2. Responding to Climate Change



2. Responding to Climate Change

Climate change will affect different regions, ecosystems, and sectors of the state's economy in many different ways, depending on the sensitivity of those systems to climate change, their ability to adapt to changing conditions, and the ability to manage associated risks. While the state and local communities have experience dealing with natural variability, climate change is moving us beyond a range where past experience is a good guide for what we might experience in the future. Climate-influenced conditions and events such as temperatures, sea levels, and storms can no longer be expected to remain within their historical ranges, and these trends are likely to continue well beyond the end of the 21st century.

Our state is already experiencing challenging economic conditions. The risks of not taking action to address climate change impacts now will only compound these economic challenges. In one study, potential costs to Washington from climate change impacts are projected to reach nearly \$10 billion per year by 2020 and \$16 billion per year by 2040.⁶ These totals reflect increased coastal and storm damage costs, increased energy-related costs (reduced hydropower production and increased demand), increased wildfire costs, increased health-related costs, costs associated with reduced water availability, and other impacts.

Key climate-related risks include:

Increased injuries and disease. Increased injuries, sickness, and even deaths are expected from infectious diseases, heat stroke, and respiratory and cardiovascular disease due to higher temperatures, heat waves, declining urban air quality, and smoke from more frequent wildfires. More frequent extreme storms are likely to cause river and coastal flooding, leading to increased injuries and loss of life. These impacts come at a time when local and state funding for public health is rapidly eroding, and health costs are increasing.

Increased damage costs and disruptions to communities, transportation systems, and other infrastructure. Communities, infrastructure, and key economic sectors could all incur significant costs due to climate change. Damage and repair costs are projected to increase for Washington's roads, bridges, ports, rail, power and communication transmission systems, and communities due to extreme storms, flooding, erosion, landslides, sea level rise, and storm surges. Problems have already started. Interstate 5 in Washington's Chehalis Basin has been closed four times since 1990 due to flooding. The December 2007 storm caused approximately \$23 million in damage to interstate and state highways in Washington as well as \$39 million in damages to city and county roads. The I-5 closure resulted in \$47 million in





⁶ Climate Leadership Initiative (2010).







lost economic output to the state.⁷ In Puget Sound counties, structures valued at approximately \$29 billion are located in flood hazard areas, placing them at risk of flood damage. Ports, rail, highways, wastewater treatment plants, and other coastal infrastructure could require costly retrofits or relocation to accommodate rising sea levels and stronger coastal storms.

Reduced water supply. Washington's snowpack has historically held more than 6 trillion gallons of water. Increasing temperatures will significantly impact snowpack in the Cascade and Olympic Mountains, leading to reduced streamflows, reduced soil moisture, higher stream temperatures, and concerns for all water users, including agriculture, municipalities, and fish and wildlife. As temperatures rise, water demand increases, as does the potential for conflict among water users. At highest risk are agricultural water users in the Yakima and Columbia basins, along with coldwater fish species such as salmon, steelhead, and bull trout.

Loss of fish, wildlife, and natural systems. Climate change is projected to cause loss of habitat and force many species to move northward or higher in elevation. Species that cannot transition quickly enough will likely perish. Higher summer stream temperatures and reduced flow are projected to increase lethal stream conditions for salmon and other coldwater species. ⁸Increased forest fires will destroy important habitat areas, leading to erosion and degraded water quality. Sea level rise is projected to eliminate valuable coastal habitats, and increased acidity in marine waters from carbon dioxide emissions and upland runoff is threatening the aquaculture and shellfish industry. Washington leads the country in production of farmed clams, oysters, and mussels with an annual value of over \$107 million.⁹ Wildlife recreation in Washington is a \$4.5 billion industry responsible for more than 60,000 jobs in the state.¹⁰

Losses to agriculture and forest industries. Agriculture and forestry industries together contribute \$50 billion annually to the state's economy. Increased disease, pests, weeds, and fire, along with reduced summer water supplies, are already affecting Washington's farms and forests. Many operations are experiencing higher costs and lower yields. Pests such as mountain pine beetle, potato tuber moths, and gypsy moths can now proliferate in Washington under warmer conditions. The area burned each year by forest fires in the Columbia River Basin is projected to double or triple by the 2080s. The average production of apples and cherries could decline by approximately \$23 million per year by 2020.¹¹

¹⁰ Washington Department of Fish and Wildlife (2011).

