



CLIMATE CHANGE PREPARATION STRATEGY

PREPARING FOR LOCAL IMPACTS
IN PORTLAND AND MULTNOMAH COUNTY | 2014



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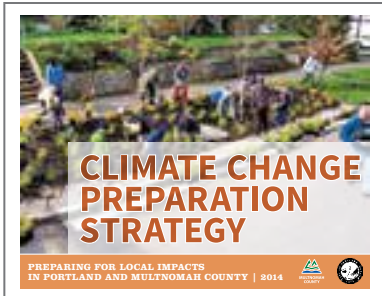
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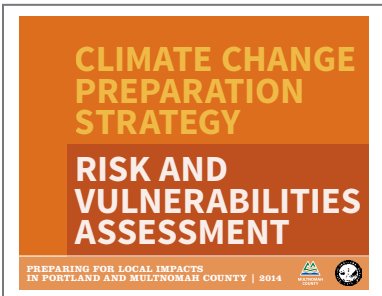
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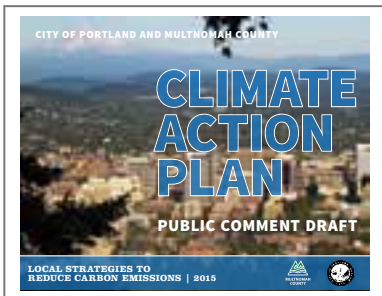


Portland’s future climate is expected to include warmer winters with the potential for more intense rain events, and hotter, drier summers with increased frequency of high-heat days. This *Climate Change Preparation Strategy* identifies actions to prepare for the changing climate in two ways: 1) reduce climate-related vulnerabilities for residents and businesses, and 2) respond to impacts when they do occur.

RELATED PLANS



The *Climate Change Preparation Strategy: Risk and Vulnerabilities Assessment* report (separate document) serves as the foundation for this strategy and provides an overview of the science and a more detailed review of the potential impacts to health and human systems, natural systems, infrastructure and the built environment. Visit: www.portlandoregon.gov/bps/climate



Addressing the primary cause of climate change, carbon emissions, remains a crucial component of climate change preparation work. This strategy is fundamentally linked to the City of Portland and Multnomah County *Climate Action Plan* (separate document), which integrates the City and County’s work to slow climate change while also preparing for the impacts that we will experience.

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Our Climate Is Changing



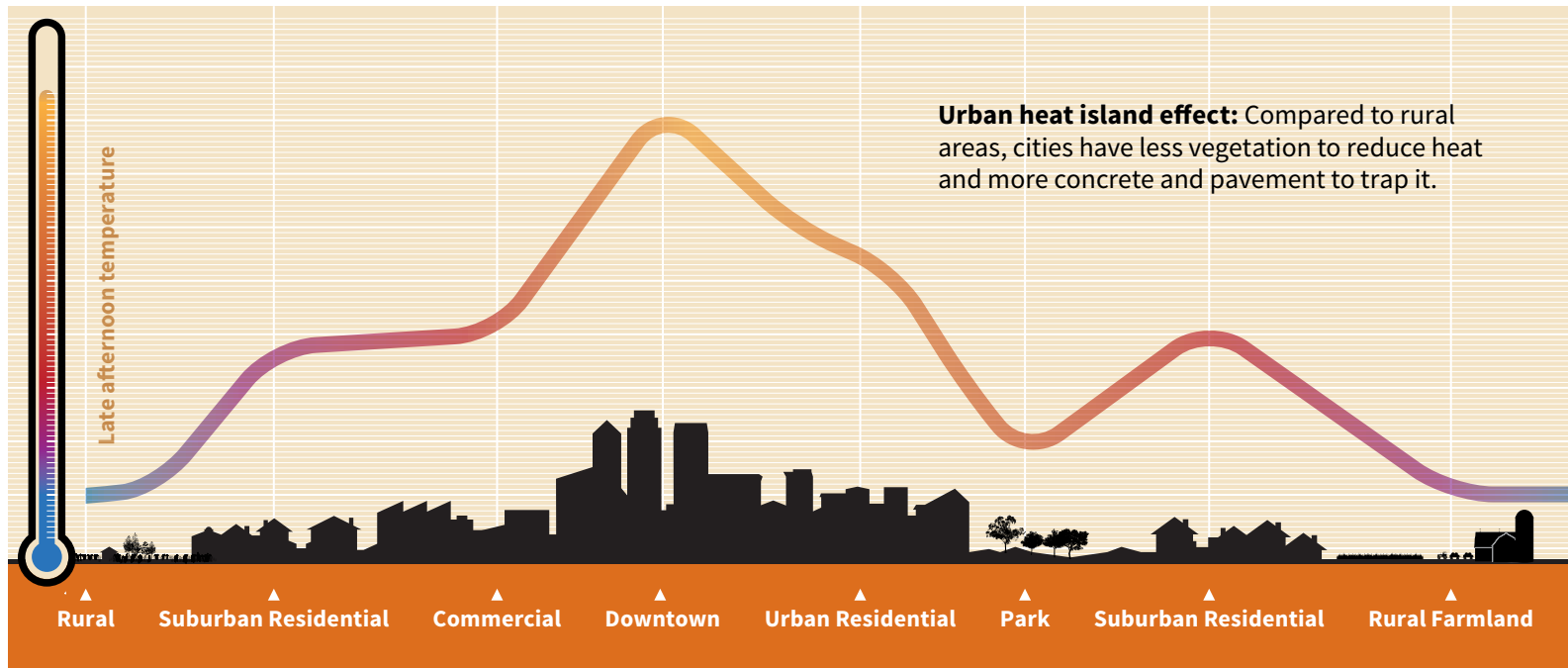
Nestled between the Cascade Mountains and the Pacific Ocean at the confluence of the Willamette and Columbia Rivers, Portland and Multnomah County are home to vibrant communities known for a high quality of life and abundant natural resources. Portland has a climate marked by warm, dry summers and cool, wet winters. Climate helps define iconic characteristics of the Portland region, creating an ideal environment for growing roses, drinking coffee and watching Great Blue Herons.

Portland's climate is changing, however. Temperatures have increased over the past century by 1.3 °F (Pacific Northwest regional average) (Dalton et al., 2013). Carbon emissions from the burning of fossil fuels and from land use changes, including deforestation, are the primary drivers for the climate change we are experiencing today and expect to see in the future. Computer models indicate the magnitude of impacts of climate change depends largely on the trajectory of future global carbon emissions. Even dramatic reductions in carbon emissions will not eliminate all climate change, and the legacy of past practices will continue to change climate patterns.

