

Appendix A

Policy synthesis: Select climate resilience plans and reports



Introduction

Local and state agencies, Tribes, and farming communities in Washington state and across the US have developed climate resilience plans to mitigate the impacts of climate change on agriculture. These plans encompass a variety of approaches, from on-farm resilience practices such as agroforestry, managed grazing, reduced tillage, and biochar amendments; to off-farm initiatives like infrastructure investments, public outreach and education, financial and technical assistance, and promotion of renewable energy in agriculture. Key objectives include but are not limited to the preservation of farmland, the enhancement of drainage infrastructure, the effective and multi-benefit management of water resources, flood protection, and the implementation of integrated pest management strategies.

This literature review examines select climate vulnerability assessments, resilience plans, and related Washington State legislation at the local, state, and national levels to support the development of the Climate Resilience Plan for Washington Agriculture.

Method and organization

Climate resilience plans that focus on agriculture are limited. Three local Washington state plans were examined for areas east of the Cascades, and four plans for areas to the west. All western plans were produced by counties, while eastern plans were produced by a county, a conservation district, and a Tribe. This review is neither exhaustive nor regionally comprehensive; rather, reports were selected to capture a representative set of local and regional climate risks and opportunities for agriculture. Plans that did not directly address agriculture were not included. Local hazard mitigation plans were generally excluded; instead, the Washington State Enhanced Hazard Mitigation Plan was reviewed as a proxy.

Plans from California, Idaho, and Oregon were included to assess how neighboring states are addressing climate and agriculture. Several national studies were also examined. This information can be used to understand and leverage local, state, and federal strategies and actions to address climate risks and opportunities for agriculture.

The literature review is organized into 5 sections:

- **Local Plans:** includes the following select climate plans:
 - West of the Cascades: King, Snohomish, Thurston, and Whatcom counties
 - East of the Cascades: Chelan County, Methow Valley, and the Territories of the Yakama Nation
- **Washington State Plans** summarize the Washington State Climate Resilience Strategy (2024) and the Enhanced Hazard Mitigation Plan (2023).
- **Washington Legislation** describes select climate-related legislation that has implications for agriculture.
- **Other State Plans** describe agricultural plans, reports, and research for California, Idaho, and Oregon.
- **National Plans** include summaries of the Fifth National Climate Assessment (2023) and the National Institute of Food and Agriculture Climate Adaptation and Resilience Plan (2022).

Synthesis of risks and opportunities included in plans

Available local and Tribal climate plans highlight the risks and opportunities for agriculture and agricultural producers in different parts of the state. These risks and opportunities are generally consistent with those identified at the state and national level. While the majority of plans focus on agricultural adaptation and resilience to climate change, several also include climate change mitigation strategies.

Common risks described in most plans include:

- **Extreme weather events:**
The escalating frequency and severity of extreme weather events like floods, storms, and wildfires pose significant threats to crop viability, soil health, infrastructure integrity, and the well-being of livestock. The risks of extreme heat, wildfire, and flood are present statewide, though areas east of the Cascades are at higher risk for extreme heat events and wildfire. The Puget Sound and Northwestern regions are considered the most vulnerable to flooding. Smoke impacts crop quality as well as the health of workers and livestock.
- **Water availability:**
Water stress emerges as a pressing concern across numerous plans, with declining water availability, changing snowpack levels, drought, seasonal changes in irrigation demand, and potential water shortages affecting crop productivity (quality and yield), planting practices, and livestock welfare. Junior water rights holders may experience greater reductions in water available for agriculture.
- **Water quality:**
Extreme precipitation events and flooding may lead to runoff and soil erosion, which can lower water quality by introducing pollutants, excess nutrients, and sediments. Moreover, higher temperatures, with irregular precipitation patterns and prolonged droughts, can accelerate evaporation, intensify contaminant concentrations, and further degrade water quality. Decreased water quality poses a significant threat to agricultural food systems and aquatic habitats.
- **Changing temperature:**
Temperature changes, including rising temperatures and shifting climate patterns, impact crop types, pest pressures, and the overall suitability of some agricultural practices. Plant hardiness zones are changing, shifting plant suitability. Frost free periods are longer, requiring adjustments to crop selection and equipment usage. For livestock, increased heat and humidity can lead to lower weight gains and milk production, greater susceptibility to parasites and disease pathogens, and—in extreme cases—death.
- **Expanding impacts and range of pests, weeds, and disease:**
Increased temperatures can contribute to the proliferation of new and existing pests, weeds, and diseases. For example, invasive cheatgrass often thrives in areas burned by wildfires. Impacts associated with pests, weeds, and disease can increase production and operation costs, decrease yields, and increase food safety issues. They can have negative implications for human and livestock health.
- **Sea level rise:**
Sea level rise and saltwater intrusion along coastal areas pose risks to some farmland and crops. Associated land subsidence and aggradation can exacerbate drainage challenges, flood risks, and soil stability issues.
- **Threat to Tribal food systems and medicinal plants:**
Water shortages, drought, wildfires, and other climate-related risks threaten the availability of traditional food systems and medicinal plants for Tribal members.
- **Increased food costs and food insecurity:**
Extreme events and longer-term droughts can disrupt food production and availability, increasing costs and decreasing the availability of food.

These documents commonly identified the following strategies to address risks:

- **Promote on-farm conservation practices:**
Management techniques like no-till farming or cover cropping are recommended to improve soil health and enhance carbon sequestration, water retention, and nutrient availability. Investments in on-farm infrastructure, technology, renewable energy, and precision agriculture are also highlighted as a means of improving farm efficiency, reducing environmental impacts, and enhancing adaptive capacity.
- **Expand and increase access to funding, technical assistance, and conservation programs:**
Conservation programs, funding, and technical assistance can be instrumental in the successful execution of on-farm resilience practices.
- **Support water conservation and efficiency measures:**
Irrigation upgrades and drought planning are emphasized to mitigate water stress and ensure long-term water security for agricultural operations.
- **Encourage diversification of agriculture products:**
Diversification is encouraged to support ecosystem resilience and expand local markets. Collaboration, education, and stakeholder engagement play a key role in implementing these strategies, with plans advocating for partnerships, policy changes, funding mechanisms, and community involvement to support climate adaptation and mitigation efforts.
- **Bolster ecosystem services through agricultural preservation:**
In addition to providing food, agricultural land can absorb and filter water, provide habitat for some species, and sequester carbon. Protecting agricultural land from development ensures that it can continue providing these and other essential ecosystem services.
- **Expand and increase opportunities to reduce GHG emissions and sequester carbon:**
There are multiple opportunities to reduce GHG emissions through farming practices, including manure management and the efficient use of fuel, fertilizer, and on-farm energy. Carbon sequestration may be enhanced through increased use of perennial plantings via hedgerows or through compost application, cover cropping, conservation tillage, and other management practices.

Local and national climate plans underscore the interconnectedness of climate risks, agricultural practices, and community resilience. These connections highlight the need for proactive planning, innovation, and adaptive strategies to address the complex challenges posed by climate change in Washington's agricultural sector.

While climate plans from nearby states identify a similar set of climate impacts, local plans provide unique insight into how Washingtonians are addressing risks across varied land types and through different statewide partnerships. Similarly, national plans highlight the same or similar risks but offer access to a more comprehensive inventory of data, research, and best practices from across the nation.

Highlights from local climate plans

This section provides an overview of select climate action and resilience plans from localities that explicitly investigated agriculture. While some entities have hazard mitigation plans for specific hazards (i.e., floods and wildfires), few have plans specifically tailored to identify and address the interconnected impacts of climate change. Even fewer investigate the impacts of climate change on agriculture. Where available, local climate plans with an agricultural component provide valuable insights into priority areas and the innovative strategies adopted by local communities to bolster resilience. The synthesis presented below highlights unique aspects of each plan, including the climate science and modeling included by localities.

Snohomish Conservation District Agriculture Resilience Plan (2019) ⁵

The Snohomish Conservation District Agriculture Resilience Plan was developed by the Snohomish Conservation District in partnership with the Snohomish County farming community, to build an agricultural landscape that is more resilient to the pressures associated with “development, population growth, flooding, shifts in weather and climate change.” The Snohomish County plan is the only local document included in this review that focuses exclusively on agriculture. It includes a comprehensive impact assessment as well as a priority needs assessment.

