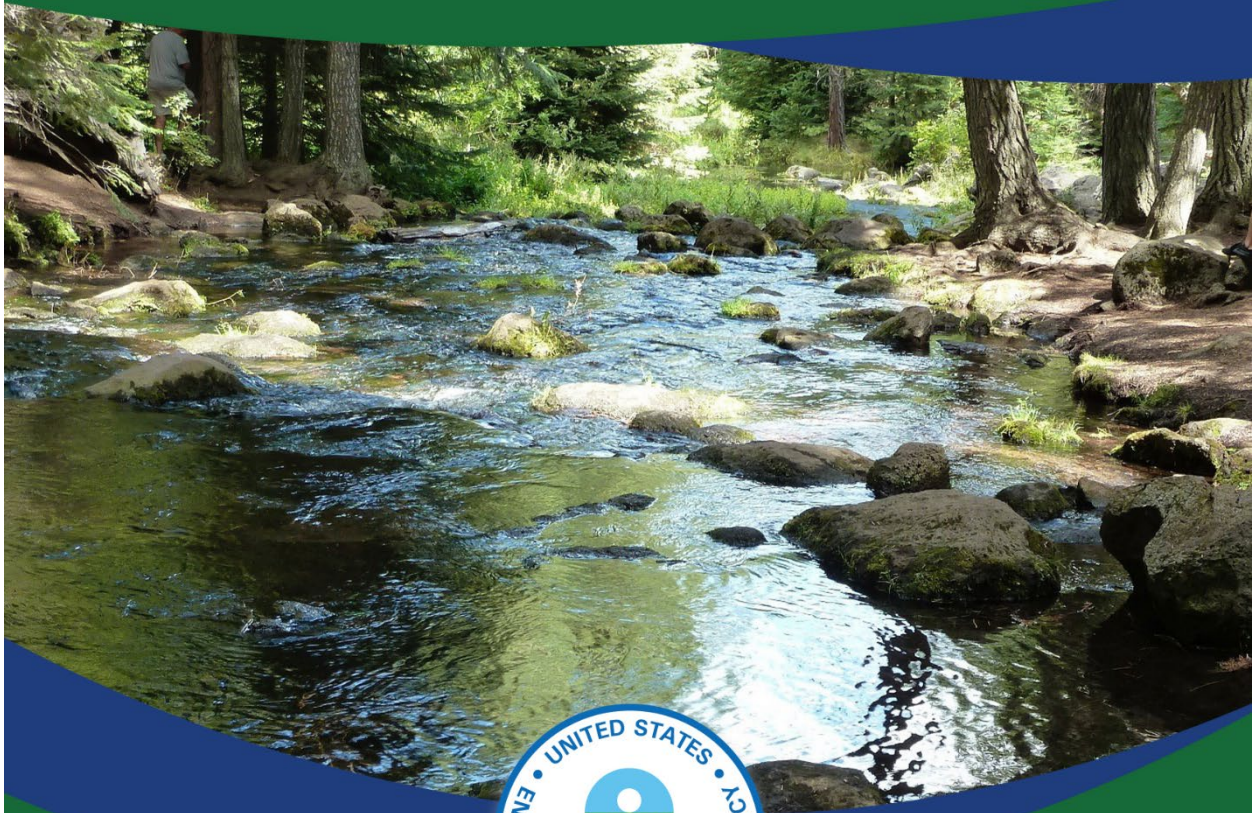


U.S. ENVIRONMENTAL PROTECTION AGENCY



REGION 10

# Climate Change Adaptation Implementation Plan

OCTOBER 2022

Prepared by the Region 10 Climate Adaptation Work Group

EPA Publication Number: 910B22001



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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

SEP 12 2022



DEPUTY ADMINISTRATOR

## Preface

Climate change is threatening communities across the nation. Millions of Americans feel the destructive effects of climate change each year when the power goes down, rivers and lakes go dry, homes are destroyed by wildfires and communities are flooded by hurricanes. Underserved communities are especially vulnerable to the climate crisis and are more likely to experience the negative health and environmental effects of extreme weather events.

The Biden-Harris Administration is actively confronting the climate crisis while also advancing environmental justice. As part of a whole-of-government approach, the U.S. Environmental Protection Agency is strongly committed to taking the actions necessary to protect human health and the environment and to increase the resilience of the entire nation, even as the climate changes.

The EPA's commitment to action is reflected in its FY 2022-2024 Strategic Plan and in the 2021 Climate Adaptation Action Plan. Both documents present priority actions the agency will take to ensure that its programs, policies and operations remain effective under future climate conditions while we work to support states, territories, tribes and communities in increasing their own adaptive capacity and resilience to climate change impacts.

From flooding at Superfund sites, to wildfires causing air pollution, to sea-level rise affecting water quality and infrastructure, the EPA will boldly address climate impacts in both its programs and the communities it serves. We recognize the importance of tribal, state and local government partnerships in efficient, effective and equitable implementation of climate change adaptation strategies. Our plans were informed and improved by input we received in listening sessions we held to engage these and other partners as we developed these plans.

To ensure we are addressing the climate crisis in a comprehensive way, each of our national program and regional offices has developed individual Climate Adaptation Implementation Plans that outline how the EPA will attain the agencywide goals described in the broader Climate Adaptation Action Plan. These plans describe how programs and regions will integrate climate adaptation into their programs, partnerships and operations. They also describe how they will help partners build their resilience and capacity to adapt, while

delivering co-benefits, including curbing greenhouse-gas emissions and other pollution, and promoting public health, economic growth and climate justice. Of course, the EPA has a major role to play on emissions reductions as well, though that is not the focus of these plans. Indeed, we must focus on both climate adaptation and mitigation to ensure our nation and communities thrive in an era of climate change.

As part of this effort, we will empower our staff and partners by increasing awareness of how climate change may affect our collective ability to implement effective and resilient programs. We will also provide them with the necessary training, tools, data, information and technical support to make informed decisions and integrate climate adaptation into our work.

The EPA will work to modernize its financial assistance programs to encourage climate-resilient investments across the nation. We will also focus on ensuring that investments funded by the Bipartisan Infrastructure Law, the Inflation Reduction Act and other government programs are resilient to the impacts of climate change. Finally, as our knowledge advances and as impacts continue to develop, our response will likewise evolve. We will work to share these developments to enhance the collective resilience of our nation.

The actions outlined in these implementation plans reflect the EPA's commitment to build every community's capacity to anticipate, prepare for, adapt to and recover from the increasingly destructive impacts of climate change. Together with our partners, we will work to create a healthy and prosperous nation that is resilient to the ever-increasing impacts of climate change — which is vital to the EPA's goal of protecting human health and the environment and to ensuring the long-term success of our nation.

A handwritten signature in blue ink, appearing to read "J.G. McCabe".

Janet G. McCabe

## Preface

In the Pacific Northwest and Alaska, the impacts of climate change are already threatening our treasured natural resources, economies and communities. Here in our beautiful corner of the country, we are experiencing record-breaking summer heat waves, increasing rainfall and decreasing mountain snowpack, more frequent and intense droughts and wildfires, warming rivers that threaten salmon, and entire native Alaskan communities being displaced due to coastal erosion.

In many cases, we know that climate change intensifies existing environmental stressors. This can be especially severe for communities of color, children, and the elderly. Through our work with more than 271 tribal governments across our Region, we also know that tribes are often on the front lines of these impacts and are leading the way on climate resilience and adaptation efforts.

This Climate Adaptation Implementation Plan serves as EPA Region 10's response to President Biden's [Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad,"](#) and EPA Administrator Regan's direction to update regional Implementation Plans as stated in the [EPA 2021 Climate Adaptation Action Plan](#).

In the sections that follow, this plan identifies strategies and priority actions we will take to strengthen climate resilience across the region with science at the foundation of our efforts; developing the climate leaders of tomorrow through training and education; and collaborating with our partners to leverage our efforts. As we move forward, the plan and its specific actions will evolve to ensure that we continue to focus our resources where they will have the most impact.

Above all, this plan is action-oriented, and our commitment is to increase climate resilience for all. We invite you to join us on this journey. The time to act is now.

Casey Sixkiller

Regional Administrator

U.S. Environmental Protection Agency, Region 10

## **Acknowledgements**

This document was prepared by the U.S. Environmental Protection Agency (EPA) Region 10 Climate Adaptation Workgroup under the leadership of the Region 10 Executive Team with additional assistance, guidance, and input from numerous staff and management across the Region 10 organization.