In the Pacific Northwest, average annual temperature is projected to increase 2 °F to 8.5 °F by the end of this century (depending on future carbon emission scenarios), with greater warming happening in the summers (Dalton et al., 2013). According to global climate models for the Pacific Northwest region, summer precipitation is projected to decrease by as much as 30 percent, and average winter precipitation is projected by some models to increase over the coming century (Mote & Salathé, 2010).

In short, Portland's future climate is projected to be characterized by hotter, drier summers with an increased frequency of high-heat days, and warmer winters with the potential for more intense rain events (Dalton et al., 2013; IPCC, 2012; OCCRI, 2010). While these changes in the climate are significant, Portland is unlikely to suffer the severity of impacts related to hurricanes, intense drought and sea-level rise as many cities around the world will face.

The Impacts Are Already Evident



On a statewide basis, increasing temperatures and shifts in seasonal precipitation patterns are already evident. For example, reduced mountain snowpack and earlier springtime melting of snow are decreasing summer river and stream flows, making it more difficult to meet water demands for both out-of-stream and in-stream needs (OCCRI, 2012).

The Portland region has experienced an increase in average temperatures of 0.5 °F to 1 °F in the past century (Washington State Climatologist). These average temperature increases are magnified by a phenomenon called the urban heat island effect because the higher concentrations of buildings and paved surfaces retain much of that heat in the urban environment. In addition, heat waves when temperatures do not cool down at night have increased in western Oregon and western Washington in the last century, increasing the potential for heat-related health problems (Bumbaco et al., 2013).

Many of the areas most impacted by the region's urban heat island effect, including downtown, along major roads and in and around industrial areas, are also areas where many low-income people live and where increased air pollution, including diesel emissions, can be found (see the Portland/Multnomah County *Climate Change Preparation Risk and Vulnerabilities Assessment* report for more information and a map of Portland's urban heat island effect).

Many of these people will become more vulnerable to heat-related climate change impacts due to: 1) lack of air conditioning or access to cooling centers, 2) aggravation of existing respiratory diseases like asthma, and 3) social isolation because of language or other cultural barriers, as well as physical and medical conditions. For example, some medications can increase sensitivity to heat, and mental illness can reduce a person's ability to recognize that their body is experiencing heat stress.

Portland's Primary Climate Risks

Hotter, drier summers with more high-heat days



Risk 1: Increased temperatures (both day and night) and frequency of high-heat days



Risk 2: Increased incidence of drought



Risk 3: Increased wildfire frequency and intensity

Warmer winters with the potential for more intense rain events



Risk 4: Increased incidence and magnitude of damaging floods



Risk 5: Increased incidence of landslides

The Impacts Will Become More Significant



HOTTER, DRIER SUMMERS WITH MORE HIGH-HEAT DAYS

Hotter, drier summers may result in several significant impacts for the Portland area. Higher temperatures lead to increased surface water temperatures, reduced flows in rivers and streams, and negative impacts on aquatic habitats and the fish and wildlife they support. Higher temperatures also result in increased air pollution, such as ground-level ozone and pollen counts, exacerbating Portland's already high incidence of respiratory illnesses and allergies. Increased summer temperatures will result in increased energy use for air conditioning.

Hotter, drier summers also mean an increased potential, over time, of wildfire in the urban forest, natural parks and open-space areas within Portland's urban environment. Such fires often have significant detrimental impacts on air quality and human health, and can damage or destroy public and private property. In addition, hotter, drier summers may negatively affect urban forest health, increasing major forest pest damage and mortality of plant and tree

species now common to the area. Hotter, drier summers may also create large-scale vegetation losses, negatively impact upland habitats and the wildlife they support, and reduce the effectiveness of green infrastructure services.

Increased heat-related illnesses and death during heat waves are of particular concern, especially for populations most vulnerable to heat such as older adults and low-income residents. Transportation infrastructure may also be impacted during heat waves as a result of issues with bridge expansion joints, pavement integrity and the possible warping of light-rail tracks.

The Portland/Multnomah County *Climate Change Preparation Risk and Vulnerabilities Assessment* report (separate document) further explores the primary and secondary climate risks and vulnerabilities associated with regional climate change projections.



WARMER WINTERS WITH THE POTENTIAL FOR MORE INTENSE RAIN EVENTS

Climate model projections are unanimous that winters will be warmer and that the incidence of cold extremes will decrease. For example, the number of days below freezing are projected to decrease by over 30 days by the latter part of this century (averaged over the Pacific Northwest) (Dalton et al., 2013). For precipitation, the models have less consensus than for temperature, however, the majority of models project increases in winter, spring and fall, with the potential for more intense rain events (Dalton et al., 2013).

More intense rain events would stress Portland's existing systems for managing stormwater runoff and urban flooding. More rain falling in winter would likely increase the incidence of landslides, particularly following prolonged periods of precipitation when the soil is already saturated with water. With more intense rain events, the groundwater may not have time to drain and large deep landslides may occur.

Increased flooding in the winter may also have far-reaching local impacts on economic, social and environmental systems. These impacts include water damage to homes and businesses, as well as roads, railroad tracks located within the potentially expanded floodplain, levees, bridges and culverts. Additional costs due to emergency response, business closures, lost productivity and cleanup costs can be expected.



Potential impacts from hotter, drier summers with more high-heat days



Potential impacts from warmer winters with the potential for more intense rain events

<p>Human Systems</p>	<ul style="list-style-type: none"> ▪ Heat-related illness (heat stroke, heat exhaustion) and exacerbation of existing medical conditions. ▪ Increased demand for cooling centers, especially for populations most vulnerable to heat. ▪ Earlier and extended allergy seasons affecting those with asthma and respiratory disease. ▪ Higher electricity bills due to less hydropower production and increased need for air conditioning. 	<ul style="list-style-type: none"> ▪ Demands on emergency response services during flooding events. ▪ Changes to mosquito populations requiring additional vector control efforts, including prevention at home. ▪ Increase in mold spores which can trigger asthma and other chronic health conditions. ▪ Reduced energy use to heat buildings.
<p>Natural Systems</p>	<ul style="list-style-type: none"> ▪ Lower summer stream flows. ▪ Reduced water quality due to higher water temperatures. ▪ Increased risk of wildfire. ▪ Vegetation, habitat and wildlife shifts, fragmentation and death. ▪ Increased invasive species. 	<ul style="list-style-type: none"> ▪ Increased flooding and groundwater level rise. ▪ Higher river levels. ▪ Increased erosion and potential for channel migration and sedimentation. ▪ Increased landslide risks.
<p>Infrastructure and the Built Environment</p>	<ul style="list-style-type: none"> ▪ Increased wastewater temperatures causing water quality changes, treatment process impacts and increased odors. ▪ Pavement buckling and rail warping. ▪ Increased water demand for landscape irrigation. ▪ Shifting demand for indoor and outdoor recreation activities at parks. ▪ Stress on green infrastructure facilities. 	<ul style="list-style-type: none"> ▪ Increased erosion and the potential for turbidity events in the Bull Run water supply system. ▪ Increased chance of landslides impacting transportation and pipe infrastructure. ▪ Increased bridge scour and damage to docks, boat ramps and floats. ▪ Increased flooding of roads, sidewalks, bikeways and trails and green infrastructure. ▪ Increased pumping of treated wastewater.

