empowered through development and implementation of this plan?
4. Does the climate adaptation action result in unintended adverse consequences for people of color or low-income communities? If so, how can these impacts be avoided or mitigated?
5. How are public resources and investments distributed geographically?





OPAL training retreat on Mount Tabor.

Climate Equity and Justice at the grassroots level.

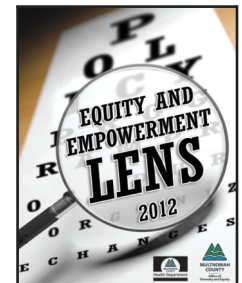
Grassroots organizations in Portland and across the country are cultivating visions of justice and equality and building movements of resilience in local communities. From environmental and green assets, to transit justice, to food security, to brownfield revitalization and youth empowerment, local organizations are leading the charge for environmental, economic and social justice.

In 2010, a strong community-based partnership of Verde, Hacienda CDC and the Native American Youth and Family Association established the Living Cully EcoDistrict. Living Cully reinterprets sustainability goals as anti-poverty strategies, bringing new environmental and social capital assets to the Cully community to respond to community needs around health, employment, education and housing. Currently, this partnership is exploring several signature projects in Living Cully, including Let's Build Cully Park!, a 25-acre brownfield conversion into a new park for the community, creating jobs and educational opportunities in the process. This effort is justice-oriented, develops leadership, builds social capital, and contributes to climate change mitigation and adaption.

Also in 2010, OPAL Environmental Justice Oregon initiated its Bus Riders Unite! transit justice program, building power with transit-dependent communities to achieve more equitable outcomes in transportation decision-making. As our transportation sector is the primary contributor to our regional and state greenhouse gas emissions, there simply is no

climate change solution without a transportation solution. Bus Riders Unite! leadership are pursuing campaigns to ensure safe, accessible and affordable public transportation in the region, both to serve as a lifeline to opportunity for transit-dependent communities and as a strategy to achieve cleaner air and a healthier environment. One example is the Campaign for a Fair Transfer, seeking to extend transfer times to three hours during the day and through the end of service after 7PM, which would provide greater value and access to transit-dependent riders who cannot afford monthly passes as well as increase overall ridership by creating new choice riders. OPAL is also working with the Multnomah Youth Commission to maintain the YouthPass benefit program for PPS high school students and extend it out to East Portland and East County school districts. YouthPass is a transformative approach to creating the next generation of transit riders and meeting triple-bottom line sustainability goals.

As Multnomah County Health Department moves forward in its climate work, we can continue to learn from these grassroots organizations that are empowering communities through environmental justice work. We are also beginning to use our own Equity and Empowerment Lens in our climate planning and implementation process, which employs a holistic and culturally responsive framework that includes references to the key areas that influence equity.



More information about how to use the lens in a decision-making process can be found at:

web.multco.us/diversity-equity/equity-and-empowerment-lens

ASSESSING VULNERABILITIES: OUR FRAMEWORK

Conducting a vulnerability assessment is one way for public health to better understand the health disparities that may be impacted by climate change; and to develop interventions or actions that keep equity in mind so that we do not further exacerbate existing disparities. Vulnerability assessments specific to climate change are becoming more popular nationwide, and there are many different processes local health departments can use to create an adaptation plan that results in community resiliency. In 2011, the Centers for Disease Control and Prevention Climate Health Program came up with five steps to help local health departments assess health outcomes and persons whose health is vulnerable to changes in our climate. This tool is called BRACE (Building Resilience Against Climate Effects) and guided the development of this plan.

Step 1: Understand the potential regional impacts of a changing climate and engage stakeholders. The purpose of this step is to set the stage of your assessment, present the local climate data and brainstorm health impacts: In this step, we:

- Convened stakeholders and oriented them to climate change in Multnomah County, meeting expectations/time commitment;
- Presented climate change 101 and local climate projections;
- Brainstormed potential local health impacts as a result of changes in temperature, precipitation and worsening air quality.

Step 2: Assess who and what areas are at risk. The primary purpose of this step is to quantify the health impacts from climate change in your community. In this step, we:

- Brainstormed data indicators for health outcomes (e.g. hospitalization for asthma), social groups (e.g. age, race, ethnicity) and environmental features (urban heat island effect) and evaluated usefulness of data sources.
- Compiled data to understand the baseline of our community's health related to these issues.

- Used tools, such as, a heat vulnerability index and GIS mapping to better understand how different geographic communities will experience climate related health impacts.

Step 3: Determine interventions. The purpose of this step is to identify the most suitable health interventions. In this step, we:

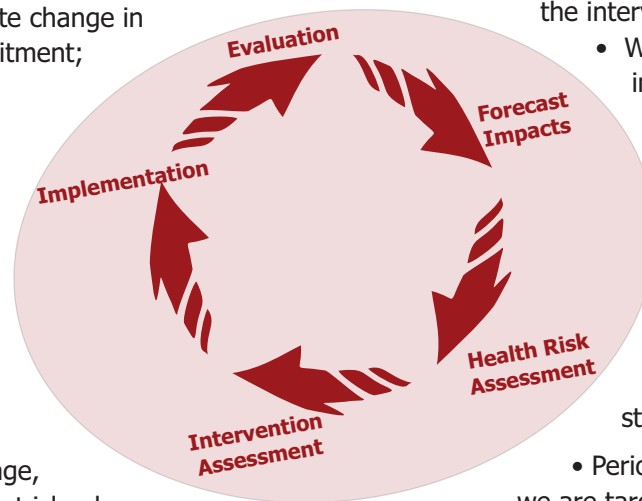
- Listed the range of health interventions available for each health outcome.
- Assessed our capacity to implement each intervention.
- Prioritized health interventions deemed most suitable for our health department.
- Identified other internal stakeholders for receipt of additional intervention feedback.

Step 4: Create a plan and implement it. The purpose of this step is to develop and implement a plan that introduces program changes that address the health impacts of climate change. In this step, we plan to:

- Present the plan to Department Leadership and get approval for the action plan.
 - Disseminate the plan to stakeholders that play a part in executing the interventions.
- Work with stakeholders to incorporate adaptations into existing community and health planning processes.
 - Pursue funding opportunities to support implementation of our plan.

Step 5: Evaluation. The purpose of this step is to evaluate your process and outcomes. Evaluation efforts should be ongoing to ensure your plan is based on the most accurate climate science and corresponding health impacts. In this step, we plan to:

- Periodically review local climate projections to ensure we are targeting our planning efforts appropriately, both in terms of health impacts and vulnerable populations.
- Periodically review our action plans to ensure adaptation measures are being implemented.





