Jamestown S'Klallam Tribe: Climate Vulnerability Assessment and Adaptation Plan

Climate Impacts and the Jamestown S'Klallam Tribe

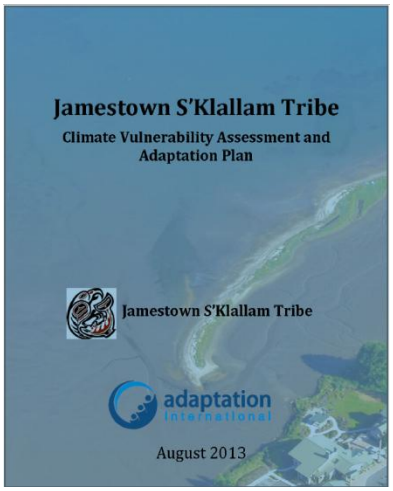
The Jamestown S'Klallam Tribe resides on the northeastern portion of the Olympic Peninsula, in northwestern Washington (see map). Historically, the Jamestown S'Klallam have adapted to both climatic changes as well as radical cultural changes brought on by colonization. In more recent years, the Tribe has identified climate change as a major concern for their community and has therefore prepared a Climate Vulnerability Assessment and Adaptation Plan to promote the continued resiliency of their community. This profile highlights the Jamestown Plan and how the tribe is designing adaptation measures that are appropriate and effective for their community.

Developing the Adaptation Plan

The Jamestown S'Klallam Tribe developed the Adaptation Plan with support from a U.S. Environmental Protection Agency (EPA) Indian Environmental General Assistance Program (IGAP) grant. The Tribe partnered with Adaptation International, a climate change consulting firm, and Washington Sea Grant, a collaborative project between NOAA and the University of Washington, to develop the plan. The plan is available at http://www.jamestowntribe.org/programs/nrs/nrs_climchg.htm.

The project team convened a committee of fifteen tribal elders, staff members, and council members, and held a two day workshop to work with the climate committee on identifying adaptation priorities and developing adaptation strategies. Adaptation International and Washington Sea Grant provided summaries of a wide range of anticipated climate impacts and the committee then identified and prioritized key areas of concern for the Tribe. This workshop provided opportunities for the committee to share their expertise and led to a multi-disciplinary and refined understanding of the specific climate issues facing the Jamestown S'Klallam Tribe.

Primary outcomes from the workshop included selection of key areas of concern and detailed climate vulnerability rankings, based on potential climate exposure, sensitivity (how susceptible an area of concern is to a given climate impact), and adaptive capacity (the ability of that system to adapt to a given climate impact). The vulnerability rankings take into account community input when prioritizing areas of concern. By investigating climate impacts and identifying key areas of concern, the Jamestown S'Klallam Tribe's climate adaptation plan reflects community priorities while also acknowledging the sectors that may be most severely impacted.



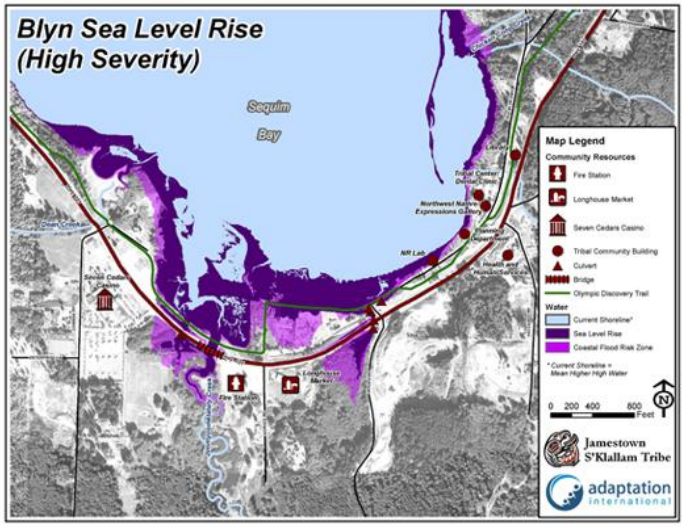
Climate Impacts Affecting the Jamestown S'Klallam Tribe

The Jamestown S'Klallam Plan identifies several climate impacts as most important to the community. Brief descriptions of the impacts are provided below, and the adaptation plan appendices offer detailed information and maps on potential

climate impacts. These maps address multiple scenarios for climate change, and provide a fine-scale perspective on how Jamestown S'Klallam lands may be impacted by sea level rise. Weblinks to these maps can be found at: http://www.jamestowntribe.org/programs/nrs/nrs_climchg.htm. Below, a brief description of each impact is provided.