Snohomish County is experiencing notable climate challenges that affect its agricultural production and are projected to intensify in the coming decades. Projections indicate that by mid-century, the area inundated during a 2-year flood event could more than quadruple in the Stillaguamish River Watershed and more than double in the Snohomish River Watershed. These increases will exacerbate issues such as bank erosion, flood debris removal, and crop damage, presenting continuous challenges for local farmers. Rising sea levels are compounding these problems by creating what is known as a “coastal squeeze.” Farms near river mouths face increased risks of drainage difficulties, saltwater intrusion, and pressure on sea dikes. Groundwater modeling indicates that by the 2050s, spring field access may be delayed by up to four weeks, with delays potentially extending to five weeks by the 2080s. Low-lying farmlands, especially those close to the Puget Sound coast, are particularly vulnerable to these impacts.

In addition to these environmental stressors, increasing air temperatures are projected to alter the region's agricultural landscape. Summers are expected to become warmer with reduced precipitation, potentially affecting crop yields negatively. Conversely, a longer growing season could open opportunities for new types of agricultural production. By mid-century, crops like corn, barley, and potatoes could mature about a month earlier, with further advancements expected by the end of the century. This shift may allow for double cropping and the cultivation of crops currently suited to warmer climates, potentially expanding market opportunities.



The Snohomish County plan proposes resilience practices and priority needs and actions. The on-farm resilience practices described in the Snohomish County plan are well aligned with those in other plans and largely represented in the synthesis section above. Notable action items include, but are not limited to:

- Explore options for increasing funding to conserve high-priority farmland, especially within floodplains (i.e., expanding the Transfer of Development Rights (TDR) program, securing grants, and leveraging additional taxes). Snohomish County has developed a priority mapping element, which ranks farmland for preservation based on criteria such as farmland quality and proximity to development threats.
- Conduct drainage needs assessments and implement projects to enhance existing drainage infrastructure capacity; assist in acquiring permits, complying with regulations, and securing funding for drainage improvements.
- Develop compensation agreements with local jurisdictions to offset costs and reduce runoff through projects or initiatives, as increased runoff from upland development exacerbates drainage challenges for farmers.
- Allocate additional funding to incentivize drought resilience practices; conduct research and on-farm trials for new drainage infrastructure (i.e. controlled release of water from drain tiles or drainage ditches) to address hotter and drier summers.



Whatcom County Climate Action Plan (2021) ⁶

The Whatcom County Climate Action Plan details the county's goals, strategies, and actions for safeguarding its natural environment from the impacts of climate change. A dedicated subsection centers on agriculture, highlighting local climate risks and proposing relevant measures to enhance resilience. As of 2017, Whatcom County ranked in the top three percent of US farm production. However, compared to the rest of Western Washington, the county lost nearly three times as many farm acres between 1997 and 2017. Whatcom County has since established a goal to maintain and preserve at least 100,000 acres to support agriculture.

The Whatcom County plan includes a vulnerability assessment, which shows that the agricultural sector's sensitivity to climate change is relatively high, but exposure and adaptive capacity may help counteract climate issues in the near term. Whatcom County identifies six strategies and actions for climate resilience in agriculture, generally focusing upon **emissions reduction, water storage, and streamflow optimization, farmland preservation, research and development of drought and heat-resistant crops:**

- Establish a water bank to facilitate water spreading, leasing, and transfer, in coordination with Natural Resource Market development.
- Develop a carbon credit program that compensates farmers for sequestering carbon.
- Provide incentives for anaerobic digesters and other manure treatment technologies to reduce methane emissions and produce renewable energy.
- Explore renewable methane markets and other economic incentives that encourage farmers to reduce emissions and chemical fertilizer use, and to install nutrient treatment systems.
- Promote small-scale, diversified farming through farm transition planning, internship programs, and partnerships with organizations that support new and small-scale farmers.
- Protect 100,000 acres of farmland through the rezoning of rural areas and the expansion of the Conservation Easement Program; collaborate with farmers to develop strategies that incentivize retiring farmers to sell land to new farmers.

Relative to their inland counterparts, counties in Western Washington benefit from greater water availability, proximity to urban markets, and milder coastal climates. Nevertheless, western counties face ongoing challenges from climate change. Whatcom County's agriculture sector is vulnerable to short- and long-term summertime droughts, which are projected to increase in frequency and severity under climate change. Irrigation water usage in the county typically sees a 25 percent increase during dry years. As precipitation patterns shift due to climate change, there will be greater demand for irrigation water, coinciding with reduced supply. Agricultural irrigation accounts for 44 percent of the county's water usage and peaks in August when streamflow is low. With reduced snowpack, more winter precipitation flows directly into streams and rivers when fields are fallow, and crops do not require irrigation; meanwhile, there is decreased water availability during the summer irrigation season.

Whatcom County features six Watershed Improvement Districts (WIDs) that collaboratively tackle agricultural water issues such as quantity, quality, and drainage. Despite their efforts, challenges with water rights persist, and there is a need for increased funding and resources. The transnational Abbotsford-Sumas Aquifer is likely to generate increased competition for water as climate change influences aquifer recharge. With increasingly dry summers and heightened water usage, the aquifer may no longer meet the region's sustainable water demands. This exacerbates the existing issue of over appropriated streams in the Nooksack River watershed, where many farms

already struggle with insufficient water rights, highlighting the urgent need for equitable water allocation as a critical aspect of climate change adaptation.

Agriculture in the county is also vulnerable to pests and diseases that affect production across Western Washington. Warmer winter temperatures and fewer freezing days have already brought northward movement of insect pests, such as the spotted-winged fruit fly (*Drosophila suzukii*) that attacks raspberries and blueberries. Since the fruit fly appeared, some farmers have had to return to the intensive spraying practices of the early 2000s. In addition, fungal pests such as Botrytis, or gray mold, and Monilinia, or mummy berry, affect raspberries, blueberries, strawberries, wine grapes, and other crops. Moreover, the relative extremity of climate impacts in other parts of the nation may encourage more people to relocate to Whatcom, thereby increasing development pressures on agricultural lands.





Chelan Climate Resiliency Strategy (2020) ⁷

The Chelan County Climate Resiliency Strategy identifies opportunities to prepare the county for both current and future climate-related challenges. Although this plan does not include a detailed assessment of agricultural risks and strategies, it does address agriculture in the context of a broader discussion of wildfire risk and water supply/demand challenges.

Chelan County has experienced several wildfires in recent history, which have burned unusually large areas at high severity. Wildfire activity is expected to increase in Central and Eastern Washington as temperatures rise. Compared to the 1980–2006 average, the area burned in Central Washington’s forests is projected to double by the 2020s and quadruple by the 2040s. Burned areas in grassland and shrub-steppe ecosystems are also expected to double by the 2040s. The Chelan County plan highlights fire and smoke damage to agricultural infrastructure and crops, crop loss, and growing season disruptions.

The Chelan County plan proposes broad strategies related to **enhancing water storage, conservation, and drought planning** which are similar in scope to those detailed in previous sections. In addition to these strategies, Chelan County details its participation in the Voluntary Stewardship Program, which supports agricultural producers to address critical area protection and promote sustainable agriculture. Through the program, producers have adopted various conservation practices such as enhancing irrigation efficiency, choosing less water-intensive irrigation methods, and upgrading or maintaining irrigation systems to minimize water waste.

Maximum summer temperatures in the county are forecasted to rise by 6.3 to 12.8 °F by the 2050s. Most climate models predict decreased summer precipitation, though accurate predictions are complicated by the region's already low summer precipitation and the complex nature of convective storms. Through the 2030s, agricultural water demand in the Columbia River Basin is expected to decrease slightly due to warmer, wetter springs and a shift to less water-intensive crops. However, as temperatures rise, this decline in irrigation demand may not continue. For Chelan County, future changes in irrigation water demand are uncertain. The county's crop mix is predominantly fruit trees, unlike the Columbia River Basin's mix of annual crops, fruit trees, and pasture. Development pressures may lead to land use changes rather than crop mix changes, impacting future water demands. Moreover, the timing of irrigation for fruit trees is less flexible than for annual crops, as trees need water post-harvest. These shifts in water supply and demand could lead to more frequent water curtailments for rights holders, especially early in the irrigation season.



