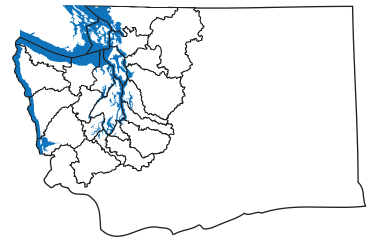
2012 State of Our Watersheds Report



WRIAs 1-23

Hoh Tribe
Jamestown S'Klallam Tribe
Lower Elwha Klallam Tribe
Lummi Nation
Makah Nation
Muckleshoot Tribe
Nisqually Indian Tribe
Nooksack Tribe
Port Gamble S'Klallam Tribe
Puyallup Tribe of Indians
Quileute Indian Tribe
Quinault Indian Nation
Sauk-Suiattle Tribe
Skokomish Tribe
Squaxin Island Tribe
Stillaguamish Tribe
Suquamish Tribe
Swinomish Tribe
Tulalip Tribes
Upper Skagit Tribe

SSHIAP
Salmon and Steelhead Habitat Inventory and Assessment Program

Northwest Indian Fisheries Commission
nwifc.org

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August 2012

Dear Reader:

We, as tribal people, call each of these watersheds home. Our lives, stories and cultures are shaped by these places and in turn these places have been shaped by us. As the first people of this region, tribes have lived on these rivers, shorelines and marine waters for thousands of years, fishing, hunting and serving as stewards of our homelands. Today, we share our homelands and natural resources with over five million people, and in the next 20 years there will likely be an additional million more that come to call western Washington their home.

Though times have changed, our lives, cultures and economies still depend on these lands, waters and resources. So important are those connections that our treaties with the United States include reserved rights to hunt and fish. Now, the commitment of those treaties is not being upheld and these reserved rights are at serious risk of being lost due to the loss and degraded nature of the habitat on which our treaty resources depend. No matter how well we manage the harvest of our fish, if there is no habitat to sustain the salmon, the treat right is lost. We are strong advocates for fish and wildlife because these treaty resources and lifeways are so dear to our tribes. However, protecting and recovering these resources requires that all of us, together, create and institute meaningful change in how we live and work here in the Pacific Northwest.

As tribal people we have told stories for a long time, and we have to keep telling our stories. The stories enclosed in this State of Our Watersheds report (SOW) are important, because they tell the stories of all of us. They document the story of environmental change resulting from increased population growth, polluted stormwater runoff, climate change, urban growth, and the diking, filling and armoring of our rivers, estuaries and shorelines. These factors have, over time, led to a transformation of the landscape that degrades the ecosystem functions necessary to provide the clear, cool, free-flowing water that salmon need.

The chapters in this report are individual "stories" compiled by each tribe describing the loss of habitat in their watersheds. The chapters do not represent the tribes' only problems or areas of interest. Instead they are intended to utilize a wide range of science and data to create a specific and representative mark in time constructing an accurate measuring stick to document the trends of salmon habitat. This way, we will know where we are making progress, where we continue to lose ground, and where we need to target our efforts.

As part of the five year review of our region's salmon recovery plans, a National Oceanic and Atmospheric Administration (NOAA) report acknowledged that habitat loss is a continuing trend, directly affecting the productivity of salmon. NOAA further acknowledged that while management of the harvest and hatchery processes are working well, management of habitat is failing.

This SOW report provides quantitative reinforcement to those NOAA findings. And as the SOW illustrates, the unfortunate truth is we are losing the battle – we are losing habitat faster than we can restore it. This report shows that all across the region there is a trend of diminishing shoreline habitat, increasing degraded riparian conditions, and decreasing water quality and quantity. We are at a crossroads. Now, more than ever, it is time to focus, refine, and align our efforts to change this course.

It is my hope that this report marks the beginning of changing that course. As this report is updated in the future, it will capture our successes and failures. In the meantime, status quo efforts will not accomplish the change necessary. We need to take approaches that go beyond volunteerism, and begin to take more regulatory and enforcement measures. Although restoration efforts are important, they cannot successfully lead us to recovery unless we also bring a halt to continued habitat degradation and loss.

This report supports our "Treaty Rights at Risk" initiative begun in 2011. "Treaty Rights at Risk" is a tribal call to action; it is a call for leadership from the top down and the watershed up to align efforts and commitment to the cause of protecting and restoring the environmental integrity of our homelands. SOW is intended to help set priorities for action and evaluate the effectiveness of our efforts. Those that want to join us in this journey are welcome to come along – those who don't need to step aside.

I have been doing this work for a lifetime. I have watched changes in the land and resources – some good, some bad. We need to *tell the truth*, and do what it takes to protect the resources on which we all depend. In this report, the images, maps, and the data do tell the truth. And the truth is we are losing our region's precious salmon resource…we need to act now.

Salmon recovery is about us. All of us. And it's going to take all of us and all we can do to make it happen.

Sincerely,

Billy Frank Jr.

Billy Frank Jr.,
Chairman

Our Thanks & Acknowledgements to the following Groups and Individuals

We would like to thank and acknowledge the participants who took time out of their regular schedules to meet with the SSHIAP staff and to review drafts to complete this report. Their tireless work and devotion to the Northwest Tribes and to this report shows in the final product. The following individuals are especially recognized (Commissioners in blue, project leads in red):

Hoh Tribe (David Hudson Sr., Steve Allison, Bob Howell, Warren Scarlett)
Jamestown S'Klallam (Scott Chitwood, Hansi Hans, Byron Rot, Randy Johnson)
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Lummi (Elden Hillaire, Merle Jefferson, Jeremy Freimund, LeRoy Deardorff, Gerry Gabrisch, Victor "Turtle" Johnson, Ben Starkhouse, Randy Kinley Sr., Alan Chapman, Jill Komoto, Diana Bob)
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Muckleshoot (Leo LeClair Jr., Holly Coccoli, Isabel Tinoco, Eric Warner, Glen St Amant, Paul Hage, Martin Fox, Karen Walter)
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Quinault (Ed Johnstone, Dave Bingaman, Larry Gilbertson, Mark Mobbs, Jim Jorgensen, Nicole Rasmussen, Tyler Jurasin, Tony Hartrich, Tom Gibbons)
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Tulalip (Terry Williams, Daryl Williams, Kit Rawson, Abby Hook, Kurt Nelson, Libby Nelson, Maria Calvi, Todd Zackey, Mike McHugh, Darla Boyer)
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The State of Our Watersheds

Executive Summary

The treaty tribes have always lived throughout the watersheds in western Washington and are leaders in the region's salmon recovery effort. No other people know these watersheds as well as the tribes and none has a greater stake in their future. The tribes believe that if salmon are to survive, we must begin to achieve real gains in habitat protection and restoration.

The treaty Indian tribes believe that salmon recovery must be focused on the watersheds where salmon begin and end their lives, and that the quality and quantity of habitat in those waters are the primary limiting factors to salmon recovery.

The State of Our Watersheds report examines key indicators of habitat quality and quantity across more than 20 watersheds in western Washington that lie within tribal Usual and Accustomed fishing areas as defined by *U.S. vs. Washington* (Boldt decision). The 1974 ruling upheld tribal treaty-reserved rights, including the right to half of the harvestable salmon returning to Washington waters every year, and established the tribes as co-managers of the salmon resource.

The goal of the State of Our Watersheds report is to provide tribes with a basic assessment of the health of their watersheds and to gauge progress toward salmon recovery. This report is part of the Treaty Rights at Risk initiative begun by the tribes in 2011 as a call to action for the federal government to exercise its trust responsibility to the tribes and lead a more coordinated and effective salmon recovery effort. More information is available at www.treatyrightsatrisk.org.

For this report, tribes focused on those portions of their watersheds of greatest concern because of habitat loss and degradation. It is important to note that the State of Our Watersheds is a living document that will be updated as new data become available, providing both a metric for assessing changes in salmon habitat and a method for monitoring those changes. The report also will be used to quantify the 10-year review of the region's salmon recovery plan.

Principle Findings:

- *Degradation Outpaces Estuary Restoration*

Estuaries in western Washington are losing functional habitat because of population increases in lower portions of watersheds. For example, in the Suquamish Tribe's area of concern there has been a 39% loss of vegetated estuarine wetland area and a 23% loss of natural shoreline habitats, particularly small "pocket" estuaries. Moreover, there are now 18 miles of bulkheads, fill and docks armoring the shoreline and degrading nearshore salmon habitat. In the Stillaguamish watershed, the sustained loss of approximately 75% of salt marsh habitat is being investigated as a major factor limiting the size of chinook populations.

- *Degraded Nearshore Habitat Unable to Support Forage Fish*

Nearshore areas provide critical rearing and forage fish for salmon. In the Port Gamble Tribe's focus area, according to studies since the 1970s, herring stocks have decreased from a status of healthy to depressed. In Port Gamble and Quilcene bays, which contain two of the largest herring stocks in Puget

Sound, approximately 51% of spawning areas inventoried by Port Gamble Tribe have been either modified or armored.

- *Freshwater Shoreline Armoring Continues Unabated*

Shoreline armoring contributes to river channel degradation by impeding natural bank erosion and river meandering, and disconnecting terrestrial and aquatic ecosystems, directly impacting salmon habitat. Young juvenile chinook have been shown to use river banks modified with riprap at densities five times lower than natural banks (SRSC; WDFW, 2005; Beamer and Henderson, 1998). The Skagit River Chinook Recovery Plan recommends no new construction of riprap without mitigation, however, since 1998 at least 1 mile has been added to the existing 14 miles of riprap shoreline along the middle Skagit River. This evidence suggests that there has actually been an increase in modified shoreline during the first five years of implementing the Skagit Chinook Recovery Plan.

- *Forest Cover Disappearing*

Timber harvest has removed vast amounts of forest cover throughout all of the watersheds. The rapid removal of forest in the watersheds can have dynamic affects on the stability of watersheds and the overall quality of salmon habitat. Large clearcuts, inadequate stream buffers and poorly maintained forest roads have all led to degraded salmon habitat. Forest cover continues to trend negatively and some lowland watershed areas are severely damaged. For example, excluding federal lands, the Makah area of concern saw an 18% decrease in forest cover from 1996 to 2006. The salmon recovery plan for the Stillaguamish watershed recommends that 80% of forest cover be mature forest in 14 forest-dominated subbasins (SIRC 2005). However, of the 14 sub-basins only two are more than 80% mature forest.

- *Streams Lack Large Woody Debris*

Large woody debris plays an important role in channel stability, habitat diversity and overall habitat quantity and quality. Unfortunately, the potential to restore large woody debris to improve salmon habitat is often restricted by land management approaches and policies. For example, in the Lummi Nation's area of concern, only 1% of the Nooksack watershed is meeting the recovery thresholds for abundance of instream wood. Similarly, estimates of large woody debris in the Green and Cedar rivers are 89% to 95% below the levels necessary for "properly functioning conditions" for salmon habitat.

- *Riparian Forests Not Recovering*

Riparian forests are an essential component of healthy fish habitat, providing shade, temperature regulation, streambank stability and food supply. However, riparian buffers along most fish-bearing streams lack necessary vegetation because of poor protection and proper management. For example, in the Stillaguamish, only 23% of the 1,777 acres of riparian area within the floodplain currently have any forest cover. In the Snohomish River basin, the Salmon Conservation Plan recommends that 150-foot buffers on both sides of fish-bearing streams be at least 65% forested. In 2006 those buffers were just 41% forested, with no gain since 1992 and little increase since that time.

- *Alarming Number of Stream Crossings, High Road Densities*

The number of roads crossing streams can greatly affect the health of salmon habitat in lowland watersheds. Projected population growth and associated land conversions will continue to push the need for more roads and stream crossings throughout the lower portions of the watersheds. Road densities impacting habitat are found in most tribal areas of concern. For example, a vast majority of watershed

units in the Chehalis basin have road densities that exceed 3 miles of road per square mile of area, the level at which streams cease to function properly. In the upper Nooksack there are more than 1,376 miles of forest roads. Road densities exceed 2 miles of road length per 1 square mile of watershed area in more than 65% of the upper Nooksack's watershed. In the Sauk River watershed there are 518 miles of U. S. Forest Service Roads. As of 2011 only 28% (147 miles) of these roads have received necessary drainage upgrades.

- *Fish Barriers Cut Off Vast Amounts of Habitat*

Salmon cannot successfully reproduce if they do not have access to spawning habitat. Despite extensive restoration efforts, many fish passage barriers, such as culverts, tide gates and levees still block salmon from accessing many stream miles of habitat. In the Quileute management area, barrier culverts fully or partially block over 168 miles of stream habitat. Most of these culverts are located on private forestlands. Barrier culverts in the Chehalis basin block or impede salmon access to over 1,500 miles of habitat.

- *Agricultural Lands Remain Degraded*

Two key limiting factors in chinook recovery are human modifications to floodplains and the loss of freshwater wetlands. Agricultural practices have played a significant role in contributing to these limiting factors, by removing trees, diking, and draining. These actions have resulted in a loss of stream channels, wetlands, stream buffers, increased sediment, and pollution in the form of runoff from agricultural activities. In 1880 the Nooksack basin contained 4,754 acres of wetland to 741 acres of stream channel. By 1938, nearly 4,500 acres (95%) of off-channel wetland area had been cleared, drained and converted to agriculture. As of 1998, the lower mainstem retained less than 10% of its historical wetlands. As of 2006, riparian areas of the Skagit River delta region are 83% impaired. Of that amount only 12% are developed; the remaining 71% of impaired lands support crops and pasture.

- *Sensitive Floodplains Being Overdeveloped*

Floodplains are sensitive lands essential to maintaining hydrologic function of streams, while also providing off-channel salmon habitat. Flood management of overdeveloped floodplains often results in diking and armoring streams, which alters both stream flows and physical habitat. Despite their sensitivity and key role in salmon survival, floodplains face a continual onslaught of development pressures. In the Lower Elwha Tribe's Area of Concern, the Morse Creek floodplain has been seriously impaired with 37% of the area being zoned for development from utility right of ways to single-family homes. Downstream of Highway 101, nearly half of the floodplain has also been zoned for similar development.

- *Rapidly Increasing Permit-Exempt Wells Threaten Water For Fish*

The state of Washington provides a water right permit exemption to property owners not served by a community water system that allows users to pump up to 5,000 gallons of groundwater per day. When more water is extracted from an aquifer than is being recharged, aquifer volume is reduced and the natural outflow from the aquifer decreases. This reduces the amount of fresh water available to lakes, wetlands, streams and the Puget Sound nearshore, which can harm salmon at all stages of their life cycle.

Since 1980, there has been an 81% increase in the number of new wells being drilled per 100 new Puget Sound residents moving into the area. The number of exempt wells in the Skagit and Samish watersheds since 1980 has increased by 611% from an estimated 1,080 exempt wells to approximately 7,232.

Conclusion

The pages of the State of Our Watersheds report are filled with examples of a single, repeating trend: key habitat attributes, such as streamside vegetation, habitat connectivity and stream flows are imperiled by human activities. This extensive loss and degradation of habitat threatens both salmon and tribal cultures and treaty-reserved rights. The principle findings in this report illustrate this alarming trend, but it is ultimately the realities contained in each tribe's watershed review that provide the most accurate depiction of habitat.

As sovereign nations, 20 Indian tribes signed treaties with the United States, ceding most of the land that is now western Washington, but reserving rights to harvest salmon and other natural resources. Today those fishing rights are being rendered meaningless because the federal and state governments are allowing salmon habitat to be damaged and destroyed faster than it can be restored. Tribal harvest has been reduced to levels not seen since before the 1974 *U.S. v. Washington* ruling that reaffirmed tribal treaty-reserved rights and status as co-managers with the right to half of the harvestable salmon returning to Washington waters. As the salmon disappear, tribal cultures, communities and economies are threatened as never before. Some tribes have lost even the most basic ceremonial and subsistence fisheries that are a foundation of tribal life.

The State of Our Watersheds report is a tool to assess, address and monitor progress on protecting and enhancing salmon habitat throughout western Washington. The report also serves as a bellwether – both an indicator and warning – that the tide of habitat loss and degradation must be turned if we are to restore the salmon resource. If we do not, we will continue down the path we are now on, which leads to the extinction of salmon and the loss of tribal treaty-reserved rights, economies and cultures. This vision of the future is unacceptable to the treaty Indian tribes in western Washington.

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2012 State of Our Watersheds Report

Introduction

The State of Our Watersheds report documents how ongoing loss and damage of salmon habitat across western Washington is fueling the loss of salmon populations and threatening tribal cultures and treaty-reserved fishing rights.

Despite deep harvest cuts, strategic use of hatcheries and a huge financial investment in habitat restoration over the past four decades, wild salmon populations continue to decline across western Washington. The reason is that we are losing salmon habitat faster then we can restore it. As this report confirms, this trend shows little sign of improvement.

The 20 treaty Indian tribes in western Washington created this report to help gauge progress toward salmon recovery and guide future habitat restoration and protection efforts. It is a living document that will be updated as new data become available, providing both a metric for assessing changes in salmon habitat and a method for monitoring those changes.

The State of Our Watersheds depicts an alarming trend of habitat loss. By closely examining tribal areas of concern, the tribes are able to capture the current state of habitat, and document changes over time.

The tribes are committed to the principle that the key to salmon recovery and sustainability is the preservation and enhancement of aquatic habitat. Our desired outcome for this report is to bring to light the management decisions that are being made to protect salmon and steelhead habitat and those being imposed on the tribes' treaty-protected hunting, gathering and fishing rights.

This report describes the loss of habitat by examining habitat attributes identified by each tribe in their area of concern. It utilizes an array of data and sources including the tribe’s own data, Salmon and Steelhead Habitat Inventory and Assessment Program's data, and data from the state of Washington and federal government. Ultimately, the report brings together decades of data and the tribal perspective to provide a view of watersheds across western Washington, as well as recommendations to protect and enhance those watersheds and the salmon they produce.

A Prognosis of the Progress of Salmon Recovery: *Treaty Rights At Risk*

According to the 2007 Puget Sound Chinook Salmon Recovery Plan developed by the state and tribal salmon co-managers and adopted by the National Marine Fisheries Service (NMFS), protecting existing habitat is the most important action needed in the short term. Despite this commitment, NMFS’ 2010 assessment of the chinook recovery plan declared that the degradation of habitat continues and protection efforts need improvement. The NMFS report revealed extensive habitat losses across key indicators such as intertidal wetlands and forest cover.

The NMFS assessment of the Puget Sound Chinook Recovery Plan indicates that responsible harvest management is doing its share to support salmon recovery. NMFS also concedes that salmon populations in many watersheds cannot recover even if harvest were eliminated completely. Yet, while harvest is accountable for recovery, habitat degradation continues steadily, destroying the salmon resource and along with it, the cultures and communities of the treaty Indian tribes in western Washington.

In response, the treaty Indian tribes in western Washington began the *Treaty Rights at Risk* initiative www.treatyrightsatrisk.org in 2011 to encourage the federal government to fulfill its treaty trust responsibility to the tribes and its duty to recover salmon by leading a more coordinated salmon recovery effort. This report continues to deliver that important message: we must protect, preserve and recover habitat if we are to successfully restore the salmon resource.

Copies of this report can be viewed online and are available on CD through the Northwest Indian Fisheries Commission website at www.nwifc.org.

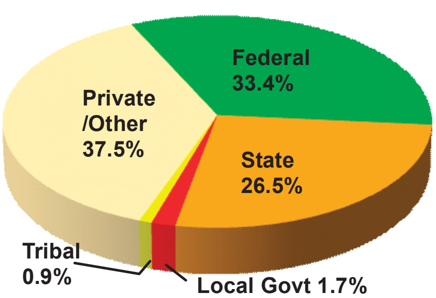
Puget Sound Regional Report

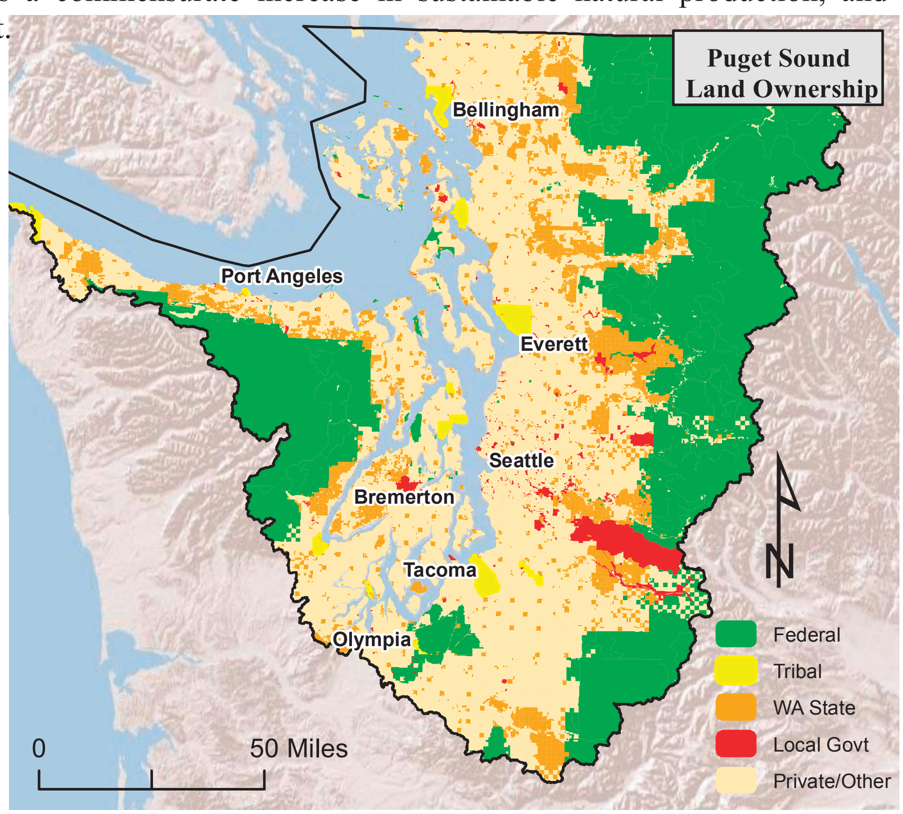
The Puget Sound Region (PSR) includes the second largest estuary in the United States covering approximately 16,577 square miles, consisting of a complex estuarine system of interconnected marine waterways and basins. The PSR has over 20 major river systems, from the Nooksack River along the Canadian border southwest to the Elwha River along the Strait of Juan de Fuca. Some of these watersheds originate in the steep high-elevation headwaters of the Cascade and Olympic Mountains with an elevation of over 14,000 feet at the glaciers of Mount Rainier. Rainfall ranges from about 16 inches annually at Sequim, Washington to over 100 inches at Mount Rainier.

The PSR is the traditional home to 19 federally recognized tribes, who have harvested and managed the natural resources of Puget Sound since time immemorial. Euro-Americans began settling the area in the 1850s primarily for the logging resources, along with opportunities in farming and mining. Lowland land clearing for agriculture began in earnest by the 1890s. By the early 1900s, denudation of the forested low-land areas was complete and nearly all of the lower portions of the basins were converted from forest production. Historically and presently, land-use has been dominated by physical geography. The foothills and mountains are mainly used for wood products and outdoor recreation. The lowlands are primarily used for agriculture and rural residential development. Most of the urban and industrial land use is concentrated near the deltas.

The PSR is home to two-thirds of the state's population, with a projected population increase of six million by 2026. The following pages look at the impacts of growth, its effects on the landscape and salmonids. Conditions such as increased impervious surface area, exempt well increases, forest cover loss, diminished riparian forest, culvert barriers, and nearshore habitat impairment all negatively affect healthy natural salmonid production. Sustainable natural salmonid production cannot increase unless the quality and quantity of habitat is increased. Natural production lost to habitat degradation and blocked passage must be mitigated by hatchery production to provide an opportunity for the tribes to exercise their treaty right to harvest salmon. Hatchery production mitigating lost natural production cannot be reduced unless there is a commensurate increase in sustainable natural production, and habitat recovery is required for that.

The Puget Sound Region is home to eight different anadromous salmonid species, pink, chum, Chinook, coho, sockeye, steelhead trout, bull-trout and cutthroat trout. Chinook, Hood Canal summer chum, steelhead trout and bull trout are all listed as threatened species under the Endangered Species Act and have Salmonid Recovery Plans targeting their recovery needs.