## **Introduction**

According to the U.S. Global Change Research Program, the Earth's climate is warming faster than at any point in the history of modern civilization, primarily because of emissions of heat-trapping greenhouse gases from fossil fuel combustion, deforestation, and land-use change. The impacts are on display every day across the nation: sea levels are rising, intense storms are becoming more frequent, and extreme temperatures continue to break records. Each of these impacts has the potential to harm human health and the livelihoods of our communities, as well as damage critical infrastructure and ecosystems that serve the communities in Region 10.

This document serves as the EPA Region 10 response to President Biden's [Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad,"](#) and the [2021 EPA Climate Adaptation Action Plan](#).

The Region 10 Climate Change Adaptation Implementation Plan (CAIP) is intended to be a living document that will be reviewed annually to demonstrate progress toward priority actions designed to increase climate resilience across the region. This plan primarily focuses on adaptation, which means taking actions to prepare for and adjust to both the current and projected impacts of climate change (EPA 2021 Climate Adaptation Action Plan). The region is also engaged in actions to address the reduction of greenhouse gas emissions (GHGs) in its climate mitigation efforts. These two concepts go hand in hand in combating the effects of climate change. As GHG emissions are lowered, it is hoped that efforts to reduce harmful impacts will be lessened, but until we can achieve significant global reductions in overall atmospheric carbon dioxide (CO<sub>2</sub>), we must plan, prepare, and act to reduce harmful impacts which are already occurring at a record pace.

This plan recognizes that not only are our critical resources and natural ecosystems vulnerable to the effects of climate change, but certain populations can be especially vulnerable to the impacts of climate change. One of the principles guiding EPA's efforts to integrate climate adaptation into its everyday actions calls for adaptation plans to prioritize helping people, places, and infrastructure that are most vulnerable to adverse climate impacts. As such, this plan will be shared publicly and will undergo a deliberate coordination and outreach effort to ensure that it is designed and implemented with meaningful involvement from all parts of society. As this plan is implemented, Region 10 will identify, engage with, and assist the populations and communities most vulnerable to the impacts of climate change.

EPA Region 10 and its partners are uniquely positioned to take effective climate action through the framework we already employ to achieve our respective missions: promote, incentivize, and enforce. Promotion includes a vast array of voluntary initiatives already exemplified through partnerships across the region. Incentivization utilizes our collective resources through both existing and new funding streams such as the [Bipartisan Infrastructure Law](#), and applying climate resilience criteria to those funding resources along with technical assistance to enable and implement climate-smart practices. Enforcement involves updating our policies, regulations, and guidance over time to ensure these practices are followed. These approaches are supported by identification of data needs and



opportunities for collaboration and coordination with partners as well as efforts to support science and research.

In the sections that follow, this plan identifies key programmatic vulnerabilities and priority actions that will be taken to address the impacts of climate change over time. In addition, the plan lays out the region's strategies to: integrate science into the foundation of our efforts to combat climate change; develop our internal climate leaders of tomorrow through training and education; and to collaborate and engage with our partners to leverage our efforts and share knowledge.

Above all, this plan is intended to be outcome and action oriented. The region will track its progress on priority actions and monitor its ability to work with partners to achieve desired results. The plan itself and actions contained will adapt over time to ensure that we focus the region's resources where needed and that we deliver on our commitment to increase climate resilience for all as an integral part of our mission to protect human health and the environment in Region 10.

### **Senior Leadership and Staffing**

Region 10's Acting Regional Administrator and Executive Team have assigned the following Senior Career Leader and staff person responsibility for overseeing the climate adaptation activities described in this plan:

Senior Career Leader:

Krishna Viswanathan  
Director  
Air & Radiation Division

Staff Person:

Dino Marshalonis  
Acting Deputy Director  
Office of the Regional Administrator

### **Region 10 Vulnerability Assessment**

This section contains an assessment of the vulnerabilities of Region 10 programs to the impacts of climate change. It builds on the work of individual assessments completed by various Program Offices in Region 10 initiated for the 2014 Climate Adaptation Implementation Plan and has been updated to reflect the latest scientific information contained in the [Fourth U.S. National Climate Assessment](#). It also draws heavily from existing efforts from the four states in Region 10, as well as the work from Tribal assessments.

This vulnerability assessment provides a qualitative evaluation of the nature and magnitude of risks associated with climate change impacts. The vulnerability assessment is based on the best available information, state and tribal vulnerability assessments, and our own best professional judgment. The assessment does not specifically distinguish timeframes (current, near-term, long-term) for impacts, although it mentions where impacts are already occurring, and it does provide judgments on the likelihood of the impact occurring in the Region. The assessment will need to be updated as our understanding of climate science evolves, and the Region will need to identify the important gaps in our scientific knowledge and technical analyses that are needed to assist in decision-making.

The overall goals of the Region 10 vulnerability assessment are to: 1) Inform staff and managers in Region 10 about the most critical impacts from climate change for their programs; 2) Motivate staff and managers to continue with existing climate change and sustainability work and integrate climate change adaptation into their program work; 3) Serve as a starting point to engage in conversations with EPA partners, especially Tribes, on future actions that are needed to adapt to climate change; and 4) Serve as a qualitative assessment of the baseline set of vulnerabilities, which can be refined as new regional information on climate science and adaptation alternatives become available.

Vulnerable populations are mentioned throughout the document. Certain parts of the population, such as communities with environmental justice concerns, children, the elderly, minorities and the economically disadvantaged, persons with underlying medical conditions and disabilities, those with limited access to information, and tribal and indigenous populations, can be especially vulnerable to the impacts of climate change. Tribes may be more vulnerable to climate change impacts because of dependence upon a specific geographical area for their livelihood; and their unique cultural, economic, or political characteristics and contexts.

Also, certain geographic locations and communities are particularly vulnerable, such as those located in low-lying coastal areas. One of the principles guiding EPA's efforts to integrate climate adaptation into its programs, policies and rules calls for its adaptation plans to prioritize helping people, places and infrastructure that are most vulnerable to climate impacts, and to be designed and implemented with meaningful involvement from all parts of society.

Region 10, in preparing this updated vulnerability assessment, reviewed documents from partner federal agencies, state agencies, and Tribes. A full list will be provided in the final document. A summary of references reviewed to update this Vulnerability Assessment is listed below:

- [Fourth U.S. National Climate Assessment](#)
- [Pacific Northwest Chapter of Fourth U.S. National Climate Assessment](#)
- [National Oceanic and Atmospheric Administration's State Climate Summaries](#)
- [EPA Report: Seasonality and Climate Change, A review of Observed Evidence in the United States](#)
- [Climate Change and Our Natural Resources: A Report from the Treaty Tribes in Western Washington](#)
- [Swinomish Indian Tribe Climate Change Initiative Impact Assessment Technical Report](#)
- [University of Washington Climate Impacts Group, Northwest Climate Assessment Report](#)
- [EPA Fact Sheet, Adapting to Climate Change: Alaska](#)
- [EPA Fact Sheet, Climate Change in Idaho](#)
- [EPA Fact Sheet, What Climate Change Means for Oregon](#)
- [EPA Fact Sheet, What Climate Change Means for Washington](#)
- [Alaska's Climate Change Strategy: Addressing Impacts in Alaska](#)
- [Idaho Climate-Economy Impacts Assessment](#)
- [Third Oregon Climate Assessment Report](#)
- [Washington State's Integrated Climate Response Strategy](#)

The following suite of significant climate change vulnerabilities and impacts, and their effects on Region 10 Programs is discussed in the sections below. Each of the vulnerability sections provide specific information on regional programmatic concerns related to these vulnerabilities.