We Must Prepare for a Range of Possible Futures



Successfully preparing for projected climate change impacts require changes in City, County and regional policies, investments and programs. At the same time, the Portland area is not immediately vulnerable to some of the gravest threats other communities face, such as sea-level rise, tropical storms, severe drought and dwindling water supplies.

Sea-level rise is an example of a risk that the City and County will continue to monitor carefully, since tidal influence reaches as far inland as Willamette Falls on the Willamette River and Bonneville Dam on the Columbia River. Changes in sea-level might raise local river levels, which in turn could increase river flooding levels by a small factor in the mid-term and more significantly in the longer-term, depending on dam operations, and the operation and maintenance of the local levee system.

The Portland region might also experience a wide range of regional and global impacts from climate change. These range from the very likely such as higher electricity prices resulting from the combination of higher summer demand and reduced availability of water for summer hydropower production—to the very difficult to predict, such as the potential for population growth beyond current

projections due to an influx of new residents moving from other areas more significantly impacted by climate change. Similarly, the global economy could experience significant disruptions from weather-related catastrophes or benefits (for example, Arctic shipping routes or Siberian wheat production), disruptions to the global food system, the shift to low-carbon products and services, or many other direct or indirect impacts of climate.

The City and County recognize that these larger social changes may cause major impacts that are difficult to anticipate. While this strategy focuses on issues for which the City and County have unique responsibilities, monitoring and anticipating these global and regional economic and social changes is an essential supplement to the focused objectives and actions described here. As a result, this strategy takes an adaptive management approach that prioritizes resilience across a range of future scenarios and emphasizes the need to monitor and respond to changes locally.

Building Resilience Requires Reducing Risks and Building Response Capacity

To prepare for climate change impacts we must reduce exposure to future risks and strengthen the capacity to respond. These activities are often referred to as “climate adaptation.” Preparing for climate change requires an approach that provides multiple benefits to the community, both now and in the future.

Meet the needs of vulnerable populations

Successful climate change preparation requires steps to understand how climate change may affect people most vulnerable to expected impacts, particularly heat and poor air quality. Portland and Multnomah County need to ensure that climate change preparation actions are prioritized in areas facing current and historical disparities, including low-income populations and communities of color.

Build resilience of natural systems and infrastructure

Many of the actions that help prepare for climate change are already underway today because they benefit the community in other ways. One example is Portland’s long-established regulations and practices to protect, manage, and expand the City’s green spaces and urban forest. These efforts help to improve air quality and reduce the urban heat island effect, which in turn improves comfort and saves energy and money by reducing the need for air conditioning.

To reduce flooding and improve stormwater management, significant work has been done to acquire and restore natural areas and floodplains, and to install green infrastructure such as bioswales and ecoroofs. In addition, the development of Portland’s groundwater well system not only supplements the region’s primary drinking water supply, the Bull Run watershed, but also improves Portland’s resilience to withstand potential impacts to the water supply system due to current climate variability as well as future climate change.

Prepare for impacts to public health

To protect public health the County currently monitors a variety of mosquito species that can carry vector-borne diseases such as West Nile Virus. As the climate changes, non-native mosquito species may establish themselves due to the warmer summers and pools of standing water from winter and spring rains. Existing vector control and integrated pest management efforts enable better identification and response to new mosquito species of concern that may migrate here due to climate change.

All of these activities benefit the community and improve resilience to natural hazards today, while also reducing exposure to future risks from a changing climate.

IMPLEMENTING THE PORTLAND PLAN

This Climate Change Preparation Strategy helps to implement several elements of the Portland Plan. The Portland Plan brought together more than 20 agency partners, including Multnomah County, and more than 20,000 residents, businesses and nonprofit organizations to create a strategic plan to make Portland prosperous, healthy, educated and equitable. It provides a structure for aligning budgets and projects across numerous public agencies, guiding policies with an eye toward the year 2035. The Portland Plan is a strategic plan with equity at its core.

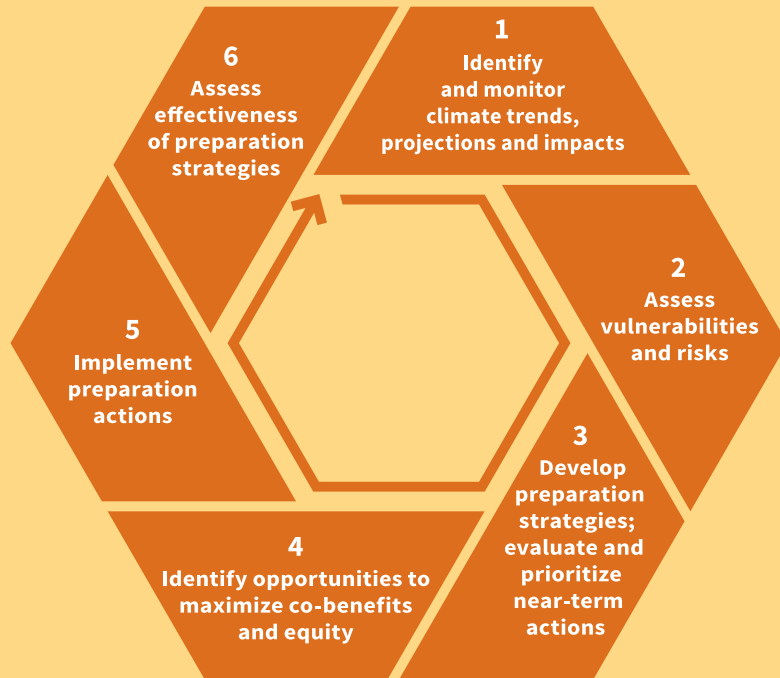
Improved resiliency is one outcome from the successful implementation of the Portland Plan. According to the Portland Plan, by 2035 individuals, communities, economic systems and the natural and built environments will have improved capacity to rebound rapidly from natural disasters, changes in the climate and economic shifts.