In February 2012, we formed a Stakeholder Advisory Committee to brainstorm public health issues and vulnerable populations that may be impacted by changes in temperature, precipitation and decreased air quality. The committee was comprised of the following Multnomah County team members:

- Community Epidemiology Services
- County Emergency Management
- Public Health Emergency Preparedness
- Vector Control
- Community Wellness and Prevention
- Health Assessment and Evaluation
- Environmental Health Services

This combination of team members brought expertise in heat-related morbidity and mortality trends, knowledge of asthma rates, awareness of emergency preparedness plans and capacity to respond to extreme weather events, knowledge of surveillance and monitoring of vectors, and overall awareness of health disparities and impacts to vulnerable populations. The group was presented with a literature review of local climate impacts and potential health effects, and participated in a brainstorm to identify vulnerable populations, including geographical and non-geographical communities.

After discussing our current capacity and gaps in plans, policies and data sets, we decided to focus on heat-related illness, respiratory disease (asthma and allergies), and vector-borne disease. We chose these based on published literature; availability of environmental, health and demographic indicators of risk; readily available data sources such as the U.S. Census Bureau; gaps in response and risk communication plans related to extreme weather events; and relevance to current disease surveillance and epidemiology practices at our health department.

Our primary health concerns:

We collected baseline information to better understand how climate-related illnesses (heat, respiratory, vectors etc.) already impact our community, especially with regards to health disparities.

Heat: After reviewing the data, the Stakeholder Advisory Committee concluded that the impacts of heat and poor outdoor air quality are of high concern given their current impact and the disparities that exist among vulnerable populations and neighborhoods. Data demonstrated that certain parts of our community are far more vulnerable to heat because of urban heat-island effect and other social factors. Climate data clearly show that our region will get warmer and will experience more extreme-heat events. The advisory committee felt strongly that we, as a community, must plan for these events and eliminate a disparity that may be amplified by climate change.

Air-Quality: Similarly to heat, poor air-quality already impacts the health of our community. A separate study commissioned by the Oregon Department of Environmental Quality, found that the air in the Portland metropolitan region exceeds health benchmarks for a number of toxics including diesel particulate matter. The study also found that there are very particular environmental justice communities who experience greater burdens from particular emission sources. The study projected air-toxics emissions for the next five years, although climate change was not one of the variables they considered. The advisory committee felt that because our air-quality will be worsening, even in the absence of climate change,

it was particularly important that we better understand the interplay between climate change and air-quality and that we begin protecting our communities now. Climate change will also bring higher concentrations of ground-level ozone, a pollutant not addressed in the study mentioned above. The combination of these concerns elevated air-quality to a primary health concern.

Vector-Borne Illnesses: the spread of mosquito populations (the primary vector of concern in our region) if affected by a variety of factors, some of which will be impacted by climate change. In Multnomah County we have a history of addressing emerging mosquito-borne diseases including West Nile virus. Because of the relative uncertainty around how climate change may impact our vector populations, the advisory committee felt it was important to acknowledge the capacity of our vector programs and ensure they are fully supported as we plan for new and emerging vector-borne diseases.

Findings

We list below the key climate risks identified in the first step of our assessment, the climate projections, the resulting health consequences, and our key actions for the next 1 to 3 years.



CLIMATE RISK #1:

INCREASED AVERAGE ANNUAL AIR TEMPERATURE

AND LIKELIHOOD OF AN INCREASE IN MORE

CONSECUTIVE HOT DAYS

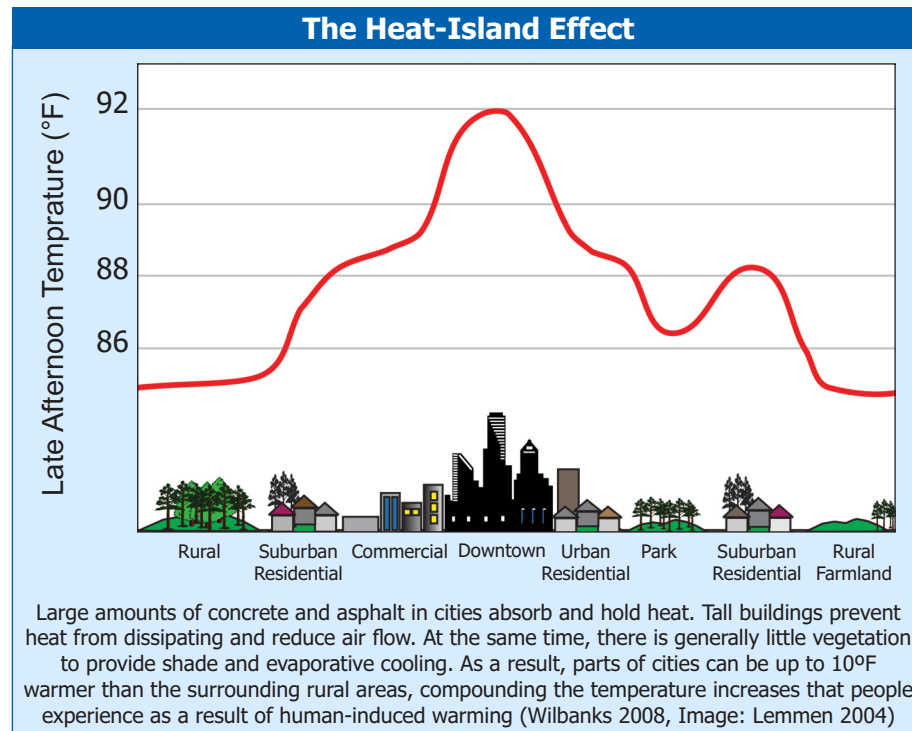
Projections: The overall trend for temperature shows warming for Multnomah County by the end of the century. Warming is most intense along the Interstate 5 corridor and in urban areas. There is also warming during the winter months, but less extreme than in the summer. Higher temperatures affect the formation of ground-level ozone, which is an air pollutant that affects health, for example, causing bronchitis and emphysema. Populations vulnerable to heat may be more impacted, such as the elderly and those who live in areas that retain heat due to a higher quantity of buildings and paved surfaces versus vegetation, known as “urban heat islands”.

Resulting Health Consequences:

- Increase in heat related morbidity and mortality, particularly among vulnerable populations such as the elderly, low income, homeless, pregnant women, and individuals with outdoor occupations;
- Increased threat of vector-borne and emerging diseases (due to longer breeding seasons), particularly West Nile virus, *V. parahaemolyticus* infection in oysters, *Vibrio* spp in shellfish, and *Cryptococcus gatti*;
- Earlier and extended allergy seasons (pollen also benefits from increases in carbon dioxide levels) impacting those with asthma and respiratory disease;
- Amplification of cardio-vascular disease.