Increased Effective Impervious Surface

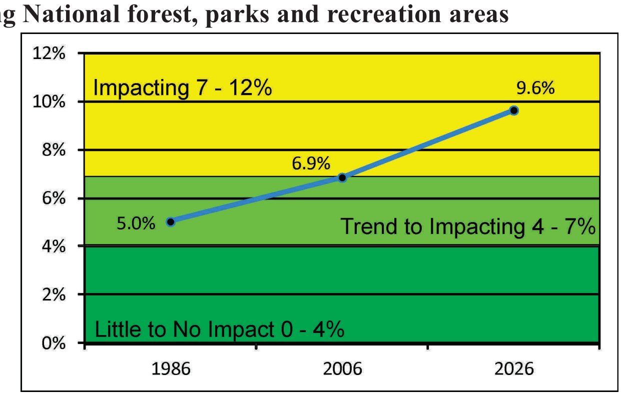
Outside of the federal park, forest service and recreation lands, the Puget Sound area impervious surface increased by 35% from 1986 to 2006. It is projected that by 2026, the impervious surface will increase another 41%, moving this area from an Impacting to Degrading category. The Puget Sound Salmon Recovery Plan (2007) lists "Minimize impervious surfaces" as a key strategy for protecting habitat.

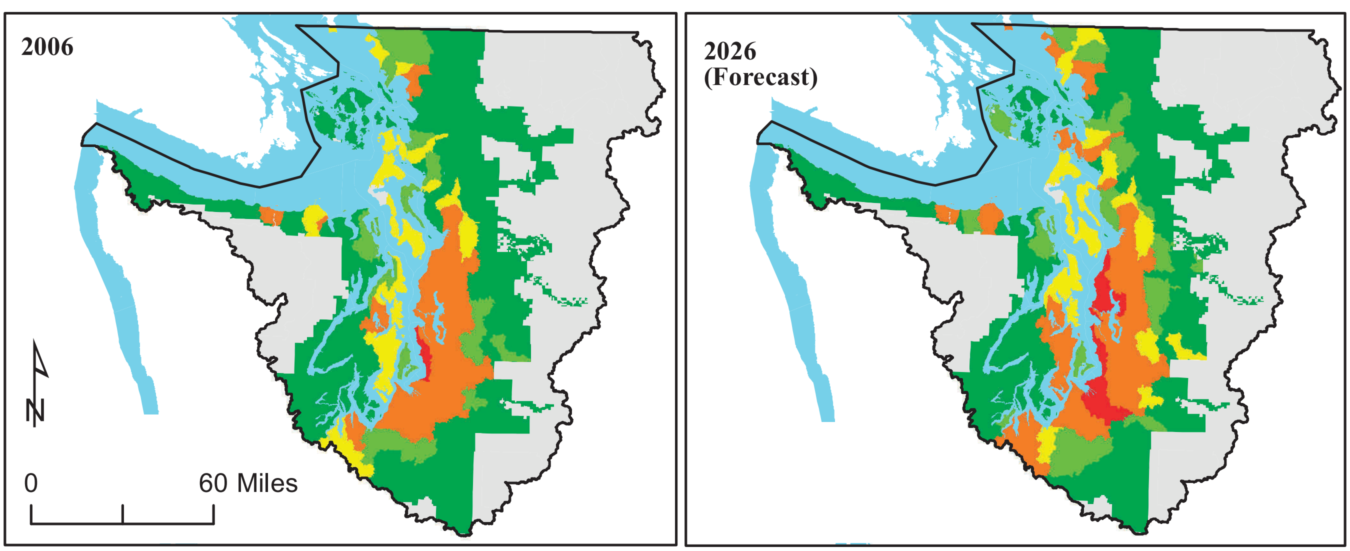
Impervious surface causes increases in stream temperatures; decreases in stream biodiversity, as evidenced by reduced numbers of insect and fish species; and contributes to pollutants in stormwater runoff, which can contaminate local aquatic systems (Schueler, 2003). As the population continues to increase, so will the impervious surface area, causing a disruption of both the ground and surface water ecologies. This disruption will negatively impact both the freshwater and marine ecosystems dependent upon the proper function of the hydrologic cycle. Currently, the Puget Sound area has a mean level of impervious surface to raise it to a "**Trend to impacting**" condition, and when considering the future population growth the area is projected to move to an "**Impacting**" condition. Individual Watershed Administrative Units (WAU) already exceed the "**Trend to Impacting**" condition, with a third more to exceed by the year 2026. By then 30 WAUs are forecast to exceed "**Impacting**" condition. The Chinook Recovery Plan has leaned heavily on local planning, land use policies, and provisions contained in the local Watershed Plans to protect critical habitat. However, even with critical area ordinances, planned development areas outside of the designated Urban Growth Areas will contribute to the increases in impervious surface area.

Puget Sound Impervious Surface (1986 - 2026 forecast) excluding National forest, parks and recreation areas (Table & Chart)

Impervious Surface Categories	# of WAUs per Category		
	1986	2006	2026*
Little to no Impact 0-4%	181	168	155
Trend to Impacting 4-7%	17	18	20
Impacting 7-12%	12	15	16
Degrading 12-40%	11	19	26
Severely Damaged >40%	0	1	4

*Forecast based upon WA OFM Population Projection





Impervious Surface Categories
Little to no Impact
Trend to Impacting
Impacting
Degrading
Severely Damaged
Puget Sound Boundary
National Park/Forest/Rec Lands
Marine Waters

Sources: WSDOT NOAA CCAP 1986 & 2006, WAOFM

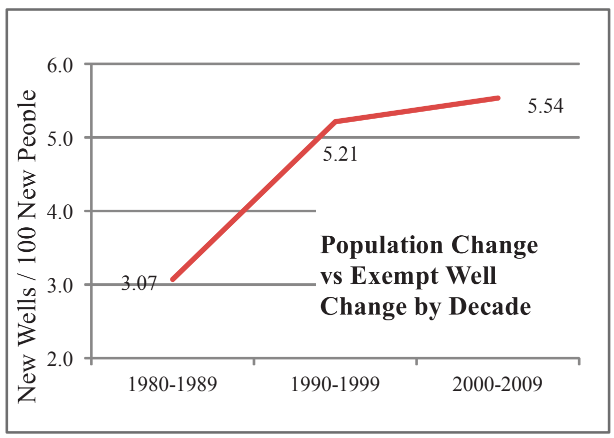
Permit-Exempt Wells in Puget Sound

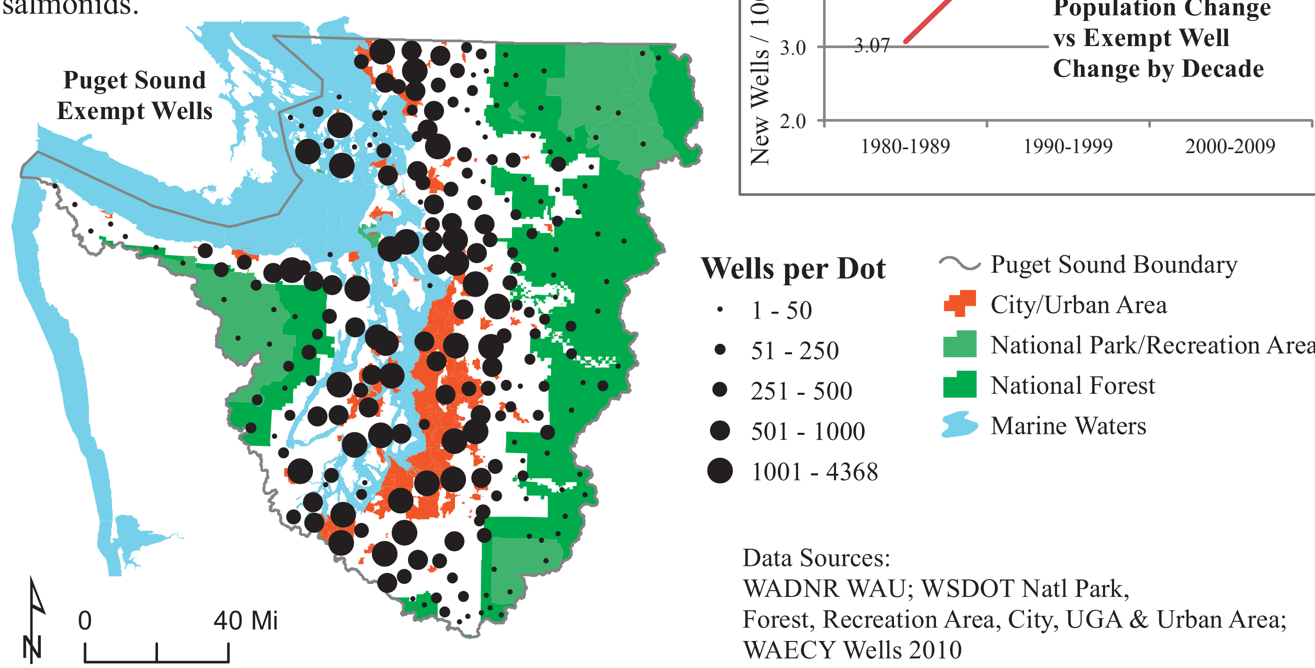
Since 1980, there has been an 81% increase in the number of new wells being drilled per 100 new Puget Sound residents moving into the area. This is an indication of a trend that as new population is added to the area, they are moving into the non-developed areas, causing the new for new wells to be drilled. Population growth leading to a high percentage of urban or rural-residential use is an identified concern in Puget Sound's Chinook Recovery Plan.

Population growth within the Puget Sound watershed, both in the past and in the near future, will have increased demands on groundwater resources. When the change in population is compared to the change in installed exempt wells, a statistical increase is observed in the relationship between the two values. For the decade beginning in 1980, a rate of 3.1 new wells were added for every 100 new people. By the decade beginning in 2000 the rate increased to 5.5 new wells per 100 new people. This trend indicates that as new population is added, an increasing number is developing land outside of areas of supplied water, and the drilling new wells without regard to aquifer sensitivity and stream recharge needs. Unchecked growth and its concomitant increase in groundwater demand will reduce aquifer volume with all its effects.

Water naturally discharges from aquifers at a rate which is controlled to a large extent by the amount of recharge. Natural outflow, from an aquifer, is discharged into lakes, wetlands and streams through springs and seeps on the surface of the land and through underwater springs to lakes, wetlands or seawater. Adequate natural outflow is essential for sustaining stream base flows, maintaining lake levels, providing fresh water inputs to the nearshore and preventing seawater intrusion.

When more water is extracted from an aquifer than is being recharged, aquifer volume is reduced and the natural outflow from the aquifer is decreased until the outflow and aquifer level balances with the input. This reduces the amount of fresh water available to lakes, wetlands, streams and the Puget Sound nearshore. Reduced lake/wetland levels and stream flows can have a negative impact on all stages of the salmonid life cycle. Reduced fresh water inputs to the shoreline and nearshore of Puget Sound can have a negative impact on shellfish and out-migrating juvenile salmonids.





Data Sources:
WADNR WAU; WSDOT Natl Park,
Forest, Recreation Area, City, UGA & Urban Area;
WAECY Wells 2010

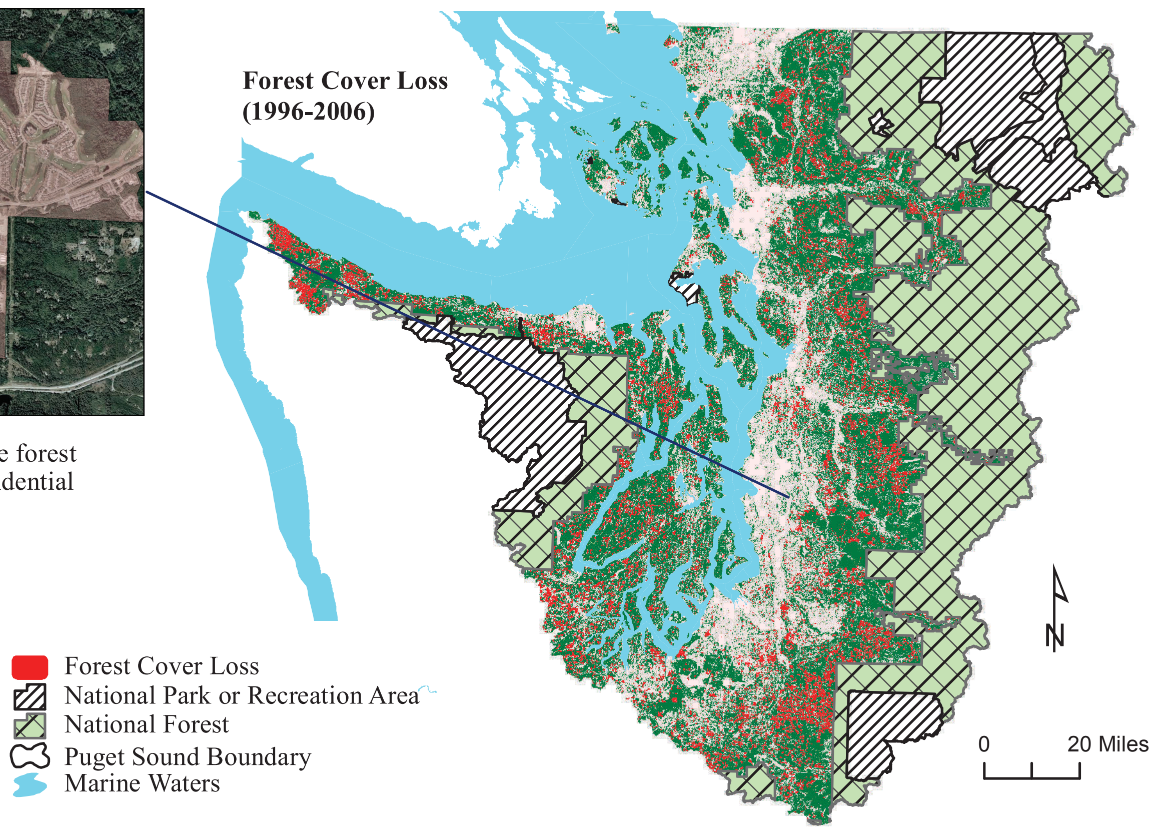
Forest Cover Loss Continues

About 8.6% of the forest cover was removed between 1996 and 2006 and the trend is to see more loss if protective actions are not taken. Minimizing forest cover removal to reduce long-term impacts is a "Key strategy for protecting habitat" component of the Puget Sound Salmon Recovery Plan (2007).

Within the Puget Sound Area (WRIAs 1 - 19) and outside of the National Park and Recreation areas, lies an area of approximately 11,950 square miles (excluding the marine waterways). In 1996, 66.7% of this area was forested, but due to timber harvesting and some land conversions, ten years later only 63.8% of the area is forested, representing a loss of 8.6% or 343 square miles of forest cover. 38.2% (or 131 square miles) of the forest cover lost is currently zoned for non-forestry uses, indicating the forest cover is not planned to be restored.

"From 1988-2004, Western Washington forest lands have declined by 25%, a loss of 936,000 acres of State and private forest land. These losses (meaning conversion to other uses), were the result of changes in market conditions for wood products, changes in land ownership, impacts from competing land uses and the health of timber stock. Recent research from the University of Washington indicates that nearly one million more acres of private forestland are threatened with conversion. Across all of Washington, the potential risk of conversion is highest in the Puget Sound region... This habitat loss is added to the existing background of land disturbance and development across Puget Sound. The numbers show a disturbing trend of continuing loss despite the State's adoption of some of the most aggressive land management tools in the Nation, including the Shoreline Management Act (SMA), Growth Management Act (GMA), Critical Areas Regulations (CAR) and the Forests and Fish Agreement, which led to changes in the Forest Practices Act to protect Salmon" (NMFS, 2011).

Snoqualmie Ridge forest cover loss for residential purposes



Sources: WADOT Park, Forest NOAA FF CCAP 1996 & 2006

Puget Sound Culvert Status

Puget Sound usable salmon habitat is a fraction of what it once was and our ability to recover the Puget Sound's salmon populations directly depends on the recovery of habitat. Over 47% of the surveyed culverts in Puget Sound are considered a passage barrier to salmon attempting to reach upstream habitat. Providing access to habitat is a key restoration priority in the 2007 Puget Sound Salmon Recovery Plan.

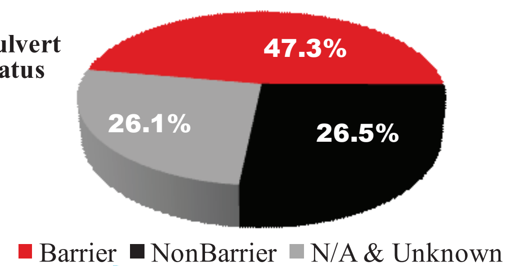
"The loss of rearing habitat quantity and quality is the primary factor affecting population performance and so processes and habitats that support this life stage are key restoration priorities" (PSSRP, 2007). "Access to habitat is critical for salmon and is often blocked by poorly designed culverts and other human-made structures" (PSSRP, 2007). "The amount of habitat that is usable by salmon is a fraction of what was once present in Puget Sound, and the ability of salmon to recover to sustainable and harvestable levels depends directly on an increase in the quantity of available habitat of sufficient quality" (PSSRP, 2007).

"In 2001, the United States and western Washington Tribes brought an action against the State of Washington for their failure to construct and maintain fish passage on state-owned culverts. In August 2007, Judge Martinez granted Summary Judgment to the United States and Tribes finding 'that the Treaties do impose a duty upon the State to refrain from building or maintaining culverts . . .' that block fish passage and thereby diminish the number of fish that would otherwise be available for Tribal harvest. The trial on the remedy was held in October 2009. Closing arguments were heard in June 2010 and we are currently awaiting a decision on the case from the District Court. [Note:] These data and figures do not correspond with the evidence that was developed in United States v. Washington, Culvert Case, 01-1. This information only reflects data from WRIA's 1-19 and does not distinguish significant blocking culverts or any updates in the database since the Culvert Case was heard before the court." (Hollowed)

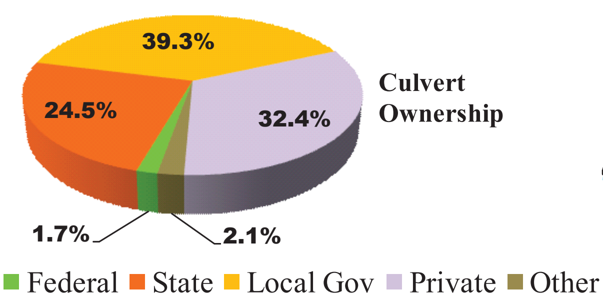
Culvert Inventory (Source: WDFW /WADNR 2010)

Owner	Barrier	NonBarrier	N/A & Unknown	Total
Federal	143	25	34	202
State	1160	621	1150	2931
Local Gov	1949	1280	1480	4709
Private	2250	1201	428	3879
Other	166	51	36	253
Total	5668	3178	3128	11974

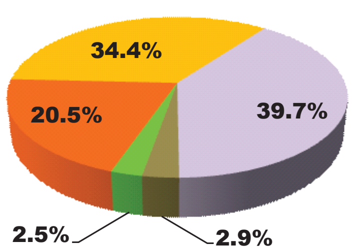
Culvert Status

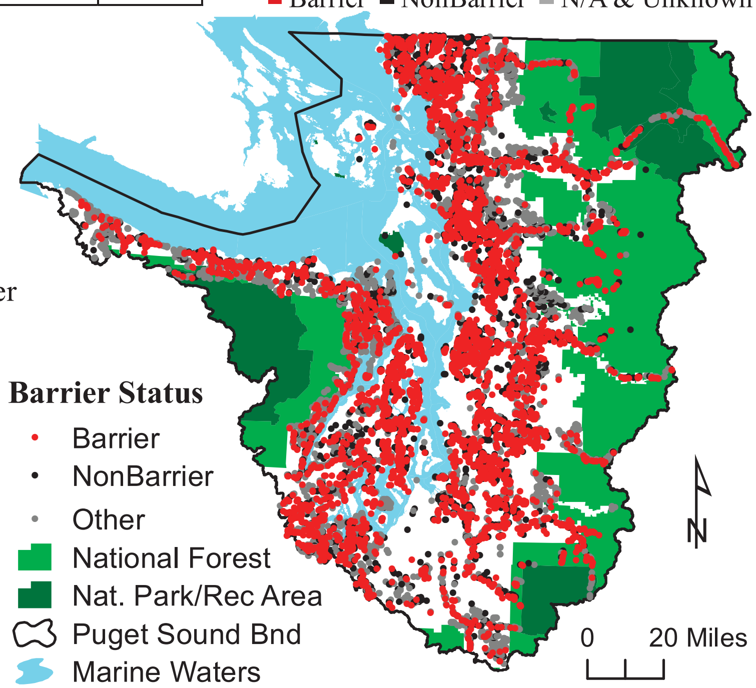


Culvert Ownership



Barrier Culvert Ownership





Sources:
WADNR Culvert,
WDFW FPDSI,
WSDOT NatPark, Rec Area, NatForest,
WAECY WRIA

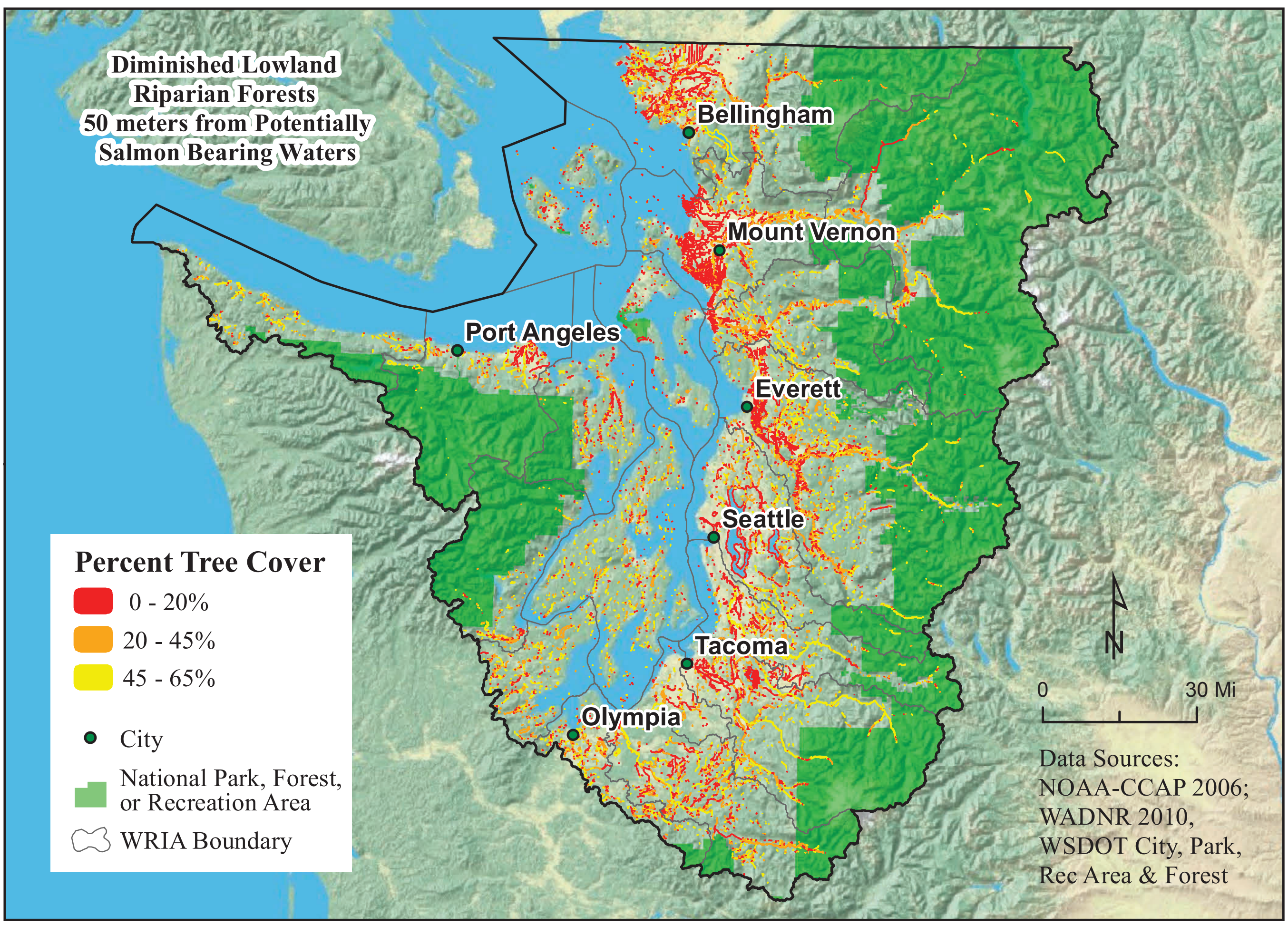
Diminished Riparian Forests

Diminished riparian forests in the lowlands of Western Washington continue to impair habitats critical to the recovery of the region's anadromous salmon. For most of Puget Sound in 2011, NMFS identified "Degraded Riparian Areas" as a limiting factor to the recovery of Chinook salmon.