This Climate Change Preparation Strategy identifies priorities and actions that will help achieve many of the goals outlined in the Portland Plan, including healthier people, a safer city, more complete neighborhoods and healthy watersheds.



HOW THIS STRATEGY WAS DEVELOPED

To develop this strategy, three inter-departmental staff teams were created to focus on health and human services, natural resources and infrastructure. Each team conducted a vulnerability assessment and developed recommended actions to address major vulnerabilities to climate change. The figure below outlines the process that the City and County are following to develop and implement this strategy.



GUIDING PRINCIPLES FOR IMPLEMENTATION

In implementing this Climate Change Preparation Strategy, the City and County are guided by these principles:

- Use the best available science at the time and stay abreast of new developments.
- Use an adaptive management approach, assemble information needed to improve efforts and promote flexible approaches that leave a range of future options available.
- Leverage existing efforts, funding, policies and programs.
- Maximize the co-benefits, improve equity outcomes and meet the needs of populations most vulnerable to climate change impacts.
- Integrate climate change preparation into operational and decision-making processes.
- Engage residents and the business community and coordinate and implement climate preparation efforts with other local and regional partners.

This Climate Change Preparation Strategy builds on existing work to understand how the climate affects the community today, how those effects are expected to change in the coming century and what can be done to prepare. The *Climate Change Preparation Risk and Vulnerabilities Assessment* report (separate document) serves as the foundation for this strategy and provides an overview of the science and a more detailed review of the potential impacts to health and human systems, natural systems, infrastructure and the built environment. In addition to identifying risks and vulnerabilities, this strategy outlines priority actions in the areas of policy development, operations, planning, human services, as well as infrastructure and natural resource management. These actions will help to minimize risks, reduce vulnerabilities and contribute to a more resilient community.

Reducing Risks to Populations Most Vulnerable to Climate Change Impacts Must Be Prioritized

All populations are affected by climate change, but not all communities have the same ability or resources to respond and recover. As a result, some are more vulnerable than others. In Portland, communities of color and low-income communities generally experience disparities that will be exacerbated by the impacts of climate change. These disparities include greater risk of poor health, reduced access to housing, un- and under-employment, limited access to transportation options and parks, higher mortality rates and the legacy of inequitable public policy.

This strategy is intended to create a more climate-resilient community. The federal Interagency Climate Change Adaptation Task Force describes climate resilience as the capability to anticipate, prepare for and recover from climate impacts on public health and safety, the built environment, the local economy and natural resources. By pursuing climate resilience, the City and County seek to ensure that the benefits of taking actions to prepare for climate change are shared by the whole community and across multiple generations.

As part of this effort, the City and County strive to understand existing aspects of the community that support resilience, such as socio-cultural networks and indigenous knowledge. Partnering with these communities to understand challenges and opportunities will enable the implementation of more effective preparation strategies.

Putting equity into practice requires asking new questions, looking at relevant data and prioritizing equity in decision-making. To ensure the most equitable outcomes possible, these or similar questions will be explored at different phases of a climate change preparation project, policy or program:

1. What are the desired results or outcomes of the action?
2. What are the current and historical racial disparities related to the action (or similar actions in the past)?
3. Does the action involve land or space? If yes, how is any historical connection to the land and the populations who hold such connections considered in decision-making?
4. Who primarily benefits from the action?
5. Are racial, ethnic, low-income populations, older adults or people with disabilities positively affected by the action? Is there a missed opportunity to reduce existing disparities these communities experience?
6. Are there unintended consequences or negative impacts of this action for racial, ethnic, low-income communities, older adults or people with disabilities? If so, what are the strategies to mitigate negative impacts?
7. How does the proposed action promote a) meaningful engagement of those most impacted, and b) transparent, inclusive and empowering collaboration?

THE PORTLAND PLAN – A FRAMEWORK FOR EQUITY

The City and County will use the Portland Plan’s “Framework for Equity” as a guide when implementing actions outlined in this strategy.

The Portland Plan defines equity as “when everyone has access to the opportunities necessary to satisfy their essential needs, advance their well-being and achieve their full potential. We have a shared fate as individuals within a community and communities within society. All communities need the ability to shape their own present and future. Equity is both the means to healthy communities and an end that benefits us all”.

The Portland Plan also states that without healthy, thriving, prepared people we cannot achieve our highest goals, implement our best plans for dealing with climate change or secure Portland’s position in the global economy. Without a city that is physically designed to last, future generations will not benefit. We want a city where we are better on a good day so we can bounce back from a bad day. It requires that everyone thrive and everyone participate.

Climate Change Preparation Yields Multiple Benefits



Not only do climate preparation actions improve resiliency against future climate impacts, but in many cases they also generate multiple quality-of-life benefits and cost savings for residents and businesses today. Many strategies already in place in the Portland area help manage existing challenges such as infrastructure maintenance, emergency preparedness and response, respiratory illnesses, environmental degradation and flooding while also helping to build resilience to climate change impacts.

For example, Portland has been installing green streets to help cost effectively manage today's stormwater runoff. These same facilities will help the community be more resilient to more intense rain events in the future. Similarly, existing efforts to increase the urban tree canopy provide multiple health and environmental benefits today — and will help cool the city in the future as temperatures rise. In turn, these efforts reduce demand for emergency and social service response by minimizing the impacts from flooding and extreme heat events. Neighborhood projects, such as tree planting or depaving events bring neighborhoods together and strengthen social cohesion.

Climate Preparation Must Be A Collaborative Effort



Portland and Multnomah County seek to lead by example as well as involve other jurisdictions, organizations, businesses and the public through outreach and engagement. Because climate change impacts are not bound by city and county lines, climate preparation must be a joint effort across jurisdictions and disciplines.

Portland and Multnomah County will continue to participate in regional climate change preparation efforts, including sharing information with other metropolitan areas in the Pacific Northwest such as Seattle and Vancouver, BC, and local jurisdictions throughout the Willamette Valley. In addition, the City and County will continue to work with partner organizations such as Metro, Portland State University, the Department of Geology and Mineral Industries and the Oregon Climate Change Research Institute to understand and track local climate projections and impacts, and the effectiveness of preparation strategies. Awareness will also be raised among the general public and health professionals of new and changing public health risks associated with climate change.

Climate Change Preparation Strategy: 2030 Objectives and Actions

This strategy focuses on human systems, natural resources and infrastructure and details actions to address the greatest vulnerabilities to climate change in those sectors. In addition, this strategy considers potential climate change risks related to the built environment, food systems, climate migrants, energy systems, jobs and the economy.

The strategy establishes 12 specific objectives for 2030 and identifies actions to build resilience into the City and County’s policies, operations, services and infrastructure. The actions in the following pages outline a set of efforts that should be significantly underway in the near-term (e.g., by the end of 2017) to begin preparing for climate change.