⁷ Washington State Department of Transportation (2008a and 2008b).

⁸ Mantua *et al.* (2010).

⁹ Northern Economics, Inc. (2010).

¹¹ Stöckle *et al.* (2010).

Priority Response Strategies

We know enough about future climate to understand the major risks, and many actions can be implemented now, at minimal budgetary cost, to reduce current risks and greatly reduce the need for costly actions in the future. Flexible approaches are needed that respond to risks and also recognize the range of the timing and degree of change as well as how people, wildlife, plants, and other systems will respond to these changes. In many cases, our existing laws and policies are the right vehicles for addressing the climate challenge with minor adjustments. In other cases, new policies will be necessary.

Responding to climate change impacts is typically referred to as "adaptation." Adaptation refers to taking steps to reduce the vulnerability of human and natural systems, increase the capacity to withstand or cope with changes in climate, and transform the system so that it is more compatible with likely future conditions. Many adaptation strategies are considered "no regrets" strategies because they help address existing stresses on our communities, economy, and environment from flooding, pests and diseases, wildfires, water shortages, and other variables while also reducing climate-related risks. "No regrets" climate adaptation actions can help advance priority goals that are beneficial to Washington State, including sustainable growth, public health, and economic competitiveness.



Seven overarching high-priority climate change response strategies identified for Washington are:

- Protect people and communities.
- Reduce risk of damage to buildings, transportation systems, and other infrastructure.
- Reduce forest and agriculture vulnerability.
- Improve water management.
- Safeguard fish, wildlife, habitat, and ecosystems.
- Reduce risks to ocean and coastlines.
- Support the efforts of local communities and strengthen capacity to respond and engage the public.

The following section describes these strategies in more detail. (See Appendix C for a complete list of strategies and actions.)



1. Protect people and communities from climate change impacts.

Enhance core public health capacity. Core public health capacity will need to be enhanced to increase surveillance, early detection, and response capabilities. Public health agencies should prepare to monitor and respond to diseases and carriers typically found in warmer climates, such as Rocky Mountain spotted fever, tularemia, and Lyme disease. Vulnerable and at-risk communities should be identified, especially for infectious diseases, heat stroke, and respiratory and cardiovascular disease caused by higher temperatures, heat waves, and smoke from more frequent wildfires. Public health agencies should raise awareness of new public health risks from climate change among health providers, health organizations, and the public.

Enhance emergency response capacity to address increasingly extreme floods and fires. State and local emergency response needs are expected to increase in flood- and fire-prone areas of the state. Police, fire and rescue, and wildland firefighting will have to prepare for increased activity, more challenging conditions, and additional costs. Populations that are vulnerable to increased incidence of floods and fires should be identified and educated about the increased risks, options to reduce risks, and appropriate responses in an emergency.



2. Reduce risk of damage to buildings, transportation systems, and other infrastructure.

Reduce flood damage by restoring floodplains and capturing more water. As extreme storms increase, the most effective and least costly approach to managing larger floodwaters is often to enhance floodplains' ability to accommodate flood flows and using "green infrastructure" approaches to manage stormwater. Reconnecting rivers with their floodplains and providing rivers room to flow often reduces downstream flood risks and damage. Natural approaches such as wetlands and soft armoring tend to be more environmentally beneficial than levees, dams, and other "hard" approaches to flood management.

Support local efforts to prepare for coastal flooding and storm surges. Provide information, guidelines, and technical support to coastal counties, cities, and tribes to help them evaluate the risks and vulnerability to sea level rise and coastal flooding in their communities. Roads, bridges, wastewater treatment plants, sewer and stormwater systems, gas and electric transmission

systems, communication systems, and other infrastructure could be at risk. Communities should consider options to reduce vulnerabilities without harming ecosystem functions.

Consider climate change impacts when siting new development and infrastructure.

Consider future climate change risks when planning for new growth or permitting new structures, even if the location is not currently in FEMA's regulatory floodplain or other critical areas designation. Ensure the building design can accommodate projected impacts and does not increase risks for neighbors.