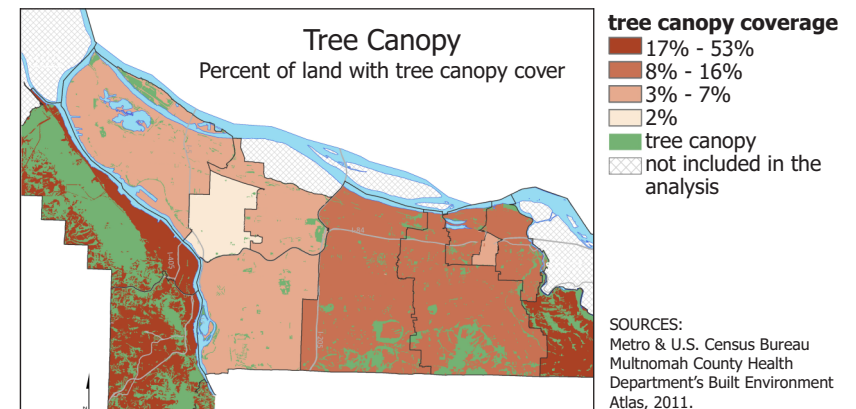
Some examples of what we are doing

Environmental Health Services' Policy, Program Development and Education team provides education and policy advocacy on emerging environmental health issues. Team members are key stakeholders in city and county urban planning efforts, working to bring a public health and equity lens to key decisions. For example, members might provide data on heat vulnerability and urban heat island effect to help shape where tree planting and other greenspace efforts occur in an effort to prevent heat-related illness and improve air quality in vulnerable communities. Our Public Health and Emergency Preparedness Team is skilled in creating risk communication messages to prevent health impacts due to natural hazards, such as extreme heat events. Our Public Information Officers play a key role in developing these messages and collaborating with agencies, such as Aging and Disability Services, to get these messages out to those most vulnerable. We can also help assure those most vulnerable know about cooling centers and how to access them.



Baseline data and analysis

Temperatures in the Portland metropolitan area have historically been mild, resulting in little to no impacts on human health. In 2008, Multnomah County saw approximately 12 days over 90 with evening temperatures just less than 70 degrees. Several consecutive days of



temperatures of 90 degrees Fahrenheit or higher combined with unusually high nighttime temperatures can lead to heat illness for populations without access to air conditioning, well insulated homes or cooling centers.

Evidence associated with extreme hot weather conditions and heat events has proven that particular population groups are at increased risk of mortality. These vulnerable populations include older adults (over 65 years), people who live alone, people of non-white origin, homeless people, people without access to air-conditioning, and people below the poverty line. As the most populous county in Oregon, Multnomah County is home to:

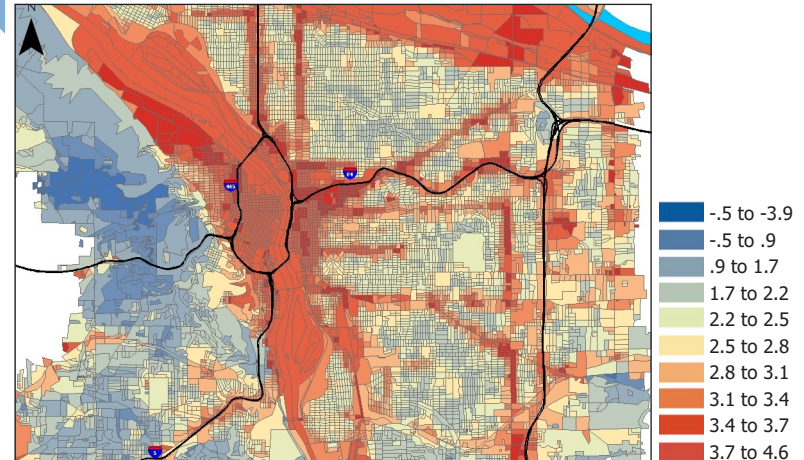
- Adults over 65: 10.7 % (Census 2010)
- People who live alone: 13.7% (Census 2010)
- Adults over 65 who live alone: 4% of the total population (Census 2010)
- People of non-white origin: 27.9% (Census 2010)
- People with no access to air-conditioning: 56.5 % (American Housing Survey)
- People with diabetes: 6.7% (Oregon DHS, 2007)
- People below the poverty line: 16% (Census 2010)

Combined with urban heat island effect, Multnomah County's population will be vulnerable to heat as the climate changes.

Portland State University recently conducted a study that looked at urban heat island effect, and highlighted areas within Multnomah County that are particularly vulnerable to heat (see illustration). Many of the geographic areas vulnerable to urban heat island effect are also areas where many community members who are of a lower socio-economic status live. These areas are vulnerable because of a lack of air conditioning, larger families living in small apartments, social isolation due to language and cultural barriers, and already diminished air quality from proximity to freeways and highways with high diesel particulate emissions.

We applied a heat vulnerability index (HVI) to Multnomah County that displays which geographic communities in our county are most vulnerable

Urban Heat Islands in Portland



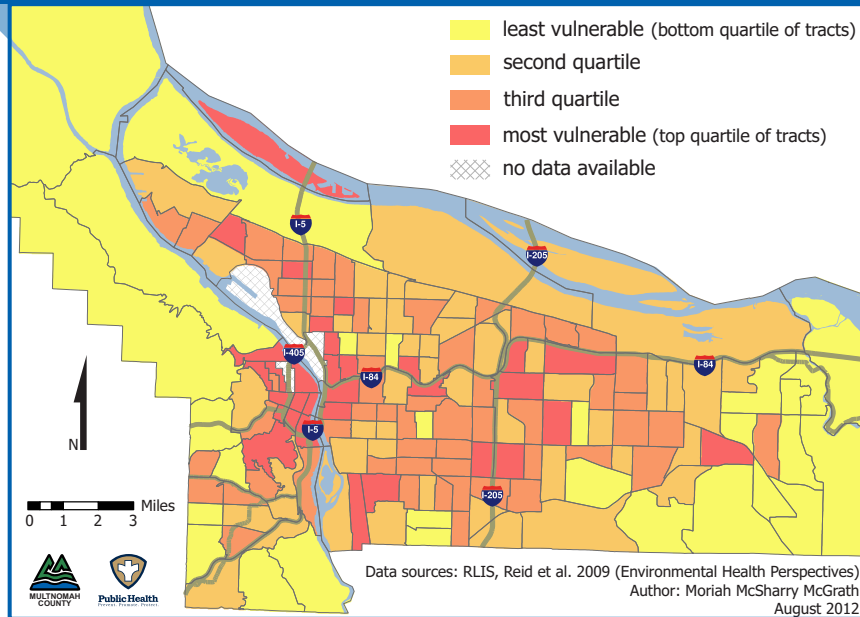
How parts of Portland vary from the region's median temperature, in degrees Fahrenheit. Minuses are cooler than the median; the rest are warmer (Shandas, 2013).

to heat. This can help us allocate resources to the areas in greatest need. We used a national HVI to locate populations vulnerable to heat at the sub metropolitan level using variables associated with vulnerability in previous studies based on work by Reid et al. in "Evaluation of a Heat Vulnerability Index on Abnormally Hot Days: An Environmental Public Health Tracking Study."

Vulnerability is determined on the following factors:

- **Factor 1 Social and Environmental Determinants:** This factor is a combination of data that describe social characteristics and environmental features including poverty, race, educational attainment and green space.
- **Factor 2 Social Isolation:** This factor describes social isolation using data that assess the percentage of the population that live alone and those over age 65 that live alone.
- **Factor 3 Air Conditioning:** This factor assesses the prevalence of air conditioning in homes through data points including the percent of homes with central air conditioning and the percent of homes with no air conditioning of any kind.