### **Significant Regional Vulnerabilities**

#### *Increased Precipitation Frequency and Intensity*

- Increased stormwater runoff and flooding can also wash pollutants and other chemical contaminants into drinking water sources, requiring additional or alternative methods of treatment and placing greater pressure on already constrained systems to meet water quality standards. Extreme events also accelerate erosion and sedimentation of streams and rivers, reservoirs, and port facilities, adversely affecting aquatic organisms and requiring more frequent dredging and the disposition of potentially contaminated sediment. These infrastructure challenges have real implications for public health and communities, especially those that are underserved or already have heightened exposures to pollutants.
- Along the Pacific coast, severe winter storms are projected to occur more often, such as occurred in 2015 during one of the strongest El Niño events on record. Climate change could enhance precipitation changes expected under natural cycles such as El Niño. Strong winter storms contribute to storm surge, large waves, coastal erosion, and flooding in low-lying coastal areas. For example, during the 2015-2016 extreme El Niño winter, wave energy along the West Coast was about 50% above normal. Several major storms hit northwestern Oregon, bringing record-breaking rainfall, high winds, and high tides. Tillamook County in Oregon experienced a state of emergency that included major highway and road closures due to flooding, failed culverts, landslides, and sinkholes. Disruptions in transportation networks affected access to food, healthcare, and social services.
- Heavy rainfall can lead to slope instabilities and landslides, which can close roadways and railways. Along the Amtrak Cascades Corridor, more than 900 coastal bluff landslides have blocked the tracks and shut down rail service since 1914, with over 240 disruptions occurring between 2009 and 2013. Landslides during winter storms have also closed major Interstates, such as the December 2015 closure of eastbound Interstate 90 near Snoqualmie Pass and the February 2017 closure of westbound Interstate 90 near Issaquah. The Oso Landslide of 2014, America's deadliest slide in history, killed 43 people and buried a mile of Washington State Route 530; the slope was destabilized by heavy seasonal precipitation 200% of the long-term average.
- Future extreme precipitation events could increase the risk of exposure to water-related illnesses as the runoff introduces contaminants and pathogens (such as *Cryptosporidium*, *Giardia*, and viruses) into drinking water. In Puget Sound, under a mid-high emissions scenario, local atmospheric heating of surface waters is projected to result in 30 more days per year that are favorable to algal blooms and an increased rate of bloom growth.
- The Oregon Health Authority recorded a large outbreak of Shigellosis (a bacterial diarrheal disease) in late 2015, affecting many people in the Portland Metro region; this outbreak was associated with unusually extreme precipitation. In January 2021, 11 million gallons of untreated stormwater and sewage were released in Puget Sound due to heavy rains overwhelming the capacity of King County's Shoreline pump station.

- Extreme precipitation events are expected to lead to flooding and increases in combined sewer overflow events and wastewater treatment plant bypass events, threatening public health exposure to a wide range of contaminants. On December 20, 2019, it rained 3.25 inches at Sea-Tac Airport, the #5 wettest day on record since 1945.
- Fluctuating groundwater levels resulting from extreme precipitation events could undermine Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and Toxic Substances Control Act (TSCA) remedies and mobilize legacy pollutants into drinking water and surface water systems. Stormwater systems may become overloaded decreasing their effectiveness to drain stormwater from remediation sites and increasing the risk of localized flooding.
- Extreme environmental events could create real (or perceived) contamination which may create a Brownfield site. Existing mediated Brownfields such as sites with capped contamination may be impacted with severe flooding.

#### *Changes in Precipitation State, Snowpack, and Snowmelt*

- Hydrologic change will likely be an important driver of future climate stress on infrastructure. As higher temperatures increase the proportion of cold season precipitation falling as rain rather than snow, higher streamflow is projected to occur in many basins, raising flood risks. An increased risk of landslides is also expected, as more mixed rain and melting snow events occur in low- to mid-elevation mountains. Increases in the amount of precipitation falling in heavy rainfall events (including atmospheric rivers) are anticipated to magnify these risks.
- Warmer winters have reduced average snowpack in the Cascades by 20 percent since 1950. The snowpack is now melting a few weeks earlier than during the 20th century, and, by 2050, it is likely to melt three to four weeks earlier. Three thousand glaciers cover about 170 square miles of mountains in Washington, but that area is decreasing in response to warmer temperatures. For example, South Cascade Glacier has decreased in size since the 1950s, with an accelerated rate of decline in recent years. Decreasing snowpack means there will be less water flowing through streams during summer, leading to fish population declines and overall reduced water availability.
- There is increased need to develop new water supply plans to meet current and projected water use demands in areas that rely on snowpack as a primary water supply. A growing number of communities are expected to grapple with challenges to their water supplies year-round. Such communities will be faced with managing competition between municipal supplies, energy production, industrial use, agricultural use, and ecological needs.
- Reduced glaciers, snowfall, snowpack and earlier spring runoff lead to drier soils and vegetation that are more subject to wildfires, which increase the polluted runoff entering waterways and impact water quality.
- Shrinking snowpack, higher evaporation, and reduced precipitation can all reduce water supplies and lead to more drying that intensifies the risk of wildfires.

### *Flooding and Fluctuating Groundwater Elevation Levels Due to Precipitation Changes*

- Extensive flooding occurred in Northwest Oregon and Southwest Washington during the winter of 2021, damaging roads and buildings and triggering Coast Guard rescue and evacuation for the community of Neskowin, OR. Astoria, OR experienced 2 inches of rain on Nov. 11, 2021, breaking a 70-year record.
- Existing conceptual site models, pathway evaluations, risk assessments, engineering and natural controls may not remain protective at existing cleanups in the CERCLA, RCRA Corrective Action, Leaking Underground Storage Tank (LUST) and polychlorinated biphenyl (PCB) Programs.
  - Increased flooding may cause increases in scouring and removal of protective caps, mobilization and spread of contaminants, impacts to local groundwater recharge rates and bank storage that can perturb the groundwater system being remediated and the remedial technology deployed, and increase groundwater elevation and flow dynamics.
  - Decreased snowfall may result in lower groundwater elevations, clay layers may crack when desiccated, no longer providing a barrier against contaminant movement, and wildfire risk may increase as soils and vegetation dry out.
  - Increased snowfall, hail and winter storms may result in increased groundwater elevations, saturation of surface soils, and power interruptions, damage and reduced access to critical remedy infrastructure, and increased melt-related flooding.
  - Decreased precipitation and/or increased pumping due to lack of surface water can lead to widespread decreases in groundwater elevation levels and changes in evapotranspiration. Changes in groundwater elevation levels and changes to groundwater flow may impact the assumptions upon which the Conceptual Site Model and remedial design are based. Decreased groundwater elevations impacts on existing remedies may include decreased groundwater capture, well screens no longer intercepting groundwater, and increased vadose zones.

### *Increased Drought*

- Increased evapotranspiration and drought may pose challenges for livestock and crops. Hot weather causes cows to eat less, grow more slowly, and produce less milk; and in extreme cases it may threaten their health. Reduced agricultural and livestock farming would lead to decreased food diversity and increased food prices.
- The changing climate will affect Washington's agricultural sector, particularly fruits and vegetables, which often require irrigation. Because streams rather than groundwater provide most of Washington's irrigation water, the expected decline in streamflow would reduce the water available for irrigation. About two-thirds of the nation's apples come from Washington, and most are grown east of the Cascade Mountains where the dry climate requires irrigation. Impacts also include anticipated decreases in potato yields and potato quality in the Northwest. Some farms

may be harmed if more hot days reduce crop yields, or if the decline in summer streamflow reduces the water available for irrigation.

- Increases in drought conditions will cause water temperatures to rise, which hurt Chinook and sockeye salmon in the interior Columbia River Basin. The combination of warmer water and lower flows would threaten salmon, steelhead, and trout. In 2015, July water temperatures in the lower Columbia River and its tributaries were higher than in any other year on record, leading to a high rate of mortality for endangered sockeye and threatened Chinook. Projections for increased stream temperature indicate a 22% reduction in salmon habitat in Washington by late century under a high emissions future. This habitat loss corresponds to more than \$3 billion in economic losses due to reductions in salmon populations and decreases in cold-water angling opportunities (\$3.3 billion).
- Drought conditions present challenges for infrastructure, especially water supplies. In Washington, the Department of Ecology allocated almost \$7 million in drought relief funds in 2015. Relief grants were used to provide backup or emergency water supplies for irrigation or human consumption where wells were failing or pumping capacity was inadequate. Already aging or underperforming drinking water, wastewater, and stormwater infrastructure will experience greater strain from droughts. Washington Department of Ecology declared another statewide drought emergency for the summer of 2021.
- Increased drought increases plant transpiration, in turn reducing soil moisture and lowering shallow groundwater elevations. Existing RCRA, LUST, and TSCA remedies that include treatment wetlands, phytoremediation, retention basins, and other surface water-based remedies may be at risk of becoming ineffective, leading to mobilized pollution to surface and groundwater. Sites vulnerable to increased evapotranspiration may also be vulnerable to wildfires and wind.
- Increases in the intensity, frequency and duration of droughts that concentrate existing nonpoint source pollution and degrade aquatic systems will amplify water quality impacts and require reconsideration of existing dilution methods for permitted point discharges.
- Tribes and indigenous communities disproportionately lack in-home access to safe drinking water and adequate water supplies, which may be amplified by increases in drought, decreased groundwater recharge, and shifting pollutant loads due to changing precipitation patterns.
- Lower flows under drought conditions would lead to less hydroelectric power production and increased consumer energy costs.
- The Oregon Health Authority recorded spikes in cases of Salmonella and E. coli during months with extreme heat in 2015.