Plan for relocation if structures are damaged by floods or other impacts. If critical structures are at risk, communities should begin now to identify safer alternative locations for those structures. This will help prevent the typical response to rebuild structures in the same flood-prone location after the disaster.

3. Reduce forest and agriculture vulnerability to climate change impacts.

Enhance surveillance and eradication of pests and disease.

Pests and disease can cause significant damage and economic losses, and these problems are projected to increase as the climate warms. Surveillance can identify new outbreaks and promote rapid response that will reduce damage and costs. These efforts should be coordinated among federal, state, tribal, and local agencies.

Promote identification of and transition to plant species that are resilient to new climate conditions. Support research and promote genetic diversity to ensure that agricultural and forest species living in Washington are able to survive under current and future climate conditions and emerging pests and diseases.

Conserve productive and adaptive farmland and forests.

Encourage local governments to adopt land use regulations and incentives to minimize conversion of farmland and forests and to support land conservation incentive programs.

Reduce forest and wildland fire risk in highly vulnerable areas. Integrate wildfire management objectives with forest, shrubsteppe and grassland restoration objectives to enhance ecosystem health and resilience from pests, diseases, and invasive species that exacerbate fire risk.





4. Improve water management to address <u>climate-re</u>lated supply reductions.

Promote integrated water management in vulnerable

basins. Projected changes in streamflow and runoff patterns will more likely increase the competition and conflicts among water users. Integrated water management will address existing and future water resources and ecosystem problems affecting fish habitat and agriculture, municipal, and domestic water supplies. This approach supports flexibility and adaptability under changing hydrological conditions. Models for this work include the water management efforts in the Columbia, Yakima, and Walla Walla basins.

Implement enhanced water conservation and efficiency programs. Reduce water demand, especially in water-limited basins, by monitoring water use and aggressively promoting and supporting water conservation and efficiency for agricultural, municipal, and industrial users.

Ensure sufficient cold water in salmon-bearing streams during critical seasons. Increasing stream temperatures can create barriers to migration and can kill coldwater fish such as salmon, steelhead, and bull trout. Shade, increased streamflow, and other measures can keep water temperatures cool and allow rivers to continue supporting coldwater fisheries.

Incorporate climate change realities into agency decisionmaking. Past hydrological data are an unreliable guide to project future conditions for water management decisions. Water resources managers will need to adapt their management and planning practice to reflect changing water availability. They need to take into account the change in timing and availability of water when planning for additional supplies, deciding whether water users may use their water rights for the amount allowed, and establishing instream flows for fish habitat and ecological purposes.

2. Responding to Climate Change

5. Safeguard fish and wildlife and protect critical ecosystem services that support human and natural systems.

Protect and restore habitat and improve the ability of species to migrate to more suitable habitat as the climate shifts. Identify and protect areas most suitable for current and future habitat as well as the connections between habitats. Land use planning policies, guidance, technical assistance, and incentive programs are effective ways for protecting, restoring, and acquiring habitat areas that provide refuge to species under stress from climate change.



Protect sensitive and vulnerable species and their habitats. Climate change will increase the stress on salmon and other culturally important species that are already sensitive or vulnerable. Climate risks and approaches to recover and protect vulnerable species should be incorporated into management and conservation plans and programs. This planning includes species recovery and management plans, water resources management plans, shoreline management plans, land use plans, and ocean management plans.

Reduce existing stresses on fish, wildlife, plants, and ecosystems. Fish, wildlife, plants, and ecosystems already face an array of existing stresses from human development, habitat loss and degradation, pollution, unsustainable harvest, and invasive species. Reducing existing threats is an important and effective way to help natural systems cope with the additional pressures from a changing climate. For example, reducing stormwater pollution improves water quality and aquatic habitat, increasing the resilience of aquatic species to additional stresses from climate change.

6. Reduce the vulnerability of coastal communities, habitat, and species.

Protect people, property, and infrastructure from coastal hazards and avoid new development in highly vulnerable areas. Rising sea levels, more extreme rainfall, and excessive runoff may increase risks to people, property, and infrastructure from coastal erosion and flooding. Communities should identify vulnerable areas and take steps to reduce threats, while also prioritizing actions that protect habitat and natural areas. Risks to coastal communities should be incorporated into land use and shoreline management plans, and regulatory tools, incentives, and technical assistance should be expanded or developed to incorporate climate risks.