Heat vulnerability index



- Factor 4 pre-existing health conditions: The final factor summarizes pre-existing health effects by assessing age and diabetes diagnoses.

The Heat Vulnerability Index tallies these indicator scores on a census tract level and creates a rating system. Although the Vulnerability Index is not an exact predictor it does help generally describe areas of the county where residents are likely to be more impacted during extreme heat events.

We reviewed baseline data for heat-related hospitalizations for the years 2002-2009, looking for cases with a diagnosis of E900.0, for excessive heat due to weather condition (as opposed to human-caused condition, such as working in boiler room). Two data sets were used: hospital discharge data and death certificates. The hospital discharge datasets tracks diagnoses assigned to people who stayed in the hospital. A person receives one primary diagnosis and up to nine more diagnoses. The diagnoses are coded the standardized fashion established by the International Classification of Disease manual's ninth edition (ICD-9).

These codes are used for billing insurance companies. Death Certificates were reviewed looking for cases with any cause of X30, for excessive heat due to weather condition as a primary or underlying cause.

There were no overnight hospitalizations due to hot climate in Multnomah County between 2002 and 2009. The ICD-9 code E900.0, for excessive heat due to weather condition did not appear as a primary or secondary diagnosis in any hospitalization. This is not surprising, given the mild climate of the Portland metropolitan region. Heat-related deaths are rare in Multnomah County. However, improved diagnostics and reporting practices will help us better understand the impacts of heat in our region. As we move forward in preparing for warmer summers, we will need to work to get the best data possible.

Key Recommended Interventions:

Objective 1.1 Monitor, diagnose and investigate health problems and hazards in the community related to extreme heat

- Conduct ongoing surveillance and monitoring of heat-related illness through review of data such as death certificates and hospital discharges.
- Establish research partnerships with institutions of higher learning to gather local data around the linkage between increased temperature and health outcomes and disparities
- Identify populations and places vulnerable by updating and analyzing our heat vulnerability index and determine population health service needs.

Objective 1.2 Inform, educate and empower community members about heat-related illness, extreme heat, and adverse impacts on health.

- Develop and distribute culturally competent and accessible extreme heat education materials, especially to vulnerable populations.
- Work with health care and social services providers to ensure their ability to provide appropriate services during extreme heat events.
- Partner with community organizations and government agencies to

assess the need for and coordinate the operation of cooling centers that are readily accessible, especially for vulnerable populations (such as the elderly, disabled and homebound individuals).

Objective 1.3 Link people with needed services to reduce safety and health risks for vulnerable populations from extreme heat events and high ozone days.

a. Develop early warning systems and response plans that alert community members when projected heat conditions pose a health risk.

Objective 1.4: Reduce the urban heat island by collaborating with government agencies and organizations that increase greenspace and tree canopy and improve cooling.



CLIMATE RISK #2:

INCREASED RESPIRATORY ILLNESS

AND ALLERGIC DISEASE

Projections:

Local air quality affects how we live and breathe. Many air toxics, such as diesel particulate matter and ozone, have been well documented as affecting our health. The region already suffers from diminished air quality, with burdens falling disproportionately on certain communities. As we see changes in our climate, we will likely see additional health impacts from poor air quality as ozone formation is highly dependent on changing weather, such as higher summer temperatures.

Understanding air toxics

“Climate changes will likely affect air quality by modifying local weather patterns and pollutant concentrations.” (Congressional testimony of Dr. Howard Frumkin, 2008).

It is likely to affect air quality through several pathways, including increased regional concentrations of ozone. Temperature increases due to climate change will likely worsen regional air quality and increase related health burdens. While greenhouse gas emissions (GHG’s, primarily CO2) that are causing climate change are not considered air toxics, the source

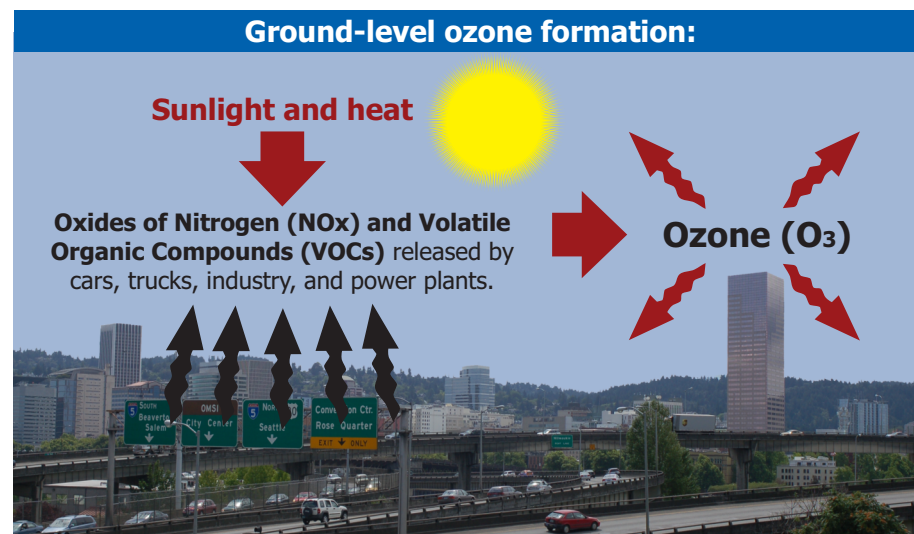
of these emissions like burning fossil fuels for transportation and construction also produce air toxics. Many strategies to reduce GHG emissions also protect public health in the short term by reducing air toxics, and long term by limiting climate change related temperature increases.

The region already suffers from significant issues of poor air quality. Compared to other areas of the state, the Portland region has the highest risk to the population from air toxics. Along with national estimates of air toxics emissions, Portland monitoring studies confirm the presence of air toxics at levels that can cause adverse health effects. From 2003 to 2007, Oregon ranked among the top 10 states with the highest percentage of adults with asthma in the nation. During 2004-07 in Multnomah County 10.0% of the White non-Hispanic adult population and 17.6% of the African-American non-Hispanic population reported current asthma (ODHS 2008). The majority of children with asthma in Multnomah County - 9.9% of the children in Multnomah County have asthma - are part of environmental justice communities where poverty, communities of color, and poor housing conditions intersect.

Low-income families are more likely to have asthma impact their quality of life, routinely seek asthma care at emergency departments, and be hospitalized due to asthma. Asthma has indirect and direct costs on the public. Emergency Department (ED) visits and hospitalizations for asthma have significant direct costs: the average ED visit is \$1,070 and the average hospitalization is \$11,540 (Hoppin, 2007). A large percentage of ED and hospitalization costs for asthma are passed on to the community in the form of more expensive health care.

What is ozone and what does it have to do with climate change?

