Climate Change Impacts the Pacific Coast and Tribal Traditional Practices

The watersheds of the Pacific Coast are experiencing the effects of a changing climate, and these trends are projected to continue or accelerate in the future. Tribal communities are on the front line of the climate crisis as traditional practices that have been sustained since time immemorial are now threatened by broadscale and far-reaching environmental changes. The harms caused by the climate crisis are compounded by ongoing damage to the ecological integrity and resilience of our watersheds as described in this report.

In the Pacific Northwest (PNW), the observed and projected trends include warmer air temperatures; shrinking glaciers and snowpack; lower summer streamflows; higher winter flood flows; shifts in streamflow patterns and timing; higher stream temperatures; larger and more frequent wildfires; warmer ocean temperatures; rising sea levels; and changing ocean chemistry, including ocean acidification and lower levels of dissolved oxygen.

In marine and coastal ecosystems, changes to water chemistry and temperature can alter the range, distribution and abundance of fish, shellfish, waterfowl and other marine species important to the tribes.[1] For example, ocean acidification interferes with shell formation, hence hindered development and survival of a number of marine species, including crabs, clams and oysters. In addition, ocean acidification has the potential to alter marine food webs and change distribution of finfish, including Pacific salmon.[2] The marine waters of Washington have become 10% to 40% more acidified since 1800.[3]

Low-lying tribal lands are susceptible to the direct effects of sea level rise (SLR), as well as flooding and erosion from stronger coastal storms and greater storm surge.[4] In vulnerable areas, flooding and erosion reduce traditional tribal shellfish harvesting areas, damage culturally important sites, and threaten tribal communities and infrastructure.

Global SLR is caused by the physical expansion of warmer water and the melting of ice sheets and glaciers, but locally, relative SLR includes the effects of vertical land movement. In western Washington, vertical land movement is dominated by tectonic forces, so the amount of relative sea level rise varies over time and location.[5]

Relative SLR at Toke Point in Willapa Bay is 1.6 inches per century; however, due to ground uplift, tidal records in Neah Bay show a relative drop in sea level at the equivalent of 6.7 inches per century. Average wave heights in the northeast Pacific Ocean have been increasing since the 1970s and this may contribute to coastal flooding and erosion more than relative SLR.[7]

Changing watershed processes pose a threat to salmon populations, which need adequate amounts of cool, clean water to survive. Overall, temperatures in PNW streams warmed by about 0.3°F (0.17°C) per decade from 1976 to 2015.[8] As stream temperatures increase, the length of time that rivers exceed salmon temperature limits for reproduction and survival grows longer. Loss of glaciers and snowpack contributes to lower summer streamflows, warmer waters, greater winter floods, and more exposed sediment washing into rivers. In Olympic National Park, glacier surface area decreased 34 percent from 1980 to 2009.[9] From 1950 to 2010,

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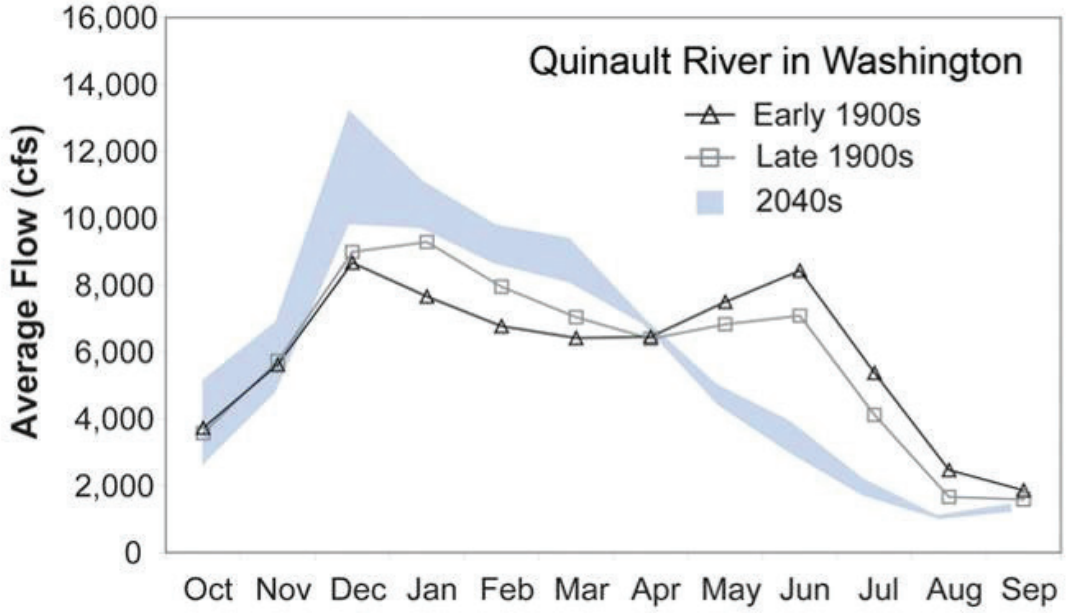

Streamflow changes in the Quinault River during the 20th century. Projections for the 2040s show a shift from two periods of high flows (from winter precipitation and spring snow melt) to just one. The 2040s curve is shaded to represent a range across a number of different climate scenarios. Source: University of Washington Climate Impacts Group cited in USGCRP 2009.[12]

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summer streamflows decreased 33 percent in snow-dominated watersheds and 36 percent in mixed rain-snow watersheds in the PNW.[10] At the same time, winter flood risk is increasing since the top 1 percent of extreme rainfall events increased in frequency by 12 percent in the PNW during the 20th century.[11]

In addition to changes in streamflow and water temperatures, climate change leaves salmon and steelhead at risk from lower levels of dissolved oxygen, more sediment in streams, greater susceptibility to disease, competition from warm-water species, and changes to the type and availability of prey.

Terrestrial plants and animals used for traditional food, medicine and cultural practices are vulnerable to major ecosystem disturbances such as wildfire, drought, pests and invasive species.[13] Warmer temperatures, changing precipitation patterns and other disturbances are causing wildlife and birds to migrate farther north or to higher elevations in search of suitable habitat, potentially moving out of traditional tribal hunting grounds.[14] In the western United States, the fire season has lengthened in conjunction with higher summer temperatures and reduced snowpack.[15] Warmer summers, lower soil moisture and higher rates of evapotranspiration leave Pacific coastal forests more prone to fires than in the past.[16] For example, the 2015 Paradise Fire in the rainforests of the Queets River valley in Olympic National Park followed the driest May and June recorded in the Forks, Wash., area since records began in 1895.[17] Ultimately the fire consumed 2,800 acres of temperate rainforest.[18] Swiss needle cast, western spruce budworm, blister rust, and mountain pine beetle are all on the rise in Washington's forests because of climate change. The mild winters and wet springs and summers of the Pacific coast offer favorable conditions for the fungus that causes Swiss needle cast. In 2015, almost 350,000 acres of Douglas fir with Swiss needle cast symptoms were found in Washington state, with the most severely affected stands located near the coast and in the Grays Harbor area.[19]

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Quileute Tribe natural resources staff use a hydrodynamic sampler in the Bogachiel River to measure the fine sediment in the water. As flood flows increase and become more frequent, the amount of sediment transported by the stream increases, potentially burying and suffocating salmon eggs.[20]