Climate Action Plan for the Territories of the Yakama Nation (2019) ⁸

The objective of the Climate Action Plan for the Territories of the Yakama Nation is to "honor, protect, enhance, and restore all human and natural resources that support historical, cultural, spiritual, and economic practices of the tribes." The Yakama Nation plan was developed through collaboration between Tribal staff and Tribal members, to identify existing and emerging climate change impacts affecting the reservation, and to devise an associated action plan.

In addition to encouraging sustainable farming practices and conducting and sharing research related to the diverse impacts of climate change on agricultural activities, the Yakama Nation plan proposes a variety of strategies, many of which are related to water infrastructure critical for agriculture:

- Evaluate the locations, costs, and benefits of constructing re-regulating reservoirs in strategic locations within the WIP district and consider a storage assessment of the potential of WIP or other sources to provide irrigation water to the Toppenish-Simcoe Unit.
- Support aquifer recharge and assess the feasibility of applying water to croplands outside the normal growing season when excess water is available.
- Install devices to accurately measure water use at all turnouts and throughout the WIP system at appropriate locations.
- Implement shrub-steppe restoration initiatives (i.e. seeding native grasses, controlling cheatgrass, and planting native shrubs like sagebrush).
- Collaborate with the Bureau of Indian Affairs to manage cattle permits for landscape health.

Relevant areas of concern within the Yakama Nation plan include farmland, shrub-steppe, and rangelands. The reservation's agricultural sector spans about 72,000 acres owned by Tribal members, mainly concentrated along the Yakima River, Satus Creek, and Toppenish Creek. This land sustains an agricultural industry that contributes significantly to the Yakama culture and economy. The reservation's 400,000 acres of shrub-steppe lands provide essential foods and medicines and serve as livestock rangeland.

The Wapato Irrigation Project (WIP), part of the larger Yakima Irrigation Project managed by the US Bureau of Reclamation, is a critical surface water source for almost all farmland on the reservation, 95 percent of which relies on irrigation. Data indicate that water shortages in the Yakima Basin, which already affect areas like the Toppenish-Simcoe Unit, are projected to worsen due to climate change. By the 2080s, under low-to-medium emissions scenarios, water shortages could limit delivery to junior water rights holders in 3 to 8 out of every 10 years. This increasing frequency of shortages will place additional stress on the already aging WIP infrastructure, necessitating improvements to enhance resilience.

Periods of drought can cause severe impacts, as in 2015 when water supply dropped to about 70 percent. These droughts can exacerbate inequalities in irrigation distribution and directly impact Tribal revenues from irrigated lands. Flooding events can further stress WIP infrastructure. Regulatory policies, including enforcement of the Tribal water code, will become increasingly important for managing these challenges. Furthermore, potential agricultural impacts from rising insect populations (i.e., Mormon crickets) pose a significant threat to crop yields.

Wildfires present an additional risk to the vegetation and land in shrub-steppe and rangeland areas, often resulting in the removal of extensive areas of sagebrush, the spread of invasive cheatgrass, and the emergence of grazing restrictions that can last over 3 years. This can affect ranchers, Tribal households reliant on lease income, and the wider economy.



King County

King County Strategic Climate Action Plan (2020) ⁹

King County's 5-year Strategic Climate Action Plan (SCAP) integrates climate action into all county operations, collaborating with cities, partners, and communities. Section I, Reducing GHG Emissions, includes a chapter

on forests and agriculture with a focus on the carbon and climate benefits of maintaining, protecting, restoring, and expanding farms and forests in the county. King County has approximately 48,000 acres of farmland, comprising about three percent of their land base. Most of King County's 1,800 farms are classified as small operations.

Under a high emissions scenario, Puget Sound is expected to experience a 200 percent increase in "very hot days," a 70 percent reduction in snowpack, a 34 percent increase in winter streamflow, and a 44 percent decrease in summer streamflow as soon as the 2060s. These impacts are associated with agricultural risks such as irrigation shortages, challenges to water supplies, river flooding, costly stormwater management and flood protection, more frequent harmful algal blooms, and threats to the health and well-being of outdoor workers.

Increased oceanic CO₂ is also listed as a climate impact that can harm marine food webs and shellfish. Although the King County plan does not expand on these risks in detail, it does propose strategies that—on a broader scale—aim to develop the body of research around climate change impacts and opportunities for resilience, promote on-farm resilience practices, and preserve existing farmland in the face of development pressures.

Some unique strategies described in King County plan include:

- Evaluate the costs and interest in increasing the use of recycled water for agricultural irrigation in the Sammamish Valley. This could address projected changes to summer streamflow low, by connecting new irrigation customers where feasible.
- Enhance coordination between departments for landslide response, reporting, and risk reduction in King County.
- Support collaboration between the Water and Land Resources Division and the Flood Control District, farmers, and other partners to reduce flooding risks. Provide access to higher ground for farm animals and equipment and construct new farm pads if feasible.
- Investigate the benefits of compost and support King County farmers in applying compost to improve soil health and demonstrate its value (i.e., conduct a literature review on the full-cycle GHG impacts of compost use on agricultural lands and, if positive, initiate at least one pilot project applying compost on county-owned farmland).
- Assist producers with enrollment and participation in federal disaster insurance programs.



Thurston County Climate Mitigation Plan (2020) ¹⁰

The Thurston County Climate Mitigation Plan addresses the current and projected impacts of climate change in Thurston County, outlining specific actions for local governments to achieve measurable progress in reducing GHG emissions.

Unlike other local plans included in this review, the agricultural segment of the Thurston County Climate Mitigation Plan places less emphasis on climate risks to agriculture and focuses instead on the role of agriculture in exacerbating climate change. GHG targets under Thurston County's plan 'Agriculture, Forests, and Prairie's' sector include:

- Reduce acres of conventionally fertilized land by 20 percent by 2030, and 50 percent by 2050.
- Manage 6,600 acres of agricultural land to store carbon through regenerative agriculture practices by 2050.
- Manage forestland and prairies sufficient to sequester 375,000 tons of CO₂ annually by 2050.

Agriculture in Thurston County encompasses large commercial dairy and egg operations, orchards, and specialty vegetables cultivated on small urban plots. The average farm size is approximately 14 acres. Approximately 500 farms raise cattle and chickens, while a significant amount of agricultural land is used for grazing and hay production. Thurston County loses over 1,000 acres of farmland annually, impacting local food networks, open space, and wildlife habitats. Programs like the Washington Wildlife and Recreation Program and Thurston County's Conservation Futures aim to preserve farmland through property or development rights purchases. Preservation of working farmland is critical for local food supply and climate change mitigation.

Two main strategies are proposed to attain these targets: Providing education and incentives (i.e. grants, loans, technical assistance) to encourage practices that reduce emissions from manure and fertilizer, and supporting the expansion of regenerative agricultural practices that increase organic matter content and water retention in soils. The Thurston County plan includes performance indicators such as acres of fertilized farmland, tons of sequestered carbon, and acres of land using regenerative agricultural practices, but does not specify how these indicators are measured.



Methow Valley Climate Action Plan (2021) ¹¹

The Methow Valley is home to many family farms that raise livestock and cultivate fruit, vegetables, grain, and hay across nearly 9,000 acres of both dryland and irrigated land. The Methow Valley Climate Action Plan represents a collaborative effort between Methow Valley community members and the Resilient Methow Planning Team and Task Force. It is among the few plans specifically developed for a region east of the Cascades.

Projections indicate that average temperatures in the valley will be 3–8°F warmer by the 2050s. The snow season is expected to see a reduction of 21–47 days in the 2040s and 2080s, respectively, with April 1 snowpack reduced by 46 percent in the 2080s. Higher peak flows and earlier seasonal flooding are also expected, with January streamflow increasing 164 percent by the 2080s. July average streamflow is projected to be 48 percent and 65 percent less in the 2040s and 2080s, respectively.