Ozone formation is dependent on sun, which results in more ground level ozone in the summer, especially with higher summer temperatures. People that live in areas with the "urban heat island" effect are more vulnerable to increases in ground level ozone. Unlike most other types of air pollution, ozone is not emitted directly into the air. Rather, it forms on

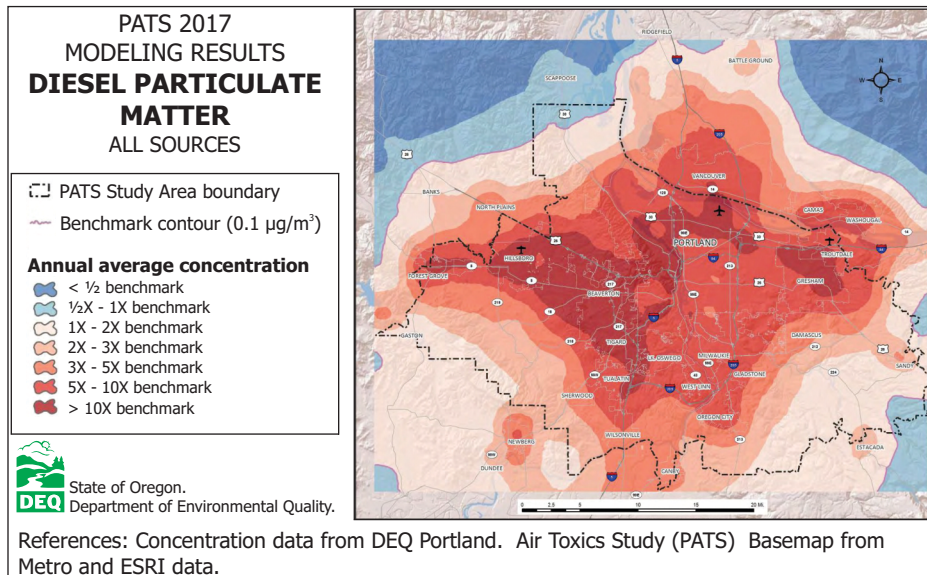


hot days when vehicle exhaust, gasoline vapors, paints, solvents, and industrial emissions "cook" together in the presence of heat and sunlight. Ozone formation is highly dependent on weather. If Oregon has more hot days due to climate change, the result may be higher ozone levels. Studies show that higher surface temperatures, especially in urban areas, encourage the formation of ground-level ozone. (EPA 2009).

Although all metropolitan areas in Oregon meet the federal health standards for ozone that were most recently revised in 1997, the EPA is considering stricter limits on ozone because the health of certain individuals is still being compromised. Several communities in Oregon may not meet this stricter standard, including the Portland, Eugene, Salem and Medford areas. The EPA is considering lowering the allowable limit for ozone, which currently sits at 75 parts per billion. Under these new rules some counties, including Multnomah County, will fall into "non-attainment," which means that EPA will formally recognize that Portland's air is dirtier than allowed, and is threatening public health and the environment. Multnomah County will be asked to put together plans for cleaning up its air.

What is diesel particulate and what does it have to do with climate change?

A recent report commissioned by the Oregon Department of Environmental Quality found that large swaths of Multnomah County will experience levels of Diesel Particulate Matter that are more than 10 times above acceptable risk levels. The map below demonstrates the projected load of toxic diesel particulate matter by 2017. The map shows that every corner of Multnomah County will have diesel particulate matter concentrations that exceed health benchmarks. Some areas in the City of Portland will have concentrations that are more than 10 times health benchmarks. The Environmental Protection Agency estimates the direct and indirect public health and environmental costs of exposure to diesel particulate in Multnomah County to be worth \$1.1 million per ton annually. Diesel particulate matter does not have a direct relationship to climate change; however, it often comes from the same sources that ground level ozone comes from. By working to reduce diesel particulate matter exposure, we are also reducing ground level ozone, and also mitigating further health impacts related to both of these air toxics.



Resulting Health Consequences:

Short-term effects of exposure include irritation to eyes, nose, and throat, as well as increased incidence of upper respiratory inflammation.

- Air pollution is associated with chronic obstructive pulmonary disease hospitalizations, respiratory and cardiovascular morbidity and mortality, acute asthma care events, diabetes mellitus prevalence, lung cancer risk, birth defects, lung impairment, fatigue, headaches, respiratory infections, and eye irritation.
- Inhaling fine particles can lead to a broad range of adverse health effects, including premature mortality and aggravation of cardiovascular and respiratory disease.

Some examples of what we are already doing:

Environmental Health Services has a long history of working on improving indoor air quality and supporting people with asthma through education, case management and policy change. We have three community-based programs working with families whose children have environmentally caused health conditions by providing nurse case management and education about indoor air quality, for example how to prevent mold and mildew, primarily in rental housing. This work on indoor air quality strengthened our understanding of how our indoor environment impacts health outcomes. As we began to learn more, we learned that outdoor air quality and air pollution is just as much of a variable in impacting respiratory issues. We realized we can mitigate asthma exacerbations outside the home as well. As a result, we served as a key stakeholder on the Oregon Department of Environmental Quality's Portland Air Toxics Solutions Advisory Committee, which provided key education on the main air pollutants in our region, and allowed us to bring a public health and environmental justice lens to the dialogue. Our hope is to build on our growing expertise to empower our clients and community members so they breathe easier no matter where they are in Multnomah County.



Baseline data analysis:

Baseline data was collected using the “Allergic Disease” indicator developed by the State Environmental Health Indicators Collaborative (SEHIC) Climate Change Indicators project as a starting point. Rates were computed for the following allergic disease-related hospital admissions based on their appearance in the hospital discharge data, using the Portland State University population estimates as the denominator. Numbers in parentheses are the ICD-9 codes used to identify the conditions.

- i. asthma (493.01, 493.02, 493.20, 493.21, 493.22, 493.81, 493.90, 493.91, 493.9.2)
- ii. hay fever/allergic rhinitis (477.9, 477.8, 477.0)
- iii. eczema/atopic dermatitis (691.8)
- iv. hives/allergic urticaria (708.0)
- v. allergic conjunctivitis (372.0, 372.30)
- vi. excessive heat due to external cause (E900.0)

To account for visits that may have included a climate-sensitive health issue as either a primary or secondary diagnosis (visits can have up to ten diagnosis codes), we computed whether each case had any of the conditions above listed in any of its diagnostic codes. This method meant that a single case could be considered, for example, an asthma-related visit and an eczema-related visit. As a result, the same visit could be included in the numerator of the rate for multiple conditions. This could be considered an inflation of the rates of climate-related health conditions.

Among the climate-sensitive allergic disease conditions, asthma is far and away the most likely to result in a hospital stay. Asthma accounted for 3,906 hospital stays – or 534 per 100,000 county residents – in 2009. Hay fever was the most next common, followed by eczema, hives, and allergic conjunctivitis. The table below shows the rates and number of cases for each individual condition by year.