Many of the actions identified in this strategy are already underway to address existing risks and vulnerabilities through the implementation of other adopted plans such as the Portland Plan, Urban Forestry Management Plan, Water Management and Conservation Plan, Watershed Management Plan, Natural Hazard Mitigation Plans, Community Wildfire Protection Plan, etc.

In prioritizing the implementation of the actions outlined, City bureaus and County departments will:

- Consider available resources and opportunities to leverage new resources.
- Take into account carbon emission reduction opportunities and other co-benefits, equity, urgency and window of opportunity.
- Integrate implementation plans into routine work planning.

Using an adaptive management approach, these actions will be reviewed and updated periodically to evaluate progress and incorporate the most up-to-date scientific data.

To assist with implementation and accountability, lead City bureaus and County departments are identified, although successful implementation will often require collaboration and coordination with other public and private-sector partners (see page 30 for explanation of agency acronyms).

HOTTER, DRIER SUMMERS WITH INCREASED INCIDENCE OF HIGH-HEAT DAYS

- 1** Decrease the urban heat island effect, especially in areas with populations most vulnerable to heat.
- 2** Minimize health issues caused by extreme heat days, especially for populations most vulnerable to heat.
- 3** Increase the resilience of Portland’s water supply to drier summers.
- 4** Increase the resilience of natural systems to adapt to increased temperatures and drier summers.
- 5** Manage the risk of wildfires as a result of drier summers.

WARMER WINTERS WITH THE POTENTIAL FOR MORE INTENSE RAIN EVENTS

- 6** Increase the resilience of the natural and built environment to more intense rain event and associated flooding.
- 7** Manage the increased risk of disease due to changes in vector populations.
- 8** Manage the increased risk of landslides due to changing precipitation patterns.

BUILDING CAPACITY TO PREPARE FOR AND RESPOND TO CLIMATE CHANGE

- 9** Strengthen emergency management capacity to respond to weather-related emergencies.
- 10** Institutionalize climate change preparation planning and best practices.
- 11** Improve the capacity of the community, especially populations most vulnerable to climate change risks, to understand, prepare for and respond to climate impacts.
- 12** Improve monitoring, evaluate effectiveness of climate change preparation actions and advance new research to support climate change preparation efforts.

HOTTER, DRIER SUMMERS WITH INCREASED INCIDENCE OF HIGH-HEAT DAYS

1	2030 Objective 1: Decrease the urban heat island effect, especially in areas with populations most vulnerable to heat.	Lead agency
1a	Adopt Comprehensive Plan policies and encourage design and development strategies, in public and private development, that reduce the urban heat island effect especially in areas with populations most vulnerable to heat.	City (BPS, PDC, BPS, BDS, BES, PBOT, PPR); County (DCS, HD)
1b	Integrate strategies that reduce urban heat island effects into the design and construction of City and County buildings.	City (OMF, PPR); County (DCA)
1c	Decrease impervious areas and increase the total ecoroof acreage in the city, and identify additional complementary heat-mitigation alternatives such as reflective roofs in public and private development.	City (BES, BPS)
1d	Implement the recently adopted tree codes and evaluate their impact.	City (PPR, BDS)
1e	Implement and expand the City’s Urban Forestry Management Plan, revegetation, restoration and land acquisition programs, and continue and expand programs that incent removal of impervious areas.	City (PPR, BES)
1f	Update environmental codes, regulations, plans, zoning and permit reviews to support strategies that reduce the urban heat island effect.	City (BPS, BDS, PPR, BES);
1g	Consider populations most vulnerable to heat and living in urban heat islands when making decisions about tree planting, protection and maintenance, green infrastructure placement, and access to vegetated open spaces and natural areas.	City (PPR, BES); County (HD, DCHS)
1h	Add or modify park plantings in under-served areas, and increase maintenance to sustain mature tree canopy, decrease tree hazards and delay tree replacement needs.	City (PPR)
1i	Apply the latest climate science in revision of urban tree canopy goals for the City and address tree canopy disparities in neighborhoods where populations most vulnerable to heat live.	City (PPR)
1j	Adopt a site development performance standard to achieve high quality green infrastructure similar to Seattle’s Green Factor for new development and redevelopment sites.	City (BES, BPS)
1k	Research, evaluate and pilot porous paving, de-paving, vegetation and/or more reflective surfaces in parking areas to reduce and cool impervious surfaces, particularly in urban heat island areas with populations most vulnerable to heat.	City (PBOT, BES); County (DCS)
1l	In infrastructure project design, consider plantings, specifications and materials that will be resilient to heat-related climate change impacts, and be cost effective over the lifetime of the asset.	City (PBOT, BES, PPR); County (DCS)

HOTTER, DRIER SUMMERS WITH INCREASED INCIDENCE OF HIGH-HEAT DAYS

2

2030 Objective 2: Minimize health issues caused by extreme heat days, especially for populations most vulnerable to heat.

		Lead agency
2a	Strengthen the Extreme Heat Response Procedure by creating a comprehensive Extreme Heat Response Plan through collaboration with community stakeholders and populations most vulnerable to heat.	County (DCHS, MCEM, HD)
2b	Identify populations most vulnerable to heat by developing and analyzing relevant demographic, hazard and risk factor data and maps (urban heat islands, air quality, and access to air conditioning) to understand potential localized climate impacts and to prioritize preparation and mitigation strategies.	County (HD); City (BPS)
2c	Work with health care and social services providers to ensure their ability to provide appropriate services during extreme heat events.	County (HD, DCHS)
2d	Partner with community-based organizations and local service providers to seniors and people with disabilities to assess the need for and coordinate the operation of cooling environments, including extended hours of Senior Center Operations, that are culturally appropriate and readily accessible.	County (DCHS, HD, MCEM); City (PBEM)
2e	Develop early warning systems and response plans that alert community members when projected heat conditions or poor air quality days pose a health risk.	County (DCHS, HD, MCEM); City (PBEM)
2f	Improve the energy efficiency of homes, apartments and commercial buildings to keep interiors cool, improving the comfort and safety of occupants and reducing the need for summer air conditioning. Encourage the planting of trees and vegetation on the south and west sides of homes and buildings to reduce summer heat gain.	County (OS, DCHS); City (BPS)
2g	Continue to invest in initiatives linking environmental conditions to health outcomes like asthma, such as the County Healthy Homes and Weatherization Assistance Program.	County (DCHS, HD)
2h	Expand the capacity to educate health care providers to recognize and report patterns of heat-related illnesses and injuries, and to inform the public about preventive actions.	County (HD)
2i	Ensure detention facilities are capable of adequate cooling during extreme heat events.	County (DCJ, MCSO)
2j	Ensure public safety staff is properly trained to recognize and respond to physical and behavioral signs of heat-related illness.	County (DCJ, MCSO)

HOTTER, DRIER SUMMERS WITH INCREASED INCIDENCE OF HIGH-HEAT DAYS

3

2030 Objective 3: Increase the resilience of Portland’s water supply to drier summers.

Lead agency

3a	Incrementally expand the groundwater capacity of the Columbia South Shore Well Field as back up to Bull Run, as detailed in the City’s Water Management and Conservation Plan.	City (Water)
3b	Continue to implement water conservation education and outreach programs in retail service areas (business, industry and government) and continue participation in the Regional Water Providers Consortium conservation education and outreach activities.	City (Water)
3c	Support regulatory efficiency programs (e.g., low-flow plumbing fixtures, Water Sense Program for appliances).	City (Water)
3d	Continue to study potential climate impacts on the Bull Run watershed in collaboration with the Water Utility Climate Alliance and Pacific Northwest Climate Scientists.	City (Water)
3e	Change design and management methods to minimize water use and waste in fountains, parks and other landscaped publicly owned or managed properties while still maintaining thriving vegetation.	City (PPR, BES, Water); County (DCA)

HOTTER, DRIER SUMMERS WITH INCREASED INCIDENCE OF HIGH-HEAT DAYS

4

2030 Objective 4: Increase the resilience of natural systems to adapt to increased temperatures and drier summers.

		Lead agency
4a	Identify habitat diversity and connectivity needs (e.g., links to and among existing natural areas, anchor locations) and prioritize habitat corridors for protection and enhancement, including through acquisition, restoration, regulations and innovative techniques such as vegetated streets, to create an interconnected network of terrestrial and aquatic habitats.	City (PPR, BES, BPS)
4b	Identify opportunities to locate and relocate infrastructure and impervious areas away from streams.	City (PPR, BES, BPS, BDS, PBOT)
4c	Review city codes and drainage rules to evaluate their ability to protect and improve stream flows, seeps, springs, wetland function, water quality including temperature, vegetation and habitat, and stormwater management during hotter, drier, summers. Use the Natural Resource Inventory and other data to track gains and losses, and propose revisions as necessary. Evaluate and pilot planting native species that are currently considered to be at the “northern” edge of their range in Portland.	City (BES, PPR, BPS)
4d	Evaluate if existing e-zones, tree codes and specifications for tree planting and street design are sufficient to protect natural resource functions needed to adapt to climate change.	City (BPS, BDS, BES, PPR)
4e	Explore new and support expansion of voluntary programs promoting increased native, drought tolerant vegetation and reduced hardscape on private property such as Audubon and East Multnomah Soil and Water District’s “Backyard Habitat,” the City’s “Treebate,” and the DePave programs. Update the Portland Plant List.	City (BES, BPS, Water)
4f	Research and experiment with different plant palettes for planting in natural areas, restoration sites, green streets, ecoroofs, rain gardens and other built infrastructure that are more tolerant to summer drought conditions and provide habitat for current and new species expanding their range.	City (PPR, BES)
4g	Continue to implement the invasive species control programs: Integrated Pest Management, Protect the Best, Early Detection and Rapid Response, and public and private invasive species control.	City (PPR, BES)
4h	Update the voluntary best management practices for nesting birds and seek opportunities to incorporate bird-friendly building design approaches into City plans, programs and projects, and work with Portland residents, building managers, architects and developers to do the same.	City (BES, PPR, BPS)
4i	Purchase private water rights if useful to enhance instream flows or limit conflicts, and consider water marketing as a potential means of dealing with specific drought events.	City (BES)
4j	Focus acquisition, restoration and management of the City’s natural areas inventory to ensure species of concern and overall biodiversity is retained.	City (BES, PPR)

HOTTER, DRIER SUMMERS WITH INCREASED INCIDENCE OF HIGH-HEAT DAYS

5

2030 Objective 5: Manage the risk of wildfires as a result of drier summers.

Lead agency

5a	Continue to work in a co-management role with the Oregon Department of Forestry, US Forest Service and local fire departments to respond to fires in and near the Bull Run watershed.	City (Water)
5b	Consider adopting nationally recognized codes to strengthen building standards in wildfire risk areas.	City (PBEM, PFR, BDS)
5c	Complete an assessment to characterize high priority wildfire risk areas, known as Wildfire Urban Interface Zones, and develop recommendations to reduce risks in and around these areas (e.g., specific building codes, vegetation management approaches).	City (PBEM, PFR, PPR, BPS); County (MCEM)
5d	Implement the 2011 Multnomah County Community Wildfire Protection Plan to reduce risk through community outreach and education, vegetation control/fuel reduction, invasive species management, restoration of fire-adapted ecosystems, and optimization of emergency preparedness and response capacity through interagency coordination.	City (PBEM, PFR, PPR, BPS, BDS); County (MCEM)
5e	Develop and implement habitat guidance for fire-adapted ecosystems that withstand natural recurring wildfires such as oak/savanna and the species that depend on them.	City (BES, PPR)
5f	Increase and improve the quality of habitat corridors and buffer areas around wildfire prone areas through mechanisms such as protection, invasive species management, acquisition, zoning, incentives and public education to increase effectiveness of the transition zones between the urban-wildfire interfaces.	City (BPS, BES, PPR, BDS)

WARMER WINTERS WITH THE POTENTIAL FOR MORE INTENSE RAIN EVENTS

6 2030 Objective 6: Increase the resilience of the natural and built environment to more intense rain events and associated flooding.

		Lead agency
6a	Work with FEMA (Federal Emergency Management Agency) to update the floodplain mapping program to reflect potential changes due to climate change variability in the 100-year floodplain maps.	City (BES, BPS, BDS, PBEM)
6b	Address floodplain hazards through the Comprehensive Plan update and provide guidance to regulate or manage development in the floodplain.	City (BPS, BDS, BES)
6c	Use updated floodplain data (see action 6a) to inform City and County land use (e.g., ensure space below the base flood elevation is not converted to habitable space), transportation and other infrastructure planning processes.	City (PBOT, BES, Water, PPR, BPS); County (DCS)
6d	Participate in federal flood protection efforts and policy decisions on the Columbia and Willamette Rivers, such as the Columbia River Treaty renegotiation and the process for Columbia River levee recertification.	City (OGR, PBEM)
6e	Participate in state and federal efforts to align the National Flood Insurance Program with the Endangered Species Act.	City (BES, BDS, BPS)
6f	Improve Portland’s rating under the National Flood Insurance Program Community Rating System and minimize flood insurance rate impacts by working with FEMA, the Oregon Department of Land Conservation and Development (DLCD), neighboring communities and landowners to: 1) develop and implement actions that minimize flood damage to structures, and 2) protect, restore and enhance natural floodplain function.	City (BES, BPS, PBEM)
6g	Implement the Portland Watershed Management Plan to restore watersheds using strategies such as land acquisition, revegetation, green infrastructure and habitat restoration.	City (BES, PPR, PBOT)
6h	Better manage stormwater by reducing the overall impervious area (currently 34 percent) within the city through depaving, green infrastructure (greenstreets, ecoroofs, trees, and raingardens), and expanding the urban forest canopy, natural areas and open space. Encourage or require private property owners and developers to implement climate change preparation measures, including limiting or reducing impervious area at site-specific and district scales.	City (BES, BDS, BPS)
6i	Develop the Stormwater Systems Plan, and update the Stormwater Management Manual and the drainage rules to better manage increased winter precipitation, including reevaluating the modeled “24 hour” storm event design standard.	City (BES); County (DCS)
6j	Research and evaluate porous paving for public roadways and private development.	City (BES, PBOT); County (DCS)
6k	Support existing pollution prevention programs and identify additional strategies to reduce the pollution-related impacts of flooding, especially in industrial areas.	City (BES, PBOT)

WARMER WINTERS WITH THE POTENTIAL FOR MORE INTENSE RAIN EVENTS

7

2030 Objective 7: Manage the increased risk of disease due to changes in vector populations.

Lead agency

7a	Develop and distribute culturally appropriate and accessible materials about vector-borne disease prevention.	County (HD)
7b	Expand the capacity to educate health care providers to recognize and report patterns of vector-borne disease illnesses and injuries, and to inform the public about preventive actions.	County (HD)
7c	Enhance the coordination between local natural resource agencies and vector control programs to ensure vector populations are managed in a way that protects human health and ensures ecological integrity and vitality.	County (HD); City (BES, PPR)
7d	Continue to update the response plan for emerging vector-borne diseases, including increased capacity for health services that are triggered by certain case thresholds.	County (HD)

WARMER WINTERS WITH THE POTENTIAL FOR MORE INTENSE RAIN EVENTS

8 2030 Objective 8: Manage the increased risk of landslides due to changing precipitation patterns.

		Lead agency
8a	Identify, map and monitor landslide hazard areas based on topographic and subsurface data, including those associated with the Bull Run water supply; coordinate efforts with surrounding jurisdictions.	City (BDS, PBOT, PPR, BES, Water, PBEM)
8b	Update code requirements and natural hazard mitigation plans based on updated landslide hazard mapping (see action 8a), when available.	City (BDS, BPS, PBEM); County (MCEM, DCS)
8c	Incorporate landslide hazard-reduction techniques into public infrastructure projects.	City (PBOT, BES, PPR, Water); County (DCS)
8d	Provide education and outreach to the public regarding ways to reduce the risk of landslides on private property.	City (BDS, PBEM); County (DCS)
8e	Advocate for local or state level landslide disaster response funding.	City (PBEM)

BUILDING CAPACITY TO PREPARE FOR AND RESPOND TO CLIMATE CHANGE

9

2030 Objective 9: Strengthen emergency management capacity to respond to weather-related emergencies.

Lead agency

9a	Develop, test, train, and update emergency response plans that address hazards likely to become more frequent or intense as the climate changes, including flood, extreme heat, landslides and wildfire.	City (PBEM); County (MCEM)
9b	Increase capacity of City and County emergency management to respond in emergency conditions and protect life, health, environment, and infrastructure assets.	City (PBEM, PPR); County (MCEM)
9c	Promote equity in hazard mitigation, and emergency response and recovery activities, and consider populations most vulnerable to weather-related emergencies in all plans and exercises.	County (MCEM, HD, DCHS); City (PBEM)
9d	Support disaster preparedness of service providers and contractors, and consider contract requirements that service providers have disaster plans in place.	County (MCEM, DCHS); City (PBEM)
9e	After weather-related emergency events, assess response to identify effectiveness, deficiencies and resources needed to build future resilience.	County (MCEM, DCA, DCHS, DCJ, MCSO); City (PBEM)
9f	Through training, educational materials and other resources, strengthen capabilities of individuals and organizations that assist in disaster response to prepare for potential climate change impacts, including disproportionate impacts on populations most vulnerable to climate change risks.	County (MCEM, DCHS); City (PBEM)
9g	Plan for projected increases in weather-related emergencies, especially high-heat days, and the resulting potential for increased violence, mental illness, chemical dependency and addiction.	County (DCHS, DCJ, MCSO)

BUILDING CAPACITY TO PREPARE FOR AND RESPOND TO CLIMATE CHANGE

10 2030 Objective 10: Institutionalize climate change preparation planning and best practices.

		Lead agency
10a	Establish a multi-bureau/multi-department adaptive management coordination team to: review emerging climate research, trends and regulations at least once a year.	City (BPS); County (OS)
10b	Develop guidelines for including climate change variables in future infrastructure decision-making and share information among City and County infrastructure agencies.	City (BES, Water, PPR, PBOT, BPS); County (DCA, DCS)
10c	Utilize an equity framework or lens to ensure preparation actions are implemented in ways that deliver more equitable outcomes and prioritize populations most vulnerable to climate change impacts.	City (BDS, BES, BPS, OMF, PBEM, PBOT, PFR, PPR, Water); County (DCA, DCHS, DCS, HD, MCEM, OS, DCJ, MCSO),
10d	Develop maps, data resources and other tools to improve understanding of localized climate change impacts, including potentially disproportionate impacts to low income populations and communities of color.	City (BPS, Water, PBOT, BES, PPR, PBEM); County (HD, DCHS, MCEM)
10e	Address climate preparation in the City and County Comprehensive Plan updates and in future updates to other plans (e.g., infrastructure, watershed, urban forestry, hazard mitigation).	City (BPS, Water, BES, PBOT, PPR, PBEM); County (DCS, MCEM)
10f	Acknowledge climate variables as a risk in asset management.	City (BPS, Water, PBOT, BES, PPR); County (DCA, DCS)
10g	Prepare for shifts and expansion of ranges of existing species and influxes of new invasive species by: 1) identifying and prioritizing species by level of concern and response; 2) institutionalizing and increasing the Early Detection and Rapid Response programs; and 3) increasing management activities on priority areas.	City (BES, PPR)
10h	As appropriate, coordinate with or require health and safety service providers to support recommendations of this Climate Change Preparation Strategy (e.g., provide education and resources about climate risks to populations most vulnerable to climate change impacts and development of continuity of operations plans).	County (DCHS, HD)
10i	Continue to raise awareness among the public, health organizations and other medical providers of new or changing public health risks associated with climate change.	County (HD)
10j	Continue to pursue energy efficiency opportunities to minimize impacts from rising energy costs and increased cooling demands in City and County owned and operated facilities.	City (OMF, PPR, BES, PBOT, Water); County (DCA, OS)
10k	Considering climate change impacts and risks, and optimize maintenance interventions, to achieve cost effective infrastructure system efficiencies.	City (OMF, PPR, BES, PBOT, Water); County (DCA, DCS)
10l	Work with Metro to integrate climate change preparation into their acquisition, restoration and management of natural areas, and their land use planning, policy and program work.	City (BPS, BES)