"Since statehood in 1889, Washington has lost an estimated 70% of its estuarine wetlands, 50% of its riparian habitat, and 90% of its old-growth forest" (NMFS, 2011 Implementation Report). "Although focusing growth inside UGAs (Urban Growth Areas) is required by GMA (Growth Management Act), the protection of forest cover has not been met by existing regulatory tools. Growth pressures clear land in UGAs, even along riparian corridors and other areas important for salmon habitat" (NMFS, 2011 App A).

The Puget Sound area consists of 19 Watershed Resource Inventory Areas (WRIA) from the Canadian border and the Strait of Juan de Fuca to South Sound and Hood Canal. Of these 19 WRIAs, all have diminished riparian forest cover. NMFS identified fifteen with "Degraded riparian areas" as a limiting factor important for recovery in their 2011 Implementation Status Assessment Final Report. The remaining WRIAs were not listed because of a lack of Chinook salmon presence or other more pressing limiting factors, but all have diminished riparian habitat.

The diminished riparian function in all watersheds and marine shoreline results in decreased water quality, temperature regulation, cover, bank stability, LWD recruitment, sedimentation, detrital/nutrient input and impacts to other biotic and abiotic conditions for salmon and their supporting environment. Human population growth will continue throughout Puget Sound, however its concomitant effects in riparian areas must be mitigated/managed to ensure recovery of this vital salmonid habitat limiting factor.



Puget Sound Nearshore Impairment

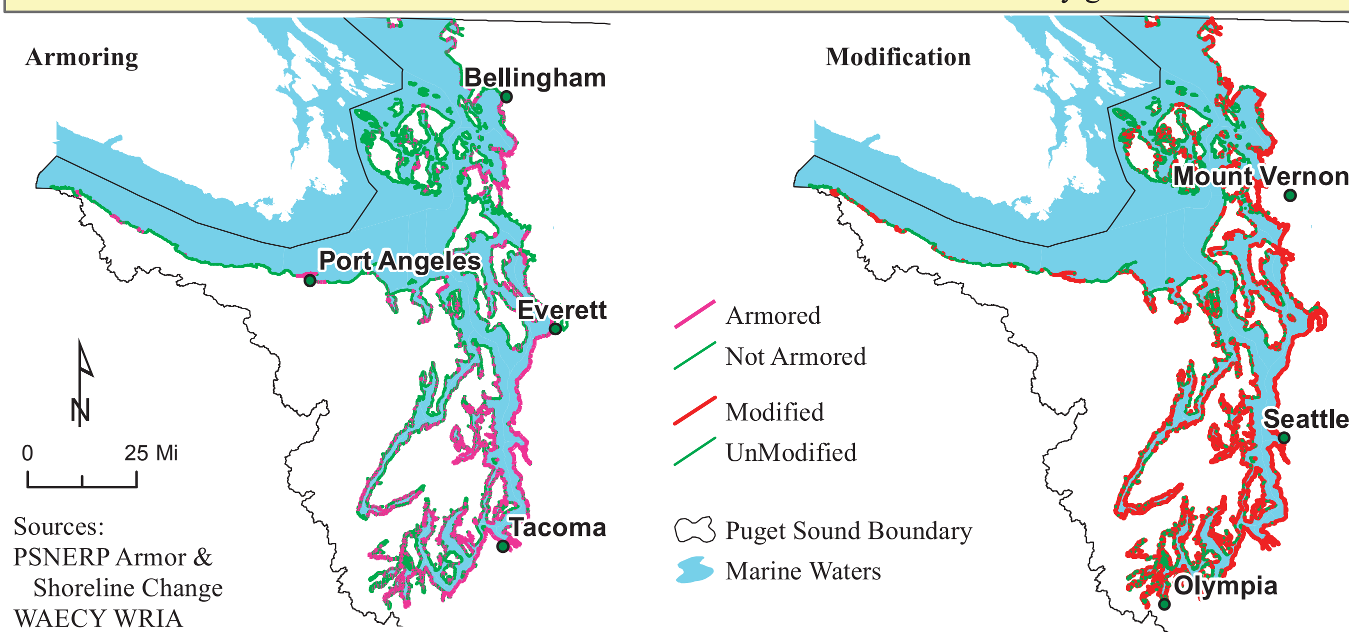
Forty Percent of Puget Sound shorelines have some type of shoreline modification stressor, with 27% of the shoreline armored. Of the 4,900 "Geographically Significant Units" identified within Puget Sound, 50% have some measure of shoreline armoring and 67% have some degree of modification. Protection and restoration of nearshore marine waters is a component of the Puget Sound Salmon Recovery Plan.

"Nearshore areas serve as the migratory pathway to ocean feeding areas. The vegetation, shade and insect production along river mouth deltas and protected shorelines help to provide food, cover and the regulation of temperatures in shallow channels. Forage fish spawn in large aggregations along protected shorelines, thus generating a base of prey for the migrating salmon fry. Salmon often utilize 'pocket estuaries'-small estuaries located at the mouths of streams and drainages, where freshwater input helps them to adjust to the change in salinity, insect production is high, and the shallow waters protect them from larger fish that may prey on them. As the juvenile salmon grow and adjust, they move out to more exposed shorelines such as eelgrass, kelp beds and rocky shorelines where they continue their migratory path to the ocean environment" (PSSRP, 2007).

"Armoring affects salmon by reducing prey density, increasing predation, and changing migration patterns that cause a decline in growth and lower survival rates" (PSNERP, 2006). "...The importance of insects as high-quality prey highlighted the terrestrial link to the marine feeding of Chinook salmon and suggests that shoreline development and land use changes will affect feeding opportunities for these fish in Puget Sound" (Duffy, 2010).

"Due to extensive development activities over the last century on many of the Puget Sound shorelines, many key nearshore processes have been significantly degraded or lost. Impairments to habitat forming processes on the shoreline include: reduced sediment input and transport, loss of riparian fringe habitat, reduced estuarine area and connectivity, filling over of upper intertidal beaches and degradation of water quality due to introduction of contaminants" (Nisqually, 2010).

"...analysis shows new bulkheads today are being built just as fast as they were a decade ago. In the past four years, the state Department of Fish and Wildlife has granted 456 permits for new bulkheads on Puget Sound. That doesn't include the old bulkheads people want to rebuild. The number it has rejected: zero" (Seattle Times, 2008). A modified nearshore habitat with diminished cover, reduced prey abundance and contaminated waters is harmful to achievement of salmon recovery goals.



Sources:
PSNERP Armor &
Shoreline Change
WAECY WRIA

Summary

The Puget Sound Region (PSR) is the second largest estuary in the United States covering about 16,577 square miles, which consists of a complex estuarine system of interconnected marine waterways and basins. The PSR has over 20 major river systems, from the Nooksack River along the Canadian border southwest to the Elwha River along the Strait of Juan de Fuca. These watersheds originate in the steep high-elevation headwaters of the Cascade and Olympic Mountains with an elevation of over 14,000 feet at the glaciers of Mount Rainier. Rainfall ranges from about 16 inches annually at Sequim, Washington to over 100 inches at Mount Rainier. The PSR is home to two-thirds of the state's population, with a projected population increase of six million by 2026.

The PSR is the traditional home to 19 federally recognized tribes, who have harvested and managed the natural resources of Puget Sound since time immemorial. The PSR's land ownership is almost divided equally into thirds between Private, Federal and State ownerships, with the 19 tribes owning less than 1%. The PSR is home to eight different anadromous fish species, pink salmon, chum salmon, Chinook salmon, coho salmon, sockeye salmon, steelhead trout, bull trout and cutthroat trout. Chinook, Hood Canal summer chum, steelhead and bull trout are all listed as a threatened species under the Endangered Species Act, and currently have Salmonid Recovery Plans targeting their recovery needs.

In the ten years between 1986 and 2006, the PSR's impervious surface area increased by 35% (not including federal and recreational lands). It is projected by 2026, the impervious surface area will increase another 41%, moving the PSR from an "Impacting" to "Degrading" category, even though the PSSRP states that the "minimization of impervious surfaces" is a key strategy for protecting habitat.

Since 1980, there has been an increase of 81% in the number of new wells being drilled per 100 new Puget Sound residents moving into the area. Population growth leading to a high percentage of urban or rural-residential use is an identified concern in PSSRP. During the 1980s, the rate of new wells being drilled was about 3.1 wells per every 100 new residents to Puget Sound. By 2000, this number increased to 5.5 new wells per 100 new people. This trend indicates that as new population settles in the PSR, an increasing number will develop land outside of areas of supplied water and drilling new wells, without regard to aquifer sensitivity and stream recharge needs.

Within the Puget Sound Area and outside of the National Park and Recreation Areas, lies an area of approximately 11,950 square miles (excluding the marine waterways). During the decade of 1996 to 2006, 8.6% of forest cover in this area was removed and the trend looking forward is to see more loss if protective actions are not taken. This 8.6% reduction in forest cover is equivalent to 343 square miles of forest cover and of this forest cover removed, 38% of the land is currently zoned for non-forestry uses, indicating a permanent forest cover loss.

Diminished riparian forest in the lowlands of western Washington continues to impair habitats critical to the recovery of the region's anadromous salmon. In 2011, NMFS identified "degraded riparian areas" as a limiting factor to the recovery of Chinook salmon for most of Puget Sound.

Since statehood in 1889, Washington state has lost an estimated 70% of its estuarine wetlands, 50% of its riparian habitat, and 90% of its old-growth forest (NMFS 2011).

Due to extensive development activities over the last century on many of the Puget Sound shorelines, key nearshore processes have been significantly degraded or lost. Forty percent of Puget Sound shorelines have some type of shoreline modification stressor, with 27% of the shoreline armored. Of the “Geographically Significant Units” identified within Puget Sound, 50% have some measure of shoreline armoring and 67% have some degree of modification.

<u>Puget Sound's high-quality salmon habitat is a fraction of what it once was and our ability to recover the PSR’s salmon population directly depends on the recovery of habitat.</u> One of the key man-made features on the landscape causing impact to salmon accessibility is culverts. Over 47% of the surveyed culverts in Puget Sound are considered a passage barrier to salmon attempting to reach upstream habitat. Another man-caused effect upon the landscape is interruption of hydrologic function. With the increase in peak flows *(from growing impervious surface area and forest cover loss)* and the decrease in ground water available to salmonid habitat *(from growing impervious surface area, forest cover loss and increase in permit-exempt wells)* the impaired hydrologic function is negatively impacting salmonids in both fresh and marine waters.

Hatchery programs will provide most of the tribes’ harvest opportunity for the foreseeable future. It is essential that these hatchery programs continue, consistent with U.S. v Washington. Natural production lost to habitat degradation and blocked passage must be mitigated by hatchery production to provide an opportunity for the tribes to exercise their treaty right to harvest salmon. Hatchery production mitigating lost natural production cannot be reduced unless there is a commensurate increase in sustainable natural production through habitat restoration and adequate habitat protection to maintain increased natural production.

Abundance of fish should be taken into account in evaluating hatchery plans, along with productivity of natural and hatchery environments, diversity, spatial distribution, and trends in the quantity and quality of habitat that supports both natural and hatchery production. As habitat quality and quantity decline, the number of fish produced per spawning pair diminishes. To the extent that watershed-specific productivity rate is driven by habitat degradation, productivity will be optimized through habitat restoration rather than hatchery program reduction (which reduces population viability by decreasing abundance and, potentially, diversity and spatial distribution). Management of all aspects of population viability will provide for the sustainability of natural and hatchery production and be consistent with the treaty right to take fish.

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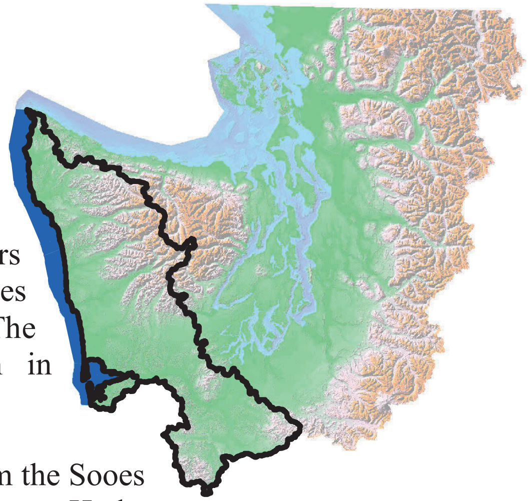
Pacific Coast Regional Report

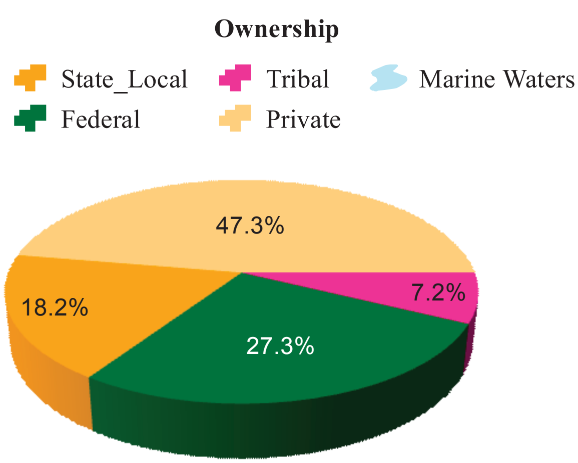


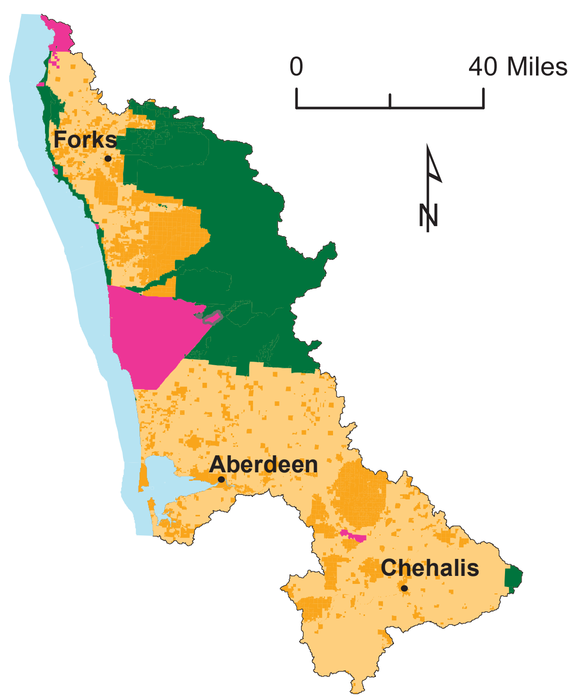
The Pacific Coast region includes WRIAs 20-23, which extend along the Pacific coastline of Washington state. The land area of these WRIAs covers approximately 4,968 square miles and consists of watersheds of the western portion of the Olympic Peninsula, south to the Chehalis River Basin. This area is heavily forested with small human population centers except for parts of the Chehalis River Basin, and has economies that rely upon timber, agriculture and recreational activities. The Chehalis River basin is the second largest river basin in Washington State, outside the Columbia River basin.

The Pacific Coast area contains eight major river systems, from the Sooes River, near Neah Bay, south to the Chehalis River and Grays Harbor estuary. The Grays Harbor estuary is one of two major estuaries on the Washington coast and includes the only deep water navigation channel and major port. The northern watersheds originate in the steep high-elevation headwaters of the Olympic Mountains, which receive over 200 inches of rain per year, while the Chehalis River watershed receives less than 40 inches of rain per year, near the town of Chehalis.

The Pacific Coast Watersheds are the ancestral and current homelands to the Makah, Quileute, Hoh, and Quinault Indian Nations who have lived and managed the natural resources along the Pacific Coast since time immemorial. The Makah Reservation is located at the northwestern tip of Washington state and, moving south, is followed by the Quileute, Hoh, and Quinault Reservations.

The Pacific Coast watersheds are home to eight different anadromous fish species: pink salmon, chum salmon, Chinook salmon, coho salmon, sockeye salmon, steelhead, bull trout and cutthroat trout. Lake Ozette Sockeye and bull trout are listed as threatened species under the Endangered Species Act. The Lake Ozette sockeye Salmon Recovery Plan was approved by NOAA in May 2009, and the Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout was approved by the USFWS in May 2004.





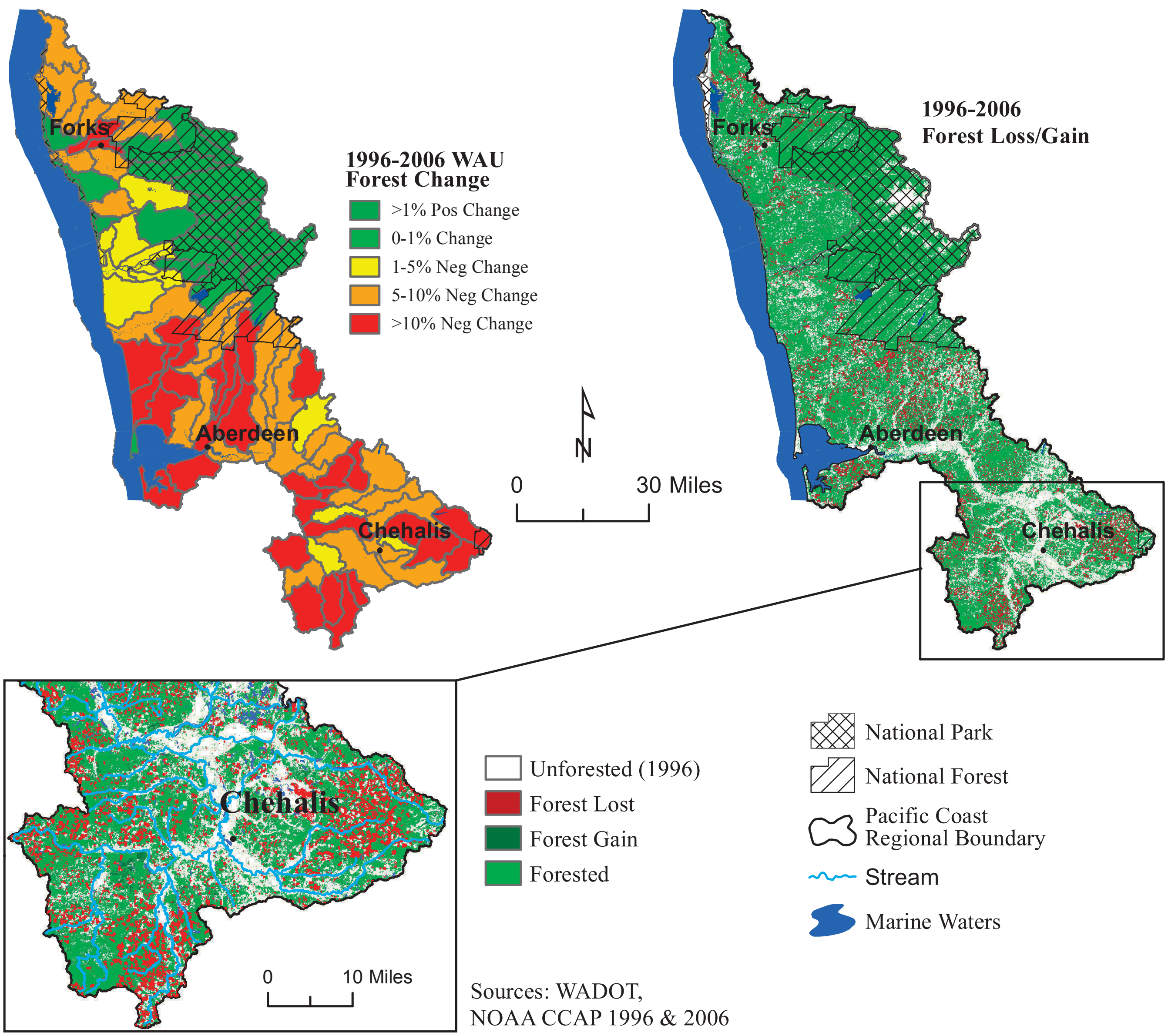
Sources: WSDOT, WADNR

Forest Cover Loss Continues

About 9.0% of the forest cover was removed between 1996 and 2006 and the trend is to see more loss if protective actions are not taken. Loss of conifer forestlands to other uses (and its concomitant negative effect on fisheries and water quality/quantity) is a concern repeatedly stated in the recovery, management and watershed plans for this region.

Within the Pacific Coastal Region (WRIAs 20 - 23) and outside of the National Park areas, is an area of approximately 4,170 square miles (excluding the marine waterways). In 1996, 75.1% of this area was forested, but due to timber harvesting and some land conversions, ten years later only 68.3% of the area is forested, representing a loss of 9.0% or 282 square miles of forest cover. Of the forest cover lost, 55.4% (or 156 square miles) is currently zoned for non-forestry uses, indicating that the removed forest cover is not planned to be restored.

While over 68% of this region remains forested, most non-park watersheds exhibited a loss in forest cover, with 30 Watershed Administrative Units (WAU) suffering a greater than 10% loss of forest cover. Per NOAA's Lake Ozette Recovery Plan "... voluminous literature shows (sic) that water yield changes begin following a significant (10 to 25 percent) reduction of forest vegetation cover" (NOAA, 2009).



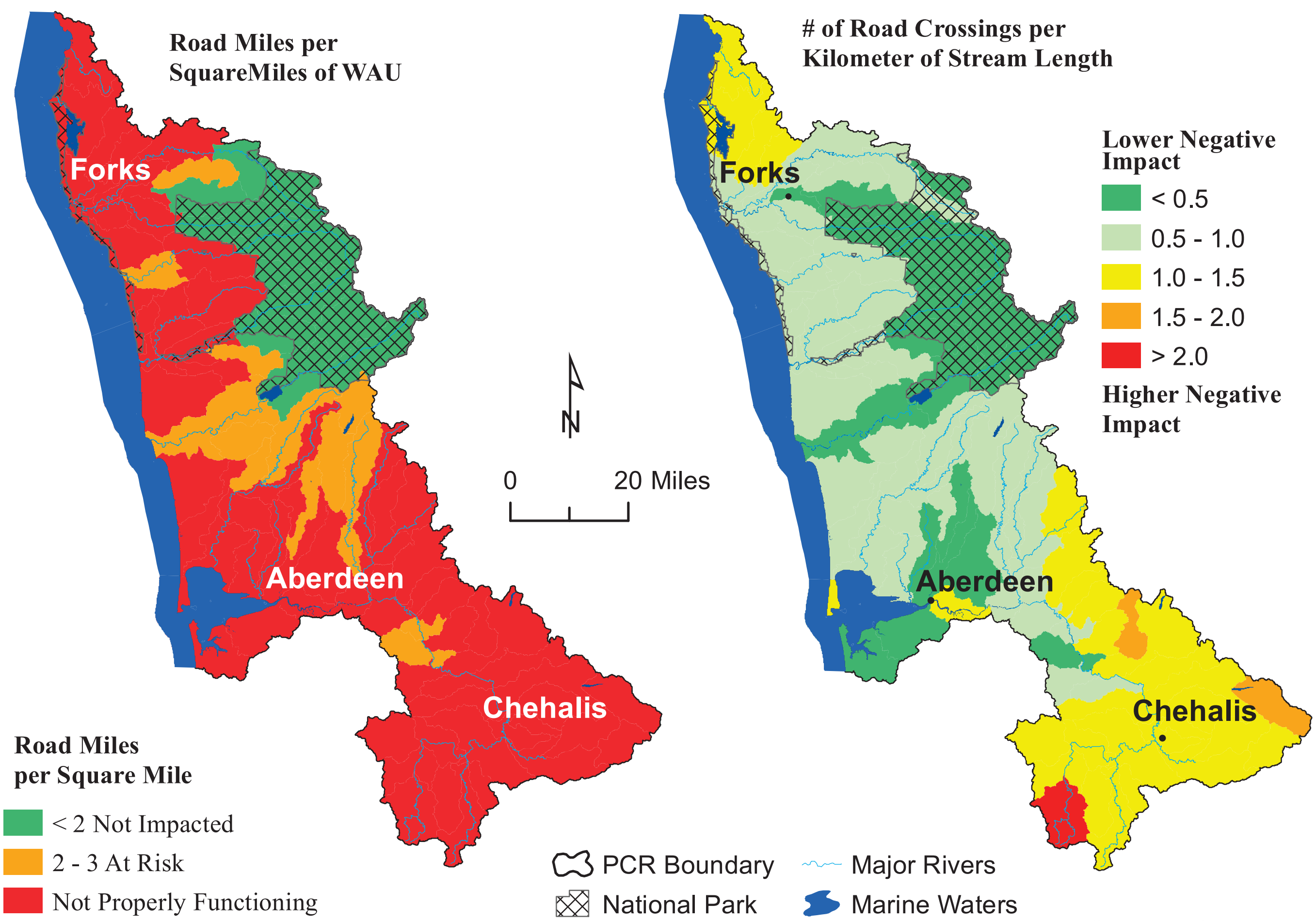
Sources: WADOT,
NOAA CCAP 1996 & 2006

Road Density and the Number of Road Crossings Have an Impact on Fish Habitat

Road densities are impacting 73% of the Pacific Coast watersheds, with road densities exceeding the three miles per square mile threshold for "not properly functioning" conditions. In addition, the number of road crossings per kilometer is trending to negatively impact the health of aquatic life in more than 35% of the Pacific Coast watersheds.

According to a NOAA 1996 report, watershed conditions are at risk when the number of road miles per square mile is between two to three miles per square mile, and are considered "not properly functioning" when road miles exceed three miles per square mile. "Roads significantly elevate on-site erosion and sediment delivery, disrupt subsurface flows essential to the maintenance of baseflows, and can contribute to increased peak flows. Roads within riparian zones reduce shading and disrupt LWD sources for the life of the road. These effects degrade habitat by increasing fine sediment levels, reducing pool volumes, increasing channel width and exacerbating seasonal temperature extremes" (NOAA, 1996).

The Upper Chehalis watershed and the watersheds north of the town of Forks are trending towards having high negative impacts. These impacts are resulting from having more than one road crossing per kilometer of stream length, with the highest number of road crossings occurring in the Chehalis, Upper Skookumchuck, and Waddel Creek watersheds. When averages exceed two road crossings per kilometer of stream length, stream health has a significantly higher probability of being degraded (Alberti et al, 2007).



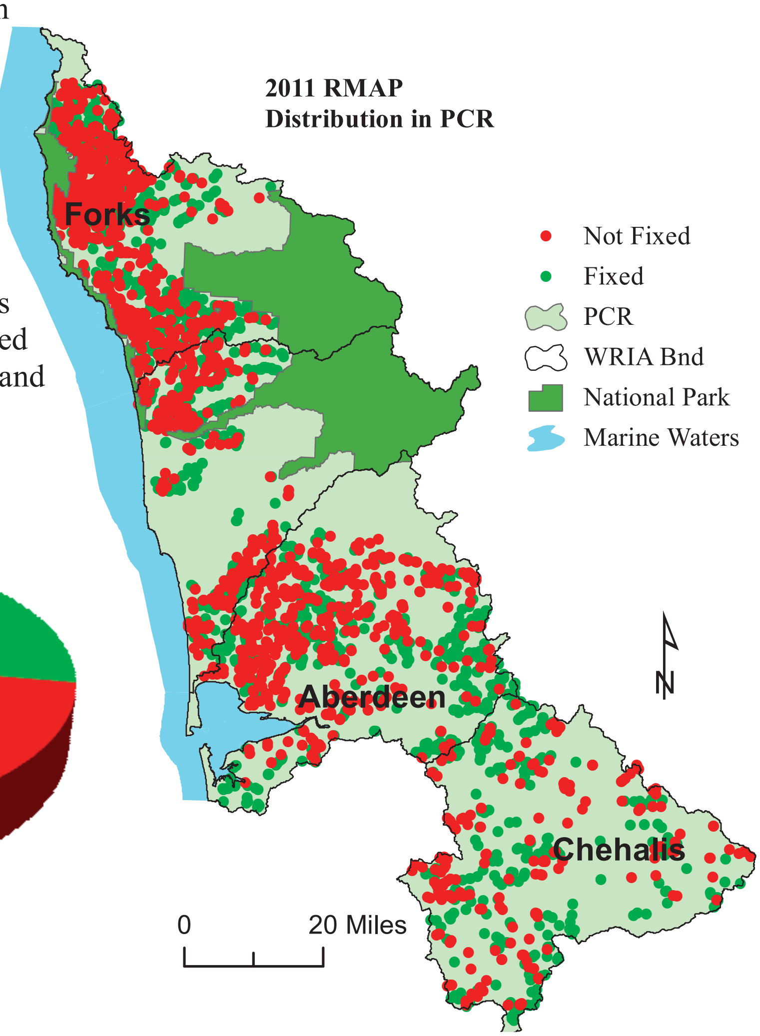
Source: WADNR 2012

Forest Road Impact on Salmonid Habitat and RMAP

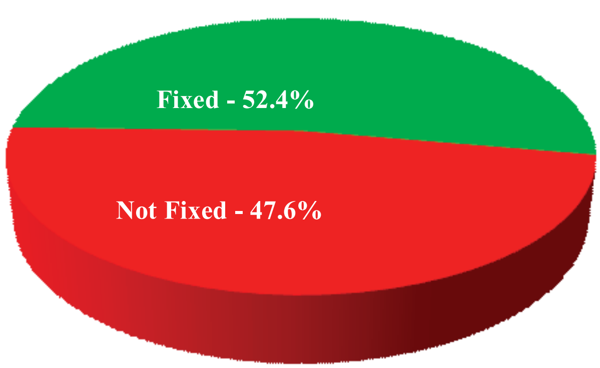
A high density of forest roads makes a significant impact on salmonid habitat in the Pacific Coast Region (PCR). To address the adverse effects of roads, most forest landowners are required to have a Road Maintenance and Abandonment Plan (RMAP) showing a schedule of needed repairs. About 47.6% of the identified culverts in the plans are still in need of repairs. Delayed RMAP compliance will negatively affect opportunities for salmon to reach their spawning and rearing habitat and may contribute to further stock decline.

With over 68% of the PCR (outside of the national parks) in active forest management, a high density of forest roads exist to facilitate commercial timber harvest. Forest roads are known to contribute to stream channel degradation because, if not properly constructed and maintained, they can be a source of sediments to streams which degrade fish habitat and water quality (Cederholm et al, 1981, Furniss et al, 1991). Also, many culverts constitute fish barriers at forest road crossings, denying salmon access to needed habitat. Denial of access to desirable habitat, and degradation to salmonid habitat, have already, and will continue to negatively impact salmon recovery.

The State's forest management laws require most private forest landowners to prepare and submit a RMAP for their forest roads. To protect water quality and riparian habitat, roads must be constructed and maintained in a manner that will prevent damage to public resources. All forest roads were to be improved and maintained to the standards of the law prior to October 31, 2016, however, due to recent legislative changes, forest landowners are now able to request an extension of up to five years. As of 2011, only 52% of RMAPs have been implemented within the PCR. In the PCR, the state, federal and local governments have met 63% of their RMAP obligations, and private forestland owners have met 49% of their obligations. A vast majority (81%) of the remaining culverts are on private lands. Of the 1,636 identified culverts remaining to be fixed, 98 were scheduled to be completed before January 2011, and 470 are as yet to be scheduled for repair.



RMAP 2011 Status



Sources:
WADNR 2011, WAECY, WADOT

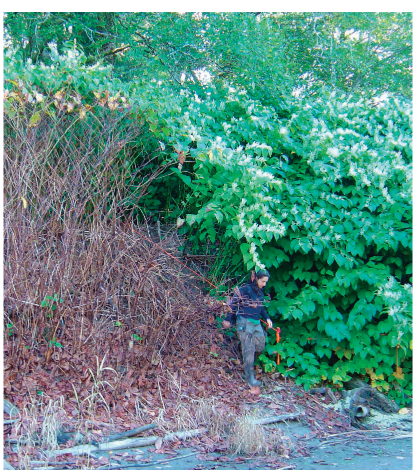
Invasive Knotweed Management

Knotweed negatively impacts salmon habitat, their food, water quality and stream physiology. Knotweed control is a component of the salmon restoration strategy for this region. Continued funding cuts threaten progress in identifying, treating and monitoring knotweed infestations.

Between 2004 and 2010, the Washington State Department of Agriculture (WSDA) and the Salmon Recovery Funding Board (SRFB) spent over $1 million to control invasive knotweed within the Pacific Coastal Region (PCR). Work is ongoing to identify, treat and monitor this invasive species within the PCR's area. However, it takes three years to treat an infestation site and several more years of monitoring to confirm it is eradicated. "...There is evidence that the small amount of live knotweed present at treatment sites can return to the original infestation level in three seasons..." (WSDA 2010). "WSDA will continue to support knotweed control as program funding allows, but further reductions in funding could require the abandonment of additional projects ...and reduce support for remaining initiatives" (WSDA, 2010).

Knotweed is present in all the WRIAs comprising the PCR. Knotweed infestations replace streambank stabilizing native vegetation, thus increasing erosion and sediment loads. Loss of native vegetation reduces riparian canopy, increases stream temperatures, and reduces invertebrate populations and recruitment of instream woody debris, all of which negatively impacts salmon. A section of stem or a small portion of root is all that is needed to start a new plant, thus its streambank destabilizing existence makes streams a ready vector for new infestations in downstream riparian areas.

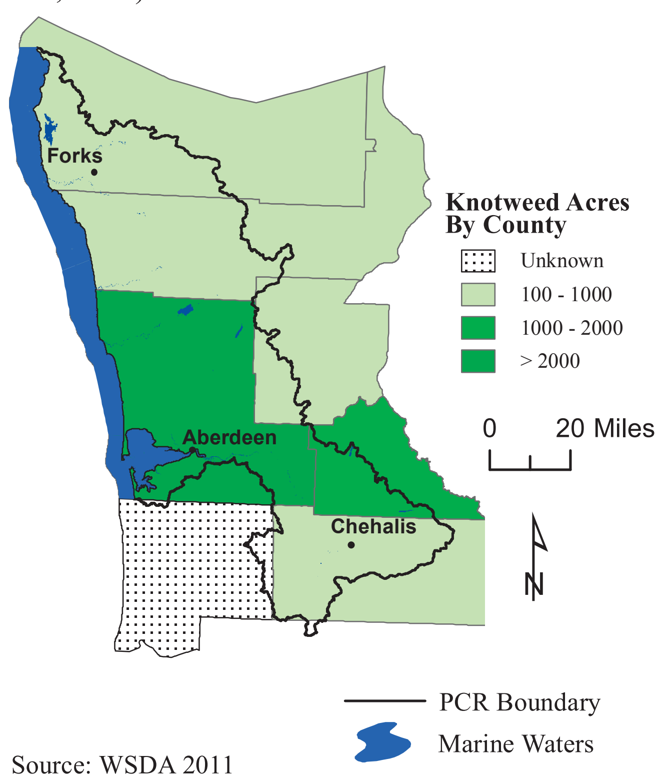
"Once established, knotweed patches compromise key ecosystem components and processes. ...Because of its extensive root system and large size, knotweed can change the shape and form of river channels and gravel bars, as well as the composition and distribution of riparian vegetation. Knotweed's propensity to grow on riverbanks and gravel bars may clog off-channel wetlands that provide critical rearing habitat for salmon. ...These collective impacts of knotweed on keystone species, such as salmon, and on critical riparian functions, can have cascading effects that may result in significant, far-reaching and long-lasting impairment of the ecosystem" (WSDA, 2006).



Treated and Untreated knotweed patch Photo: Frank Geyer, Quileute Tribe

Current Knotweed Control Projects within the Pacific Coastal Region:

11-1455 R	Hoh River
09-1390 R	Lower Quinault
07-1894 R	Naselle
06-2254 R	Prarie Creek



Source: WSDA 2011

Summary

The Pacific Coast Region (PCR) includes WRIA 20-23, which extends along the Pacific coastline of Washington state. The PCR is a largely forested region whose economy is reliant upon timber, agriculture and recreational activities. High road density & road crossings, forest cover loss, and invasive species (knotweed) are all contributing to habitat degradation within the PCR.

The PCR contains ~28,000 miles of streams and ~19,000 miles of roads, with 90% of those roads unpaved. Some Watershed Administrative Units (WAU) have road densities as high as 11 road miles per square mile of watershed and 2.2 road crossings per kilometer of stream length. This high density of roads (and their related effects) makes a significant impact on stream health, salmonid habitat and salmon recovery in the PCR.

To address the adverse effects of forest roads, large forest landowners are required to have a Road Maintenance and Abandonment Plan (RMAP), showing a schedule of needed repairs. However, due to recent legislature changes, forest landowners are now able to request an extension of up to five years, delaying the required repairs to protect and enhance fish habitat. The delay in the RMAP implementation will have a negative effect on salmon trying to reach their spawning and rearing habitat, which will likely contribute to furthering the stock decline.

In the PCR, about 9% (282 square miles) of the forest cover was removed between 1996 and 2006 and the trend is to see more loss if protective actions are not taken. With over 55% (156 square miles) of the land with the forest cover loss being withdrawn from further timber growth, salmon habitat has been permanently lost. Loss of conifer forestlands to other uses (and its concomitant negative effect on fisheries and water quality/quantity) is a concern repeatedly stated in the recovery, management and watershed plans for the PCR.

Another concern is the status of the invasive species program within the PCR. Knotweed has been and is being treated within the PCR but several thousand acres still remain. The risk of it spreading is great, if monitoring and treatment is not continued following the initial treatment project. Knotweed has the potential to be a serious threat to stream health and salmon habitat if it is not removed. Knotweed negatively impacts salmon habitat, their food, water quality and stream physiology. Knotweed control is a component of the salmon restoration strategy for this region. However with continuing funding cuts at all levels of government, existing progress in identifying, treating and monitoring knotweed infestations is threatened. If not completely eliminated, knotweed patches will re-infest to greater than their original extent.

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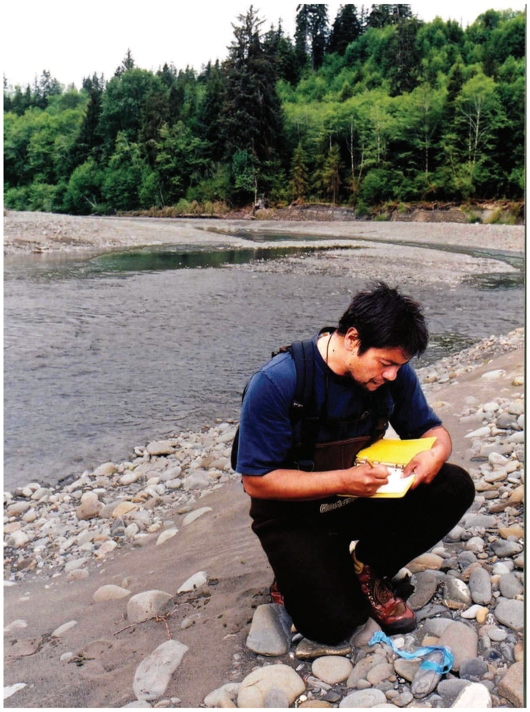
State of Our Watersheds Report
Hoh River Basin



Growing up on the Hoh, I remember hiking upriver with my nets to catch steelhead and camping out. It's good to know that by doing this work, I'm doing something that benefits the tribe in some way too.

RICHARD SHERIFF, HOH TRIBE

The Hoh Tribe

Chalá·at: People of the Hoh River

The Hoh River Indians are considered a band of the Quileutes but are recognized as a separate tribe. The Hoh Indian Reservation was established by an Executive Order in 1893. The Hoh Reservation consists of 443 acres located 28 miles south of Forks, and 80 miles north of Aberdeen. The Hoh Reservation has approximately one mile of beachfront running east from the mouth of the Hoh River and south to Ruby Beach.

The Hoh Tribe has formed a Tribal Government under Public Law 89-655, providing for a basic roll of tribal members. The governing body is elected by secret ballot biannually in November.

Land Management Limits Salmon Production

A Hoh tribal fishermen checks the net for fish near the mouth of the Hoh River.

The Hoh River Basin is one of least developed watersheds on the Washington coast. The basin includes the Hoh Rain Forest, a large temperate area protected within the Olympic National Park. Commercial forestry and National Park are the two primary land uses within the watershed. A significant portion of the upper Hoh Basin lies within the Olympic National Park, but downstream of the Park, considerable habitat problems exist.

A limiting factors analysis was conducted by the Washington State Conservation Commission (Smith 2000) and identified several factors limiting salmonid production in the basin: fish access problems from culvert passage and cedar spalts; increased stream sedimentation; altered riparian areas; as well as scoured, incised channels with few spawning gravels and large woody debris.

A Watershed Plan (Golder Associates, 2009) was developed to address these limiting factors with specific actions and management strategies.

The strategies involved:

1. Protection of habitat and habitat forming processes;
2. Collection of information where data gaps exist; and
3. Restoration projects to reinstate or advance the recovery of habitat, habitat protection formation processes that affect the salmonid ecology.

Landscape-Scale Problems Difficult to Address

Insufficient time has elapsed to assess the progress toward the goals and objectives of this habitat recovery strategy, only general conditions and trends can be highlighted.

- **The timber harvest rotation within the watershed has led to significant reductions in hydrologic maturity. Approximately 54% of the private forest land was harvested in the middle Hoh River Basin. This has led to increased peak and mean daily flow (Achet 1997) and affects the quality and routing of water, sediments and other material to streams. The resultant degradation of floodplain habitat and altered flow regime are significant habitat factors limiting salmonid production (Smith, 2000). Without restoration action, natural recovery from this scale of habitat disturbance will take several decades to mend.**
- **Road maintenance and abandonment issues are also a problem within the Hoh River Basin. An estimated 54 miles of fish habitat remained blocked from nonfunctioning culverts and constitute a major impact on fish habitat. Replacement schedules for addressing these blockages have yet to be finalized.**
- **Considerable impacts to salmonid ecology have resulted from floodplain and riparian infrastructure (i.e., road, revetments, etc.) that impede normal habitat and channel function. Ten percent of the Hoh River mainstem has been impacted by shoreline armoring. These structures negatively affect natural ecological processes by impeding bank erosion river meandering and the recruitment and retention of large woody debris.**
- **A positive development in habitat recovery efforts involves the elimination of knotweed plants, which were extensively distributed throughout the Hoh River Basin. These invasive plants are known to displace native species and negatively affect fish habitat. A multi-year effort was initiated by the Hoh Tribe with the goal to completely eradiate knotweed plants in the Hoh River Basin. Today, this effort has resulted in significant stem count reductions, showing that the control measures have been effective (Silver 2011).**

Bernard AfterBuffalo Jr., Hoh tribal fisheries technician, and Warren Scarlett, water quality and habitat biologist for the tribe, install thermographs in Hoh watershed streams. The thermographs record stream temperature at regular intervals, allowing the Hoh Tribe to see changes over time, and before, during and after land management practices. The tribe has been tracking stream temperatures in the watershed since 1992.

Hoh Basin Summary

The Hoh Basin has remained largely rural and heavily forested with relatively low levels of impervious surface from human development. Its economy is natural resource based; fisheries, forestry, and tourism are the three main economic activities. The environmental impacts associated with these activities, particularly bank armoring associated with roadways and timber harvest, are altering and in some areas accelerating the natural physical river processes and thus having an adverse effect on fish habitat.

Commercial forestry remains the major land use activity in the Hoh basin. According to WDNR records, 31% of the available private forestlands were harvested in the 12-year period between 1998 and 2010. In the Middle Hoh sub-basin, the harvest rate was 54%. Forest practices result in the loss of riparian vegetation, disturbance of soils, construction of roads and installation of culverts. The removal of vegetation typically affects the quantity and routing of water, sediments and other materials to streams. It also negatively impacts the recruitment and retention of large woody debris (LWD) in streams. Lack of LWD has been identified as a factor limiting salmonid production in the basin and this deficiency still requires attention.

The effects of timber harvest operations are compounded by improperly constructed and maintained roads; this situation is made worse when construction involves shoreline armoring. The mainstem Hoh River has over 3.7 miles of riprap between river mile 1 and 37. These structures contribute to river channel degradation by impeding bank erosion and river meander, the basic forces for most riverine ecological processes and functions. They also increase the erosive potential of peak flows which cause channel incision and streambed scouring.

In the Hoh basin, road densities are clearly higher outside the Olympic National Park, the result of the network of roads built for commercial timber harvesting. The highest road densities of 4.0 miles/sq mile and 5.5 miles/sq mile occurred in the Middle Hoh and Lower Hoh subbasins respectively. Higher road densities generally result in increased sediment delivery to streams, which reduces the quality of water and spawning gravels for salmon.

Road Maintenance and Abandonment Plans Slowed

To address the aquatic habitat and fish passage issues caused by roads, most forest landowners are required, under the Washington State Forests and Fish law, to have a Road Maintenance and Abandonment Plan (RMAP), showing a schedule of repairs needed to upgrade road systems at stream crossings. An analysis of WDNR RMAP data shows that at least 46% of barrier culverts are still in need of repairs. These block a total of 53.74 miles of fish habitat. About 90% of these problem culverts are on private lands. The recent extension granted landowners to meet their RMAP commitment means that this problem will likely persist for the duration of this extension.

Invasive knotweed plants are a threat to salmon spawning and rearing habitat in the Hoh basin because they can displace native species and alter riparian vegetation. In 2002, a multi-year effort was initiated by the Hoh Tribe to completely eradicate these plants in 29.75 river miles of the active Hoh River channel migration zone and adjacent terraces. Knotweed stem count numbers show that peak numbers were reached in 2003, one year after the project started. Since then, there have significant stem count drops in all the sites. Close and frequent monitoring to avoid a resurgence and spread of the invasive plant will be needed.

Although the Hoh River basin continues to support healthy runs of salmonid species, there are significant threats to fish habitat. Land-use practices particularly associated with forestry activities and road maintenance continue to alter watershed processes, resulting in stream channel degradation. This calls for increased protection and restoration of fish habitat.

A part of the Hoh River valley north of Highway 101.

Looking Ahead

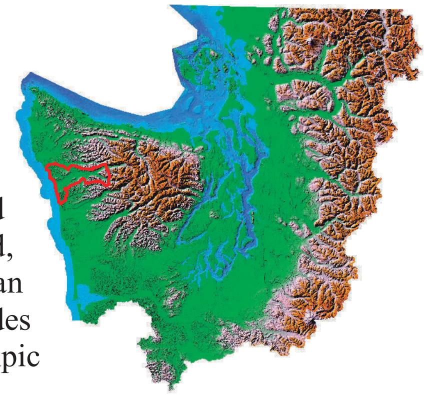
Salmon need cool, clean, highly oxygenated water to survive. Even in an area as rural as the Hoh watershed, land management activities threaten salmon survival and the future of the Hoh people who depend on them culturally and economically.

Elevated stream temperature is one of the cumulative effects of land management activities, which have altered surface water runoff, groundwater recharge, streamside plant communities, and in-channel structures such as logjams.

In all likelihood, continued land management activities will preclude many streams from a complete recovery of natural temperature conditions. What salmon need, people need too. To ensure a future for the next seven generations, land management rules already in place need enforcement and those that are not adequate to protect fish need to be adapted to do so.

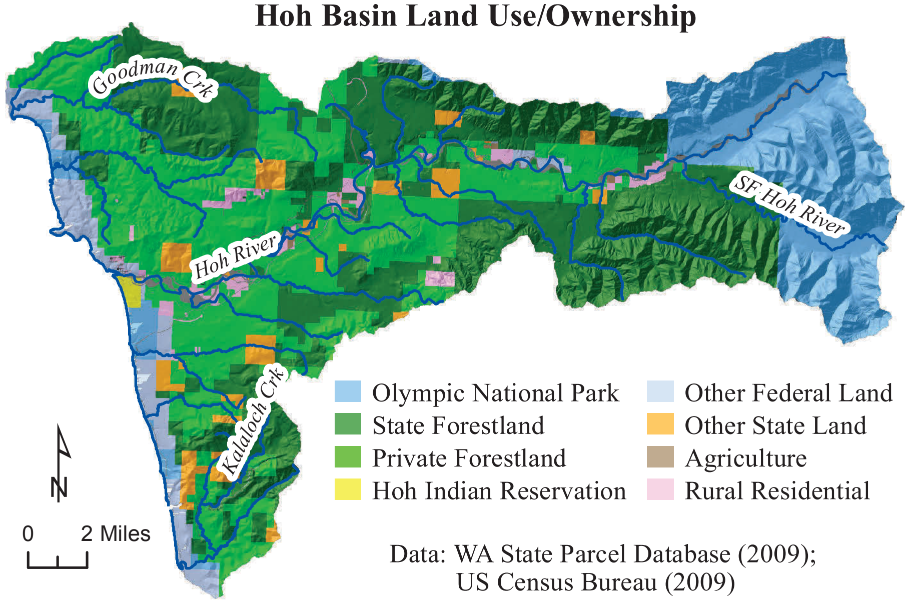
Hoh Tribe
(Hoh River Watershed and Independent Tributaries)

The Hoh Tribe's Area of Concern comprises portions of WRIAs 20 and 21 along the west side of the Olympic Peninsula. It includes the Hoh River and all independent tributaries which drain into the Pacific Ocean, from Goodman Creek south to Kalaloch Creek.



The largest basin in the area is the Hoh River which originates at the Hoh Glacier on Mount Olympus. From its source, it flows westward through the Olympic National Park, then through foothills and a broad, flat floodplain before emptying into the Pacific Ocean at the Hoh Indian Reservation, the ancestral home of the Hoh people. The basin includes the Hoh Rain Forest, a large temperate area protected within the Olympic National Park.

Hoh Basin Land Use/Ownership

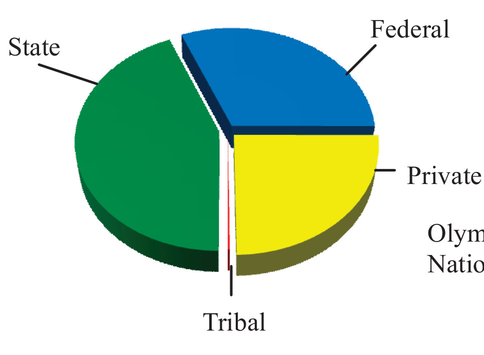


Stream flows are generally provided by a mean annual precipitation in the range of 140 to 165 inches, the highest in Washington State.

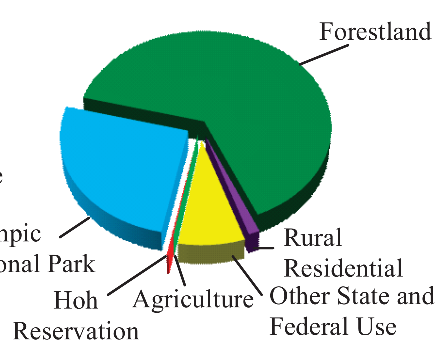
About 60% of the basin is forestland owned and managed by Washington State DNR and private timber companies. The portion of the watershed which lies in the Park has been generally exempt from logging and other major human impacts.

This basin supports all five species of Pacific salmon as well as cutthroat trout, bull trout and Dolly Varden (Phinney and Bucknell, 1975, McHenry et al., 1996, Smith, 2000). The Hoh River, some adjacent shoreline, and tributaries are designated critical habitat for bull trout (Endangered and Threatened Wildlife and Plants, 2010).

Hoh Basin Land Ownership



Hoh Basin Land Use



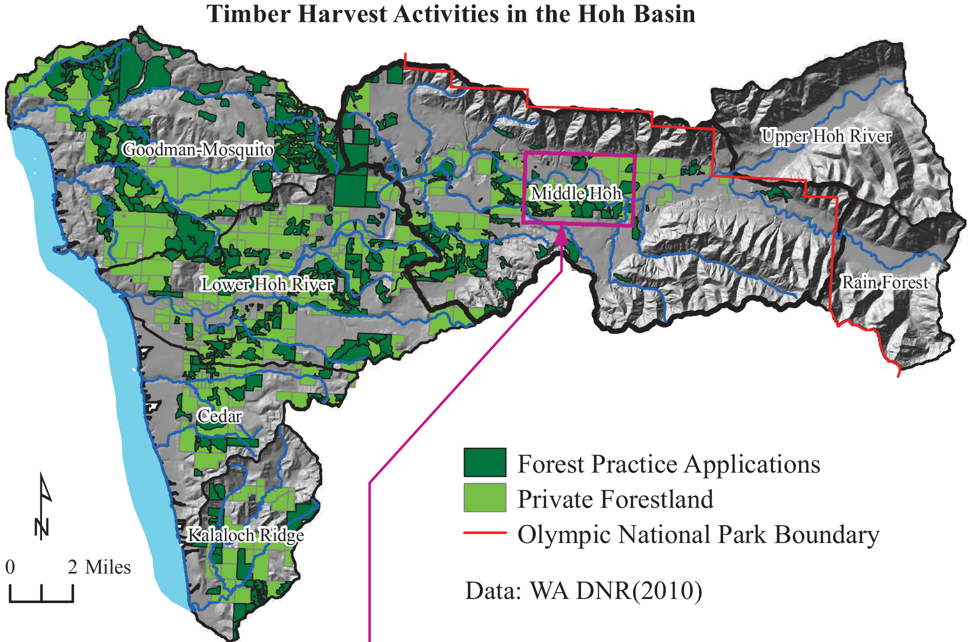
The Hoh Basin is heavily forested with relatively low impervious cover from human development. However, Smith (2000) identified several factors limiting salmonid production in the basin downstream of the Park. These include fish access problems from culverts and cedar spalts, increased stream sedimentation, altered riparian areas, as well as scoured, incised channels with few spawning gravels and large woody debris. The WRIA 20 Watershed Plan (Golder Associates, 2009) includes specific actions and management strategies for addressing these limiting factors.

Impacts of Timber Harvest Operations

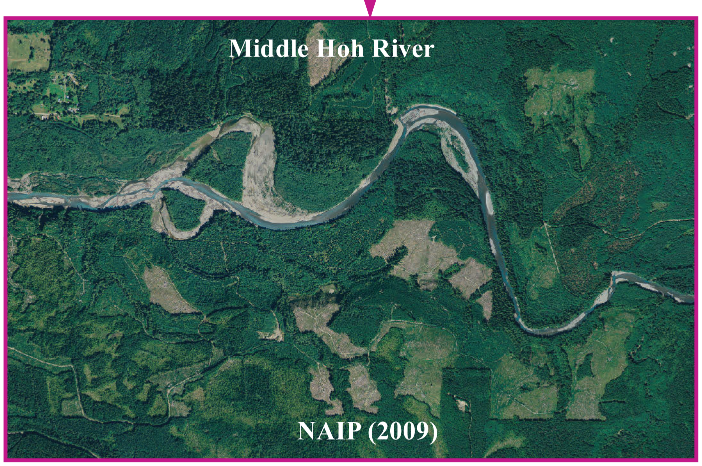
Thirty-one percent of the private forestlands in the Hoh basin were harvested between 1998 and 2010. The Middle Hoh River sub-basins saw the greatest impact with 54% of the private forestlands harvested.

Commercial timber logging occurs in all watersheds within the Hoh basin, particularly in the Lower Hoh and Middle Hoh sub-basins. This removal of vegetation has resulted in poor large woody debris and riparian conditions in the basin (Smith, 2000; Golder and Associates, 2009). Debris flows are common and devastating, resulting in scoured, incised channels with few spawning gravels for salmon. The WRIA 20 Watershed Plan (Golder and Associates, 2009) recognizes the significant conversion of forests to other uses as a threat to watershed planning and management objectives.

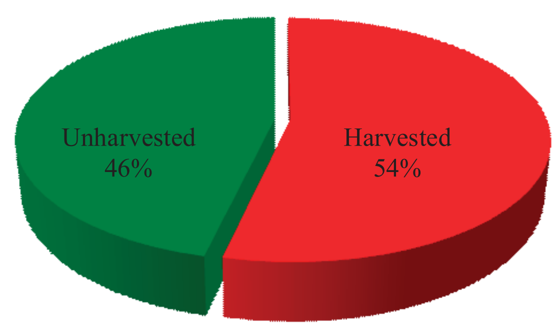
Timber Harvest Activities in the Hoh Basin



Thirty-one percent of the private forestlands in the Hoh basin have been harvested between 1998 and 2010. An additional 5% of state forestlands were also harvested in the same time period. The Middle Hoh River sub-basin saw the greatest impact with 54% of the private forestlands harvested. This rapid removal of vegetation significantly impacts peak and mean daily flow in the Hoh basin (Achet, 1997) and affects the quantity and routing of water, sediments and other materials to streams.



Middle Hoh River Forest Practice Activity: 1998-2010



Reductions in hydrologic maturity with the resultant degradation of floodplain habitat and altered flow regime are significant habitat factors limiting salmonid production in this basin (Smith, 2000). These conditions may be improved by altering timber harvest rates, particularly in the Middle Hoh River sub-basin.

Impact of Roads on Habitat

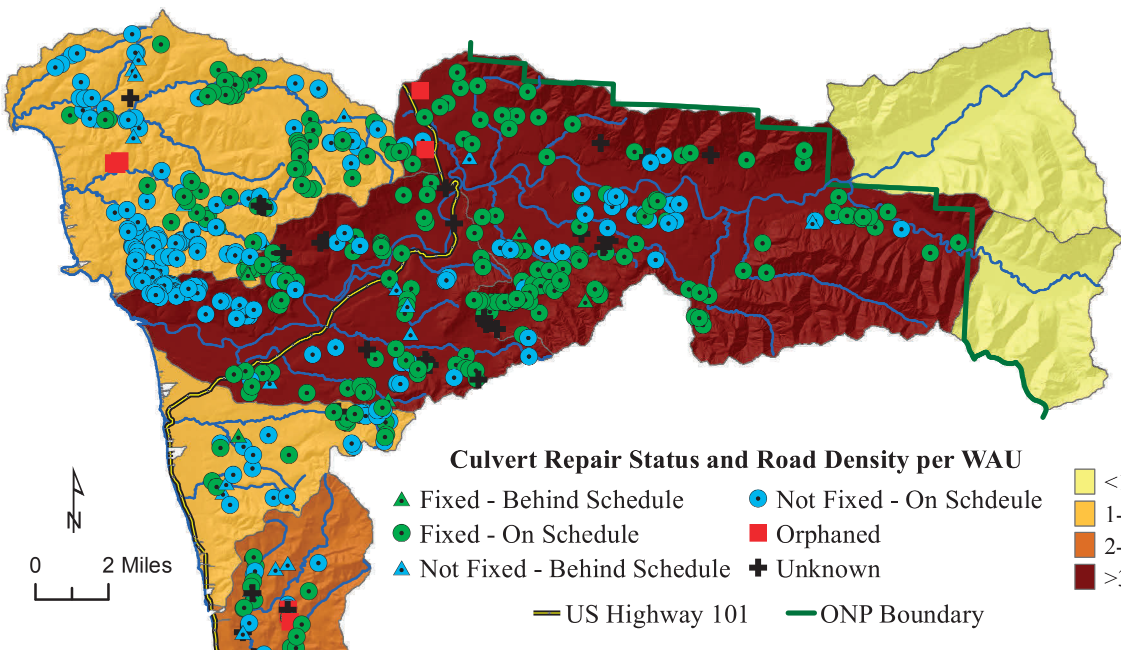
A high density of forest roads makes a significant impact on fish habitat in the Hoh basin. To address the adverse effects of roads, most forest landowners are required to have a Road Maintenance and Abandonment Plan (RMAP), showing a schedule of needed repairs. About 46% of the identified culverts in the plan are still in need of repairs, blocking a total of 53.74 miles of fish habitat. A vast majority (90%) of these culverts are on private lands.

One of the goals of the WRIA 20 Watershed Plan (Golder Associates, 2009) is to reverse stream channel degradation. Forests roads are known to contribute to this problem because, if not properly constructed and maintained, they can be a source of sediments to streams which degrade fish habitat and water quality (Cederholm et al, 1981, Furniss et al, 1991) Also, many culverts may constitute fish barriers at forest road crossings.

Road densities were higher outside the Olympic National Park (ONP), the result of the network of roads built for commercial timber harvesting.

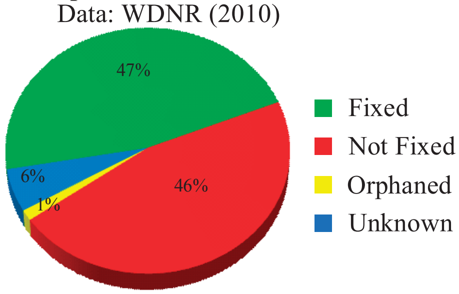
Braden Creek culvert removal
Photo: Debbie Ross-Preston

At least 46% of the culverts identified in this basin in the Road Maintenance and Abandonment Plan (RMAP) are still in need of repairs to support upstream and downstream migration of fish species. About 90% of these are on private lands. These culverts constitute a significant negative impact on fish habitat.

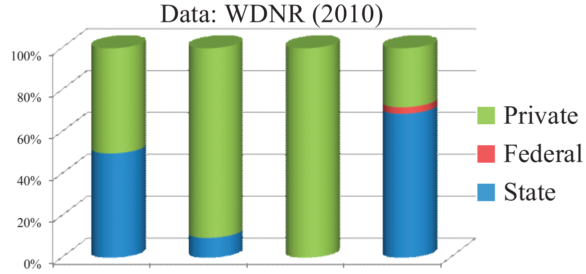


Data: WDNR RMAP (2010), WDNR Trans (2011),
Jefferson County Roads (2010), WSDOT State Routes (2006)

Culvert Repair Status in the Hoh Basin
Data: WDNR (2010)



Repair status of culverts in the Hoh Basin showing ownership
Data: WDNR (2010)

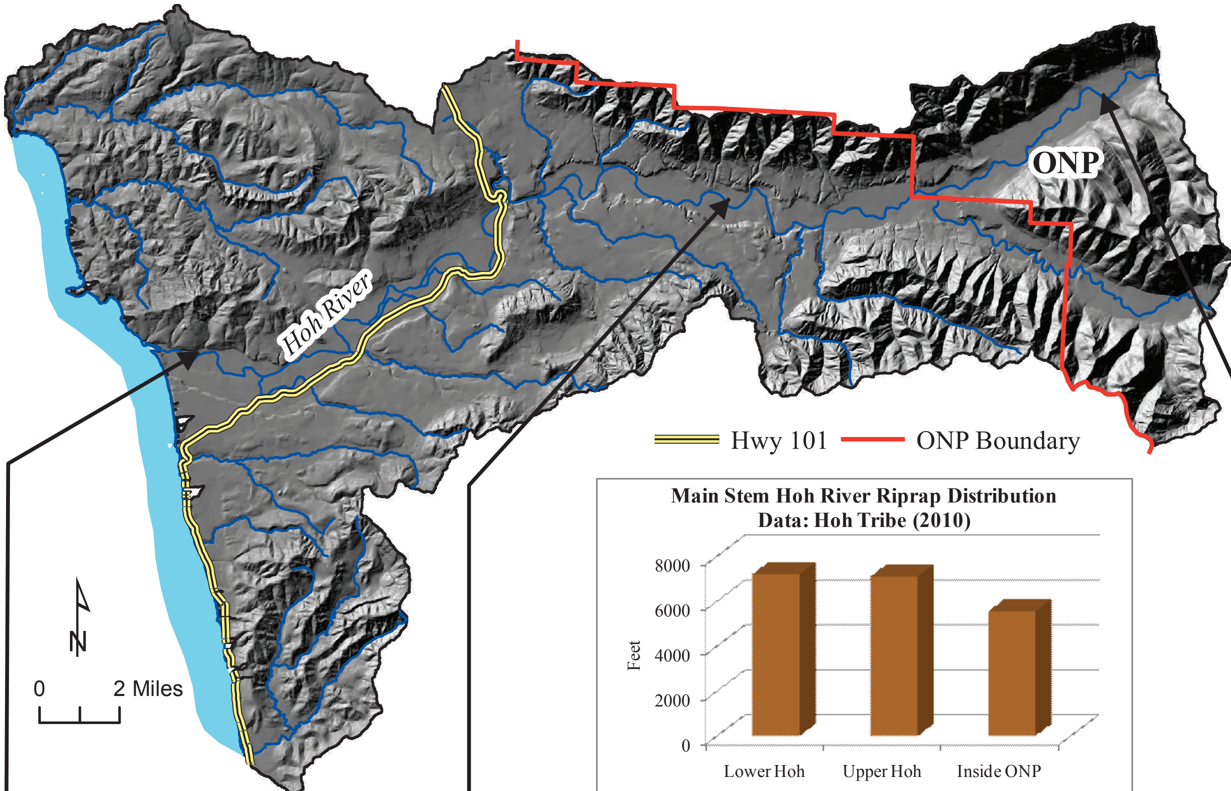


Bank Ripraps Impact River Functions

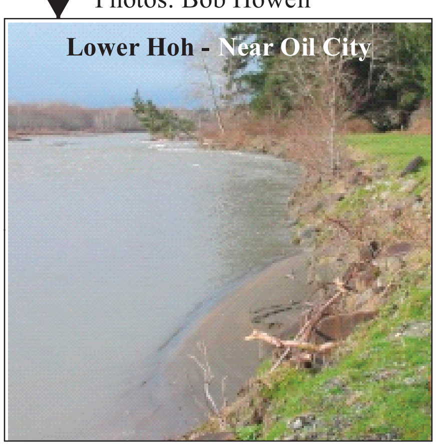
Ten percent of the Hoh River mainstem has been impacted by shoreline armoring. These structures contribute to river channel degradation by impeding bank erosion and river meander, the basic forces for most riverine ecological processes and functions.

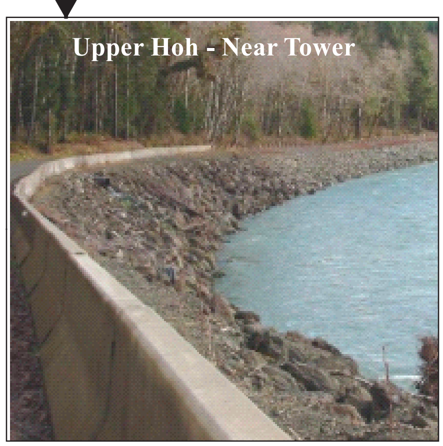
One of the goals of the WRIA 20 Watershed Management Plan (Golder Associates, 2009) is to restore the natural function of stream channels by reversing stream channel degradation, increasing floodplain storage, and improving aquatic habitat conditions. Some of the degradation of the Hoh River results from river meandering and erosion being halted by rock riprap bank protection. These structures also prevent the recruitment and retention of large woody debris (LWD) in the stream, a problem identified as a factor limiting salmon production (Smith, 2000).

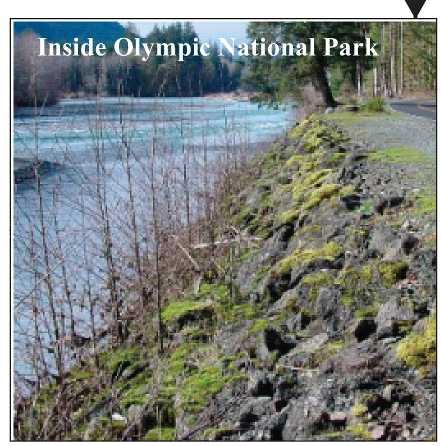
The mainstem Hoh River has over 3.7 miles of riprap between River Mile 1 and 37. Although most of these structures are in the reaches of the river outside the Olympic National Park (ONP), some parts of the river in the rather pristine Park have also been riprapped. Some restoration actions recommended in the Watershed Plan, like LWD reintroduction, may be needed to mitigate the effects of ripraps.



Photos: Bob Howell







Invasive Knotweed Plants Threaten Critical Habitat

A goal of the WRIA 20 Watershed Management Plan (Golder Associates, 2009) is to "control or eradicate knotweed and other noxious weeds that affect fish habitat." A multi-year effort initiated by the Hoh Tribe to completely eradicate knotweed plants in the Hoh River basin has resulted in significant stem count drops, showing that the control measures have been effective.

Invasive knotweed plants are known to displace native species and alter riparian vegetation, and can cause long-term changes to the structure and functioning of the riparian forests and adjacent fish habitats (Udo, 2008; Urgenson et al., 2009). In 2002, the Hoh Tribe started a project to completely eradicate these plants in 29.75 river miles of the Hoh River channel migration zone and adjacent terraces (Silver, 2010).

Photo: Matthew Sciacca, 10,000 Years Institute

A crucial question is whether the control measures have been effective in controlling the size and distribution of these invasive plants found in the riparian zone of the Hoh River.

Fig. 1. Hoh River Knotweed Stem Counts for River Miles 26-29.

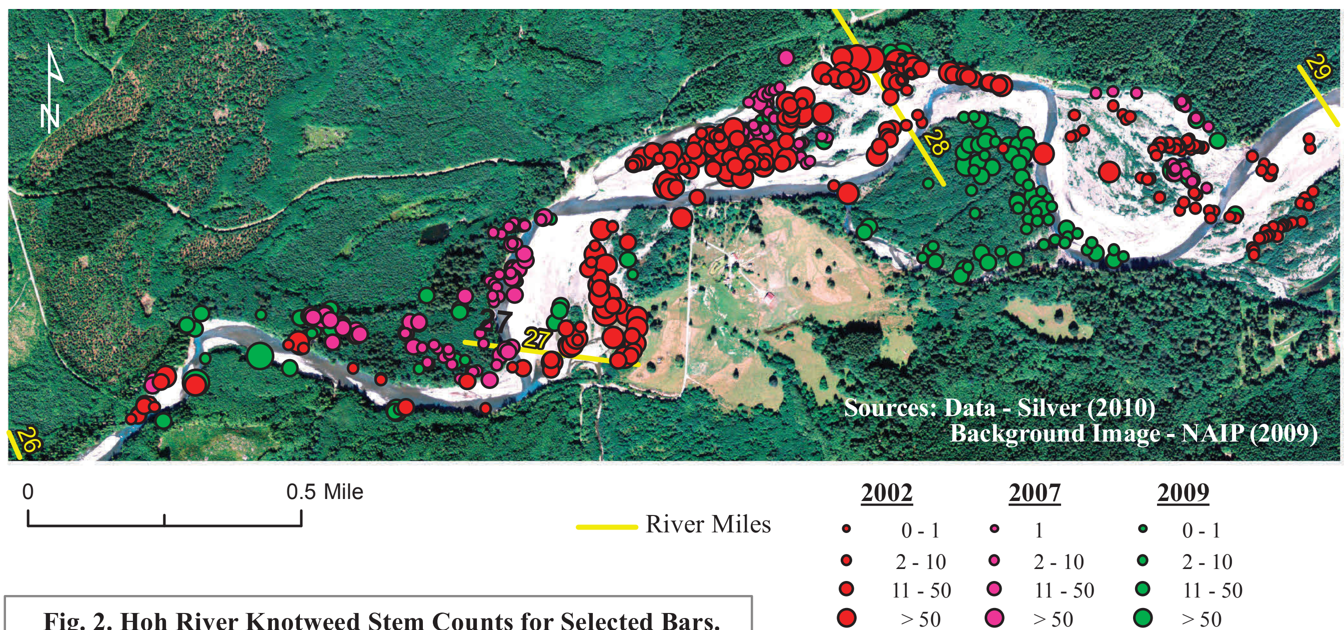


Fig. 2. Hoh River Knotweed Stem Counts for Selected Bars.

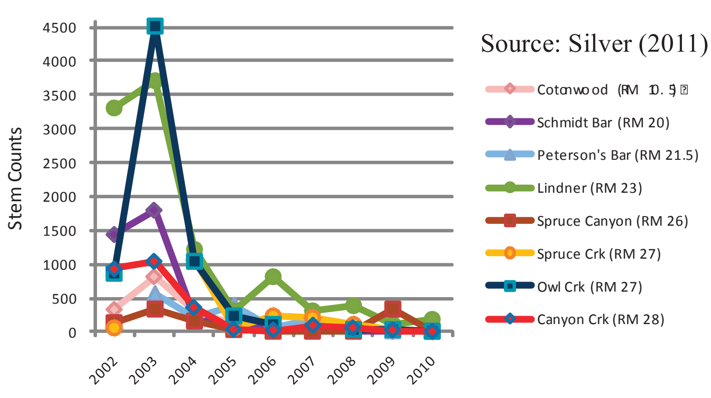
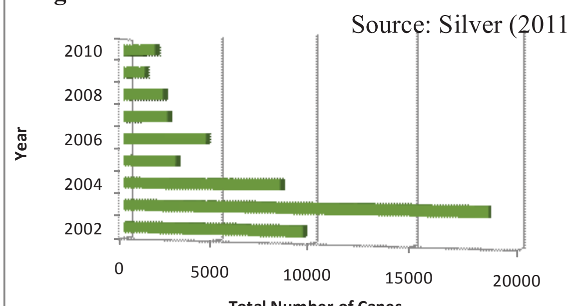


Fig.3. Total Knotweed Cane Count for all Sites.



Knotweed stem count numbers from Silver (2011) show a reduction in the sizes and distribution of the plants as shown in Fig.1 for river miles 26-29. Data for other sites (Figs. 2 and 3) also show significant drop in numbers and an overall downward trend. However, more monitoring is needed.

Summary

The Hoh Basin has remained largely rural and heavily forested with relatively low impervious cover from human development. Its economy is natural resource based, relying heavily on fisheries, hunting, commercial forestry, agriculture, and tourism. The natural resources which these economic activities rely on also depend greatly on the condition of the watersheds that make up the surrounding forestlands. Human activities, particularly bank armoring and logging, are altering, and in some areas, accelerating the natural physical river processes and thus having an adverse effect on fish habitat.

This report covers an area of the basin generally referred to as the Hoh Tribe's Usual and Accustomed Area. About 20% of the study area lies within the Olympic National Park while another 60% is forestland owned and managed by the Washington State Department of Natural Resources (WDNR) and private timber companies. Human activities in the basin are concentrated downstream of the park.

Commercial timber logging is a major activity in the Hoh basin. In the 12-year period between 1998 and 2010, 31% of the available private forestlands were harvested, according WDNR records. In the Middle Hoh sub-basin, the harvest rate was 54%. Forest practices result in the loss of riparian vegetation, disturbance of soils, construction of roads, and installation of culverts. The removal of vegetation typically affects the quantity and routing of water, sediments and other materials to streams. It also negatively impacts the recruitment and retention of large woody debris (LWD) in streams. Poor LWD has been identified as a factor limiting salmonid production in the basin.

The effects of timber harvest operations are made worse when banks are reinforced with riprap. The mainstem Hoh River has over 3.7 miles of riprap between River Mile 1 and 37. These structures contribute to river channel degradation by impeding bank erosion and river meander, the basic forces for most riverine ecological processes and functions. They also increase the erosive potential of peak flows which cause channel incision and streambed scouring.

In the Hoh basin, road densities were clearly higher outside the Olympic National Park, the result of the network of roads built for commercial timber harvesting. The highest road densities of 4.0 miles/sq mile and 5.5 miles/sq mile occurred in the Middle Hoh and Lower Hoh sub-basins respectively. Higher road densities generally result in increased sediment delivery to streams which reduces the quality of water and spawning gravels for salmon.

To address the aquatic habitat and fish passage issues caused by roads, most forest landowners are required, under the Washington State Forest and Fish law, to have a Road Maintenance and Abandonment Plan (RMAP) showing a schedule of repairs needed to upgrade road systems at stream crossings. An analysis of WDNR RMAP data shows that at least 46% of barrier culverts are still in need of repairs. These block a total of 53.74 miles of fish habitat. About 90% of these problem culverts are on private lands. The recent extension granted landowners to meet their RMAP commitments means that this problem may persist for a while.

Invasive knotweed plants are a threat to critical habitat in the Hoh basin because they can displace native species and alter riparian vegetation. In 2002, a multi-year effort was initiated by the Hoh Tribe to completely eradicate these plants in 29.75 river miles of the active Hoh River channel migration zone and adjacent terraces. Knotweed stem count numbers show that peak numbers were reached in 2003, one year after the project started. Since then, there have been significant stem count drops in all the sites. In the Owl Creek and Lindner river bars, the stem counts dropped from a peak of 4,517 (2003) to 11

(2010), and 3717 (2003) to 179 (2010), respectively. These results show that the control measures have been effective. Although desirable, the trend for smaller, less widely distributed knotweed plants creates additional challenges for future knotweed control in the Hoh River riparian zone because the plants are more difficult to find for proper control. This calls for close and frequent monitoring to avoid a resurgence and spread of the invasive plant.

Although the Hoh River basin continues to support healthy runs of salmonid species, there are significant fish habitat threats. Land-use practices particularly associated with forestry activities continue to alter watershed processes, resulting in stream channel degradation. This calls for increased protection and restoration of fish habitat.

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State of Our Watersheds Report
Dungeness-Snow Basin

The tribe bought the land around Jimmycomelately Creek and restored it back to its natural migrating path, the way a river, or in this case, a creek breathes. We had threatened species, coho and chum, but they're now coming back in strong numbers. So we're doing the right thing. But it wasn't just us. Fish and Wildlife was involved, the local community was involved and the state was involved. So it took a village of interested parties to make it work – and we made it work.

– RON ALLEN,
JAMESTOWN S'KLALLAM TRIBE

The Jamestown S'Klallam Tribe

The Jamestown S'Klallam Tribe is part of the Klallam Band of Indians that have resided throughout the Strait of Juan de Fuca, Hood Canal and Port Gamble Bay for generations. They are party to the Point No Point Treaty of 1855, when tribes ceded most of their traditional lands to the U.S. government.

Headwaters of the Dungeness basin are in federal lands (USFS and National Park) and much of the watershed has remained forested. Commercial forestry is the predominant land use in the upper watershed. The remaining area is a mix of agricultural, rural residential and urban development.

This report will focus on portions of the Dungeness Basin and surrounding marine waters, which is only a portion of the area that the Jamestown S'Klallam Tribe works in and manages.

Degradation of Dungeness Basin

The Focus Area for the Jamestown S'Klallam Tribe includes portions of WRIA 17 (Quilcene-Snow) and WRIA 18 (Dungeness-Elwha). The headwaters are in federal ownership, mostly ringed by state and commercial forests. This landownership pattern has concentrated development in the watersheds' lower elevations. Consequently, major land use impacts on salmon habitat have occurred primarily from floodplain and shoreline development, as well as commercial forestry.

Technical analysis has identified the significant habitat limiting factors for decline of the region's salmonid populations as:

- **Estuarine habitat loss and degradation;**
- **Loss of channel complexity from loss and recruitment of large woody debris;**
- **Floodplain modifications;**
- **Sediment aggradation;**
- **Loss of littoral drift (Haring 1999).**

Culverts like this one, which led into the small 4-acre Pitship Estuary before being replaced with a fish-friendly bridge, prevent migrating juvenile salmon from taking advantage of estuaries for rearing and feeding.

Recovery Plan Includes Protecting Habitat and Fish

The Jamestown S'Klallam Tribe and volunteers conducted a fish survey on the Dungeness River by snorkeling at night. The tribe was looking for fish around logjams built in 2007 and 2008 to create salmon habitat in a stretch of river nearly devoid of it.

The overall salmon recovery strategy for the region seeks to maintain habitat integrity to protect and strengthen wild stocks while restoring habitat for the formerly productive, but currently weak wild stocks.

Specific recovery goals and prioritized actions are identified in the North Olympic Peninsula Lead Entity (NOPLE) strategy. NOPLE has established priorities for both watershed and nearshore processes to recover ecological function. Priority work is related to hydrologic regime, sediment supply, lower river hydrodynamics, water quality, canopy cover and nutrient input.

The identified goals for the NOPLE Recovery Plan are:

- Maintain and improve ecosystem productivity and genetic diversity;
- Protect highly productive habitats and populations and restore impaired habitat and populations with productive potential;
- Utilize the best available science to set regional priorities;
- Recognize socio-political factors in decision making; and
- Provide direction and focus for project sponsors.

Recovery Efforts Lagging

At the 5-year mark, a review of key environmental indicators for the Dungeness-Elwha Basin (WRIA 18) recovery planning area reveals a continued decline in water quality, floodplain and riparian processes, as well as shoreline habitat condition. Both internal and outside review has concluded that recovery efforts are behind the expected pace of implementation (Chinook Implementation Assessment Report).

This finding is partially explained by funding shortfalls for large-scale projects and a shortage of staff for both restoration and preventative measures, such as compliance, enforcement and monitoring.

Nearshore habitat loss along the Strait of Juan de Fuca is a concern for the Jamestown S'Klallam Tribe's Focus Area. About 36% of the shoreline within this area has been modified or armored as of 2003. The impact of armoring such as bulkheads and docks can reduce or eliminate productive, shallow water habitat through filling or alteration of sediment sources, sediment transport and accretion of these sediments along the nearshore (Hirschi 2003). These activities present a serious threat to sand lance, surf smelt, and herring spawning habitat conditions in WRIA 17 and 18. Approximately 51% of inventoried sand lance, surf smelt and herring habitat in the Jamestown S'Klallam Tribe Focus Area have been modified. Drift cell impairments are another serious concern which have negatively affected the movement of gravel and sand to forage fish spawning beaches.

In 2006, when property owners on this beach near Sequim complained about flooding, they worked with the Jamestown S'Klallam Tribe to create a natural berm on the beach instead of a bulkhead. The properties are protected from flooding while the shoreline remains natural, providing good habitat for salmon, eelgrass, clams, forage fish and birds.

Development Impacts Forests, Water Quality

This section of the Dungeness River is a stone's throw from Ward Road in Sequim due to dikes that were built decades ago to control flooding of the river. In turn, the river still threatens to flood properties while salmon habitat degrades.

Population growth is forecasted to continue within the Focus Area over the coming decade. This raises concerns about increases in impervious surface area which can negatively impact water quality and local watersheds.

Impervious surface areas cause increases in stream temperatures, decreases in stream biodiversity, and contributes to pollutants in storm water runoff, which can contaminate local aquatic systems (Schueler 2000).

Sensitive stream habitat elements may be lost when 10% of the watershed is covered by imper- vious surface area. Between 1986 and 2006, impervious surface area increased from 5.5% to 7.1% in total for the Focus Area. Impervi- ous surface area increased from 18.04% to 27.96% (9.9%) in the Bell Creek Basin and from 12.33% to 18.77% (6.4%) in the Dungeness Valley Basin.

The lower reaches of these basins are now in the impacting or degrading category due to the amount of impervious surface area that now exists.

Retention of forested land cover is critical for watershed health. A minimum of 65% forested land cover is needed to prevent severe stream degradation (Booth et al. 2002). In 2006, four basins within the Focus Area were below this threshold, including the Dungeness Valley Basin at 43.8%. In the Dungeness, some forest cover has been regained through replanting, but much has been lost as forest land is developed. Land conversion within the Focus Area is a concern as three basins lost 4 to 10% of their forest cover from 1992 to 2006. These trends place a greater emphasis on restoring forest cover through riparian and riparian-adjacent vegetation planting as a means to restore salmon habitat.

Looking Ahead

"Every River Has its People" has long been a saying that describes the importance of the Dungeness River to the people, fish and wildlife that reside here. In spite of outward appearances, the Sequim/Dungeness is a watershed in serious trouble. Hydrological modifications of the Dungeness River, including a 3-mile long Corps of Engineer levee and five private levees, have caused such serious aggradation in the lower river that flooding is a constant threat.

The whole watershed has been hydrologically modified by a 100-year-old irrigation system which withdraws water from the Dungeness River to irrigate 26,000 acres of what used to be all farmland but is now rapidly converting to residential uses, with some hobby farms and commercial development. River water is grossly over-appropriated and in late summer, low river flows threaten salmon spawning and rearing.

Of the seven salmon stocks, four are listed as threatened under the Endangered Species Act. Shellfish beds in both Dungeness and Sequim Bays are closed to harvest due to either bacterial pollution or toxins associated with algal blooms.

The growth trend of the focus area is approximately 1.3% per year, and the population is expected to increase by 20,000 people in the next 20 years (WRIA 18 Plan). Within the past five years there has been a proliferation of commercial development and its associated impervious surfaces. Stormwater runoff impacts fresh and marine waters and is a contributing factor to shellfish downgrades. Urban and residential growth in the watershed relies almost entirely on groundwater sources that are hydraulically linked with the Dungeness River. Except for the city of Sequim (population 5,300 out of over 25,000), the entire watershed is served by individual and a few community septic systems, many of which are likely contributors to marine bacterial pollution (DOH sanitation surveys).

Despite the commitment in the PS Chinook Recovery Plan that protecting existing habitat is the most important action needed, habitat is declining. Nine elements related to regulations identified in the recovery plan have not had any implementation action and are not being forwarded by an identified lead (Judge, M.M. 2011). This is because the local county government is moving forward with required actions only, such as the SMP update, and other local entities do not have jurisdiction or authority to make changes. The North Olympic Lead Entity for salmon recovery self-reports (and Judge, M.M. 2011 concurs) that we are behind expected pace of implementation for area including Dungeness. The efforts are mainly limited by a lack of funds for large-scale restoration projects and an inadequate amount of staff and project sponsor capacity.

Conditions in the Dungeness that are harmful to both fish and humans have been described in the Dungeness Flood Control Plan (1990), Dungeness Comprehensive Flood Hazard Management Plan (2009) and several salmon recovery documents. However, twenty years of recognition has not resolved the harmful condition. In fact, local salmon recovery and water quality efforts have been heavily weighted in favor of capital actions, rather than on funding and implementing non-capital programs (Judge, M.M. 2011). Part of this is a legacy from early lead entity work which was directed to focus primarily on capital actions. Part of it stems from the limited funding available, which tends to favor on-the-ground capital actions. Another issue is that many of the non-capital regulatory and protection actions are governed by others. Political support is needed to affect those changes (Judge, M.M. 2011). A focused message to foster community will and political support to protect remaining high quality habitat is needed.

Rootwads and logjams installed in creeks and rivers are common, as part of an effort to restore habitat for salmon, such as in this side channel of the Dungeness River.

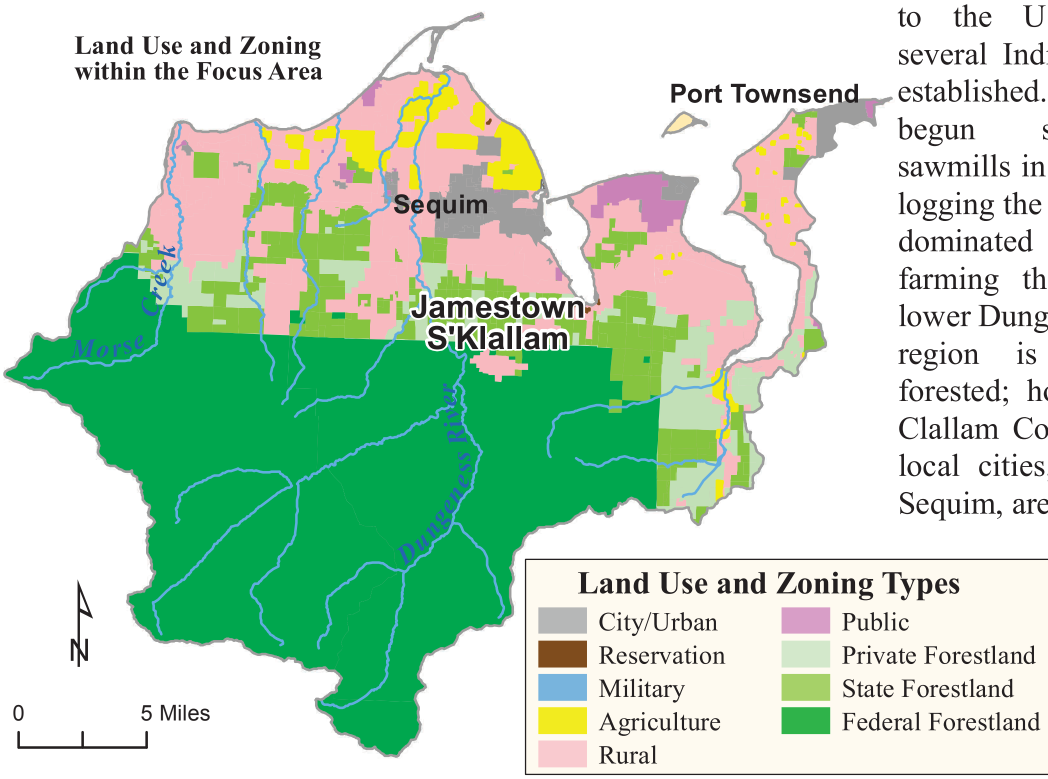
Jamestown S'Klallam Tribe

The Focus Area for the Jamestown S'Klallam Tribe report is in the northeast corner of the Olympic Peninsula and includes portions of WRIA 17 (Quilcene-Snow) and WRIA 18 (Dungeness-Elwha) in the rain shadow of the Olympic Mountains. Its watersheds drain north to the Strait of Juan de Fuca and Admiralty Inlet. These watersheds include the Dungeness River, whose headwaters are located in the Olympic National Park and U.S. Forest Service wilderness areas, as well as several smaller independent drainages.

The topography and precipitation patterns vary dramatically within the Focus Area, from high mountain ridges with 240 inches of annual precipitation to lowland valleys with only 15 inches of annual precipitation. Geologic features in the landscape were created from a combination of seismic uplift, glaciation, and fluvial processes. These past and current forces have had important consequences for the evolution of coastal shoreline features, stream drainages, and headwater wetlands, many of which provide important spawning and rearing habitats in the nearshore for many forage fish and salmonid species, including the ESA Threatened Hood Canal/Eastern Strait Summer Chum and the Puget Sound Chinook.

Many streams in the Focus Area have natural periods of low flows and may go dry during the summer months when precipitation is sparse. This renders streams particularly vulnerable to human impacts, such as from riparian vegetation removal and water extractions. While these streams may not flow year-round, they still provide important spawning habitat for fish populations, including coho and fall chum.

The Klallam were the first human inhabitants in the eastern Strait region where they had villages and fishing camps along the shorelines and near the mouths of major streams, enjoying the benefits of the plentiful fish and shellfish resources. After the signing of the Point No Point Treaty of 1855, the S'Klallam tribes ceded their lands to the U.S. government and several Indian Reservations were established. Euro-Americans had begun settlements around sawmills in the region to continue logging the old-growth timber that dominated the landscape, and farming the floodplains of the lower Dungeness River. Today the region is largely rural and forested; however, Jefferson and Clallam Counties, along with the local cities, Port Townsend and Sequim, are rapidly developing.



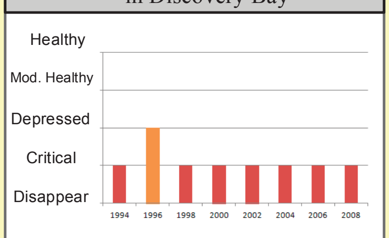
Data Sources: Clallam County, 2010; Jefferson County, 2007; WADNR, 2009

Sand Lance, Surf Smelt, and Herring Spawning Habitat Conditions are Threatened

Approximately 51% of inventoried sand lance, surf smelt and herring spawning habitat in the Jamestown S'Klallam Tribe focus area has been modified or armored. Armoring and modification interrupts the movement of gravel and sand to these beaches and could negatively affect spawning habitat as a consequence. Herring stocks are in critical status in Discovery Bay.

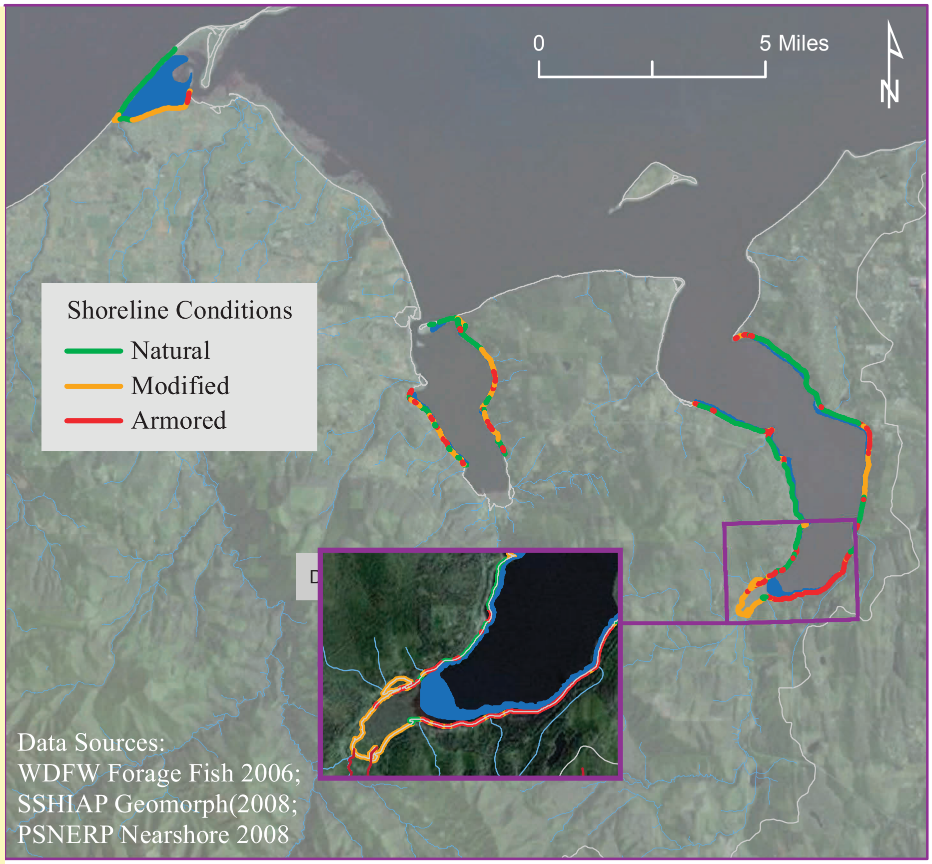
Forage fishes are small, schooling fishes that are key prey for larger predatory fish and wildlife in a marine food web. (Pentilla, 2007). Sand lance is recognized as being one of the key elements of a juvenile Chinook's nearshore diet (Duffy, 2010). Pacific herring are also a valuable indicator of watershed health. They serve as an important bait fish for tribal fishermen. In the graph below, you will see the critical status that pacific herring have been suffering in Discovery Bay, one step away from disappearance.

Herring Stock Decline in Discovery Bay



Data derived from WDFW Status Report, 2008

A large proportion of the shoreline of these basins has been altered in various ways by human activities, to the possible detriment of these species. Sand lance and surf smelt spawn on upper intertidal beaches consisting of sand and gravel. Development on shorelines negatively affects spawning sites (Pentilla, 2007).



Data Sources:
WDFW Forage Fish 2006;
SSHIAP Geomorph(2008;
PSNERP Nearshore 2008

Surf Smelt

Pacific Sand Lance

Photos of sand lance & surf smelt from WDFW

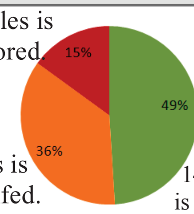
Herring

Photo of herring from University of North Carolina

WDFW Documented Forage Fish Spawning

This pie chart reveals the proportion of armoring and modification in known forage fish spawning areas along shorelines, which can affect the natural sediment dynamics of spawning beaches and potentially impact the habitat for these fish.

4 miles is armored.

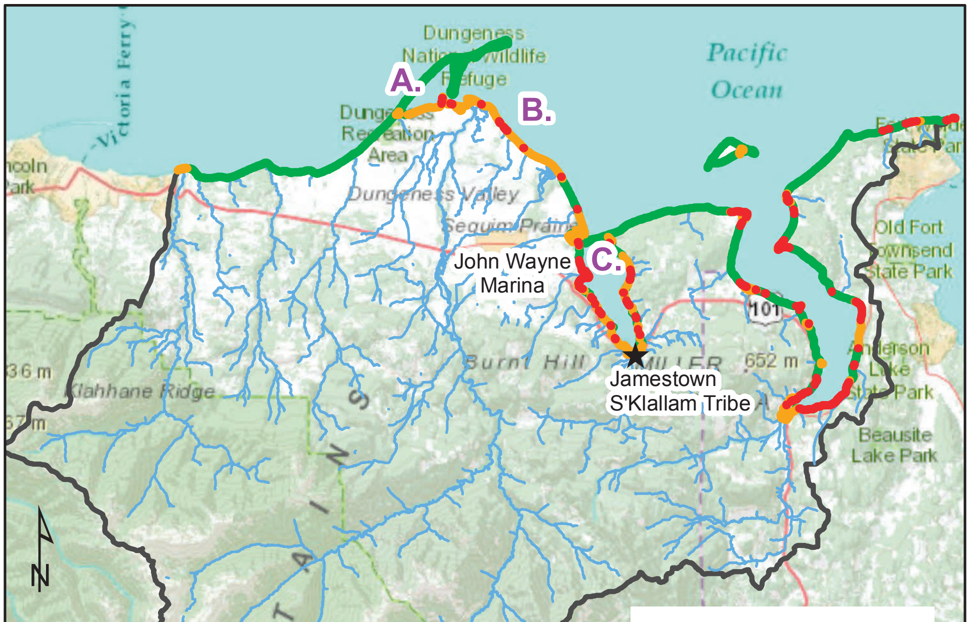


11 miles is modifed.

14 miles is natural.

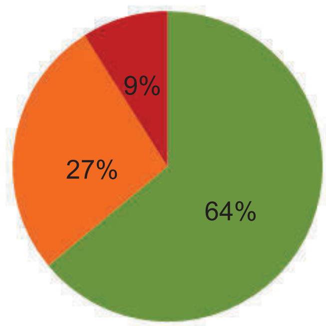
Nearshore Habitat Loss in the Strait of Juan de Fuca for the Jamestown S'Klallam Tribe's Focus Area

About 36% of shoreline in the Jamestown Tribe's focus area has been modified or armored. The Action Agenda (Puget Sound Partnership, 2009) has identified habitat alteration as a threat in the Puget Sound and Strait of Juan de Fuca, including armored shorelines (such as docks and bulkheads) which cover beaches that produce valuable plant life and native nearshore species that provide food for salmon, such as the Summer Chum and Puget Sound Chinook.