#### *Increased Number and Severity of Wildfires*

- Climate change can increase the frequency and severity of fires that burn forests, grasslands, and desert vegetation. Since 1984, about 4 percent of the land in Oregon has burned per decade, and nearly 1 percent of the land in Idaho has burned per year since 1984, making it the most heavily burned state in the nation. Changing the climate is likely to more than double the area in the

Northwest burned by forest fires during an average year by the end of the 21st century. The 2021 wildfire season had surpassed all other historical annual events at the halfway point of the year, with 44,647 reported wildfires that burned 5.6 million acres of land. Washington state had more than 630 fires by the first week of July, outpacing the 2015 record wildfire season.

- Longer summers and higher temperatures create an environment that is conducive to larger fires. Between 1970 and 2000, the length of the snow-free season increased by about ten days across Alaska, primarily because of earlier snowmelt, leading to an earlier spring. These conditions give vegetation and soils more time to dry out, increasing the likelihood of wildfires.
- Wildfires can result in road and railway closures, reduced water quality in reservoirs, and impacts on the energy sector. The Goodell wildfire in August 2015 forced Seattle City Light to de-energize transmission lines around its Skagit River Hydroelectric Project for several days. The combined impact of damages and lost power production totaled nearly \$3 million. The Eagle Creek fire along the Washington–Oregon border in 2017 led to the closure of Interstate Highway 84 and an adjacent railway, likely increasing shipping costs and creating negative economic impacts on tourism and regional small businesses.
- Climate change can increase the impacts of wildfires on humans, such as respiratory illness and smoke inhalation. Smoke events during 2004 - 2009 were associated with a 7.2% increase in respiratory hospital admissions among adults over 65 in the western United States. In Boise, Idaho, 7 of the last 10 years have included smoke levels considered “unhealthy for sensitive groups” (including children) for at least a week during the fire season, causing some cancellation of school-related sports activities. More frequent wildfires and poor air quality are expected to increase respiratory illnesses in the decades to come. Airborne particulate levels from wildfires are projected to increase 160% by mid-century under a lower scenario, creating a greater risk of smoke exposure through increasing frequency, length, and intensity of smoke events.
- Wildfires lead to degraded ambient air quality as well as degraded indoor air quality. Smoke exposure increases acute respiratory illness, respiratory and cardiovascular hospitalizations, and medical visits for lung illnesses. Wildfires also occur during the summer season when ozone concentrations tend to be highest, leading to potential human health risks from multi-pollutant exposures.
- More frequent and intense wildfires that may release polluted runoff from fire-scorched areas into waterways pose additional water quality threats to water supplies. Wildfires can change the porosity of near-surface and surface soils and thereby modify groundwater flow and exposure pathways. Extreme temperatures from fires may change chemicals of concern at remedial cleanup sites. Wildfires can reduce vegetative cover surrounding or at a site, increasing surface-water runoff resulting in catastrophic flooding that increases pollutant loading to nearby waterbodies and spreads contamination or impacts remedies and remedy infrastructure at cleanup sites.
- Wildfires also increase the risk of landslides, erosion, and debris flow. Wildfires may render critical remedial infrastructure inoperable and disaster debris management related to wildfire events could impact waste disposal sites or cause blockage for drinking water system intakes. Growing post-wildfire debris flows may inundate transportation infrastructure during severe precipitation events.

- Fires or livestock grazing may accelerate the conversion of grassland to desert in response to changing climate.

### *Sea-Level Rise*

- Rising sea-level may cause increased shoreline erosion, increased groundwater elevations, increased salinity in groundwater, changes in water chemistry at surface water near-shore cleanups, greater likelihood of storm surge impacts, saturation of surface soils, increased likelihood of flood risks, and damage and reduced access to critical remedy infrastructure (e.g., wastewater treatment plants, ferry terminals, highways, and railroads along Puget Sound). Concentrations of people and infrastructure along coastlines presents notable vulnerabilities for community safety and critical infrastructure during natural disaster events or other climate driven impacts (e.g., coastal inundation, erosion, and sea level rise).
- Recent reports from the University of Washington's Climate Impacts Group indicate a 1.5 foot sea level rise in Puget Sound by 2100 is likely, with estimates also suggesting a rise of 7 feet could be possible. Rising sea level in Alaska is complicated by permafrost thaw and tectonic plate isostatic rebound as well as decreased gravitational influence, but rising waters are already forcing some Alaska villages to relocate to higher ground; estimated relocation costs are up to \$400 million per village.
- Sea level rise poses water inundation risks to low-lying remedial cleanup sites. Treatment wetlands, settling ponds, or other surface water components of remedies are threatened by sediment deposition and salt-water infiltration. Compromises to the remediation system may result in releases of contamination and contaminant migration creating new exposure pathways.
- Sea level rise is expected to increase contamination of drinking water supplies and waterways through mobilizing or releasing toxic contaminants into nearby surface waters, groundwater, or soil. Saltwater intrusion is also expected to impair freshwater ecosystems and alter species ranges or survival.
- Low-income, underserved, or rural communities, and communities with environmental justice concerns, with decentralized water infrastructure may face greater risks from sea level rise, saltwater intrusion, and flooding that will lessen drinking water quality from individual wells and the functioning of detached septic systems.
- Along the coast, sea level rise is projected to increase flood risks in low-lying areas and will likely magnify the potential for coastal erosion and infrastructure damage during extreme events with high storm surge and wave hazards. By the end of the century, the upper sea level rise projection of 4.3 feet would impact significant infrastructure investments throughout the Northwest, particularly in the low-lying urban areas of the Puget Sound and Portland.
- In coastal areas, sea level rise will likely lead to saltwater intrusion into groundwater supplies.

### *Permafrost Thaw*

- Permafrost is frozen ground that restricts water drainage and strongly influences water flows and affects the design and maintenance of infrastructure. In Alaska, permafrost is under 80% of the land. Some climate models project the complete loss of near-surface permafrost from large parts



of Alaska by the end of this century. As the ice in the soil melts, the soil subsides and can change the local topography and surface water flow. This will lead to surface instability, sinking of infrastructure and buildings, and will impair human and animal movement on the land. Industrial infrastructure at these sites, such as pipelines, well cellars, freezeback landfills, and other critical remedy-related infrastructure is also at risk from thawing, subsiding, and other related risks. Potential impacts of critical infrastructure failure are wide ranging, from loss of safe drinking water or electricity to exposure to wastewater pathogens and toxic materials from ruptured waste management facilities.

- By 2100, Alaska's North Slope is expected to thaw 65 feet down, indicating all of Alaska infrastructure will need to be completely rebuilt. In 2018, Alaska Department of Transportation spent \$4.5 million repairing sinking infrastructure in and around the Nome runway, and it is expected that the fixes will only last three to five years as subsidence continues.
- Permafrost currently acts as a natural barrier to groundwater flow and effectively contains contaminant plumes. As permafrost thaws and the ice melts it may cause release of the contaminants, and unpredictable groundwater flow, making new routes of exposure possible. Warming soils can also change the chemical constituents of concern. Melting soil ice can result in local flooding and invasive species. When permafrost soils drain, they are more at risk of wildfire as well as erosion due to high winds, sea-level rise and storm surge.
- Thawing permafrost, loss of coastal sea ice, sea level rise, and more intense extreme weather events are increasing erosion and flooding along Alaska's northwestern coast, which is causing extensive damage and creating new dangers to residents that lead to relocation as a safety approach.
- Flooding of residential (and business) structures from permafrost thaw could result in poor indoor air quality due to mold.

#### *Increase in Average Annual Air Temperature*

- Rising ocean temperatures resulting from warmer atmospheric temperatures harm marine ecosystems. Warming waters increase the frequency of toxic algae blooms (such as "red tide") that cause shellfish poisoning and lead to closures of beaches and shellfish beds. Warmer waters also allow invasive species from southern waters to move northward.
- Heat-related illness and injury is a significant public health concern, particularly in inland areas of Eastern Oregon, Eastern Washington, and Idaho. Prolonged exposure to extreme heat can cause heat exhaustion, heat cramps, heat stroke, and death, as well as exacerbate pre-existing chronic conditions, such as various respiratory, cerebral, and cardiovascular disease. During extreme heat events in King County, Washington, from 1990 to 2010, heat-related hospital admissions were 2% higher and deaths 10% higher than the average for that period, with an increased demand for emergency medical services for children, outdoor laborers, and the elderly. The state of Oregon has also recorded spikes in heat-related emergency room visits. The heatdome of 2021 caused widespread concern for public health during the record-shattering and prolonged extreme heat that covered much of Washington, Oregon, and Idaho, with temperatures in excess of 105 degrees several days in a row – reaching 116 degrees in Portland OR on June 28, 2021.

- Increased air temperature levels could lead to areas being designated as nonattainment for multiple National Ambient Air Quality Standards (NAAQS), triggering additional Clean Air Act requirements. In general, increased ground-level ozone concentrations occur during high temperature periods as well as particulate matter concentrations during cold weather events.

### **Special Emphasis on Climate Change Adaptation Needs of Tribes**

Under the Constitution, treaties with tribal nations are part of the supreme law of the land, establishing unique sets of rights, benefits and conditions for the treaty-making tribes who were forced to cede millions of acres of their homelands to the United States, in return for recognition of property rights in land and resources as well as federal protections. Tribal treaty rights have the same legal force and effect as federal statutes and they should be integrated into and given the fullest consideration throughout EPA's collective work. Reserved rights are the rights tribes retain that were not expressly granted to the United States by tribes in treaties. Treaty and reserved rights, including but not limited to the rights to hunt, fish and gather, may be found both on and off-reservation lands. Agencies should consider treaty and reserved rights in developing and implementing climate adaptation plans in order to protect these rights and ensure the Agencies meet their legal and statutory obligations and other mission priorities as we work to combat the climate crisis.

In September 2021, EPA joined 16 other federal agencies in signing a [Memorandum of Understanding](#) (MOU) that committed those parties to identifying and protecting tribal treaty rights early in the decision-making and regulatory processes. Accordingly, EPA will consider and protect treaty and reserved rights in developing and implementing climate adaptation plans through strengthened consultation, additional staff training and annual reporting requirements.

EPA Region 10 serves 271 federally recognized tribes in Alaska, Idaho, Oregon, and Washington. The EPA recognizes its unique legal relationship with tribal governments as set forth in the United States Constitution, treaties, statutes, executive orders, and court decisions. The EPA works with tribes on a government-to-government basis to protect the land, air, and water of tribes consistent with the federal trust responsibility.

“Tribes,” when used in this document, refers to federally recognized tribes. Federally recognized tribes include any Indian or Alaska Native tribe, band, nation, pueblo, village, or community that the Secretary of the Interior acknowledges to exist as an Indian tribe pursuant to the Federally Recognized Indian Tribe List Act of 1944, 25 U.S.C.479a.

Tribes are especially affected by climate change given their relationship and connection with the natural environment. Additionally, the ability to move away from impacts is limited given many have reservations, treaty rights, reserved rights and traditional ecological knowledge that are connected to specific places and resources.

Tribes continue to report dramatic changes to their environments due to climate change. Many have relayed serious concerns about their access to traditional foods such as salmon, marine mammals, shellfish, and plants which are used for cultural, medicinal, and subsistence purposes. Some tribes have experienced impacts to their economy as well (e.g., sales of fish). Additionally, tribes report degraded salmon habitat, drought, declining water tables, increased wildfires, reduced and earlier spring snow melt, decrease in sea ice, increased rates of harmful algal blooms, and thawing permafrost.

The [Swinomish Impact Assessment](#) described impacts that may be relevant to other Tribes including:

- Shrinking land base (due to sea level rise and enhanced coastal erosion);
- Inundation of coastal sites and artifacts;
- Exposure of burial sites and human remains from strong storm events;
- Loss of cultural use plants;
- Impacts within traditional use areas; and
- Loss of historic subsistent natural resources used by indigenous tribes such as fishery resources, wildlife, traditional foods, native plants, and holistic medicines.

In the areas served by Region 10, Tribes are leaders in taking action in climate change adaptation. Here are a few examples of Tribes advancing our scientific understanding and creating more resilient communities and landscapes; this is not an exhaustive list of tribal work but highlights the diverse array of tribal adaptive efforts underway:

- Sitka Tribe's Southeast Alaska Tribal Ocean Chemistry Research
- Alaska Native Tribal Health Consortium's Local Environmental Observer Network
- Jamestown S'Klallam Tribe's Strategy for Dungeness River Floodplain Protection and Restoration
- Nooksack Indian Tribe Climate Change Research and Hydrologic Restoration
- Protection Against Storm Surge at the Quinault Indian Nation Village of Taholah
- Makah Tribe Ocean Acidification Research in Neah Bay
- Lummi Nation Wetland and Habitat Mitigation Bank and Energy Efficiency and Clean Energy Study
- Swinomish Indian Tribal Community Forest Resilience Project
- Tulalip Tribes' Conference for Regulatory Harmonization
- Swinomish Climate Change Initiative for Community Health Outcomes
- Stillaguamish Tribe Floodplain Protection
- Suquamish Tribe Zooplankton Imaging System Monitoring

EPA Region 10 is committed to supporting tribes in their work to understand how climate change is affecting their lifeways and how they plan to adapt to these changing conditions. Additionally, we respect and support the sovereignty of tribes as they develop and operate their own environmental programs or choose to partner with other entities.

Related to funding, Region 10 recognizes that:

- Enhancing and protecting the flexibility and availability of federal funding for Tribes is essential to helping Tribes respond to climate change.
- Providing technical assistance will help under-resourced Tribes make progress towards their environmental goals.
- It is critical to provide early and accessible information on available EPA funding. Funding announcements should clearly describe eligibility requirements.
- It is important to work with National program offices to ensure tribes have access to EPA funding.

## **Priority Actions**

Region 10 is addressing climate change adaptation across all our programmatic areas of responsibility. We will continue to integrate climate change adaptation and resiliency into our existing programs and identify new opportunities to increase adaptive capacity and resiliency as regulations change, new initiatives and priorities are instituted, and funding opportunities are identified. Region 10's climate adaptation priority actions align with the five agency-wide priorities outlined in the 2021 [EPA Climate Adaptation Action Plan](#):

1. Integrate climate adaptation into EPA programs, policies, rulemaking processes, and enforcement activities.
2. Consult and partner with states, tribes, territories, environmental justice organizations, community groups, businesses, and other federal agencies to strengthen adaptive capacity and increase the resilience of the nation, with a particular focus on advancing environmental justice.
3. Implement measures to protect the agency's workforce, facilities, critical infrastructure, supply chains and procurement processes from the risks posed by climate change.
4. Measure and evaluate performance.
5. Identify and address climate adaptation science needs.

Region 10's priority actions rely on partnerships with state, tribal, and local environmental organizations. They were constructed within the legal bounds of our existing environmental statutes, are extensions of existing or planned program actions which are tailored to address specific climate change vulnerabilities, and include efforts related to communication, education, and outreach.

Region 10 will take steps to ensure the outcomes of infrastructure investments using Infrastructure Investment and Jobs Act (IIJA, or Bipartisan Infrastructure Law [BIL]) funds are resilient to the impacts of climate change. Region 10 will explore opportunities to integrate climate change considerations into its financial assistance programs in order to expand support for projects that increase climate resilience while delivering co-benefits for public health, the mitigation of greenhouse gases, and the reduction of other pollution. Region 10 will also provide technical assistance to recipients of BIL funds to help them make climate smart infrastructure investments.

Region 10 Priority Actions are listed below grouped by agency-wide climate priority; full details can be found in the [EPA Office of Policy Climate Adaptation database](#).

*Agency Priority 1. Integrate climate adaptation into EPA programs, policies, rulemaking processes, and enforcement activities.*

<b>Utilize Clean Water Act/Safe Drinking Water Act State Revolving Fund (SRF) programs to fund resiliency activities</b>	
<i>Fiscal Year Start-Complete</i>	2022-2026
<i>Performance metric</i>	Total green project reserve dollars for all Region 10 states and Tribes
<i>Associated Vulnerability</i>	Flooding, drought, sea level rise, storm surge, permafrost thaw, shoreline erosion

<i>Co-benefits</i>	Green Infrastructure, resilient and healthy coastline ecosystems, consistent sources for safe drinking water, reduced flooding.
<i>Resource requirements</i>	Additional resources required
<i>Notes</i>	This work will support federally recognized tribal governments, as well as non-native communities.

**Incorporate climate adaptation into Performance Partnership Agreement (PPA) process to enhance state partnerships**

<i>Fiscal Year Start-Complete</i>	2022-2026
<i>Performance metric</i>	Interim: successfully signed agreements which have enhanced language around climate adaptation relevant to our state partners; long-term: active climate adaptation engagement with our states through annual meetings and shared science priorities which advance environmental justice.
<i>Associated Vulnerability</i>	Specific vulnerabilities vary by location
<i>Co-benefits</i>	Co-benefits vary by state, public health, environmental justice
<i>Resource requirements</i>	No additional resources required
<i>Notes</i>	EPA will increase integration of climate change adaptation into our PPA processes with Alaska, Idaho, Oregon, and Washington.

**Facilitate and co-lead National Climate Workgroup as sub-lead for EPA Regional Air and Radiation Divisions to advance air science, policy, and understanding of implications for climate adaptation**

<i>Fiscal Year Start-Complete</i>	2022-2023
<i>Performance metric</i>	TBD; variable based on workgroup needs
<i>Associated Vulnerability</i>	Specific vulnerabilities vary by project
<i>Co-benefits</i>	Clean air, public health, education
<i>Resource requirements</i>	No additional resources required
<i>Notes</i>	

**Conduct climate change vulnerability analyses for Region 10 Superfund National Priorities List sites**

<i>Fiscal Year Start-Complete</i>	2022-2024
<i>Performance metric</i>	Completion of Vulnerability Analysis for all Region 10 National Priority List sites. Selections made for full-scale Climate Assessment. Completion of 2-4 full site vulnerability assessments.
<i>Associated Vulnerability</i>	Specific vulnerabilities vary by project
<i>Co-benefits</i>	Co-benefits vary by project
<i>Resource requirements</i>	Resource needs and funding sources for assessment of non-National Priorities List sites will be determined after the initial Vulnerability Analysis is completed. Any actions to be conducted based on the outcome of the full-scale Climate Assessments will be determined on a site-specific basis.

<i>Notes</i>	This analysis will initially include reviewing all Region 10 National Priority List sites to rank site remedies from the most to least vulnerable to the effects of climate change. Superfund Emergency Management Division will propose two to four sites in the high-risk category to undergo an initial Vulnerability Assessment to be conducted with Office of Land and Emergency Management/Office of Superfund Remediation and Technology Innovation for national consistency. Based on the outcome of the initial Vulnerability Assessment, a subset of sites may be selected by EPA Headquarters to undergo a full-scale Climate Assessment.
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**Target inspections of facilities in climate vulnerable areas**

<i>Fiscal Year Start-Complete</i>	2023-2026
<i>Performance metric</i>	Number of Region 10 Enforcement and Compliance Assurance Division (ECAD) targeting staff receiving training on use of vulnerability assessment tools, number of inspections conducted in climate vulnerable areas
<i>Associated Vulnerability</i>	Specific vulnerabilities vary by location
<i>Co-benefits</i>	Co-benefits vary by state, public health, environmental justice
<i>Resource requirements</i>	Additional resources required
<i>Notes</i>	Climate vulnerable areas in Region 10 also tend to be areas housing communities with environmental justice concerns.

**Conduct systematic review and include climate change adaptation criteria in Grant Program requirements**

<i>Fiscal Year Start-Complete</i>	2023-2026
<i>Performance metric</i>	Number of grants including climate adaptation requirements, funding for climate adaptation
<i>Associated Vulnerability</i>	Specific vulnerabilities vary by location
<i>Co-benefits</i>	Benefits include improvements to environmental and/or ecosystem conditions and management (including tons greenhouse gas (GHG) reduced); Measurable improvements in public health conditions, increased community and environmental resilience, increased community, environmental, and economic sustainability
<i>Resource requirements</i>	No additional resources required
<i>Notes</i>	Region 10 would look to award grants in Fiscal Year 2023 for projects that advance climate priorities with measurable outputs and outcomes. If more funding becomes available, funding could potentially be added to this grant program. R10 will explore any nexus with related Environmental Justice and Justice40 goals.

**Review and update vulnerability assessments and require modifications to remedy actions for legacy cleanup Resource Conservation Recovery Act (RCRA)/Toxic Substance Control Act (TSCA) Long Term Stewardship (LTS) sites**

<i>Fiscal Year Start-Complete</i>	2023-2026
<i>Performance metric</i>	Percentage of current and LTS cleanups mapped for climate vulnerabilities, number of existing cleanups where a vulnerability assessment is requested, percentage of new PCB cleanups with LTS with a baseline vulnerability assessment that have submitted an updated vulnerability assessments, percentage of new PCB cleanups with LTS where the updated vulnerability assessments identified a modified to the remedy decision is necessary, percentage of new PCB cleanups with LTS where the remedy is modified based on the updated vulnerability assessments

<i>Associated Vulnerability</i>	Specific vulnerabilities vary by location
<i>Co-benefits</i>	Reduced releases of toxic waste into local communities
<i>Resource requirements</i>	Additional resources required
<i>Notes</i>	Action will occur in two phases, with Phase 2 modifications dependent on Phase 1 vulnerability assessment recommendations

*Agency Priority 2. Consult and partner with states, tribes, territories, environmental justice organizations, community groups, businesses, and other federal agencies to strengthen adaptive capacity and increase the resilience of the nation, with a particular focus on advancing environmental justice.*

**Create Resource Conservation Recovery Act (RCRA)/Toxic Substance Control Act (TSCA) facility maps with current and predictive information on climate change hazards**

<i>Fiscal Year Start-Complete</i>	2022
<i>Performance metric</i>	One climate threat map as deliverable
<i>Associated Vulnerability</i>	Specific vulnerabilities vary by location
<i>Co-benefits</i>	Co-benefits vary by facility
<i>Resource requirements</i>	No additional resources required
<i>Notes</i>	Anticipated final deliverable in FY22

**Coordination with the Northwest Climate Adaptation Science Center (NW CASC) and Region 10 Divisions on science needs and available climate change resources**

<i>Fiscal Year Start-Complete</i>	2022-2026
<i>Performance metric</i>	Review existing NW CASC resources, communicate resiliency-relevant, existing NW CASC resources to R10 programs, participate in NW CASC SAC meetings and vote on research options, identify climate adaptation research topics relevant to R10 that were not the subject of research proposals and conduct outreach to regional universities to discuss EPA's needs on these subjects.
<i>Associated Vulnerability</i>	Specific vulnerabilities vary by location
<i>Co-benefits</i>	Climate vulnerable areas in Region 10 also tend to be areas housing communities with environmental justice concerns.
<i>Resource requirements</i>	No additional resources required
<i>Notes</i>	Region 10's participation will consist of two simultaneous efforts: 1) reviewing existing resources (e.g., publications, reports, story maps) and communicating relevant resources to Region 10 programs and 2) participating in steering NW CASC's future research efforts towards Region 10's needs towards related to climate resiliency knowledge and implementation.

**Establish long term sites for monitoring climate impacts in Region 10 (streamflow and temperature)**

<i>Fiscal Year Start-Complete</i>	2022-2023
<i>Performance metric</i>	Develop report
<i>Associated Vulnerability</i>	heavy precipitation events and wildfires
<i>Co-benefits</i>	environmental justice, carbon neutrality, cost savings to federal government

<i>Resource requirements</i>	Resource needs dependent on the nature and extent of outreach and communication with regional partners
<i>Notes</i>	Changes in streamflow and/or stream temperature can influence the development of harmful algal blooms (HABs), the suitability of a stream for aquatic life, and the availability of water for drinking, agriculture, energy production, and other uses. It is important for Region 10 to incorporate regional long-term streamflow and water temperature changes within aquatic monitoring programs so that we can develop adaptation measures that address water quality and water availability challenges associated with climate change.

#### **Deploy mobile laboratory to investigate active fire impacts on human health**

<i>Fiscal Year Start-Complete</i>	2022-2025
<i>Performance metric</i>	At least one deployment of the mobile laboratory to a wildland urban interface (WUI) fire (2023-2024), at least one deployment of the mobile laboratory to a prescribed fire (2023-2024), evaluation of data (2024-2025)
<i>Associated Vulnerability</i>	wildfires
<i>Co-benefits</i>	Clean air, human health, environmental justice
<i>Resource requirements</i>	Additional resources required
<i>Notes</i>	Emissions and health impacts from both prescribed and WUI fires must be quantified to inform development of smoke management plans and State Implementation Plans (SIPs). Measurement sites will be selected based on knowledge of past fire activity and smoke impacts; tribal communities and communities with environmental justice concerns will be given priority.

#### **Work with Region 10 states and Tribes to develop and implement smoke management plans and work with Tribes on adaptation to wildfire and smoke**

<i>Fiscal Year Start-Complete</i>	2022-2026
<i>Performance metric</i>	Host and facilitate meeting by Q4 of FY22, with at least 75 participants. The outcome of this action is education and skills to create individual smoke management plans by each partner participant.
<i>Associated Vulnerability</i>	Wildfire
<i>Co-benefits</i>	Clean air, public health and air quality
<i>Resource requirements</i>	No additional resources needed within EPA. However, funding may be needed to support travel and participation in this training event.
<i>Notes</i>	Translate learnings into streamlined strategies for community preparedness and response and smoke management. State agencies will have a clear set of actions to adapt to increased impacts of smoke on public health and air quality.

#### **EPA support to Region 10 Tribes taking action to address climate change**

<i>Fiscal Year Start-Complete</i>	2022-2024
<i>Performance metric</i>	200 of the 271 (50 per fiscal year) Tribes within Region 10 will incorporate climate adaptation actions into their EPA Tribal Environmental Plans (ETEPs) and General Assistance Program (GAP) grant workplans.
<i>Associated Vulnerability</i>	Specific vulnerabilities vary by Tribe and location
<i>Co-benefits</i>	Co-benefits vary by Tribal partner
<i>Resource requirements</i>	No additional resources required.



<i>Notes</i>	Region 10 GAP team will continue to negotiate with Tribes in Region 10 to include climate adaptation actions in GAP workplans and as part of ETEP renewals. Region 10 will utilize national guidance on which actions should be considered climate adaptation work within the context of ETEPs and GAP workplans to ensure national consistency. Actions may include: developing a draft climate adaptation plan; identifying potential impacts of climate change; assessing vulnerability; planning efforts; applying for additional funding (e.g., applying for funding from others such as FEMA); adaptation measures such as green infrastructure; restoration projects providing flood benefits; improved coordination with other key organizations (e.g., a state or federal partner); estimate financial impacts. Once actions are reviewed and counted by the GAP team as part of a grantee performance review, Region 10 will focus future outreach to the remaining Tribes who have no such actions as part of their workplan. In FY 23 and beyond, Region 10 GAP training team will target geographic areas where those Tribes remain, to make them aware of climate work possible under GAP.
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**Represent and lead EPA’s engagement in the Bering Sea Task Force on climate resiliency**

<i>Fiscal Year Start-Complete</i>	2022-2026
<i>Performance metric</i>	Short term metrics include identifying EPA equities and areas of collaboration within the Bering Sea Task Force. Intermediate metrics include meeting with the Bering Sea Tribal Advisory Council to understand the tribal priorities of the Region and then determining appropriate roles for EPA engagement. Long term metrics include active climate adaptation principles integrated into EPA’s work in the Bering Sea Climate Resilience Area. The Task Force intends this to be a model of other climate resilience areas.
<i>Associated Vulnerability</i>	Ocean warming, loss of sea ice, shoreline erosion
<i>Co-benefits</i>	Public health, environmental justice
<i>Resource requirements</i>	No additional FTE required. Funding will be needed to support implementation of scientific priorities associated with EPA’s work in the Bering Sea which further climate resilience. Travel resources will be required to support community engagement, when appropriate.
<i>Notes</i>	Executive Order 13754 directs a coordinating framework through the establishment of the federal Bering Task Force and the Bering Intergovernmental Tribal Advisory Council, which offers an opportunity to build long-term and working (day-to-day) relationships that can lead to mutual trust and understanding from multiple perspectives (science, Indigenous Knowledge, agency and policy). The Northern Bering Sea region has been experiencing severe impacts from climate change due to ocean warming and severe loss of seasonal sea ice and will benefit from a coordinated federal approach to ensure the resilience of the region. The Task Force is working now to identify cross agency objectives and deliverables to be consistent with the following, “It shall be the policy of the United States to enhance the resilience of the northern Bering Sea region by conserving the region's ecosystem, including those natural resources that provide important cultural and subsistence value and services to the people of the region. For the purpose of carrying out the specific directives provided herein, this order delineates an area hereafter referred to as the "Northern Bering Sea Climate Resilience Area," in which the exercise of relevant authorities shall be coordinated among all executive departments and agencies (agencies). All agencies charged with regulating, overseeing, or conducting activities in the Northern Bering Sea Climate Resilience Area shall do so with attention to the rights, needs, and knowledge of Alaska Native tribes; the delicate and unique ecosystem; the protection of marine mammals, fish, seabirds, and other wildlife; and with appropriate coordination with the State of Alaska.”

**Leverage Diesel Emission Reduction Act (DERA) funding and greenhouse gas (GHG) mitigation**

<i>Fiscal Year Start-Complete</i>	2023-2026
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<i>Performance metric</i>	Total dollars for all R10 states and Tribes, number of replaced diesel engines
<i>Associated Vulnerability</i>	Specific vulnerabilities vary by location
<i>Co-benefits</i>	Clean air, public health, energy and cost savings
<i>Resource requirements</i>	No additional resources required
<i>Notes</i>	Projects replacing old diesel engines with newer/cleaner devices produce emissions reductions of criteria pollutants, as well as certain toxics and GHGs. Newer engines are more efficient, leading to decrease in energy used and an overall emissions benefit.

**Identify the impact of increased hydrological variability (flooding/droughts) on contaminant mobility and toxicity at contaminated sites**

<i>Fiscal Year Start-Complete</i>	2024-2025
<i>Performance metric</i>	Peer-reviewed scientific article(s) delivered to reach as vast of an audience as possible
<i>Associated Vulnerability</i>	Flooding, drought, sea level rise, storm surge
<i>Co-benefits</i>	Clean water, human health. In addition to the benefits for Region 10, a process-based understanding of the impacts of climate change on metal/metalloid mobility could be extrapolated and/or emulated at a national-scale.
<i>Resource requirements</i>	No additional resources required to complete one study. Additional resources needed to complete multiple studies, especially if the studies are conducted concurrently.
<i>Notes</i>	

*Agency Priority 3. Implement measures to protect the agency's workforce, facilities, critical infrastructure, supply chains and procurement processes from the risks posed by climate change.*

**Enhancements to Region 10 facilities in the coastal zone**

<i>Fiscal Year Start-Complete</i>	2022-2026
<i>Performance metric</i>	Installation of an EV charging station and PV panels at Region 10 Manchester Laboratory
<i>Associated Vulnerability</i>	heavy precipitation events and wildfires resulting in more frequent power outages that impede the lab's ability to carry out its mission.
<i>Co-benefits</i>	Climate vulnerable areas in Region 10 also tend to be areas housing communities with environmental justice concerns.
<i>Resource requirements</i>	Additional resources required
<i>Notes</i>	Discussions are currently occurring between Region 10 Mission Support Division and EPA Headquarters regarding funding of charging stations at multiple Region 10 sites.