Table : Allergic-disease related hospitalizations, rates per 100,000 and number of cases in Multnomah County 2002-2009

year	asthma		hay fever		eczema		hives		conjunctivitis	
	rate	cases	rate	cases	rate	cases	rate	cases	rate	cases
2002	553.1	3,717	13.7	92	2.5	17	1.5	10	0.4	3
2003	501.3	3,410	14.7	100	1.9	13	4.0	27	0.1	1
2004	488.7	3,367	15.7	108	2.2	15	2.0	14	0.3	2
2005	513.4	3,576	15.5	108	3.0	21	2.7	19	0.0	0
2006	468.6	3,308	15.7	111	4.0	28	3.1	22	0.6	4
2007	448.8	3,209	18.3	131	2.5	18	2.0	14	0.1	1
2008	529.3	3,830	21.3	154	4.0	29	3.7	27	0.1	1
2009	534.3	3,906	17.9	131	4.2	31	3.1	23	0.1	1

Key recommended Interventions:

Objective 2.1 Monitor, diagnose and investigate health problems and hazards in the community related to high ozone days

- a. Conduct ongoing surveillance and monitoring of respiratory illness and impacts of air quality on health status through review of data such as death certificates and hospital discharges.
- b. Identify populations and places vulnerable by developing and analyzing an air quality index and implement an asthma syndromic surveillance system.

c. Establish research partnerships with institutions of higher learning to gather local data around the linkage between increased temperature, air quality (specifically ground-level ozone) and health outcomes and disparities.

Objective 2.2 Inform, educate and empower community members about air quality and high ozone days and adverse impacts of poor air quality on health.

a. Develop and distribute culturally competent and accessible education materials focused on respiratory-related illness, especially to vulnerable populations.

b. Develop and implement a Clean Air campaign with community partners, to distribute air pollution advisories.

Objective 2.3 Link people with needed services to reduce safety and health risks for vulnerable populations from high ozone days.

a. Develop early warning systems and response plans that alert community members when projected poor air quality days pose a health risk.

b. Support the continuation of existing initiatives linking environmental conditions to health outcomes like asthma, such as the County Healthy Homes programs.

Objective 2.4 Work to advance recommendations from related planning processes designed to improve air-quality.

a. Research community engagement and policy-making processes working to address poor air-quality in the region.

b. Research how the Health Department can best advance recommendations from the Portland Air Toxics Solutions report that work to reduce the exposure of toxic air pollutants, particularly in environmental justice communities.



CLIMATE RISK #3:

IMPACTS FROM INCREASED SUMMER TEMPERATURES

AND PRECIPITATION ON VECTOR-BORNE DISEASE

Projections: It is most likely that the county will experience wetter winters and a slight decrease in precipitation in the summer months.

Resulting Health Consequences:

In combination with increased temperatures, shifts in precipitation may result in changes to our profile of vectors and vector-borne diseases in two ways:

- Climate change may result in prolonged breeding seasons for mosquitoes with vector capacity that are currently found in Multnomah County.
- Climate Change may make our area more hospitable to vector species (i.e. *Aedes Aegypti* and *Aedes Albopictus*) that are currently not known to exist in our region.



Monitoring mosquitoes in the field.

What we are already doing:

The Vector Control program is responsible for mosquito surveillance and control throughout Multnomah County by means of an integrated program. This holistic approach uses multiple complimentary methods such as identification of insect or animal species of concern, prevention, surveillance, treatment and education. Adult and immature mosquitoes are collected, counted and identified to determine the levels of local populations. Some species of adult mosquitoes are tested for the presence of mosquito-borne diseases such as West Nile virus. Vector Control prioritizes immature mosquito control before they become flying, biting adults.

Multnomah County Vector Control is well prepared to address emerging vector populations and the diseases they spread. The introduction of West Nile virus in Oregon in 2005 presented an opportunity for the program to develop policies, procedures and relationships to quickly respond to increased demands on their services. This included developing template risk communication materials and memorandums of understanding with property owners of large ideal mosquito habitats.

Baseline data analysis:

Multnomah County Vector Control currently surveys approximately 18 mosquito species that are considered native to Northwest Oregon, 6 which have vector capacity. Non-native species have been detected in our

area, but only three have considerable vector capacity for WNV and other encephalities. Only one (*Ochleratus japonicus*) of the eight has become established. Research shows that there are two mosquito species that could become a greater concern in the region, *Aedes albopictus* and *Aedes aegypti*, as we experience wetter winters and warmer summers.

As the climate in Multnomah County changes, it is likely that species that are transported here could begin to establish themselves due to the warmer summers that mimic the habitat of their current distribution and an increase in pools of standing water left from heavier winter and spring rains. These conditions provide ideal environments for eggs to hatch, especially if the water has low turbidity and/or high nitrogen content, which is typically associated with increased fertilizer runoff from homes, parks, golf courses, and agriculture during the rainy season. Additionally, eggs can withstand dry conditions for up to five years and the larvae emerge after rainfall raises the water level in the containers or habitat in which they live. This means that as the summers become hotter and drier in the region, these mosquito species will continue to thrive and could become an additional important vector species. Vulnerable populations impacted by vectors can include homeless residents, older adults, people with suppressed immune systems and children.

Key recommended interventions:

Objective 3: Protect the health and safety of community members from vector-borne diseases

- a. Survey and monitor for vector-borne diseases by collecting, analyzing, and interpreting data related to vector ecology and emerging public health threats. Coordinate with Centers for Disease Control and Prevention (CDC) on information about changes in vector- water- and food-borne diseases across the country.
- b. Create a response plan for emerging vector borne diseases. Surge capacity for health services are triggered by certain case thresholds.
- c. Work with building and zoning authorities to require new developments

in at-risk areas to include features that reduce habitat and mitigate health risk of vector populations

d. Develop and distribute culturally competent and accessible vector-borne disease prevention materials

e. Expand the capacity to educate health care providers to recognize and report new or unusual patterns of illnesses and injuries, and to inform the public about preventive actions they can take

f. Continue the coordination between local natural resource agencies and Vector Control programs to ensure vector populations are managed in a way that protects human health, regulatory compliance, and ensures ecological integrity and vitality.

LIMITATIONS TO OUR ANALYSIS:

We did not have access to emergency department discharge data, which is an important record of health problems. Because the hospital discharge data only track people who stay overnight at the hospital, only the most serious problems are recorded in the dataset. Certain conditions may be responsible for many visits to the emergency room, but may not have much of a presence in the hospital discharge data because few of the patients were admitted to the hospital for an overnight stay. Because they are used for billing purposes rather than diagnostic purposes, ICD-9 codes may not accurately reflect the character of a person's condition. Furthermore, none of these data provide information about health problems that are not treated at hospitals or not treated at all (unless they result in death).

Vector-borne diseases are generally under-reported. Not all people with a disease will seek medical care, and medical professionals may not correctly diagnosis the condition. After a condition is diagnosed, it may not be reported to the state even if the law requires doing so. This failure to report is more common in diseases that are spread through vectors rather than between people.