Broad agricultural impacts listed in the Methow Valley plan include but are not limited to pollinator loss, crop and livestock stress and loss, reduction in water availability for production, increased irrigation needs, new limits on some irrigators, increased soil erosion, and infrastructure loss. Most proposed strategies encompass **information-sharing, growing the financial sustainability of farms, expanding access to technical assistance and conservation programs, and increasing opportunities for on-farm carbon storage.**

Unique actions associated with these broad strategies include:

- Create an adaptation grant fund to help farmers purchase resiliency-enhancing tools (e.g., shade and wind protection, hail and insect barriers, emergency feed, equipment upgrades, and infrastructure improvements).
- Determine the feasibility of a carbon offset program to compensate farms for stewardship, restore abandoned farmlands to carbon banks, and develop a biochar pilot project.
- Lobby to fully fund and staff the Okanogan County Extension office.
- Support the Methow Conservancy's "Carbon Farming Learning Group," which provides educational resources such as planning software, training, field trips, and soil testing.

Washington State plans

Washington State has adopted multiple climate policies and plans over the past two decades. The Washington State Climate Resilience Strategy was adopted in 2024, updating its 2012 predecessor, the Washington State Integrated Climate Response Strategy. This review includes the 2024 Strategy and the Washington State Enhanced Hazard Mitigation Plan.

The risks outlined in this section align closely with those identified in local plans, with the Washington State Enhanced Hazard Mitigation Plan offering valuable supplemental details on observed and projected risks and impacts. Similarly, the strategies aimed at mitigating these risks generally mirror those in local plans. Nevertheless, the Washington State Climate Resilience Strategy (2024) provides unique insights into the necessary statewide coordination and collaboration among agencies and stakeholders required to implement cross-jurisdictional goals. This collaboration extends to partnerships with local governments, Tribal nations, industry stakeholders, nonprofit organizations, and academic institutions.

Washington State Climate Resilience Strategy (2024) ¹²

The Washington State Legislature directed ECY, in partnership with nine other state agencies (including WSDA), to update the state's Integrated Climate Response Strategy (2012) and prepare a new Washington State Climate Resilience Strategy (RCW 70A.05). The strategy addresses the greatest climate risks facing Washington, highlights existing agency efforts that support climate resilience, and proposes new actions agencies can take to help communities, infrastructure, and natural and working lands become more resilient to:

- Drought and reduced water availability
- Marine and coastal changes
- Flooding
- Extreme heat
- Wildfire and smoke

The Climate Resilience Strategy identifies eight strategies to focus agency efforts on addressing the impacts of climate change. These include responses to climate-driven hazards and emergencies, support for Tribes and local governments to implement resilience actions, resources to help agriculture and working lands adapt to changing climate conditions, infrastructure improvements, and improved water management for people, farms, and ecosystems. The actions detailed under each strategy recognize the unequal impacts of climate change on overburdened communities and vulnerable populations, and help agencies center environmental justice through their efforts. Strategy four specifically focuses on supporting the vitality and viability of agriculture.

The Climate Resilience Plan for Washington Agriculture and the Washington State Climate Resilience Strategy were developed concurrently. As such, they are intended to complement each other and amplify the need for significant investments into agricultural resilience, which supports overall state resilience. The following topics are covered under actions in both state plans:

Table 1. A crosswalk of topics included in both the Climate Resilience Plan for Washington Agriculture and the Washington State Climate Resilience Strategy, and associated action numbers.

	WSDA Climate Resilience Plan for Washington Agriculture	Washington State Climate Resilience Strategy
Data Collection and Sharing	Actions 1.1.1, 1.2.3, 2.1.1, 2.1.2, 2.1.2, 2.2.1, 2.2.2, 4.1.2	Actions 4C, D
Farmland Preservation	Action 2.4.1	Action 4A
Food Security	Action 1.2.2	Action 2J
Funds for On-Farm Climate Adaptation	Actions 2.3.1, 2.3.2	Action 4B
Hazard Preparedness	Actions 1.1.2, 1.2.1, 4.1.1, 4.1.3, 6.1.2	Actions 2A-E, H, I, K, 3D, 6A
Offal Composting	Action 1.3.1	Action 2G
Pest and Disease Mitigation	Actions 5.1.1, 5.1.2, 5.2.1	Action 2F
Regulatory Efficiency	Actions 4.1.1, 6.1.1, 6.1.2	Action 3A
Water Use Efficiency	Actions 3.1, 3.1.2	Actions 6A, 6F-H
Water Quality	Action 3.2.1	Actions 5B, C, 8L
Workforce Development	Actions 2.2.1, 4.2.1, 4.2.2	Action 4C

Washington State Enhanced Hazard Mitigation Plan (2023) ¹³

The Washington State Enhanced Hazard Mitigation Plan (SEHMP) addresses the dynamic and rapidly changing hazard landscape in the state, driven by population growth, urban development, and climate change. Washington state has witnessed more frequent and severe wildfires, storms, floods, and secondary effects like landslides and diminished air quality in recent years. The SEHMP serves as a comprehensive resource for assessing risks and vulnerabilities and implementing long-term, targeted mitigation actions. It contains a Hazard Inventory and Vulnerability Assessment (HIVA) to identify specific risks and vulnerabilities, followed by a Mitigation Strategy outlining state actions for risk reduction.

Although the SEHMP does not comprehensively address the intersection of hazard planning and agriculture, it briefly highlights the implications of wildfires and floods for the movement of farm equipment and products, the impacts of wildfires on transmission lines and powerplants that support agricultural processes, and the effects of drought on critical irrigation systems. Moreover, many natural hazards included could have significant impacts on agricultural production and operations, even when the connection is not explicitly addressed. The SEHMP identifies the following relevant hazards and their regional influences:

- Drought is especially severe in regions east of the Cascade Range. More than half of the state's land area experienced severe (or worse) drought conditions in 2021 (Figure 7). Distribution of drought hazards across the region is expected to increase as climate change continues, with Western Washington becoming more drought prone.