Increasing Temperatures and Changing Precipitation: By synthesizing existing climate research on the region, the project team was able to identify several impacts related to increasing temperatures. As average temperatures increase in response to rising concentrations of greenhouse gasses in the atmosphere, the Northwest is projected to experience more frequent and severe extreme heat events, as well as warmer river and ocean water temperatures. These projected temperature increases, will have adverse effects on glaciers and snow pack by causing greater glacial retreat and further diminishing the depth and duration of snow pack. These changes have implications for the health and sustainability of culturally important marine and freshwater species as well as important water resources, like drinking water. Early snowmelt is projected to lead to higher river flows earlier in the year and lower flows during the summer. This will impact river ecology by altering flows during key migration times and affecting salmon spawning habitat. Salmon of the Dungeness River are particularly adapted to its bimodal hydrology and therefore rely on the historical hydrologic patterns and trends for their continued survival. The region is already water stressed. For instance, the Dungeness River has been identified as "water-critical" by the state of Washington due to low flows and competing agricultural and ecological water demands on the river.

Sea Level Rise and Coastal Flooding: Combining global and regional sea level rise data with local data on vertical land movement (the rise and fall of land based primarily on tectonic plate movement), project researchers estimated that the relative sea level near Blyn—a town in Jamestown S'Klallam territory—will rise between 0.5 feet and 2 feet by the year 2050. Sea level rise will increase the risk of coastal flooding and erosion, which may damage homes and other infrastructure, and disrupt coastal ecosystems. Human response to sea level rise, such as armoring or fill, may further exacerbate stresses to nearshore ecological functions. In an effort to identify areas of greatest impact, the project team developed detailed maps of projected sea level rise and coastal flood risk for some portions of the Jamestown S'Klallam Tribal territory. These maps use the best available high resolution LiDAR based elevation data available through FEMA and the Puget Sound LIDAR Consortium (PSLC).



Links to these maps can be found here: http://www.jamestowntribe.org/programs/nrs/nrs_climchg.htm.

Ocean Acidification: Ocean acidification poses a serious threat to the health of shellfish, which the Tribe relies upon for ceremonial, subsistence, and commercial harvests. OA also poses a threat to other marine organisms such as phytoplankton, which form the base of many marine

foodwebs. Increasingly corrosive ocean waters (high acidity water) prevent young marine life from growing the shells that they require for survival. Increased acidity has already been observed in the Strait of Juan De Fuca as well as many other regions of the world.

Crab Shack. Jamestown Beach. Photo by Sharilyn Neidhardt. 2011

The upwelling pattern of ocean waters along the Washington coast promotes the acidification of surface-level ocean water by pushing carbon-rich, corrosive, deep ocean water toward the surface. The particularly strong upwells in Washington's oceans make the shoreline in Jamestown territory particularly vulnerable to ocean acidification. Oyster farmers in the Puget Sound have already experienced the effects of ocean acidification; in the mid-2000s, upwelling events led to production-level failures of Puget Sound oyster farms. This type of effect is expected to continue and worsen with climate change.

Forest Habitat Changes: Wildfires have increased in frequency in the region since 1970. There is a major concern that drier temperatures will shift forest ecosystems from a Western Hemlock forest-type to a Douglas Fir forest-type. Western Redcedar relies on a Western Hemlock forest-type to thrive; this cedar is a critically important cultural resource that Jamestown S'Klallam people have relied upon for thousands of years.

Human Health: Impacts to culturally important plants and animals that nourish physical, emotional, and spiritual health of tribal citizens have the potential to harm the community's health. Indirect changes to the environment, such as degraded air quality, as well as climate-related impacts such as increased wildfires, storms, and floods have the potential to directly affect human health. Further, diminished opportunities for shellfish harvest (see ocean acidification above) lessen physical activity and require substitution with less healthful foods.

Key Areas of Concern

From this set of potential climate impacts, the project team and the climate committee identified key areas of concern. The team created summaries of how each area of concern will be impacted, why each impact is important to the Jamestown S'Klallam Tribe, and finally, potential adaptation measures for the Tribe to consider. The detailed summaries can be found at: http://www.jamestowntribe.org/programs/nrs/nrs_climchg.htm. Each area of concern reflects tribal community and tribal government priorities, and is described briefly below:

Jamestown S'Klallam pullers on the Canoe Journey to Quinault, 2013

Salmon: Salmon are a critical cultural, subsistence, and economic resource for the Tribe. Salmon enable tribal members to practice and retain their traditions and connection to their Usual and Accustomed areas, and fishing is a major source of physical activity. Salmon promote community health in a variety of ways.