CLIMATE CHANGE

AS A DETERMINANT OF PUBLIC HEALTH:

THE LONG-TERM PERSPECTIVE.

This plan presents some of the most likely impacts that our changing climate will have on the health of the people in Multnomah County as well as concrete measures to be implemented in the short term to reduce these risks. Ongoing research and evaluation in the US and worldwide enables us to improve our understanding of the health risks related to climate change and to identify optimal health promotion practices that we can adopt locally.

The range of potential new threats to our health brought about by climate change is vast and varies greatly depending of geographical locations:

- On one level, ongoing epidemiological surveillance of the health of the people of Multnomah County is essential to enable us to respond quickly to emerging health problems, whatever they may be.
- Additionally, the process of assessing local vulnerabilities, reviewing current scientific literature and implementing new specific protective measures will need to be renewed regularly to take into account updated knowledge, lessons learned, and best practices.

The second and third National Climate Assessment reports include a specific chapter on Human Health (NCADAC 2009 and NCADAC 2013). In complement to the three main types of risks we have identified in Multnomah County (extreme heat events, worsening air quality, and vector-borne diseases), the authors of these national reports also list the following climate-related threats:

- **Plant allergens.**

Increased concentration of CO₂ in our atmosphere is contributing to increasing pollen production, which consequently increases human exposure to pollen that causes allergic rhinitis and related asthma (see illustration).

- **Molds**

Floods, extreme rainfalls and rising temperature can foster the growth on indoor molds and fungi that can increase respiratory and asthma-related conditions.

- **Forest wildfires**

The frequency of forest wildfires is predicted to increase. This can reduce air quality and increase both respiratory and cardiovascular diseases.

- **Mental Health and Stress-related Disorders**

Catastrophic events such as heat waves, floods, wildfires and hurricanes lead to high levels of anxiety and post-traumatic disorders. Some people with mental illnesses are specifically vulnerable to heat. Knowledge of climate change can in itself lead to anxiety and despair in some people.

- **Food- and Waterborne Diarrheal Diseases**

Temperature, precipitation patterns, and extreme rainfall events are known to affect the transmission of a variety of pathogens in water and food, and this may notably increase the incidence of Salmonellosis and Campylobacteriosis.

Climate change and plant-based allergens.

The diagram features a blue header with the title 'Climate change and plant-based allergens.' Below the header, a black arrow labeled 'RISING CO₂ LEVEL' points to a black arrow labeled 'Increased pollen production and longer pollen season.' This arrow points to a black arrow labeled 'Increases in asthma and allergies.' The central part of the diagram shows a green plant on the left and a human silhouette on the right. A yellow cloud containing many small brown dots (representing pollen) flows from the plant towards the human's nose and mouth. The human's lungs are visible, indicating the respiratory system's exposure to the allergens.

The level of CO₂ in our atmosphere has risen from less than 320 parts per million in 1960 to close to 400 ppm today and plant biology is directly affected by CO₂ levels. The quantity of pollen produced by ragweed is doubled by current CO₂ levels compared to CO₂ concentration of a century ago, and could double again in predicted future atmospheric conditions (Ziska and Caufield 2000). In parts of the US, the duration of ragweed pollen season has increased between 1995 and 2011 by as much as 13 to 27 days, with the largest increases being observed in northern cities (Ziska 2011). These factors increase human exposure to pollens that causes allergic rhinitis and related asthma. Worldwide, the prevalence, incidence and morbidity of asthma have increased over recent decades, and climate change has been identified as a plausible contributor to this long term rise (Beggs 2006).

We are therefore paying close attention to these concerns. To a large extent, these other threats are already addressed by ongoing local policies and programs. For instance, Multnomah County already has in place an integrated program on asthma that includes public education of how to keep our homes healthy (including free of mold), tailored support for low-income families affected by asthma, and broader policy work designed to make housing healthier. Overall, the main question will be to assess whether and to what extent each of these other threats will affect our region and whether specific additional public health measures need to be implemented locally.

A CALL FOR BROADER AND BOLDER

ACTIONS ON CLIMATE CHANGE

Climate change constitutes a unique challenge for humanity. Changing habits can be difficult. Social norms can prevent individuals from adopting more environmentally responsible behaviors (Gifford, 2011). If every person that you know drives a car on a daily basis, you usually do not want to be the odd one who will instead ride a bicycle and use public transportation (even if at some level, you know that doing so would vastly reduce your individual carbon footprint). Thankfully however, not all individuals conform and social norms do change. In Portland for instance, bicycle traffic has more than tripled since 2000 (as reported in the 2012 Portland Bicycle Count).

Sociologist Kari Norgaard has identified that negative feelings often triggered by the notion of climate change- notably guilt, fear and helplessness - often make people prefer to avoid thinking or talking about the issue altogether (Norgaard, 2011). She states,

“A big piece of what is so paralyzing for people is the sense that they are alone in actually taking climate change seriously, which in turn makes them further convinced that there is nothing really that can be done. (...) Certainly having a group of people around you who are doing something can make people feel more empowered. I think we do need to encourage people to be involved in their local communities in figuring out what the impacts of climate change will be in their communities and working together, which will both make climate change more visible, more politicized and create community around it at the same time.” (Norgaard and Lertzman, 2011)

This plan presents a series of very concrete public health actions designed to make our community more resilient to ongoing and upcoming changes in our local climate. It is based upon and largely inspired by a very rapidly growing worldwide network of public health professionals and researchers who are designing and implementing a vast array of solutions to protect our health in these challenging times. These actions are embedded in much broader efforts on climate change mitigation and adaptation currently undertaken by local, state and federal agencies (including President Obama's Plan to Fight Climate Change announced in June 2013) as well as countless initiatives by community-based organizations and private businesses. In other words, we all have a role in protecting our health from the impacts of our changing climate and to keep our planet safe and hospitable for future generations.

Ultimately, what is healthy for our planet is also best for our individual health. It is imperative that public health professionals and their partners be given the tools, resources, and policy recommendations to make this an integral part of their already essential work. This plan is a first step at addressing the local health impacts of climate change.