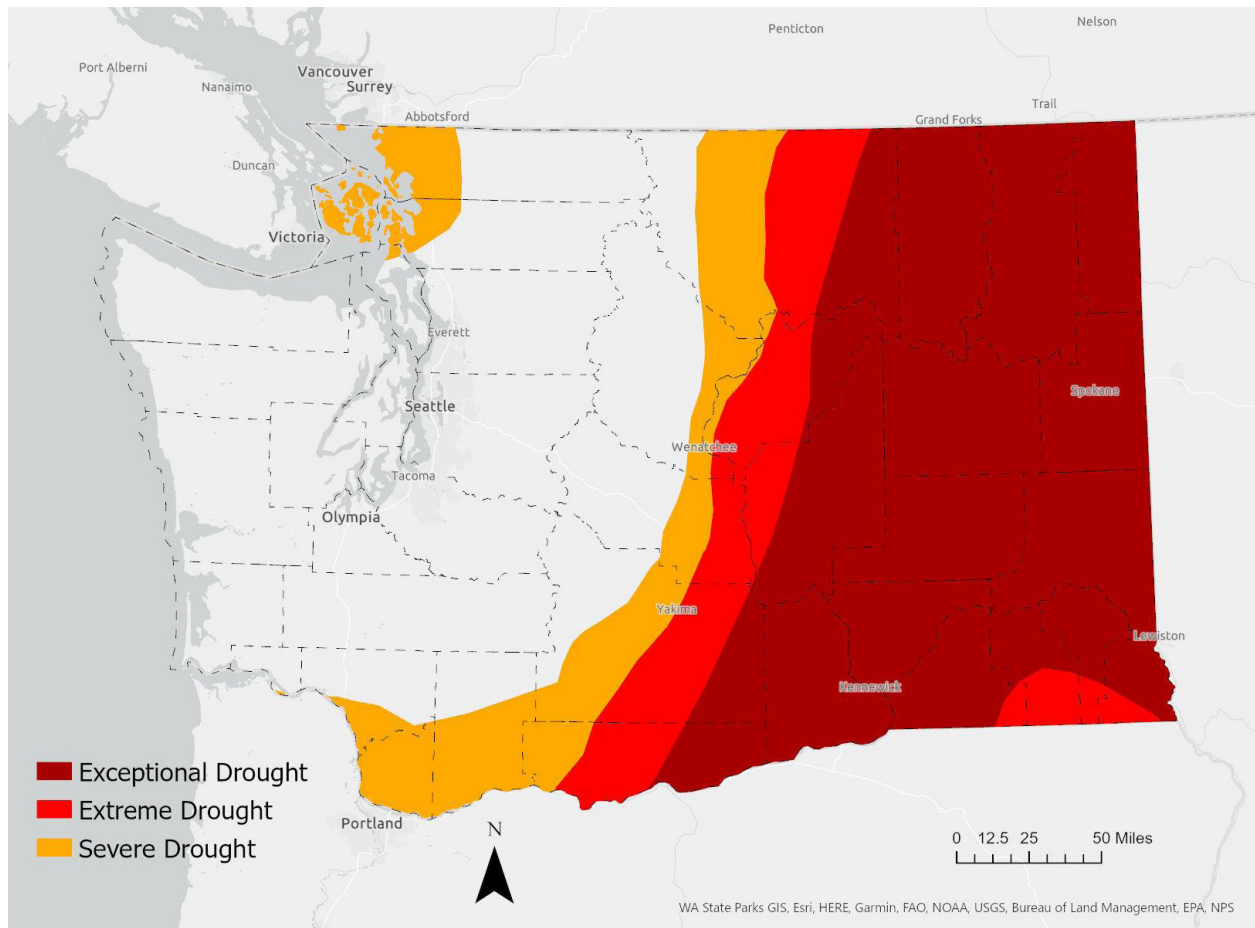


Figure 7. Map of Washington drought conditions in 2021. Source: Washington State Enhanced Hazard Mitigation Plan (2023) ¹³

- Increased outbreaks of animal disease, crop disease, and pest infestations can cause widespread devastation of livestock and crops.
- More than 400,000 properties in Washington state (13 percent of state properties) have a greater than 26 percent chance of being affected by flooding within the next 30 years. The Puget Sound and Northwestern regions are at the highest risk of flooding due to the frequency of coastal and riverine flood disasters and the vulnerability of communities and critical assets in that area (Figure 8). About 2.5 percent of the state's public roads are in 1 percent or 0.2 percent annual chance flood zones.

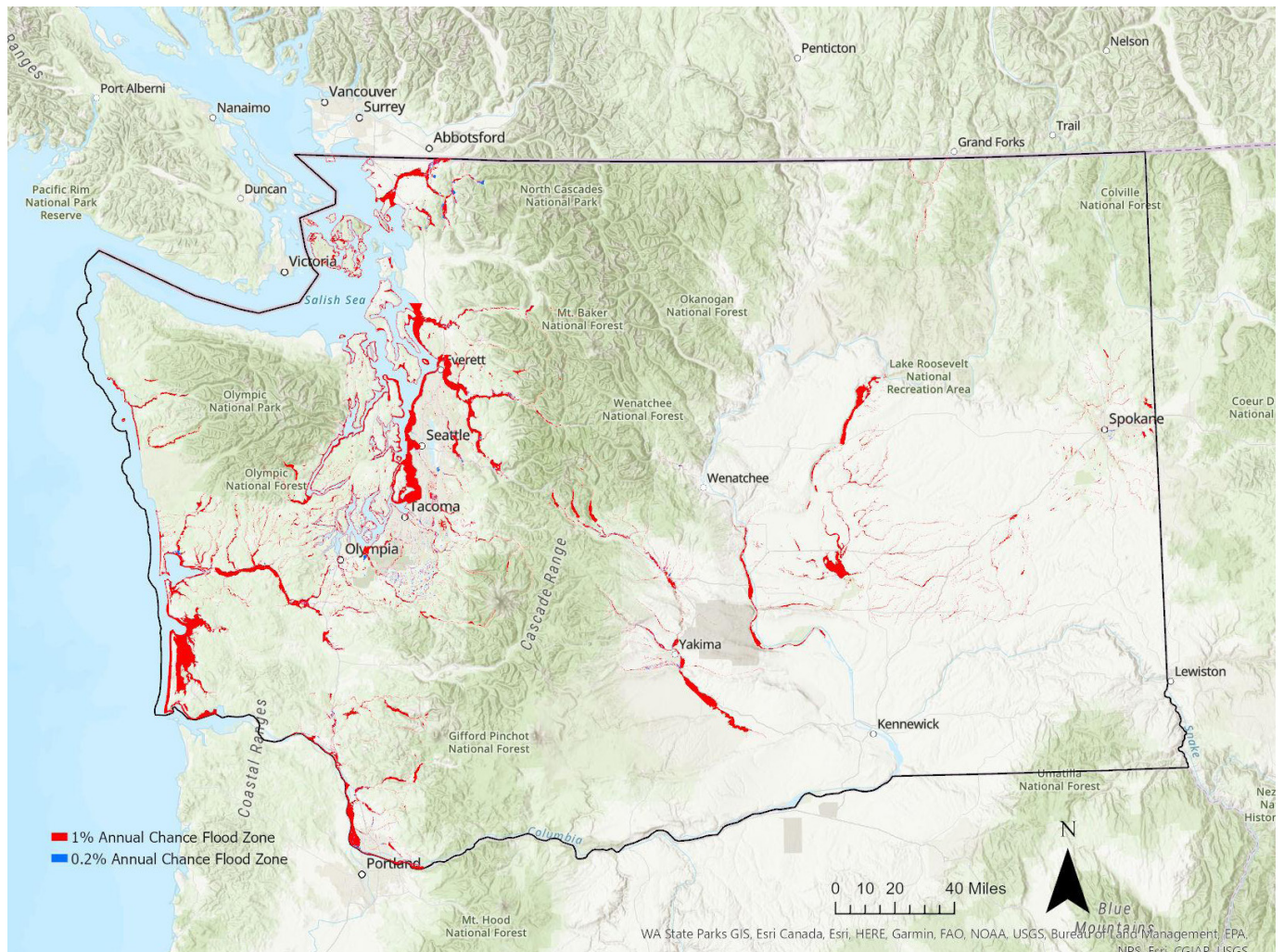


Figure 8. Map of regions in Washington with a 1 percent (in red) and 0.2 percent (blue) annual chance of flooding. Note: Areas without shown do not indicate no flood zones, but rather a lack of available spatial data. Source: Washington State Enhanced Hazard Mitigation Plan (2023) ¹³

- An estimated 2,000 state-owned or -leased facilities, 20,000 miles of public roads, 3,000 miles of transmission lines, and 18 percent of power plants are situated within the most wildfire-prone regions in Washington. Wildfire hotspots are primarily located in Central and Eastern Washington (Figure 9).