**Reduce resource consumption by reviewing facilities in Region 10 through lens of [Executive Order 14057](#) "Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability" to identify opportunities to save energy and resources**

<i>Fiscal Year Start-Complete</i>	2022
<i>Performance metric</i>	At least a 50% reduction in printed paper by the end of FY22, based on national baseline developed from FY19 data

<i>Associated Vulnerability</i>	Specific vulnerabilities vary by location
<i>Co-benefits</i>	Energy and cost savings, reduced carbon footprint, helps meet National Archives and Records Administration requirements
<i>Resource requirements</i>	No additional resources required
<i>Notes</i>	Anticipate additional actions driven in part by new national Senior Sustainability Workgroup tasked with implementing Executive Order 14057

### **Training Plan for Enhancing Staff Knowledge About Climate Adaptation**

Consistent with *EPA's 2022-2026 Strategic Plan*, Goal 1: Tackle the Climate Crisis, Region 10 will provide training to enhance staff, management, and partner awareness and knowledge of relevant climate change data and information, impacts, and climate adaptation approaches. Training for staff will focus on raising awareness, enhancing knowledge, and increasing understanding on how climate change is likely to impact EPA's mission and programmatic work. Furthermore, our regional training will highlight existing and future tools that can be used to enhance our work as it relates to climate change adaptation.

In accordance with *EPA's Strategic Plan*, EPA program offices will develop, update, and expand existing climate adaptation training modules to prioritize two primary goals: 1) to increase awareness about the importance of climate adaptation and encourage all EPA staff and partners to consider the changing climate in the normal course of business; and 2) to introduce specific methods and tools for integrating climate adaptation into decision-making processes.

Region 10's Laboratory Services & Applied Science Division will supplement national training efforts by creating additional training content specific to Region 10. Topics will include discussions of climate impacts to Tribes and communities with environmental justice concerns, focused learning sessions on specific climate threats (e.g., permafrost thaw in the Arctic), and training on existing ORD science tools that can be used by EPA staff to better understand, teach, or adapt to climate change in their daily work on behalf of the people we serve.

Several program offices are scheduled to release a climate adaptation training module in FY22-23. Measurement and evaluation of progress facilitates a better understanding of Region 10 staff climate adaptation knowledge, awareness, and engagement. Region 10 will evaluate staff participation levels by tracking the percentage of Region 10 or divisional staff that were trained on an annual basis for each training module for FY 22-24. The training schedule and targets will be updated as training modules become available by program offices. Taking Climate Adaptation 101 will be a mandatory training for all new hires and added into Individual Development Plans (IDP).

Whenever possible, Region 10 will distribute training opportunities and materials to external partners to maximize the benefit and enhance collaborative learning.

### **Science Needs**

Implementing effective strategies to adapt to the changing climate requires that decisions be grounded in the best available science on climate change risks, impacts, vulnerabilities, and adaptive management practices. Throughout EPA, there is a growing need for up-to-date information on existing data, models, and tools relevant to climate change adaptation. As part of the EPA-wide Climate Adaptation Plan

process, all regional and program offices must identify their own priority science needs related to climate change adaptation.

Region 10 Science Steering Council representatives identified priority science needs across all divisions and media programs using guidance from EPA's Office of Research and Development (ORD) Climate Workshop, where initial feedback on climate science research needs was solicited from the regions. In December 2021, the Region 10 Science Steering Council updated its [2022 R10 Science Priorities](#) after briefing our Acting Regional Administrator and Executive Team. There were significant changes at the division level from years past; specifically, a greater focus on identifying program-specific needs to assess climate impacts and build resilience. This information was provided to ORD to help it identify and address priority research needs for the entire agency to support the integration of adaptation planning into the agency's activities.

Region 10 has prioritized the following science needs related to climate for 2022:

- Understanding of current and future changes in permafrost near Alaska villages and near oil and gas development and waste management facilities in the Arctic

Research needs include: 1) How facilities are impacted by changing conditions in the Arctic. Information on climate change in arctic environments especially regarding permafrost and coastal storm surges as it relates to Resource Conservation and Recovery Act (RCRA) Corrective Action and Permitting and polychlorinated biphenyl (PCB) Approvals. What amount of temperature change would result in thawing of permafrost and to what depth? Without ice to contain storm surges how will that effect erosion at the coast and in coastal riverbeds? 2) Permafrost. A better understanding of the fate and transport mechanisms for contaminants in a permafrost environment is needed in order to properly make decisions when characterizing the nature and extent of hazardous constituents at facility solid waste management units. 3) Climate Change Treatment, Storage, and Disposal (TSD) facility impacts maps to include Alaska. Develop maps on how climate change will affect permitted TSD facilities. There are regional and national parts of this question. 4) Assess health impacts from waste in rural Alaska Tribal communities. The environmental impacts of Class III landfills will be impacted by a changing climate.

- Evaluate Harmful Algal Bloom (HAB) formation as a result of climate change related events and develop tools to improve HABs early warning and control responses

Harmful algal blooms impact fish and shellfish harvesting in marine and freshwater environments, recreation, drinking water, livestock watering, irrigation water, and many other aspects of daily life. However, tools that can assist States, tribes and local governments in identification and mitigation of HABs impacts are currently lacking and would benefit from additional research. Specifically, less expensive and more broadly deployable technologies that provide improved early warning of HABs issues *in situ* and via remote sensing and modeling are needed to assist agencies with response and mitigation. In addition, research is needed to: 1) determine whether there is a correlation between climate change related events (e.g., wildfires) and HABs formation; 2) evaluate the role of benthic and plankton organisms in anatoxin production, a neurotoxin often

implicated in mortality events associated with HABs; and 3) develop health advisory thresholds associated with specific toxins of concern (e.g., anatoxin).

- Research to help Region 10 respond to climate-induced increases in wildfires impacts to air quality and water quality

Air quality impacts from summertime wildland fires are significant in WA, OR, and ID, and Region 10 communities have experienced Air Quality Index scores of 151 (unhealthy) or higher due to wildland fire smoke in recent summers. It is important for Region 10 and its state, local, and tribal partners to effectively monitor current air quality conditions during fire season and forecast changes in these conditions, as well as to understand the water quality impacts following fires. In addition, research on the differing air and water quality impacts of prescribed, wildfire, and wildland urban interface (WUI) fires is needed.

- Research to understand how climate change will affect salmon recovery efforts and how to best counteract it

Several biological and life-cycle processes are seasonal and based on environmental cues (e.g., fish migration, phytoplankton blooms, spawning). Seasonality shifts in timing and intensity of extreme precipitation events also greatly affects the effectiveness of many stormwater Best Management Practices (BMPs) because they are typically designed to manage water based on data from historical events. In many locations in Region 10, the transition from summer drought to wet fall weather delivers large quantities of toxic pollutants from the built environment and this coincides with salmon spawning and migration. 6PPD-quinone is a ubiquitous tire antioxidant recently identified in stormwater and highly toxic to Coho salmon. Research is needed to: 1) develop analytical and monitoring methods for 6PPD-quinone; 2) evaluate toxic effects and pathways of 6PPD-quinone and other tire wear components; 3) identify a safer alternative for use in tires, and 4) assess the remediation potential of 6PPD-quinone and its source, tire dust.

- The impact of climate change on water quality predictions from existing, proposed, and abandoned mining areas.

Changing climatic conditions have the potential to influence the chemical reaction rates and redox chemistry that control fate and transport of metals at mine sites. There is a need for studies that can directly address the influence of changes in temperature and precipitation (wetting/drying of mine-related materials) can have on metal mobility, future water quality predictions, and downstream water quality impacts. Understanding the long-term impacts of climate change on metal mobility from proposed, current, and abandoned mine sites is an important issue in multiple EPA programs, including the National Environmental Policy Act (Environmental Impact Statement predictions of water quality at proposed and expanding mining operations), Superfund (evaluating water quality changes due to climate change which can impact selection of remedial actions), as well as international relationships (e.g., transboundary mining impacts on U.S. waters).

## **Conclusion**

Region 10 is committed to identifying and responding to the challenges that a changing climate poses to human health and the environment. Climate change can pose significant challenges to the Region 10's ability to fulfill its mission; as such, Region 10 must adapt to climate change if it is to continue fulfilling its statutory, regulatory and programmatic requirements. Region 10 developed this Plan to provide more detail on how it will carry out the work called for in the agency-wide plan; our Plan articulates how Region 10 will integrate climate adaptation into its planning and work in a manner consistent and compatible with its goals and objectives. This living document describes our commitment to help build the nation's adaptive capacity that is critical to the goal of protecting human health and the environment.