REFERENCES

- APHA - American Public Health Association. Climate Change: Mastering the Public Health Role. April 2011.
- Beggs PJ, Bambrick HJ. Is the global rise of asthma an early impact of anthropogenic climate change? *Ciência & Saúde Coletiva* [online] 2006, 11 (June - September).
- CPMC - City of Portland and Multnomah County. Climate Action Plan 2009. Available at www.portlandoregon.gov/bps/article/268612
- EPA. National Ambient Air Quality Standards for Ozone. 2009. Available at: <http://www.epa.gov/glo/actions.html>
- Frumkin H, Hess J, Luber G, Malilay J, McGeehin M. Climate change: The public health response. *Am J Public Health*. 2008;98(3):435-445.
- Gifford, R. The Dragons of Inaction: Psychological Barriers That Limit Climate Change Mitigation and Adaptation. *American Psychologist*. 2011; Vol. 66, No. 4, 290–302
- Guidry VT, Margolis LH. Unequal respiratory health risk: Using GIS to explore hurricane-related flooding of schools in Eastern North Carolina. *Environ Res*. 2005;98(3):383-389.
- Hoppin P, Jacobs M. Investing in Best Practice for Asthma. A Business Case for Education and Environmental Interventions. 2007.
- IPCC. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.
- Karl TR, Melillo JM, Peterson TC (eds). *Global Climate Change Impacts in the United States*. Cambridge University Press, 2009.
- Lancet. The health benefits of tackling climate change: An executive summary for the Lancet series.; 2009. Available at: www.thelancet.com/series/health-and-climate-change.
- Lemmen D.S. and Warren F. J. Editors. *Climate Change Impacts and Adaptation: A Canadian Perspective*. Ottawa, ON: Climate Change Impacts and Adaptation Program, Natural Resources Canada, 2004.
- NCADAC - National Climate Assessment Development Advisory Committee. draft Third National Climate Assessment report. 2013. Available at ncadac.globalchange.gov/ (accessed July 5, 2013) (Important note: as of July 2013, only the draft version of the Third National Climate Assessment was made available.)
- NCADAC - National Climate Assessment Development Advisory Committee. Second National Climate Assessment report. 2009. Available at www.globalchange.gov/what-we-do/assessment/previous-assessments (accessed July 5, 2013)
- Norgaard K. *Climate Denial: Emotion, Psychology, Culture, and Political Economy*. The Oxford Handbook of Climate Change and Society. 2011.
- Norgaard K, Lertzman R. A Dialog Between Renee Lertzman and Kari Norgaard. *ECOPSYCHOLOGY*. 2011.
- OCCRI. Oregon Climate Change Research Institute. Oregon climate assessment report. Corvallis, Ore.: 2010. Available at: ocri.net/ocar [Accessed December 16, 2010].
- ODHS. Oregon Department of Human Services, Public Health Division, Center for Health Statistics. Behavioral Risk Factor Surveillance System data for 2003 through 2008;
- OHHS. Oregon Health and Human Services. 2009 Client Data Base.
- Oregon DHS. Health Promotion and Chronic Disease Prevention. 2004-2007 BRFSS county-level information. Oregon Department of Human Services Available at: www.oregon.gov/DHS/ph/hpcdp/pubs.shtml [Accessed October 21, 2010].
- Ramin B, Svoboda T. Health of the homeless and climate change. *Journal of Urban Health: Bulletin of the New York Academy of Medicine* 86, 654–664. 2009.
- Shandas V. Healthy Trees Healthy People: Connecting urban forests, air quality, and public health. Presentation at the Conference Urban Forestry Strategies: Linking People and Landscapes. 2013.
- Smock, K. 2013 Point-in-Time Count of Homelessness in Portland/ Multnomah County. Kristina Smock Consulting. June 2013. Available at: www.portlandoregon.gov/phb/article/451470
- U.S. Census Bureau. American Community Survey 5-year estimates.; 2010. Available at: factfinder.census.gov/servlet/DatasetMainPageServlet?_program=ACS [Accessed January 18, 2011].
- Vynne S, Adams S, Hamilton R, Doppelt B. Building climate resiliency in the Lower Willamette Region of Western Oregon. Eugene, Ore.: The Resource Innovation Group's Climate Leadership Initiative; 2010. Available at: www.theresourceinnovationgroup.org/building-climate-resiliency/.
- Wilbanks, TJ and all. "Effects of Global Change on Human Settlements." In *Analyses of the Effects of Global Change on Human health and Welfare and Human Systems*, edited by J. L. Gamble, 89-109. Vol. Synthesis and Assessment Product 4.6. Washington, D.C.: U.S. Environmental Protection Agency, 2008.
- World Health Organization. Protecting health from climate change. Geneva: World Health Organization; 2009. www.who.int/globalchange/publications/reports/9789241598880/en/index.html
- Ziska, L.H. and F.A. Caufield, 2000a: The potential influence of rising atmospheric carbon dioxide (CO₂) on public health: Pollen production of common ragweed as a test case. *World 24 Resources Review*, 12, 449-457
- Ziska, L., K. Knowlton, C. Rogers, D. Dalan, N. Tierney, M.A. Elder, W. Filley, J. Shropshire, 16 L.B. Ford, and C. Hedberg, 2011: Recent warming by latitude associated with increased length 17 of ragweed pollen season in central North America. *Proceedings of the National Academy of 18 Sciences*, 108, 4248-4251

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- Page 16: Left Side: Street by Arnaud Simon / Right side: US Government - Global Change Program.
- Page 19: Corel Corporation.
- Page 22: Ice block at beach near Jökulsárlón, by Andreas Tille. GNU Free Documentation License
- Page 24: SUMMER by Vered Adir. Creative Commons 3.0.

ADDITIONAL RESOURCES

- **Climate Change: Mastering the Public Health Role.**

American Public Health Association. April 2011.

www.apha.org/NR/rdonlyres/6B7B9486-E485-4473-8992-B42A73DF95BF/0/ClimateChgGuidebookApril11.pdf

- **Ready for change: Preparing public health agencies for the impacts of climate change.**

Climate Leadership Initiative. Eugene, Ore.:

The Resource Innovation Group; 2010.

www.theresourceinnovationgroup.org/storage/pubhealthpremanual5-10lr.pdf

- **Are We Ready?**

Preparing for the Public Health Challenges of Climate Change.

Environmental Defense Fund. 2008.

www.edf.org/health/reports/are-we-ready

- **A human health perspective on climate change.**

Interagency Working Group on Climate Change and Health. Bethesda, Md.: National Institutes of Health; 2010.

www.cdc.gov/climateandhealth/pubs/HHCC_Final_508.pdf

- **Climate Change Workgroup.**

National Association of City and County Health Officials.

www.naccho.org/topics/environmental/climatechange/

- **Everybody's movement:**

Environmental justice and climate change.

Park A. Washington, D.C.: Environmental Support Center; 2009.

www.yale.edu/divinity/dislocations/documents/everybodysmovement_AngelaPark.pdf

- **Conveying the Human Implications of Climate Change: A Primer for Public Health Professionals.**

Weathers MR, Maibach E, and Nisbet M. George Mason University Center for Climate Change Communication; 2011.

www.climatechangecommunication.org/report/new-climate-change-communication-primer-public-health-professionals

- **Progress report of the Interagency Climate Change Adaptation Task Force: Recommended actions in support of a national climate change adaptation strategy.**

White House Council on Environmental Quality. Washington, D.C.: Executive Office of the President of the United States; 2010.

www.whitehouse.gov/sites/default/files/microsites/ceq/Interagency-Climate-Change-Adaptation-Progress-Report.pdf

- **The President's Climate Action Plan.**

The White House. June 2013.

www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf