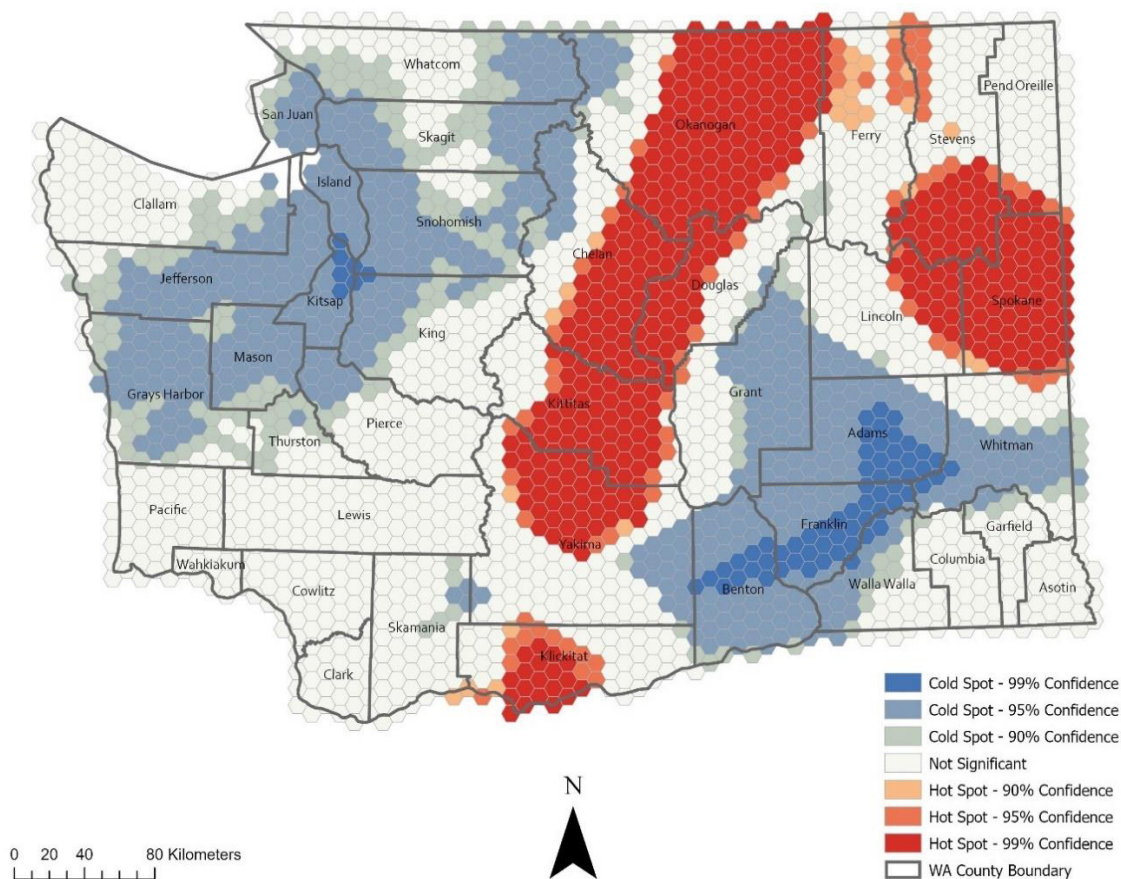


Figure 9. Wildfire hot spots and cold spots based on wildfire activity between 1970 and 2020. Source: Zerbe et al., (2022) in Washington State Enhanced Hazard Mitigation Plan (2023) ¹³

- Extreme weather events in Washington include atmospheric rivers, tornadoes, heat waves, and hailstorms. Each year, there is a 72 percent chance of a disaster declaration due to extreme weather, with Western Washington being the most vulnerable (Figure 10). At least 18,000 miles of public roads—including more than 2,000 miles of national and state highways—are situated in counties where extreme weather events are most prevalent.

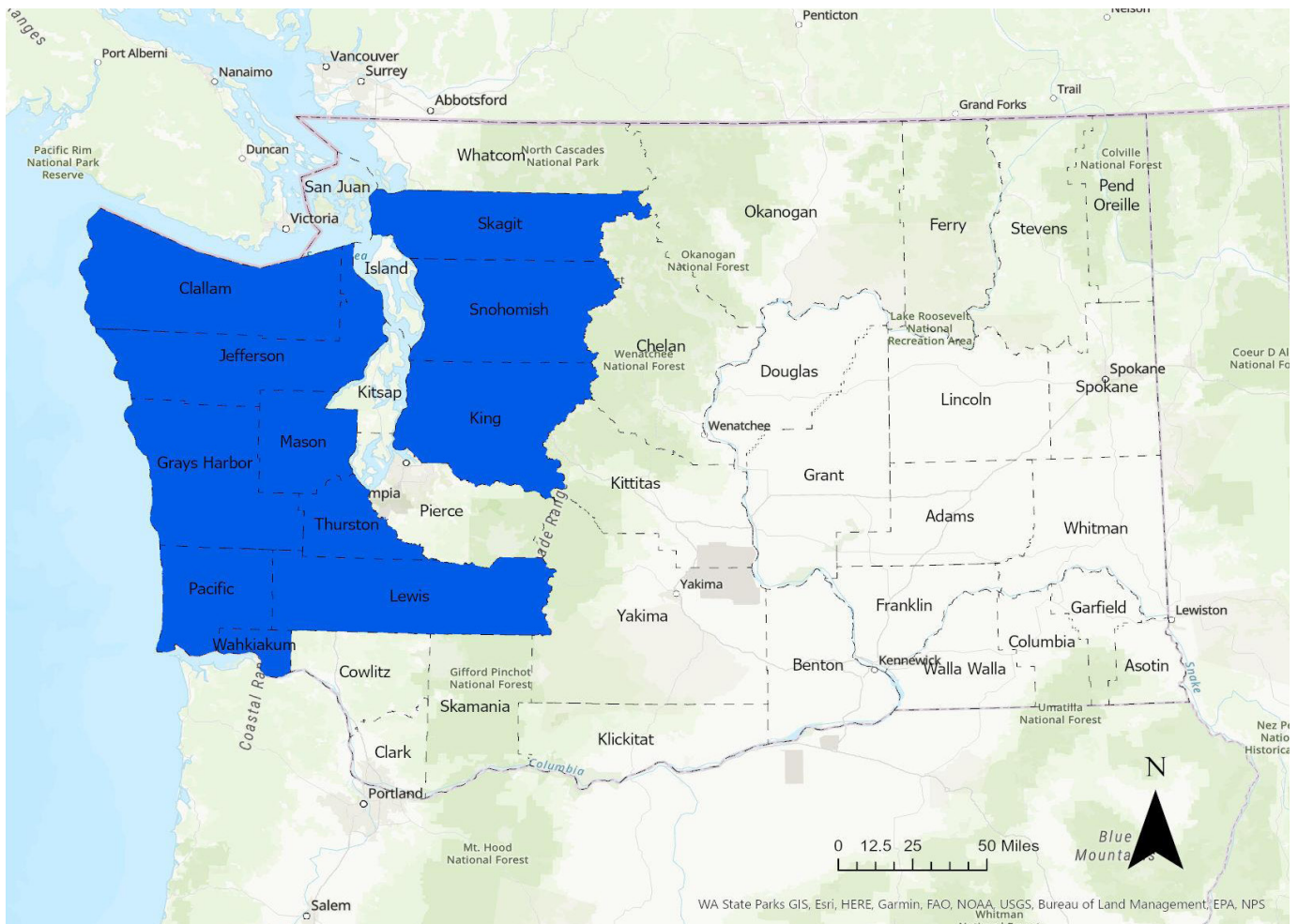


Figure 10. Areas in the 75th percentile for weather-related disasters since 1980. Source: Washington State Enhanced Hazard Mitigation Plan (2023) ¹³

Washington legislation

Washington State has actively pursued climate policies for the past several years. These initiatives reflect the state's commitment to climate resilience, mitigation, and adaptation. State-level efforts include requirements for agencies to outline climate resilience priorities and plans, address gaps in resilience strategies, and coordinate implementation efforts. The legislation also focuses on integrating climate considerations into comprehensive plans, reducing GHG emissions, promoting clean energy technologies, and enhancing workforce training for climate-related industries. The state has implemented GHG "cap-and-invest" systems and is committed to achieving ambitious emission reduction targets, signaling a shift towards clean energy and climate-friendly practices across various sectors. Relevant legislation is highlighted below. Where possible, specific implications for the agricultural sector are included.

HB 1170 (2023-2024): HB 1170 and the companion SB 5093 mandated an update to Washington State's 2012 Integrated Climate Response Strategy. As detailed above, these activities resulted in the collaboratively produced Washington State Climate Resilience Strategy (2024). Participating agencies, including WSDA, will revise the strategy every 4 years and report progress biennially to the Governor's office. HB 1170 also requires agencies to "...consider current and future climate change impacts... and incorporate climate resilience and adaptation actions as priority activities when planning, designing, revising, or

implementing relevant agency policies and programs.” The Climate Resilience Plan for Washington Agriculture is an important step in implementing HB 1170 for WSDA.

HB 1181 (2023-2024). HB 1171 proposed updates to the Growth Management Act (GMA) by incorporating new climate change and resilience goals. It introduced a mandatory climate change and resilience element that certain counties and cities must include in their comprehensive plans under the GMA. The bill mandates these jurisdictions to address the adverse impacts of climate change, outlining actions to reduce GHG emissions and vehicle miles traveled. The Department of Commerce is tasked with developing model guidance and publishing action-oriented guidelines for counties and cities. The bill also requires annual publication of per capita vehicle miles traveled by the Department of Transportation, updates to Shoreline Master Program guidelines by the Department of Ecology to address sea level rise, and inclusion of climate change impacts in optional comprehensive flood control management plans. Furthermore, the Department of Health is directed to ensure that water system plans initiated after June 30, 2025, incorporate a climate resilience element at the time of approval, with an accompanying guidebook update for implementation assistance.

The Washington Department of Commerce’s Climate Element Planning Guidance ¹⁴ provides guidance relevant to the implementation of HB 1181. As part of this guidance, jurisdictions are tasked with exploring climate impacts, auditing plans and policies, assessing vulnerabilities and risks, setting emissions reduction targets, developing measures and implementation plans to achieve targets, integrating measures into comprehensive plans, and evaluating progress. The following information from this process is relevant to Washington’s agriculture sector:

- Potential climate-related agricultural impacts identified in the guidance include changes in crop yields; increased exposure of farmworkers to extreme heat; potential for “double cropping”; increased heat stress on crops and livestock; reduced water availability for crops, livestock, and processing, along with warmer growing seasons; alteration in weeds and plants that grow with crops; increased pest and disease outbreaks as well as weeds which impact lending opportunities and crop insurance for farmers; and increased food scarcity after hazards that disrupt both food transportation and distribution.
- A crosswalk with the GMA identified the following shared goals:
 - Reduce sprawl
 - Promote economic development
 - Maintain and enhance natural resource industries
 - Protect and enhance the environment
 - Promote and prioritize climate change mitigation and resilience
- Priority actions in the agricultural sector include:
 - Reducing agricultural pollution
 - Using agroecology, agriculture land management, and livestock practices for absorbing carbon
 - Preserving land for agriculture, recreation, open space, and rural/wild purposes

HB 1176 (2023-2024). HB 1176 develops opportunities for service and workforce programs to support climate-ready communities. In brief, it establishes the Washington Climate Corps Network to enhance climate-related service opportunities for young adults and veterans. It also forms the Clean Energy Technology Workforce Advisory Committee, tasked with advising policymakers on expanding the clean energy technology workforce in Washington and developing strategies to address the challenges associated with policy transitions related to climate change. Additionally, the bill directs the Washington State Workforce Training and Education Coordinating Board to assess the needs of the clean energy technology workforce and provide recommendations to the Governor and Legislature.

The Climate Commitment Act (CCA), RCW 70A.65 (2021). The CCA aims to reduce GHG emissions to address climate change. The legislation sets targets, requiring a 45 percent reduction below 1990 levels by 2030, 70 percent by 2040, and net-zero emissions by 2050. To achieve these targets, Washington implemented an economy-wide “cap-and-invest” system, making it the second state with a declining, enforceable limit on climate pollution. The program supports emission reductions from large emitters, thereby raising revenue for investments to transition the state to a resilient, net-zero emissions economy by 2050. The cap-and-invest program is seen as a critical component of meeting science-based GHG reduction targets, complemented by sector-specific policies such as the Clean Energy Transformation Act. Enforcement of emission reductions began in 2023.

The CCA has significant implications for Washington state agriculture. Although agriculture is exempt from reporting GHG emissions and participating in cap-and-invest auctions, it is still affected economically and environmentally. The CCA has raised substantial funds, including for agricultural projects like STAR, the Compost Reimbursement Program, and Sustainable Farms and Fields (SFF), supporting conservation practices and climate-smart projects. While there is an ongoing need for more CCA investment into agriculture, future eligible activities include incentives for dairy anaerobic digesters, on-farm renewable energy, farmworker housing weatherization, and farm fleet electrification.

SB 5116 (2019–2020). The Clean Energy Transformation Act is a commitment on the part of the state to achieve a greenhouse-gas-emissions-free electricity supply by 2045. This shift towards clean electricity will empower residents and businesses in Washington state to fuel their buildings, homes, vehicles, and appliances using carbon-free sources like wind and solar energy. By reducing reliance on fossil fuels, this initiative aims to enhance community health, stimulate economic growth, generate family-sustaining jobs, and help the state reach its climate objectives.

Clean Fuel Standard, HB 1091 (2021–2022). The Clean Fuel Standard in Washington state mandates that fuel suppliers reduce the carbon intensity of transportation fuels, aiming to cut statewide GHG emissions by 4.3 million metric tons annually by 2038 and stimulate economic development in low-carbon fuel production. This standard complements the CCA and aligns with similar standards in California, Oregon, and British Columbia. Fuel suppliers must progressively lower carbon intensity to 20 percent below 2017 levels by 2034 through various methods such as process efficiency improvements, producing/blending low-carbon biofuels, or purchasing credits from low-carbon fuel providers, including electric vehicle charging providers. This bill has the potential to create new revenue streams for dairy producers, who may be newly incentivized to install methane capture technologies for biofuel production.

The Healthy Environment for All (HEAL) Act, RCW 70A.02 (2021). The Healthy Environment for All Act (HEAL) was passed by the Legislature in 2021. It is the first statewide law to create a coordinated and collaborative approach to environmental justice, making it part of the mission and strategic plans of key state agencies. The law requires WSDA, ECY, Commerce, Health, Natural Resources, Transportation, and the Puget Sound Partnership to identify and address environmental health disparities in overburdened communities and for vulnerable populations by developing and implementing a community engagement plan and Tribal consultation framework and conducting an environmental justice assessment on significant agency actions, among other changes. The law also created the Environmental Justice Council (EJC), made up of 16 members who are community, youth, Tribal, and agency representatives.

Agriculture occurs across Washington state’s diverse geographies and landscapes, including in many overburdened communities with health disparities due to environmental exposures and other socioeconomic factors. The HEAL Act is expected to bring significant funding and focus to agricultural communities to address these challenges.

Other state plans

Climate resilience plans and studies from other states can provide valuable insights into the climate risks and priority focus for agriculture in the Pacific Northwest and Intermountain West region. California's Natural and Working Lands Climate Smart Strategy is one of the most comprehensive state strategies that addresses agriculture. Oregon's initiatives, outlined in Executive Order 20-04, are at an earlier stage, serving as a first step to assess the impacts of climate change on agriculture in Oregon. Research on the economic impacts of climate change on agriculture in Idaho offers lessons and approaches that can inform WSDA's efforts to enhance agricultural resilience and sustainability in Washington state. Common themes across the plans include the importance of **nature-based solutions, community engagement, science-driven policies, and adaptive management practices.**

California Natural and Working Lands Climate Smart Strategy (2022) ¹⁵

California's lands play a vital role in the state's mission to achieve carbon neutrality and climate resilience. The Natural and Working Lands Climate Smart Strategy defines the state's landscapes, details how their improved management can support climate goals and broader objectives, highlights key nature-based climate solutions and identifies opportunities for regional climate-smart land management.

Although this document shares many broad climate risks and resilience strategies with other plans, it also provides guidance on tracking actions and measuring outcomes, including success indicators that could prove relevant in the regional and regulatory contexts of Washington and other states. Agriculturally relevant indicators include:

- Acres of natural and working lands being managed to deliver climate benefits (i.e., acres of land under durable conservation easements that include climate-smart management requirements).
- Potential to apply nature-based solutions (i.e. through the use of COMET Planner or similar tools).
- Agricultural acres benefitting from on-farm technical assistance, demonstration projects, and incentives.
- Percent change in soil organic matter and soil moisture content.

Agriculturally relevant infrastructure indicators include the existence of:

- Regional, local, and traditional food harvesting, processing, storage, and related infrastructure to support the agriculture industry and food security.
- Managed aquifer recharge capacity, especially in over-drafted basins and areas in need of long-term groundwater storage.
- Compost infrastructure capacity.

Oregon Department of Agriculture: E0. 20-04 Climate Report (2020) ¹⁶

The Oregon Department of Agriculture (ODA) plays an important role in leading and supporting local food systems, agriculture, livestock, aquaculture, and natural resources. With Oregon agriculture contributing significantly to the state's economy and employment, climate change adaptation is essential to sustaining competitiveness in diverse markets.

Climate change impacts pose challenges to ODA's mission and operations in 4 key areas: planning, budgets, investments, and policy decisions. Executive Order 20-04 and its predecessor direct state agencies to integrate climate change considerations into these key areas. The order focuses on planning, including

stakeholder engagement, prioritizing work with a nexus to climate, allocating staff resources to climate-related work, and identifying opportunities to reduce GHG emissions from agency facilities and operations. The order also considers the budget, investments, and policy initiatives necessary for the agency to complete climate-related work.

Economic Impacts of Climate Change on Agriculture in Idaho¹⁷

The Economic Impacts of Climate Change on Agriculture in Idaho, authored by the University of Idaho's McClure Center for Public Policy Research, provides a comprehensive overview of the unique impacts of climate change on soil, weeds, crops and commodities, and water. Documented impacts align with those from other plans and focus on challenges with soil health, weed pressure, crop and livestock stress, and water availability. Additionally, the report highlights 3 case studies that demonstrate current adaptation and experimentation within various agricultural sectors. These case studies have the potential to inform future resilience efforts.

- **Case study 1:** In response to reduced groundwater availability, Idaho farmers in the Eastern Snake Plain Aquifer region have adapted to address water resource constraints. A survey of farmers conducted in 2018 revealed that a majority of the 265 respondents undertook at least one adaptation action, with an average of 9 distinct adaptations reported. Common strategies included improving irrigation system efficiency, reducing spending on inputs or equipment, irrigating less frequently, changing crop rotation, and adopting more efficient irrigation systems. While some opted for extreme measures like selling land or exiting farming altogether, the diverse array of adaptations highlights the need to incentivize and support agricultural adjustments to climate change while considering local farming practices.
- **Case study 2:** Developed by University of Idaho researchers and The Nature Conservancy in collaboration with ranchers in Oregon and Idaho, RangeSAT is a decision-support tool that offers near-real-time estimates of biomass through Landsat satellite data for adaptive grazing management. It enables end-users to access pasture- and ranch-specific maps and graphs of above-ground biomass, normalized difference vegetation indices, and climate variables from 1984 to the present. Ranchers utilize RangeSAT to plan livestock movements, assess past management decisions, and visualize vegetation changes over time. The tool has been used in bunchgrass prairie and select sagebrush steppe locations in Southern Idaho. RangeSAT and similar tools (including Washington's StockSmart) aim to enhance conservation outcomes and ranch sustainability amidst climate variability. However, challenges in usability and awareness persist, requiring further refinement for effective adoption by ranch operators.
- **Case study 3:** Herbicide resistance on inland Pacific Northwest farms is a problem expected to intensify with climate change. Given the increasing resistance of weeds to common herbicides, community-based management at a regional level is becoming increasingly important. A 2018 survey of PNW wheat growers revealed awareness of herbicide resistance issues, with 60 percent engaging in communication with neighbors and 67 percent recognizing the necessity of cooperative management. Drawing on Dr. Elinor Ostrom's community management principles, a toolkit was developed to guide the creation of community-based herbicide resistance management strategies. Community groups in Idaho and Washington are utilizing this toolkit to develop region-specific plans, emphasizing cooperation, cost reduction, and engagement with policymakers.

National plans

Fifth National Climate Assessment (2023) ¹⁸

The Fifth National Climate Assessment addresses the human welfare, societal, and environmental implications of climate change and climate variability for 10 regions of the US, including the Northwest, which covers Idaho, Oregon, and Washington state. The report covers 20 national topics, paying special attention to observed and projected risks and impacts of climate change, as well as the prospects for risk reduction, and the implications of various mitigation pathways. Chapter 11, “Agriculture, Food Systems, and Rural Communities,” focuses on the impacts of climate change on agricultural productivity through altered rainfall patterns, increased occurrences of climate variation, and evolving pest pressure patterns. Adaptation techniques include **climate-friendly farming and management strategies, the adoption of new technologies, and the modification of production inputs.**

This assessment details the socioeconomic and ecological costs of climate change in food systems. For instance, total factor productivity (TFP), which has grown steadily in the US (1.4 percent per year) since 1948, has seen a 12 percent reduction in growth over 54 years (1961–2015). Unless US agricultural innovation and adaptation can double TFP growth rates relative to recent historical trends, agricultural TFP is expected to decline to pre-1980s levels by 2050, with crop prices increasing significantly. For instance, the price of corn is projected to increase by around 26 percent in response to a 5.5 percent reduction in production. Soybean prices are expected to increase by 30 percent in response to a 19 percent reduction in production.

Moreover, in labor-intensive fruit and vegetable systems, high temperatures and humidity affect farmworker productivity, safety, and earnings. Instances of heat-related stress and death are much more common among farmworkers than among all other US civilian workers.

Another notable and relevant risk described in this plan is that of crop migration. Plant hardiness zones are projected to migrate northward and towards higher altitudes with climate change, prolonging frost-free periods and requiring adjustments in agricultural methods like crop selection and equipment usage. Plant hardiness zones help local farmers and gardeners identify optimal crops to plant and when to plant them.

In response to these risks, the assessment proposes several on-farm agroecological approaches to land management that mitigate climate impacts and reduce agricultural emissions, along with select adaption strategies. For example, innovations in alternative food production, including urban agriculture, controlled-environment farming, and sustainable aquaculture, show potential for reducing emissions. Aquaculture, with its high feed-conversion efficiency and lower overall GHG emissions compared to other animal proteins, is highlighted for its potential to increase protein production, human nutrition, and food availability. Importantly, the assessment notes that certain production approaches can involve more infrastructure or energy inputs per unit of food production, increasing their GHG emissions compared to conventional farming practices, so careful planning is required.

Advancements in analytic capabilities can help policymakers understand risk variations that are influenced by social, economic, and ecological factors. For example, metrics that capture a community's ability to prepare, adapt, and recover from disruptions highlight a greater risk to rural communities than previously quantified using only expected annual loss due to natural hazards.

National Institute of Food and Agriculture (NIFA) Climate Adaptation and Resilience Plan (2022) ¹⁹

Through an agency-wide survey effort in 2021, the National Institute of Food and Agriculture (NIFA) identified the following climate vulnerabilities: water quantity and quality, agroecosystem productivity and sustainability, food and nutrition security, resilience to extreme weather, the education pipeline, and continuity of operations. Risks not addressed extensively elsewhere include:

- **Pollinator health:** Pollinators are critical to agricultural production. Extreme weather events and shifting weather patterns threaten pollinator health by interfering with the timing of flowering and pollination. Native pollinators also face impacts arising from forage and host plant biodiversity loss and from the emergence of pests, invasive species, and pathogens.
- **Supply chain disruptions:** Supply chain disruptions are another major concern related to extreme and variable weather events. Disasters caused by naturally occurring hazards can impact commodities at all stages of the supply chain—production, processing, distribution, and consumption. In turn, this can hinder innovation and research due to higher costs or delays in supply manufacturing and distribution.

NIFA's climate adaptation actions encompass five topic areas: new NIFA programming, strategic planning, organizational effectiveness, stakeholder outreach and education, and cross-cutting actions. An additional task is to improve reporting mechanisms that track climate change expenditures and impacts via:

- **Metrics:** The Climate Change Priority Team at NIFA will identify which impact metrics are useful and practical to gather from grant applicants. For specific funding opportunities related to climate change science, NIFA will ask applicants to propose and report metrics on climate adaptation, GHG mitigation, and related co-benefits.
- **Tracking:** NIFA will review its current methods for tracking awards to better identify climate change projects and will train staff in these tracking techniques. These steps will enhance the accuracy of NIFA's climate change expenditure reporting to leadership and the Office of Management and Budget.
- **Open Data:** NIFA aims to develop advanced analytics (such as artificial intelligence) and visualization dashboards for climate change science projects that are available internally and to the public.
- **Impacts:** NIFA plans to increase analyses of climate-related investments by jurisdiction and institution to determine their effects on climate adaptation in various communities.

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