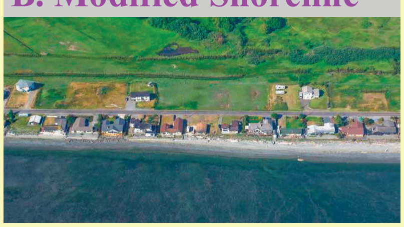
Shoreline alterations such as jetties and rockwalls interrupt the flow of sand on beaches. Docks and bulkheads cover beaches so that plant life and fish species cannot produce in these areas (PSP, 2009). Data collected on shoreline conditions in this region shows that 64% is natural, 27% is modified and 9% is armored (Figure 1).

Figure 1: Calculated Shoreline Conditions



A. Natural Shoreline

B. Modified Shoreline



C. Armored Shoreline

Oblique photos from Washington Coastal Atlas, 2006

The impacts of bulkheads, docks and other forms of armoring can reduce or eliminate productive, shallow water habitats through filling or alteration of sediment sources, sediment transport and accretion of these sediments along the nearshore (Hirschi, 2003). Almost all of the nearshore coastline adjacent to the Jamestown S'Klallam reservation is forested and undeveloped, which is notable compared to the area near the John Wayne marina in the northeastern shore of Sequim Bay. (Photo C)

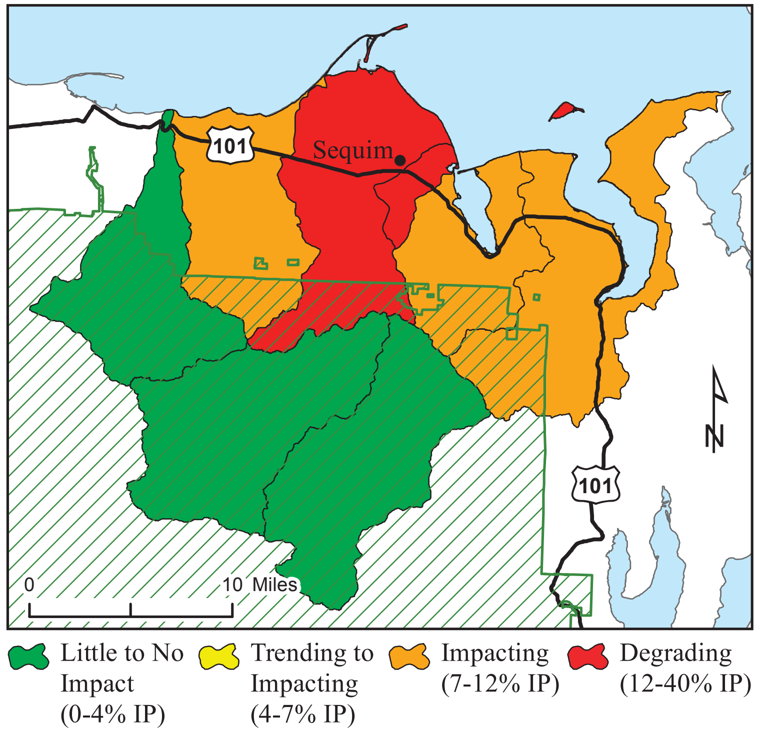
This area has had a long history of occupancy by the S'Klallam Tribal Members up until the time of non-Indian settlement (Kennedy and Thomas 1977). The marina, dock, fill, parking lots and launch ramp have impacts that are severe in the erosion zones (Hirschi, 2003). The marsh habitat partially isolated by the road fill to the south of the marina is of interest for restoration and can likely support juvenile salmon (Byron Rot, personal communication, 2011).

Impervious Surface Negatively Impacts Water Quality

High population densities lead to large amounts of impervious surfaces, including roads and other infrastructures, negatively impacting the local watersheds and resulting in loss of salmon habitat. Sensitive stream habitat elements may be lost when 10% of the watershed is covered by impervious surface area (IP). The total Focus Area IP increased from 5.5% to 7.1% between 1986 and 2006. Three basins had over 10% IP in 2006.

While the Sequim-Dungeness area enjoys many benefits of being a predominantly rural landscape, it is misleading to think that translates into good water quality. Any level of human disturbance has an impact on watershed processes. Impervious surface area (IP) is well documented as a coarse measure of human impact on watershed scale hydrology and biology (Alberti et al., 2007; Booth et al., 2002; Booth and Jackson, 1997). IP causes increases in stream temperatures, decreases in stream biodiversity, and contributes to pollutants in stormwater runoff, which can contaminate local aquatic systems (Schueler, 2000). The Hood Canal and Strait of Juan de Fuca Summer Chum Recovery Plan describes thresholds of 10% IP in a watershed at which sensitive stream habitat elements are lost, while 25 to 30% IP results in poor water quality conditions (HCCC, 2005). Each watershed has a different reaction to a given amount of IP: thresholds serve only to generalize the continuum of degradation that accrues as IP increases and forest cover is lost (Booth et al, 2002).

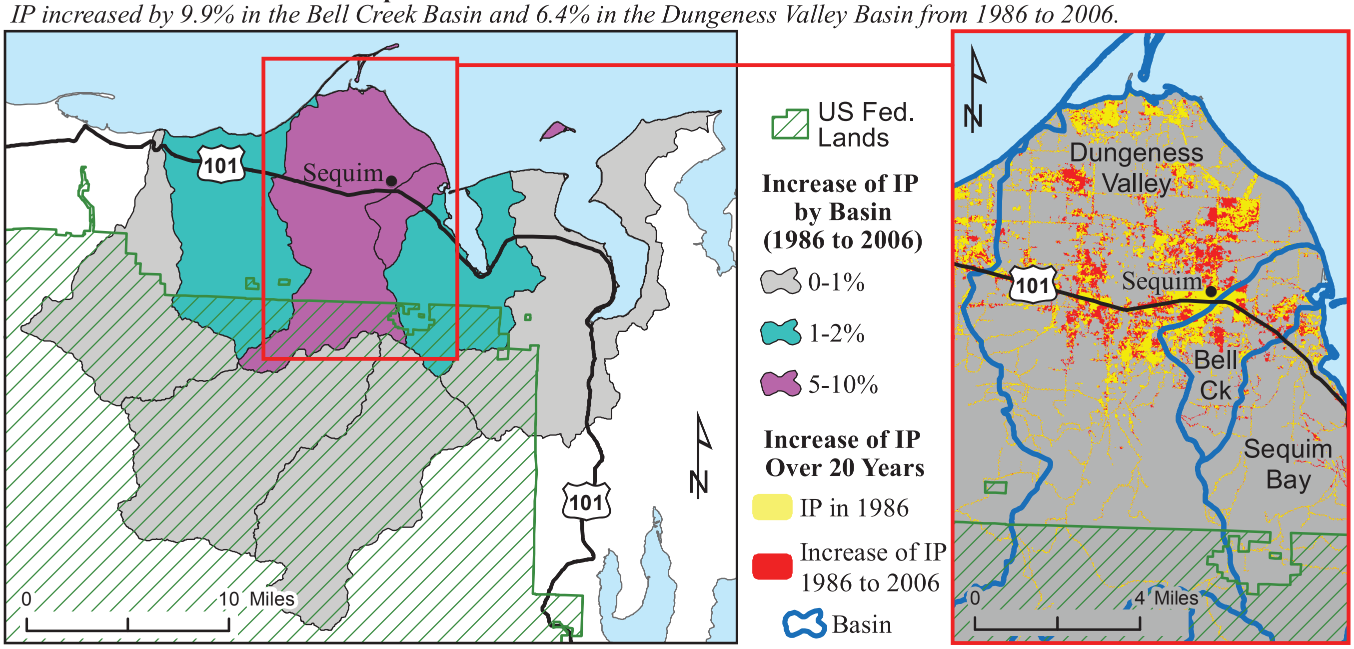
Watershed Degradation from Impervious Surface Area (IP)



Data Sources: NOAA CCAP, 2010; WADNR, 2009; WADNR, 2006; WAECY, 1999

Impervious Surface Area Increased Between 1986 and 2006

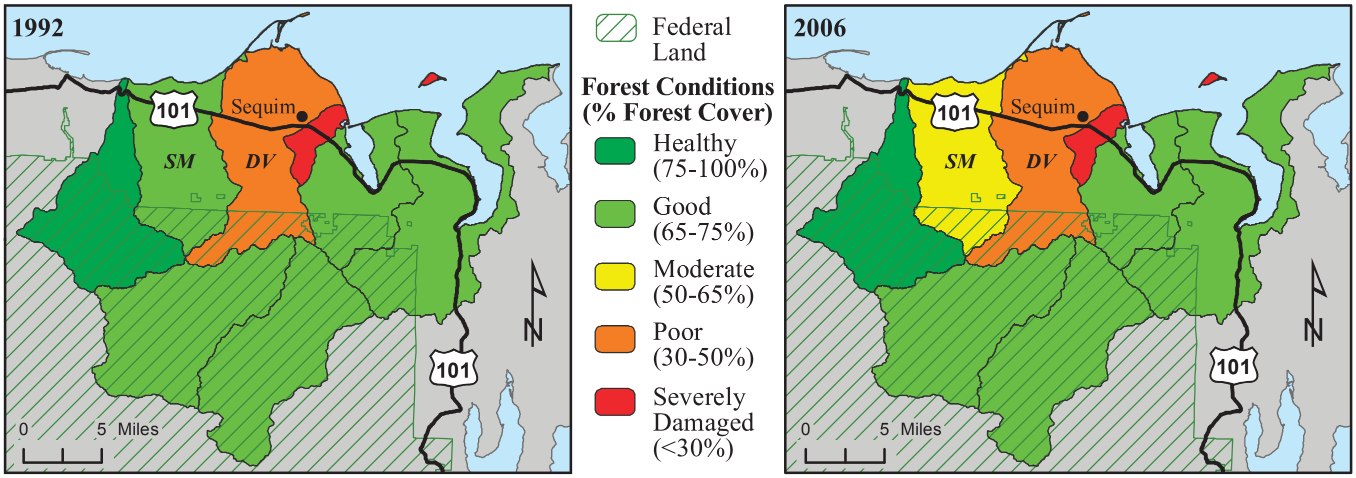
IP increased by 9.9% in the Bell Creek Basin and 6.4% in the Dungeness Valley Basin from 1986 to 2006.



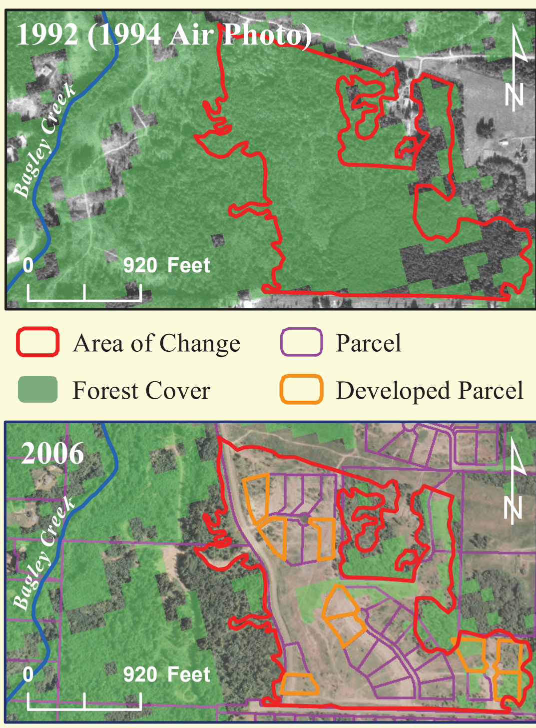
Forested Land Cover Critical for Watershed Health

A minimum of 65% forested land cover is needed to prevent severe stream degradation. Four basins in the Focus Area were below this threshold in 2006, including the Dungeness Valley (DV) at 43.8%. While some forest cover is regained through plantings in working forests, much more is lost as forestland is developed. Three basins lost 4 to 10% of their forest cover from 1992 to 2006, the most being the Siebert McDonald basin (SM) at 9.5%.

Percent Forest Cover by Basin



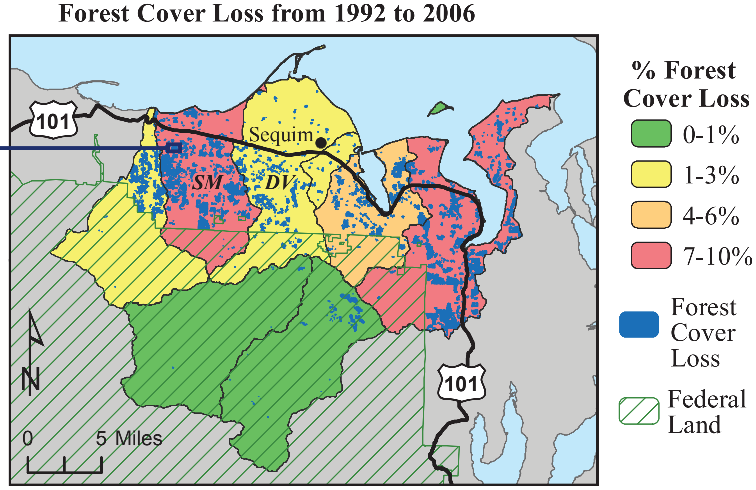
Land Conversions Result in Loss of Working Forests



Seventy acres of forested land cover was removed after two Forest Practice Application activities between 1999 and 2007 at this site near Bagley Creek. Nine new homes were built on the converted land between 2007 and 2010, with room for at least 19 additional homes.

Forested land cover is a vital component to the health of stream ecosystems at the watershed and riparian corridor scale (Stewart et al, 2001). The Hood Canal and Eastern Strait of Juan de Fuca Summer Chum Salmon Recovery Plan (HCCC, 2005) states that the "removal and modification of native riparian forests increases water temperatures, reduces stability of floodplain landforms, and reduces large woody debris recruitment to stream channels." Loss of forested land cover causes degradation to aquatic systems even when the level of impervious surface is low (Booth et al, 2002). The threshold for minimal to severe stream degradation is 65% forest cover (Booth et al, 2002); however, any level of disturbance has an impact on stream biology (Morley, 2000). Restoring forest cover through riparian and riparian-adjacent vegetation planting is a vital element in the restoration efforts of salmon habitat in the Dungeness River (DRRWG, 1997).

Forest Cover Loss from 1992 to 2006



Data Sources: NOAA C-CAP, 2010; UW WA Statewide Parcel Database, 2010; NAIP Imagery, 2006; NAPP Imagery, 1994

Summary

The Jamestown S'Klallam Tribe's focus area is located in the northeast corner of the Olympic Peninsula and includes portions of WRIAs 17 and 18. The watersheds in this area drain into the Strait of Juan de Fuca and include the Dungeness River, which once supported impressive runs of Spring Chinook and Summer and Fall Pink salmon (Lichatowich, 1993). A century of withdrawals, riparian forest harvest, filling, and development in the floodplain have made the Dungeness River watershed a ghost of what it used to be (Rot, 2003). This is the home watershed of the Jamestown S'Klallam Tribe; healthy habitat and salmon runs are both culturally and economically significant to the Tribe. Although a large portion of the focus area is contained within the Olympic National Park and the United States Forest Service wilderness area, many of the habitats are heavily impacted by land use, water extractions, infrastructure, and other habitat alterations, especially along shorelines and critical environmental areas.

A minimum of 65% of land cover should be forested to prevent severe stream degradation (Booth et. al, 2002). Four basins in the focus area were below this threshold in 2006, including the Dungeness Valley at 43.8%. While some forest cover is regained through plantings in working forests, much more is lost as forestland is developed. Three basins lost between four and 10% of their forest cover from 1992 to 2006, the greatest being in the Siebert McDonald basin at 9.5%. Population increase is another factor that has contributed to the degradation of watersheds in this area, resulting in the increase of impervious surface area near valuable habitat. High population densities lead to increased amounts of impervious surfaces which negatively impact the local watersheds and result in the loss of salmon habitat (Alberti et. al, 2007). The Hood Canal and Strait of Juan de Fuca Summer Chum Recovery Plan (HCCC, 2005) states that sensitive stream habitat elements may be lost when impervious surface area covers 10% of the watershed. The impervious surface area has increased from 5.5% to 7.1% between 1986 and 2006 in the focus area. Three basins had greater than 10% increases in 2006. About 36% of shoreline in the Tribe's focus area has been modified or armored. The Action Agenda (PSP, 2009) has identified habitat alteration as a threat in Puget Sound and the Strait of Juan de Fuca. Habitat alterations, including armored shorelines, impair beach and nearshore habitat for native plant vegetation and nearshore species that provide food for salmon, such as summer chum and Puget Sound Chinook. Important forage fish habitat has also been threatened along these shorelines. Approximately 51% of inventoried sand lance, surf smelt, and herring spawning habitat in the focus area have been modified or armored. Armoring and modification interrupts the movement of gravel and sand to these beaches, negatively affecting spawning habitat. Herring stocks are in critical status in Discovery Bay (WDFW, 2008).

The Jamestown S'Klallam Tribe is extremely concerned about climate change and is working toward developing data that will show the effects of this major issue. They continue to work toward the protection and restoration of healthy and functional nearshore, estuarine, and river habitat, restoring those areas that are degraded, and conducting research to understand the organisms and the land/water they occupy.

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State of Our Watersheds Report
Dungeness-Elwha Basin

When I start thinking about what you could start researching for the Elwha River Restoration Project, there's just an endless supply. We're talking about the Elwha River as an example of what our streams would be like if they were well taken care of.

**– ROB ELOFSON,
LOWER ELWHA KLALLAM TRIBE**

The Lower Elwha Klallam Tribe

The Lower Elwha Klallam Tribe is part of the Klallam Band of Indians that have resided throughout the Strait of Juan de Fuca, Hood Canal and Port Gamble Bay for generations. They are party to the Point No Point Treaty of 1855, when tribes ceded most their traditional lands to the U. S. government.

The Dungeness-Elwha Basin (WRIA 18) has remained largely rural and forested with a natural resources-based economy focused on shellfish harvesting, commercial forestry, commercial fisheries, tourism, and agriculture. Major land use impacts on salmon habitat have occurred from floodplain and shoreline development, road construction and past logging practices.

This report will focus on the northwest portion of WRIA 18 basin and surrounding marine waters, which is only a portion of the area that the Lower Elwha Klallam Tribe co-manages.

Degradation of Dungeness-Elwha Basin

The western portion of the Dungeness-Elwha Basin (WRIA 18), east of the Elwha River to Morse Creek, contains watersheds that have headwaters located within the Olympic National Park and U.S. Forest Service wilderness area, comprising 76% of the planning region.

This landownership pattern concentrates development in the watershed's lower elevations. Consequently, major land-use impacts on salmon habitat have occurred primarily from floodplain and shoreline development, as well as road construction and past logging practices.

At the 5-year mark, a review of key environmental indicators for the Dungeness-Elwha Basin recovery planning area reveals a continued decline in water quality and quantity, floodplain and riparian processes, and shoreline habitat conditions. Both internal and outside reviews have concluded that recovery efforts are behind the expected pace of implementation (Millie Judge 2010).

Funding shortfalls for both large-scale projects and adequate staff capacity are cited as contributing factors for this finding. In addition, progress on many non-capital regulatory and protection actions governed by other entities also are negatively affected by these same funding shortfalls as it takes staff to engage on these issues as well.

A housing development along Ennis Creek. Population growth has contributed to degraded water quality and salmon habitat conditions.

Technical analysis has identified significant habitat limiting factors for the region's declining salmonid populations as:

- **Estuarine habitat loss and degradation;**
- **Loss of channel complexity from loss of recruitment of large woody debris;**
- **Floodplain modifications;**
- **Sediment aggradation;**
- **Loss of littoral drift (Haring 1999). [Note: This is the 1999 Washington State Conservation Commission Report of Limiting Factors].**

Recovery Plan Includes Habitat Restoration

The North Olympics Salmon Coalition worked with the Lower Elwha Klallam and Jamestown S'Klallam tribes to build logjams and redirect Morse Creek back into its historic channel.

The overall recovery strategy for the region seeks to maintain and improve habitat integrity to protect and strengthen wild stocks while restoring habitat for formerly productive but currently weak wild stocks (NOPLE 2005).

The North Olympic Peninsula Lead Entity (NOPLE) developed a habitat recovery strategy that incorporates specific recovery goals, focused areas, and prioritized actions that were developed through various recovery planning processes. NOPLE established priorities for both watershed and nearshore processes. The prioritized processes include hydrologic regimes, sediment supply, lower river hydrodynamics, water quality, canopy cover, and nutrient input.

The identified goals for the NOPLE Recovery Plan are:

- Maintain and improve ecosystem productivity and genetic diversity;
- Protect highly productive habitats and populations and restore impaired habitat and populations with productive potential;
- Utilize the best available science to set regional priorities;
- Recognize socio-political factors in decision-making; and
- Provide direction and focus for project sponsors.

Salmon Require Healthy Shorelines

Shoreline armoring and water quality issues impede improving productivity and genetic diversity within the eastern portion of Strait of Juan de Fuca. In WRIA 18, west of Morse Creek, 71% of the shoreline is armored. By comparison, only 2% of the shoreline is armored to the east.

Shoreline armoring isolates the nearshore habitat from the sediment source bluffs. These alterations interrupt the natural sediment dynamics of the shoreline (e.g. sand and gravel movement) leading to the potential degradation or elimination of spawning habitat of key forage fish.

Coupled with this degradation is the impairment to the area surrounding Port Angeles Harbor, stemming the annual discharge of 36 million gallons of combined sewage/stormwater overflow. Anthropogenic impacts have closed historic shellfish tracts and contributed to declines in shellfish and fish populations utilizing the harbor. The detrimental effect of these impacts can be seen in stock assessment data.

In WRIA 18, only 1 of 305 surveys found forage fish west of Morse Creek compared to the 81 successful results to the east. A healthy and abundant marine food web is essential to recovering and sustaining the planning region's salmonid populations.

These culverts on Ennis Creek within Port Angeles are partial barriers for juvenile salmon trying to get to the Strait of Juan de Fuca.

Population Growth Challenges Habitat Recovery

Morse Creek has been severely affected by development within WRIA 18. The creek's floodplain has been zoned for development, including utility right of ways and single family homes.

The expected population growth within the planning area will challenge the recovery goal to protect existing productive habitat and recover impaired habitat. Population growth occurs with increases in impervious surface area, causing a disruption of both ground and surface water ecology.

The Port Angeles area saw a 35% increase of impervious surface from 1986 to 2006. The 2006 estimate for impervious surface area is 11.6% which is at the top end of the range for the Impacting Category (6.5-12%). The forecasted growth results in projections for impervious surface area well into the Degrading Category by 2026 (SSHIAP).

Current land-use policies and ordinances have not been effective at protecting salmon-bearing streams within the planning area. Morse Creek is perhaps historically the most significant salmon stream in the Elwha-Dungeness Basin after the Elwha and Dungeness rivers.

The Morse Creek floodplain has been seriously impaired with 37% being zoned for development, from utility right of ways to single family homes. Downstream of Highway 101, 49% of the floodplain has been zoned for similar development. Its tributary watersheds platted for urban development "will likely result in additional significant stormwater impacts" (Entrix Inc 2005). Much of this impact is associated with the conversion of forestland to other uses such as residential development. About 5% of the forest cover within the Lower Elwha, Port Angeles, and Morse Creek Watershed Administrative Units was removed between 1986 and 2006.

Water Quality and Wells Impacted by Development

Surface and ground water ecology is impacted by urban development via the increase in exempt wells. Between 1986 and 2006, the number of wells in this planning area increased by 275% while the population in Clallam County grew by 28%.

Prior to 1986, the average well depth was 114 feet; By 2006, new well depth averaged 145 feet. Shallow wells withdraw water from the same aquifers that replenish wetlands, recharge streams and supply fresh water to marine nearshore habitats vital to salmon and shellfish. This increase in wells along the narrow coastal plain of the Elwha-Dungeness Basin has negatively impacted the watersheds and nearshore environments. This impact will continue as the area's population is forecast to grow as much as 31% by 2026.

White Creek at Highway 101 is a tributary to Ennis Creek. The culvert shown here is a barrier to fish trying to get deep into the watershed to spawn. Stormwater, as shown pouring out of the pipe left of the culvert, is a major issue contributing to degrading water quality within the watershed.