Climate models show that significant areas of Jamestown S'Klallam traditional fishing territory may experience temperature increases that will be stressful for salmon in the near future. One particular concern is how rising water temperatures will interact with other stressors to impact salmon health. Adopting strategies that address non-climate stressors such as water pollution, urbanization near rivers, and diversion of river flow for irrigation, may help promote salmon health and increase the salmon's resiliency to climate impacts.

Clams and Oysters: Shellfish are an important source of revenue and food for tribal citizens. Additionally, gathering of inter-tidal shellfish is an easily accessible activity (e.g. it does not require the financial commitment of a boat) and an important source of exercise for the community.

Ocean acidification threatens the ability of shellfish to form shells, which leads to reduced shellfish health and increased mortality of larvae. Already, commercial oyster production in Washington has experienced intermittent failure linked to ocean upwell events, which bring CO_2 rich and more corrosive water closer to the surface. A scientific cruise through the Puget Sound that measured acidity and aragonite levels (which reflect the availability of the calcium carbonate that shellfish use to build their shells) found that the effects of ocean acidification are becoming apparent in Jamestown S'Klallam territory. Increased monitoring of pH (acidity) levels, and restoration and transplanting of shellfish populations may become necessary if ocean acidification renders portions of the shoreline inhospitable to young shellfish.

Shellfish Biotoxins: In addition to threats to shellfish health, changes to the climate may threaten human health via increasing rates of shellfish poisoning. Certain algal species produce compounds that are toxic to humans and can accumulate in shellfish. These Harmful Algal Blooms (HABs) are caused by a complex interaction of environmental factors, which are poorly understood. However, increases to ocean temperatures have been linked to rises in the incidence of HABs. In the Puget Sound region, increased ocean temperatures are projected to significantly increase the period of time during which HABs may occur. Paralytic Shellfish Poisoning (PSP) is an especially worrisome biotoxin in the Northwest. In 2011, PSP outbreaks caused a shortened geoduck season. Continued or increased shellfish harvest closures would further stress the Jamestown S'Klallam Tribe economically, nutritionally, and culturally. In response to these concerns about biotoxins, the Tribe is considering how to implement improved monitoring and awareness programs.

Jamestown S'Klallam Tribal Center

Wildfires: Wildfires may have negative impacts on both human and environmental health for the Jamestown S'Klallam community. The increasing severity and frequency of wildfires associated with climate change not only threaten the stability of forest ecosystems that the Tribe relies upon, but also poses a threat to infrastructure. Because much of Jamestown S'Klallam land is in the rain shadow of the Olympic Mountains—which is drier than other parts of coastal Washington— the Tribe may face a more significant risk from wildfire than other

coastal Washington peoples. Wildfires bring increased risks to homes and buildings on the urban-wildland interface and to respiratory health. Although air quality is not currently among the top health concerns for tribal citizens, increased wildfires may make respiratory problems a more prominent health concern in the future.

Cedar Health: Western Redcedar plays a wide variety of important roles for the Jamestown S'Klallam people, including being a traditional building material, canoe building material, and mode of artistic expression. As forests adapt to changing precipitation, warmer temperatures, increased and otherwise altered wildfire regimens, and drier summers, cedar may decline within Jamestown S'Klallam Usual and Accustomed gathering places. Jamestown S'Klallam cedar gatherers have already noticed that the optimal gathering time for harvesting cedar bark is moving earlier in the year. A potential adaptation measure is to monitor and aid trees in assisted migration by planting trees in areas that will be less susceptible to these changes or may soon change into ideal cedar habitat.

Tribal Businesses: The Tribe derives important revenue and provides jobs to tribal citizens and the larger community through both its 7 Cedars Casino and a local store, the Longhouse Market. Rising sea levels and increased flood risks may reduce the numbers of tourists supporting these tribal businesses, which would also threaten the financial stability of both the Tribe and its people.

Highway 101: This highway is the major connection between the Jamestown S'Klallam community and other communities. Several points on Highway 101 are vulnerable to sea level rise and storm events. If Highway 101 is flooded or temporarily closed, tribal citizens, and in particular Tribal Elders, may be temporarily unable to receive assistance or medical attention. The Tribe is considering outreach measures for the community to help with disaster-preparedness, and the research team recommended working with the state to anticipate, prepare for, and mitigate potential impacts to Highway 101.