Prevent coastal habitat degradation and destruction and seek opportunities for upland habitat creation as sea levels rise. Rising sea levels will cause a loss of valuable coastal habitats. As coastal flood risk increases, landowners should use natural approaches to reduce flood risks without harming species or habitat. Policies and incentives should be developed at the state or local level to reduce habitat degradation and destruction from hard armoring of coastlines. Incentives and regulatory tools should be modified or developed to guide development away from hazardous coastal areas to prevent costly flooding and to allow coastal ecosystems to be created in newly inundated areas.

Reduce shellfish vulnerability to ocean acidification by reducing land-based contributions of carbon and polluted runoff to the marine environment. Acidification is caused by both atmospheric carbon dioxide and land-based contributions of carbon from sources such as polluted runoff and leaking septic systems. While atmospheric carbon dioxide contributions can only be slowed by reducing carbon emissions, the pace of acidification in some parts of Puget Sound can be reduced by eliminating polluted runoff, leaking septic systems, and other sources of

land-based carbon in the waters.



7. Support the efforts of local communities and strengthen capacity to respond and engage the public.

Identify existing and new funding mechanisms to support adaptation work at the local level. In some cases, climate adaptation can be integrated into existing programs with little or no cost or additional resources. In many cases, the cost of making changes and actively managing natural and built environments to cope with the impacts of changing climate may be substantial. However, these costs are far less than costs of inaction. State agencies should leverage existing federal and state funding as well as seek new sources of funding to implement high-priority adaptation projects at the state and local levels.

Develop an institutional structure to improve coordination and support an integrated approach. Successful climate change adaptation cannot be accomplished by a single agency or organization. An effective structure is needed to support cross-agency collaboration, ensure implementation of cross-cutting strategies, and link efforts across all governmental agencies, nongovernmental organizations, and other interests. An improved coordination mechanism is needed to determine and provide state input on research needs and priorities, develop mechanisms to track and monitor progress in implementing the strategies and actions, and ensure new information on climate impacts and effective responses is integrated.

Support information-gathering on climate impacts and ensure scientific information is easily accessible. Understanding of climate impacts and responses is growing rapidly and is continually being expanded. Tracking climate-related trends such as sea level rise, severe storms, and pest and disease invasions can help the state prepare and respond with the least cost and disruption. Tools need to be developed to make this information accessible and useful to the public and to decision makers at all levels.

Engage the public in determining appropriate responses to climate change. The state must provide leadership to ensure that communities, businesses, schools, and the public have accurate information and a forum to consider climate impacts and responses. Agencies should develop consistent messages, provide access to relevant information, and work with partners, stakeholders, and others to identify concerns and prioritize responses.



State Agency Climate Adaptation Planning

State government has an important role in responding to climate impacts. The Washington State Legislature mandated state agencies to lead by example in planning for and responding to the impacts of climate change:

State agencies shall strive to incorporate adaptation plans of action as priority activities when planning or designing agency policies and programs. Agencies shall consider: The integrated climate change response strategy when designing, planning, and funding infrastructure projects; and incorporating natural resource adaptation actions and alternative energy sources when designing and planning infrastructure projects.¹²

This climate change response strategy establishes a framework for state action. The actions identified are broad and do not address who, when, and where to implement actions. Action plans with nearand long-term steps to implement the strategies and the broad actions should be developed by various lead agencies. In many cases, the advisory group reports identify more specific near-term actions that could be included in future action plans.

To advance the goals in the response strategy, the Department of Ecology should work with other key agencies to implement the response strategy and ensure that adaptation is integrated into agency policies, programs, and funding programs. Guidelines and information are needed to:

- 1. Educate agency leadership and staff on climate impacts and assess how climate change will affect their operations, services, and critical assets managed or owned by the agency, such as highways, forests, agricultural and habitat lands, water resources, and buildings.
- 2. Evaluate agency operations and programs, including existing enabling legislation, through a "climate lens," to determine what activities need to be adjusted to take into account climate variability and changes. This evaluation should consider such questions as the following:
 - Is the policy, program, or investment sensitive to current and future changes in climate, such as observed or projected temperature, precipitation, streamflow, sea level, storms, or water quality?
 - *Will climate impacts alter the effectiveness of the existing plan, policy, program, or project?*
 - What is the level of risk and vulnerability to climate impacts?
 - Are adjustments or modifications needed to account for climate impacts and to help achieve the intended objectives?

¹² Codified in <u>*RCW* 43.21M.040</u>.

- 3. Incorporate climate impacts and response into programs or projects managed by local governments and organizations that receive funding or are regulated by state government, and build local capacity to address climate change.
- 4. Develop a plan for near- and long-term actions to implement this response strategy.

Barriers Limiting an Effective Response to Climate Change

1. Inadequate information and experience.

- Outdated assumptions that future conditions will vary within historic bounds.
- Limited knowledge and experience in dealing with climate-related risks.
- Limited knowledge of effective response strategies.
- Lack of tools, maps, and guidance for communities to identify risks, assess vulnerability, and account for ranges of variability.
- Limited stakeholder awareness and engagement.

2. Inadequate institutional support for adaptation.

- Short-term perspectives and tendency to focus on near-term risks and benefits.
- Conflicting mandates and incentives.
- Fragmented decision-making and lack of coordination across levels of government and between governments.
- Legal barriers.

3. Lack of resources.

- Insufficient financial resources.
- Lack of human resources.
- Limited information on costs and benefits of climate change response strategies.

4. Public beliefs and attitudes.

- Skepticism about the science of climate change.
- Lack of understanding of the difference between weather and climate.
- Climate science is sometimes described in abstract technical terms that do not resonate.
- Lack of awareness of the near- and long-term risks of climate change and the benefits of acting.



Current Legal Framework for Climate Change Adaptation

We have a broad set of state, local, and federal laws that may be used to reduce risks of climate change on natural and human systems. This section highlights current statutory programs that can provide policymakers a solid foundation to address and reduce the impacts of climate change, though it is not a complete list.

State Comprehensive Emergency Management Plan and the State Hazard Mitigation Plan. RCW 38.52 requires that each political subdivision has a comprehensive emergency management plan that is based on the hazards the community faces. These plans are reviewed at the local level and updated at least every four years. Each of the plans is submitted to the state emergency management division for review to ensure consistency with the State Comprehensive Emergency Management Plan (CEMP). The CEMP, along with the State Hazard Mitigation Plan and its foundation document, the Hazard Inventory and Vulnerability Analysis, are the right vehicles to integrate and address climate risks and hazards.

Growth Management Act. The Growth Management Act's (GMA) policy foundation to control sprawl, protect our infrastructure investments, and conserve and protect our natural environment makes it central to planning for and reducing climate change impacts. Under the GMA, every county, city, and town is required to protect critical areas, including critical aquifer recharge areas, fish and wildlife habitat conservation areas, frequently flooded areas, geologically hazardous areas, and wetlands. Many local jurisdictions have been implementing a range of policies, programs, and regulations aimed at slowing down the impact of climate change on their communities.

Shoreline Management Act and Shoreline Master Programs. The Shoreline Management Act focuses on three basic policy areas: shoreline use, environmental protection, and public access. Local governments and Ecology work in partnership to develop Shoreline Master Programs for managing shorelines and help protect and restore important habitats, keep water clean, protect properties, and provide recreational opportunities to Washingtonians. This program continues to evaluate options to plan for storm surge, coastal flooding, and sea level rise. In 2010, Ecology released voluntary guidance for local governments on how to incorporate sea level rise into Shoreline Master Program updates.

Federal climate adaptation initiatives

In 2009, the Obama Administration convened the Interagency Climate Change Adaptation Task Force to develop recommendations on how federal policies, programs, and planning efforts can better prepare the United States for climate change. The Task Force released a set of recommended actions in support of a national climate change adaptation strategy in 2010, and federal agencies are currently working to implement several cross-cutting national strategies:

- National Action Plan for managing freshwater resources in a changing climate.
- National Ocean Policy Implementation Plan, which includes a series of actions to address resiliency and adaptation to climate change and ocean acidification.
- National Fish, Wildlife & Plants Climate Adaptation Strategy.

More information on federal implementation of the national adaptation strategy is available from: <u>www.whitehouse.gov/administration/eop/ceq/initiatives/adaptation/evolving-components</u>

Federal agencies are also developing agency-specific plans to strengthen existing adaptation efforts and establish long-term priorities to respond to the challenges and opportunities that climate change poses to their missions, operations, and programs. By June 2012, under Executive Order 13514, agencies will submit their climate adaptation plans to the White House Council on Environmental Quality and the Office of Management and Budget.

For more information, see the Agency Climate Change Adaptation Planning section on CEQ's website: <u>www.whitehouse.gov/administration/eop/ceq/initiatives/adaptation</u>

For more information and background on the U.S. response to climate change, see the America's Climate Choices reports developed by the National Academy of Sciences: <u>http://nas-sites.org/americasclimatechoices/</u>

Coastal Zone Management Act. The Coastal Zone Management program is a voluntary state/federal partnership that encourages states to adopt their own management programs to meet the federal goals of protection, restoration, and appropriate development of coastal zone resources. Through the Department of Ecology, Washington State participates in the nationwide Coastal Zone Management (CZM) Program. Washington's CZM Program strives to preserve and protect coastal resources in the state. It sets up estuarine reserves that are jointly managed by the state and federal governments.

Watershed Planning Act. In 1998, the Washington State Legislature enacted a statewide Watershed Planning Program to encourage comprehensive, long-range water resource planning through voluntary collaborative efforts at the watershed level. Because of its statewide scope, high levels of support and participation, and its collaborative nature, the watershed planning program presents a useful vehicle for adaptation to impacts of climate change. Several of the planning groups have discussed the potential impacts of climate variability and change, and some have included these impacts in the technical assessments required for each watershed.

State Environmental Policy Act. The State Environmental Policy Act (SEPA) is intended to ensure that environmental factors are considered during decision-making by state and local agencies to encourage the development of environmentally sound proposals. SEPA requires the identification and evaluation of probable impacts for all elements of the environment and the development of mitigation measures that will reduce adverse environmental impacts.



Floodplain Management Act. The Floodplain Management Act requires the State to plan and prepare for flood hazards to improve public safety and prevent damages to property and infrastructure. Ecology partners with local governments to implement the act.

Clean Water Act and Water Pollution Act. The federal Clean Water Act requires the State to identify sources of pollution in waters that fail to meet state water quality standards (e.g., temperature) and to develop water quality improvement reports (including Total Maximum Daily Loads, or TMDLs) to address those pollutants. TMDLs establish limits on pollutants that can be discharged to the water body and still allow state standards to be met. Washington already has a significant number of water bodies, marine sediments, and groundwater polluted by an array of



pollutants. Regulatory tools—including water quality standards, National Pollution Discharge Elimination System (NPDES) permits, and section 401 water quality certification—as well as non-regulatory tools (such as Water Quality Financial Assistance) exist to clean up polluted waters, control stormwater pollution, prevent point source water pollution, and reduce nonpoint source water pollution.

Forest Insect and Disease Control Act (RCW 76.06). The law's primary goal is to expand and improve forest health problem detection, distribution of information and technical assistance to landowners, as well as coordination between all landowners. The law offers consultation regarding sources of risk to landowners such as insect infestations, diseases, tree overcrowding, and weather damage. The Department of Natural Resources (DNR) is responsible for implementation of the law. DNR monitors forest health to record the extent of insect and disease damage and gain advanced warning of outbreaks by certain pests.

Water resources laws. Several state water laws and programs are aimed at improving water management by seeking out new water supplies for both instream and out-of-stream uses; funding and incentivizing conservation, water use efficiency, reclaimed water, and shallow aquifer recharge; and enhancing water resources data and information.

Laws providing incentives. Several state and federal laws and programs are dedicated to ensuring protection for our state's forests, farmland, and aquatic resources; acquiring land to protect wildlife and ecosystems; and providing incentives for private landowner conservation. Specific examples include but not limited to the following:

- Washington Wildlife and Recreation Program
- Estuary Salmon Restoration Program
- Conservation Reserve Program
- Conservation Reserve Enhancement Program
- Forest Legacy Program
- Farmland Preservation Program
- Wetland Reserve Program
- Grassland Reserve Program