BUILDING CAPACITY TO PREPARE FOR AND RESPOND TO CLIMATE CHANGE

11	2030 Objective 11: Improve the capacity of the community, especially populations most vulnerable to climate change risks, to understand, prepare for and respond to climate impacts.	Lead agency
11a	Provide education and resources about climate risks to the public, especially those most vulnerable to potential impacts like high-heat and flooding.	County (HD, DCHS)
11b	Continue to update existing emergency preparedness and response plans with increased emphasis on protecting, communicating with and serving low income populations, communities of color, older adults and people with disabilities during weather and wildfire-related emergencies.	County (DCHS, HD); City (PBEM)
11c	Develop and distribute culturally appropriate and accessible materials about extreme heat and related respiratory-illness, especially to populations most vulnerable to those impacts.	County (HD, DCHS)
11d	Link low-income populations, communities of color, older adults and people with disabilities to services that help reduce safety, health and financial risks associated with climate change impacts.	County (HD)
11e	Explore opportunities to provide financial resources for climate preparation efforts to culturally specific organizations.	County (HD, DCHS, OS)
11f	Build capacity and leadership within communities most vulnerable to climate change impacts by promoting, supporting and leveraging community-specific strategies, projects and events.	City (BPS, BES, PPR); County (HD, DCHS, OS)

BUILDING CAPACITY TO PREPARE FOR AND RESPOND TO CLIMATE CHANGE

12

2030 Objective 12: Improve monitoring, evaluate effectiveness of climate change preparation actions and advance new research to support climate change preparation efforts.

		Lead agency
12a	Assess data gaps and identify, compile and regularly update priority data for the Portland area (e.g., hydrology, floodplains, fires) for climate change trend tracking.	City (BES, PPR, PBOT, Water); County (HD)
12b	Implement the Portland Area Watershed Monitoring and Assessment Program (PAWMAP) which monitors stream flow and temperature quarterly, as well as key fish and wildlife species.	City (BES)
12c	Continue to support federal and state monitoring of river levels such as US Geological Survey gauge monitoring, and coordinate and strategically supplement the data with additional flow and water quality data collected through PAWMAP.	City (BES)
12d	Continue to update the City’s Natural Resource Inventory as needed.	City (BPS)
12e	Monitor impacts of climate change on aquatic and upland habitats, including forested areas and critical habitat types (e.g., wetlands, native oak), and aquatic and terrestrial fish and wildlife species. Determine if additional management strategies are warranted.	City (BES, PPR, Water)
12f	Track Combined Sewer Overflow/Sanitary Sewer Overflow design storms (every five years).	City (BES)
12g	Track the condition of major assets (e.g., roads, bridges, retaining walls, parks assets, etc.) to determine if maintenance needs to be more frequent due to weather patterns that cause damage.	City (PBOT, PPR); County (DCS)
12h	Monitor river levels and bridge lift frequencies.	City (BES); County (DCS)
12i	Begin rainfall event-based monitoring of sediment accumulation in pipes and stormwater facilities.	City (BES)
12j	Monitor stormwater and wastewater temperatures.	City (BES)
12k	Continue to monitor recreation trends and literature regarding the effect of climate change on recreational trends.	City (PPR)

BUILDING CAPACITY TO PREPARE FOR AND RESPOND TO CLIMATE CHANGE

12 2030 Objective 12: Improve monitoring, evaluate effectiveness of climate change preparation actions and advance new research to support climate change preparation efforts.

		Lead agency
12i	Continue to monitor Best Management Practices for park facilities (e.g., durable and resilient materials that hold up well to climate changes; energy and water efficiencies of water play/spray features; climate resilient planting materials).	City (PPR)
12m	Monitor heat-related illness and impacts of air quality on health status through review of data such as death certificates and hospital discharges.	County (HD)
12n	Monitor response capability (resources) as climate change impacts affect demand for emergency response.	City (PBEM)
12o	Monitor, diagnose and investigate health problems and hazards in the community related to extreme heat and high ozone days.	County (HD)
12p	Investigate possible new diseases, insects, molds, fungi and invasive trees that may affect fish, wildlife and habitats.	City (BES, PPR)
12q	Survey and monitor for vector-borne diseases by collecting, analyzing, and interpreting data related to vector ecology and emerging public health threats.	County (HD)
12r	Coordinate with Centers for Disease Control and Prevention on information about changes in vector-, water- and food-borne diseases across the country.	County (HD)
12s	Monitor migration trends and research the potential for accelerated regional population growth beyond current projections due to national or global changes in the climate.	City (BPS)
12t	Research the potential impacts of climate change on local food safety and security.	County (OS)
12u	Establish research partnerships with institutions of higher learning to: (1) gather local data around the linkage between increased temperature, air quality (specifically ground-level ozone), and health outcomes and disparities; (2) identify tree species most suitable for future climate change conditions.	City (PPR, BES); County (HD)
12v	Monitor climate change preparation initiatives, activities or interest from tribes, communities of color and low-income populations to identify opportunities for collaboration.	City (BPS, BES, PBEM, PPR); County (OS, HD)

Lead Agency

City acronyms

BDS = Bureau of Development Services
BES = Bureau of Environmental Services
BPS = Bureau of Planning and Sustainability
OGR = Office of Government Relations
OMF = Office of Management and Finance
PBEM = Portland Bureau of Emergency Management
PBOT = Bureau of Transportation
PFR = Portland Fire and Rescue
PPR = Portland Parks and Recreation
Water = Portland Water Bureau

County acronyms

DCA = Department of County Assets
DCHS = Department of County Human Services
DCJ = Department of Community Justice
DCS = Department of Community Services
HD = Health Department
MCEM = Multnomah County Office of Emergency Management
MCSO = Sheriff's Office
OS = Multnomah County Office of Sustainability

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