Tribal Campus: The Tribe's natural resources lab and planning department buildings may be threatened by sea level rise or storm surges in the near future. Within the next 20 years, these buildings will require replacement or significant repairs unrelated to climate impacts. Considering sea level rise and storm surge in these renovations and/or future relocation will help ensure that the tribal campus is able to continue serving the community in the future.

Jamestown S'Klallam Tribal Center

Water Supplies and Wastewater: The plan identifies two water sources as key areas of concern: the Jamestown Beach well, which supplies water to several tribal homes, and the well that supplies water to the tribal campus. Decreased summer rainfall and rapid snow pack melt may alter the reliability of these wells in the future. There is an effort to diversify water supplies of the tribal campus, including the potential installation of a rainwater filtration system. The Jamestown Beach well, on the other hand, is exceedingly old and needs to be replaced. When retrofitting or replacing this well, sea level rise must be considered, as saltwater intrusion could render the well non-potable. While climate impacts affecting tribal water sources are a concern for the Jamestown S'Klallam

community, the impacts are not as immediate as those facing other key areas of concern and there are clear adaptation options such as relocating the wells. Because of this, tribal citizens and the project team identified these areas as a medium priority for action. Wastewater tanks on the tribal campus are also a concern. During a major storm event, there is a risk that the wastewater treatment infrastructure could be damaged, creating a threat to human health. In response, the project team proposed that when these wastewater tanks are replaced, they be sited above or beyond the projected storm surge zones.

Moving Forward

In addition to laying the groundwork for future adaptation strategies, the Jamestown S'Klallam Tribe developed a four-step plan to help guide their climate adaptation efforts in the future:

1. Prioritize adaptation strategies for implementation and identify responsible parties for implementation;
2. Build community support for climate preparedness;
3. Incorporate climate preparedness into Tribal Government operations and policies;
4. Collaborate with surrounding communities, the county, and other stakeholders to monitor key changes to local and regional climate that are likely to affect the Tribe.

The plan states that *"preparing for, or adapting to, the impacts of climate change is not an outcome, but a process."* Bearing this in mind, the Jamestown S'Klallam Tribe is taking actions that will help create a positive process of adaptation for their community.

Resources

- Adaptation International: http://adaptationinternational.com
- Jamestown S'Klallam Tribe: http://www.jamestowntribe.org/
- Jamestown S'Klallam Tribe. 2013. *Climate Vulnerability Assessment and Adaptation Plan*. Petersen, S., Bell, J., (eds.) A collaboration of the Jamestown S'Klallam Tribe and Adaptation International. http://www.jamestowntribe.org/programs/nrs/nrs_climchg.htm
- U.S. Environmental Protection Agency, Indian Environmental General Assistance Program: http://yosemite.epa.gov/r10/tribal.nsf/grants/igap
- Washington Sea Grant: http://wsg.washington.edu/

For more information, please contact:

Byron Rot, Habitat Program Manager, Jamestown S'Klallam Tribe, brot@jamestowntribe.org
Hansi Hals, Environmental Planning Manager, Jamestown S'Klallam Tribe hhals@jamestowntribe.org
Sascha Petersen, Executive Director, Adaptation International, sascha@adaptationinternational.com,
Ian Miller, Coastal Hazards Specialist, Washington Sea Grant, immiller@u.washington.edu

Photographs in this profile were provided by the Jamestown S'Klallam Tribe and Adaptation International.

Tribal Climate Change Profile Project:

The University of Oregon Environmental Studies Program and the USDA Forest Service Pacific Northwest Research Station are developing tribal climate change project profiles as a pathway to increasing knowledge among tribal and non-tribal organizations interested in learning about climate change mitigation and adaptation efforts. Each profile is intended to illustrate innovative approaches to addressing climate change challenges and will describe the successes and lessons learned associated with planning and implementation. For more information about the PNW Tribal Climate Change Project, contact Kathy Lynn at kathy@uoregon.edu, or visit http://tribalclimate.uoregon.edu/.

Carson Viles, a University of Oregon undergraduate research assistant with the Project, is coordinating development of these profiles. Carson is an enrolled member of the Confederated Tribes of Siletz Indians. He is in the Clark Honors College and is pursuing a degree in Environmental Studies. Carson can be contacted at cviles@uoregon.edu.

Special thanks to Hansi Hals and Byron Rot with the Jamestown S'Klallam Tribe, Sascha Petersen, Adaptation International, and Ian Miller, Washington Sea Grant, for their assistance in developing this profile.