Looking Ahead

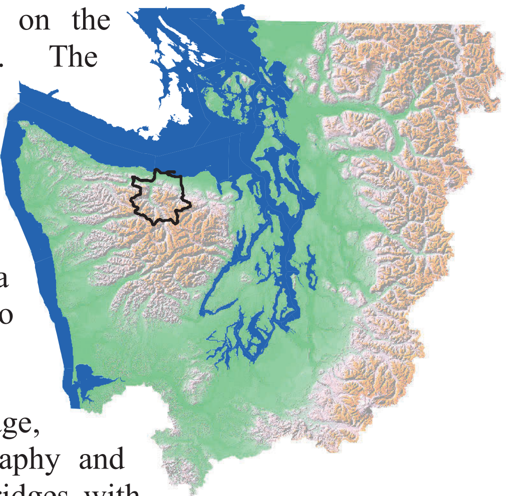
Greater focus and effort is required on conservation measures and restoration activities to offset these negative habitat trends. Upgrading the regulatory framework that serves to protect salmon habitat must occur if the underlying assumption to all the Puget Sound salmon recovery goals is to be realized – that existing habitat will be protected from loss (SSFPG 1999).

The forecasted population growth and associated development will result in impervious surface area to be in the Degrading Category by 2026 (SSHIAP).

The Clallam County's Shoreline Master Program, which governs land-use activities and protection of nearshore, estuarine, and river habitat, is currently under review. Adjustments in local land use policies and critical area ordinances will be needed to improve these negative trends and impact projections if the identified salmon habitat recovery goals are to be achieved.

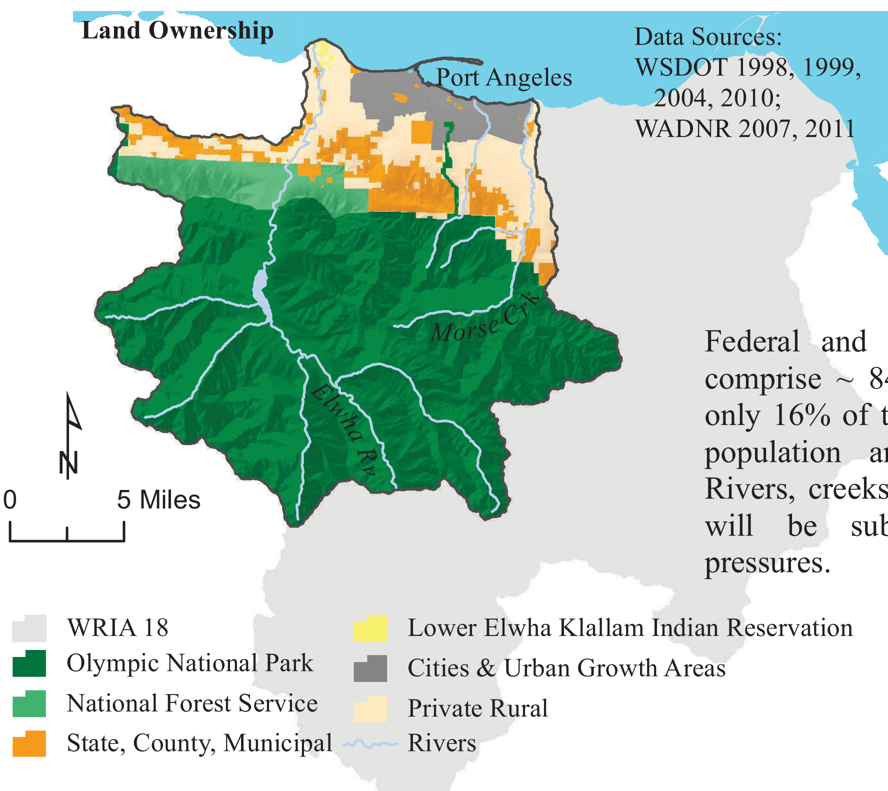
This planebed in Morse Creek is in need of habitat restoration. It has riffles and substrate appropriate for salmon habitat, but there are few calm pools of water available for salmon. The fish use pools of water for resting and feeding as they make their way to and from the Strait.

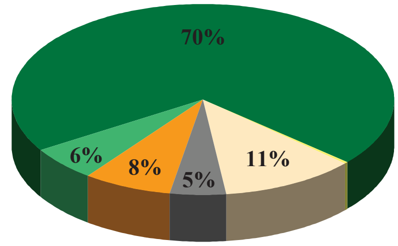
Lower Elwha Klallam (Dungeness-Elwha Basin)



The Lower Elwha Klallam "Area of Concern" will focus on the northwest portion of the Dungeness-Elwha Basin (WRIA 18). The Dungeness-Elwha Basin is located along the northeast portion of the Olympic Peninsula with its watersheds draining to the Strait of Juan de Fuca. There are two principle watersheds the Dungeness and the Elwha Rivers, whose headwaters are found in the Olympic National Park and U.S. Forest Service wilderness areas. In addition to these two large river systems, a number of smaller independent drainages (i.e. Morse Creek) also occur in the basin.

This chapter will focus on an area between Morse Creek drainage, east of Port Angeles, west to the Elwha River. The topography and precipitation patterns vary dramatically, from high mountain ridges with 240 inches of annual precipitation, to lowland valleys with 25 inches of annual precipitation. ESA-listed Puget Sound Chinook and Hood Canal/Eastern Strait Summer Chum occurs in the basin, along with coho, fall chum, pink salmon and steelhead. Bull trout occur in the Elwha drainages. The Klallam were the first human inhabitants to the eastern Strait region, with villages and fishing camps most often associated with stream mouths where they could take advantage of plentiful fish and shellfish resources. With the Point No Point Treaty of 1855, the tribes ceded their lands to the U.S. government and by this time, Euro-Americans had already begun clearing and farming the floodplains and were soon cutting the old-growth timber along the shorelines. Though much of the region remains rural and forested, the city of Port Angeles has developed rapidly. Additional anthropogenic impacts include the two dams, which began in 2011. These are located along the lower mainstem of the Elwha River, have blocked all anadromous fish access to the majority of the watershed since the early 1900s, and have had profound impacts on downstream salmonid habitat.



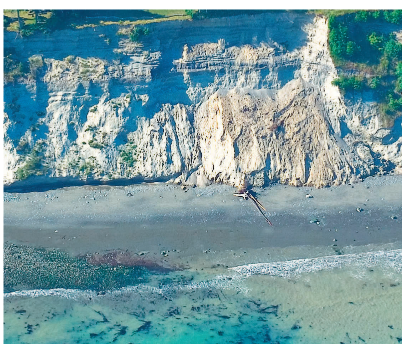


Federal and other government managed lands comprise ~ 84% of the focus area. That means only 16% of this area is available for the current population and its projected future growth. Rivers, creeks and marine shorelines in this area will be subject to increased development pressures.

Shoreline Armoring Impacts Forage Fish and Their Habitat

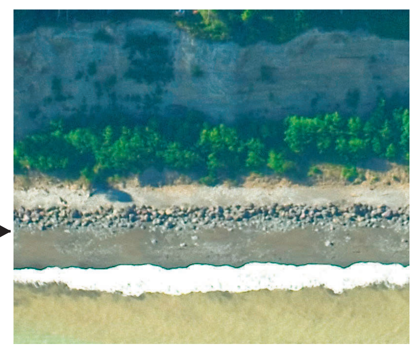
West of Morse Creek 71% of the shoreline is armored, isolating the nearshore habitat from the sediment source bluffs. In WRIA 18, only one of 305 surveys found forage fish west of Morse Creek compared to the 81 successful results to the east.

Due to the extensive armoring of the shoreline, sediment source bluffs have become disconnected from their associated beaches and marine nearshore. This armoring negatively affects the nearshore environment necessary for salmon survival, and severely limits forage fish habitat development and maintenance. "Disruption of sediment processes, including sediment sources and transport, has had a profound effect on the Elwha nearshore. A 9,000-foot bulkhead, installed in the late 1950s along the shoreline to protect the city of Port Angeles industrial water line, has disconnected a critical feeder bluff that is estimated to have formerly provided over 70% of beach material to central Strait of Juan de Fuca beaches" (Shaffer), especially impacting Ediz Hook, a large natural sandspit that forms Port Angeles Harbor. "Further limiting sediments, the Elwha and Glines Canyon dams have resulted in large-scale sediment starvation to the nearshore of the Elwha nearshore for almost a century. Combined, the dams and bulkhead have resulted in significant long-term erosion along the nearshore from the mouth of the river to Port Angeles Harbor" (Shaffer). The cumulative effect of losing nearly all the sediment supply directly caused the erosion of Ediz Hook and led to its extensive armoring. "Dam removal will result in only a partial restoration of the nearshore. Management of the nearshore, which includes a wide spectrum of local, city, county, state, tribal and federal jurisdictions, also plays a key role in nearshore restoration. Nearshore restoration associated with dam removal provides a potential benefit to both the community and the ecosystem. Citizen participation in all elements of this nearshore work is critical for success" (Shaffer).



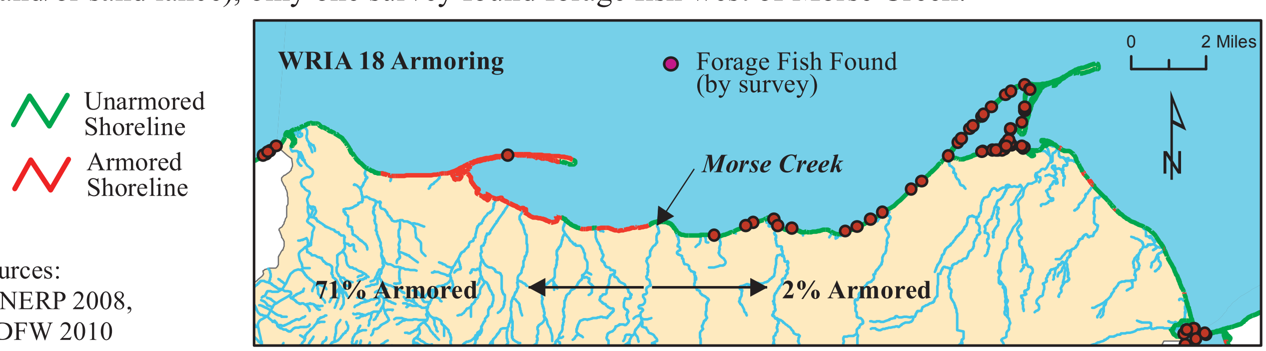
Unarmored Feeder Bluff east of Morse Creek

Armored Feeder Bluff west of Morse Creek protecting pipeline



Source: WA Ecy Shoreline photos

"Shoreline armoring is widespread, severely degrading shoreline currents, sediment processes, vegetative communities, vertebrate and invertebrate communities (salmonid food sources), and the protective habitat provided by natural shorelines" (Entrix Inc, 2005). Sand lance and surf smelt, which make up a major portion of the diets of juvenile Chinook salmon, spawn almost exclusively on sand and gravel beaches, making them especially vulnerable to the degrading effects of shoreline modification and armoring. From Morse Creek west, 71% of the shoreline is armored; going eastward only 2% is armored. Of the 305 forage fish surveys conducted in WRIA 18 by WDFW (with 82 positive for surf smelt and/or sand lance), only one survey found forage fish west of Morse Creek.

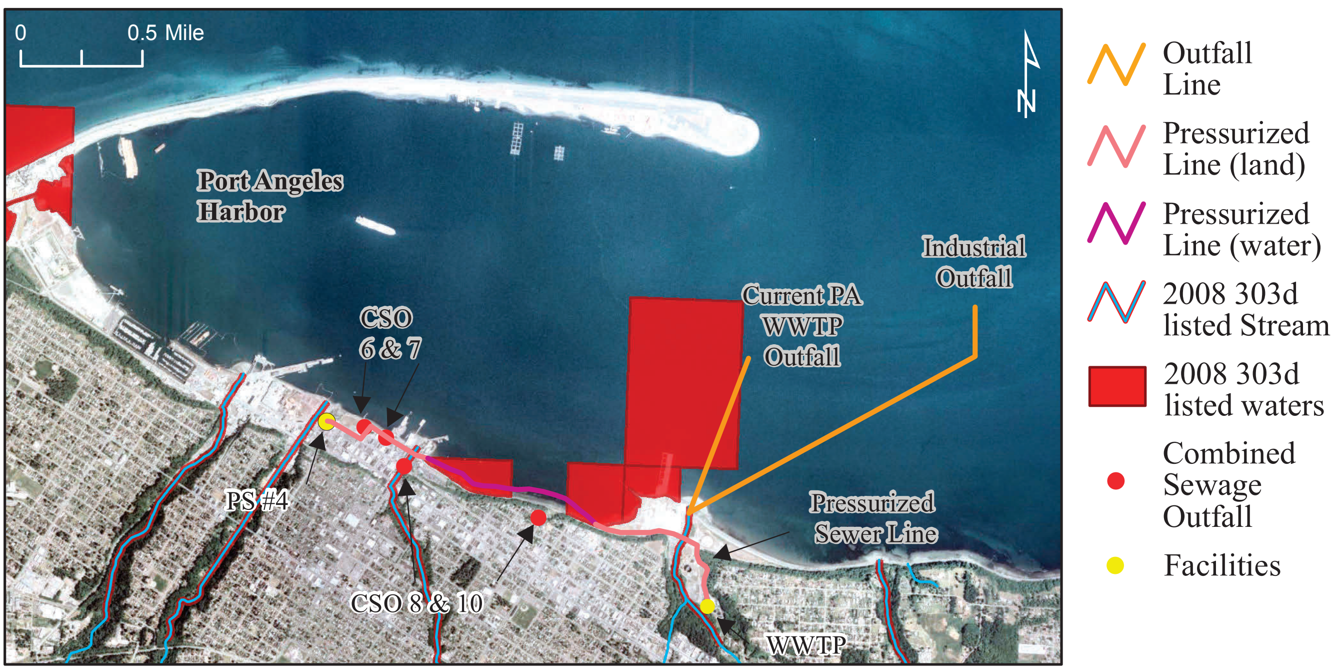


Sources:
PSNERP 2008,
WDFW 2010

Port Angeles Harbor Water Quality Impairment

Port Angeles Harbor (Harbor) is impaired physically, chemically and biologically. The annual discharge of 36 million gallons of combined sewage/stormwater into the Harbor is one of the contributors to the Harbor's impaired condition. Anthropogenic impacts have closed historic shellfish tracts and contributed to declines in shellfish and fish populations utilizing the Harbor.

Nearshore environments provide all lifecycle requirements to resident shellfish and are critical to the survival of juvenile salmon. In addition, the nearshore habitat provides essential habitat for adult salmon as they complete their life cycle to spawn in their natal streams. The nearshore and estuarine environments in Port Angeles Harbor have been historically severely altered and degraded and the overall water quality of this area is very poor. The Harbor has received past and present pollutant contributions from various industrial operations. Combined Sewer Outfalls (CSO), wastewater outfalls, runoff and "direct surface water discharge from six freshwater creeks in the area, all of which have varying degrees of residential and commercial land-use influences [stormwater inputs]. Five of the creeks are listed as impaired in terms of water quality and biological quality by the Clallam County Streamkeepers. [. . .] Harbor fisheries have been impacted due to environmental quality issues. [. . .] Marine biota in Port Angeles Harbor may be at risk for bioaccumulation of contaminants found in sediments either through direct uptake of contaminants by benthic organisms, or by indirect biomagnification of chemicals up the food web" (ECY & Env Inc, April 2008).



Between 2006 and 2010, an annual average of 80 CSO discharge events occurred, releasing a mean of over 36 million gallons into the Harbor nearshore. There are 4000' of forcemain, 30' to 40' offshore within the Harbor between Pump Station #4 (PS#4) and the Waste Water Treatment Plant (WWTP). "The Harbor Sewer Main is the most Serious Environmental & Health Risk in the event of Failure. Difficulty will pervade in effecting a timely repair on this system in an underwater marine environment should such a rupture occur. It is imperative that this pressurized sewer pipe be replaced outside of the harbor as soon as the City can effect it" (Michael Puntenney, PA City Engineer, 5/24/2011 presentation).

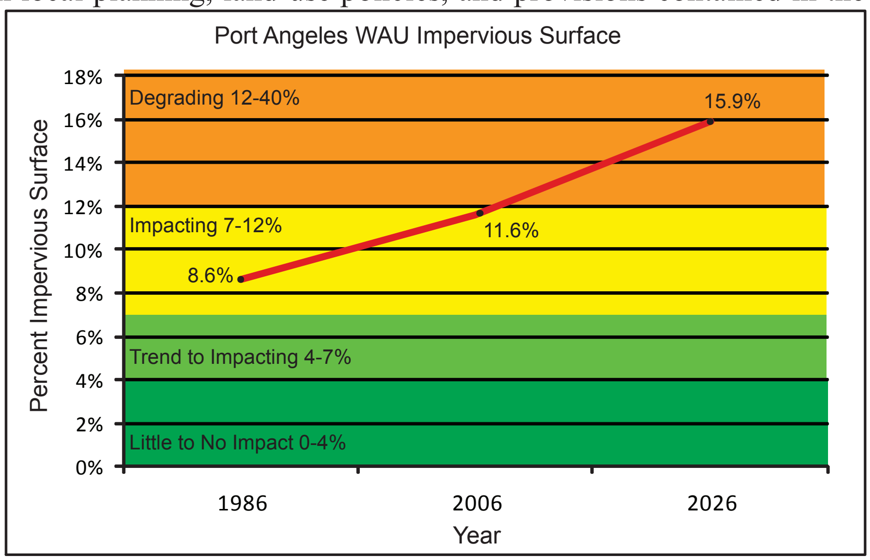
32.7% of CSO overflows are from alleys draining directly to sewage system and 40.5% of CSO overflows are from groundwater entering aging sewers via infiltration through broken pipes, defective joints, etc. (from 5/24/2011 presentation).

Increased Effective Impervious Surface

The Port Angeles area saw a 35% increase of impervious surface, from 1986 to 2006. It is projected that by 2026, the area of impervious surface will increase another 37%, moving this area from an "Impacting" to "Degrading" category, resulting in a lowered salmon population.

As the population continues to increase, so will the impervious surface area, causing a disruption of both the ground and surface water ecology. This disruption will negatively impact ecosystems dependent upon the proper function of the hydrologic cycle. The city of Port Angeles sits astride the lower reaches of five creeks and if you include the Urban Growth Area another two streams are additionally at risk of being impacted. "As the percentage of impervious basin increase above 7% you begin to lose salmon. We are already seeing this in systems like Valley Creek and Tumwater Creek" (McHenry).

Impervious surface causes increases in stream temperatures, decreases in stream biodiversity, as evidenced by reduced numbers of insect and fish species, and contributes to pollutants in stormwater runoff which can contaminate local aquatic systems (Schueler, 2003). Currently, the Port Angeles area has a level of impervious surface to raise it to an "Impacting" condition, and when considering the future population growth the area is projected to move to a "degrading" condition. The Chinook Recovery Plan has leaned heavily on local planning, land-use policies, and provisions contained in the WRIA 18 Watershed Plan to protect critical habitat. Even with critical area ordinances, planned platted development areas outside of the UGA will contribute to impervious surface area increases.

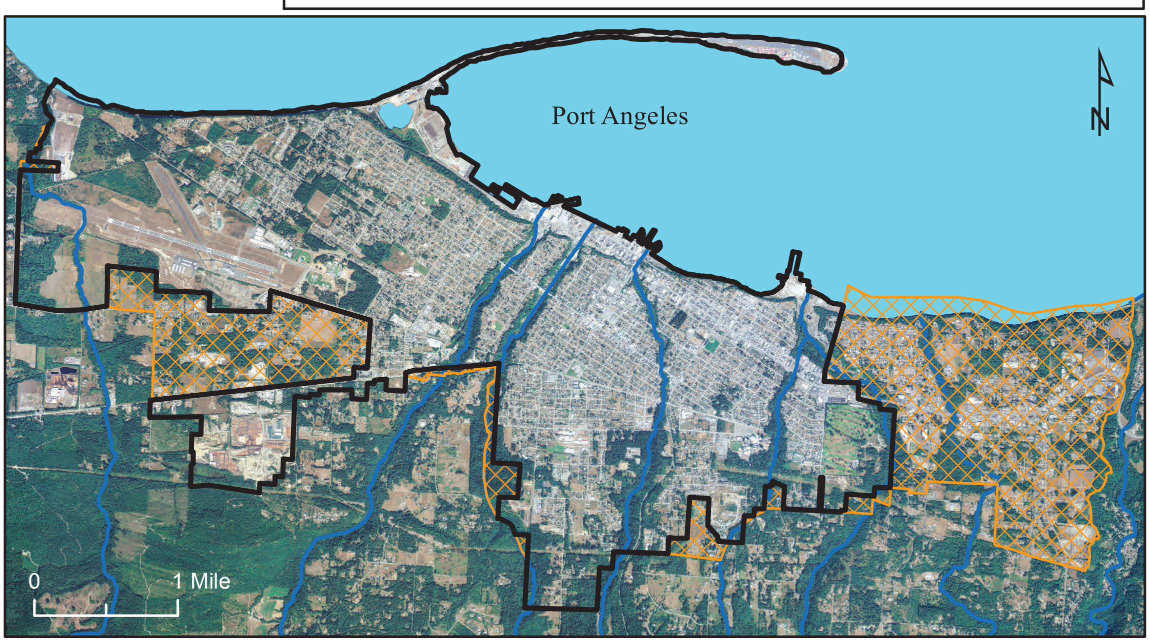


City & Urban Growth Boundaries

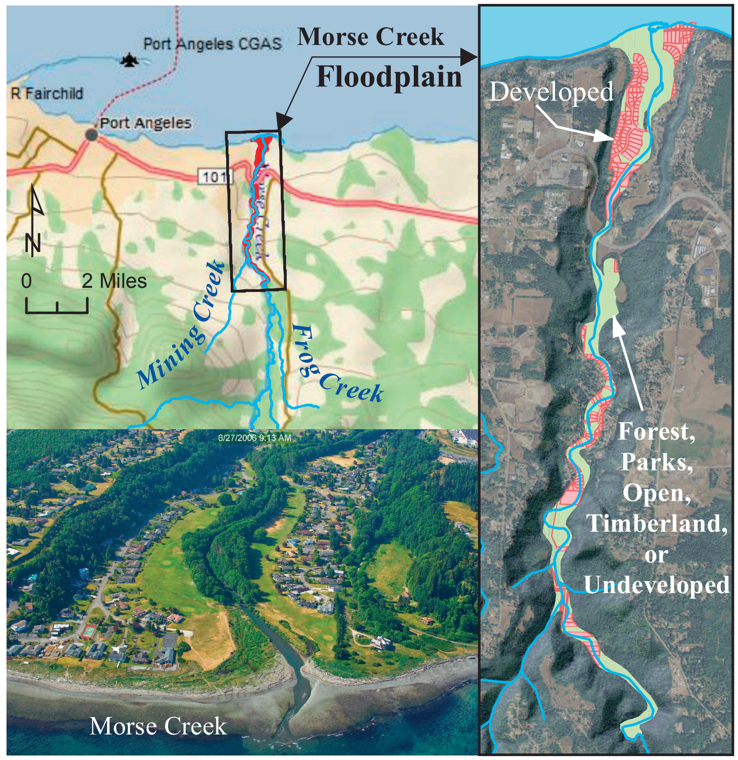
Port Angeles City Limits
Urban Growth Area
Streams

Sources:
NOAA CCAP,
WSDOT,
& WADNR

2026 Impervious Surface Forecast (SSHIAP) based upon WAOFM Population Forecast and NOAA CCAP data



Morse Creek Floodplain Impairment



The Morse Creek floodplain has been seriously impaired with 37% being zoned for development from utility right of ways to single-family homes. Downstream of Highway 101, 49% of the floodplain has been zoned for similar development.

The Morse Creek floodplain is “severely impaired” (PNPTC, 2006). Tributary watersheds, platted for urban development “will likely result in additional significant stormwater impacts” (Entrix Inc, 2005).
"Excepting the Elwha and Dungeness rivers, Morse Creek is perhaps historically the most significant salmon stream in the Eastern Strait sub-region" (PNPTC, 2006). Historically, the lower reaches of Morse Creek were unconfined and meandering with multiple channels. The sediment supply was sufficient to produce a pronounced spit with a secondary tidal creek outlet. "Morse Creek is known to have produced a high diversity of salmon species in greater numbers than would be expected for a stream of its size." "Anadromous fishery stocks known to have inhabited Morse Creek include spring/summer Chinook, coho, chum, and pink salmon, summer and winter steelhead, and searun cutthroat trout" (Entrix Inc, 2005).

What was once a wide productive floodplain has been modified to the extent that only the topography is recognizable. "The lowest two miles of Morse Creek have been most affected by a combination of land development, channelization; diking and armoring; road and other floodplain constrictions; and riparian vegetation removal." "Constriction of the channel and floodplain results in greater channel scour during high flow events, as well as in the elimination of escape cover outside the active channel..." "Below Highway 101 Morse Creek is effectively diked on both banks (from RM 1.2 to its mouth). This alluvial reach was formerly unconfined and meandering" (Entrix Inc, 2005).

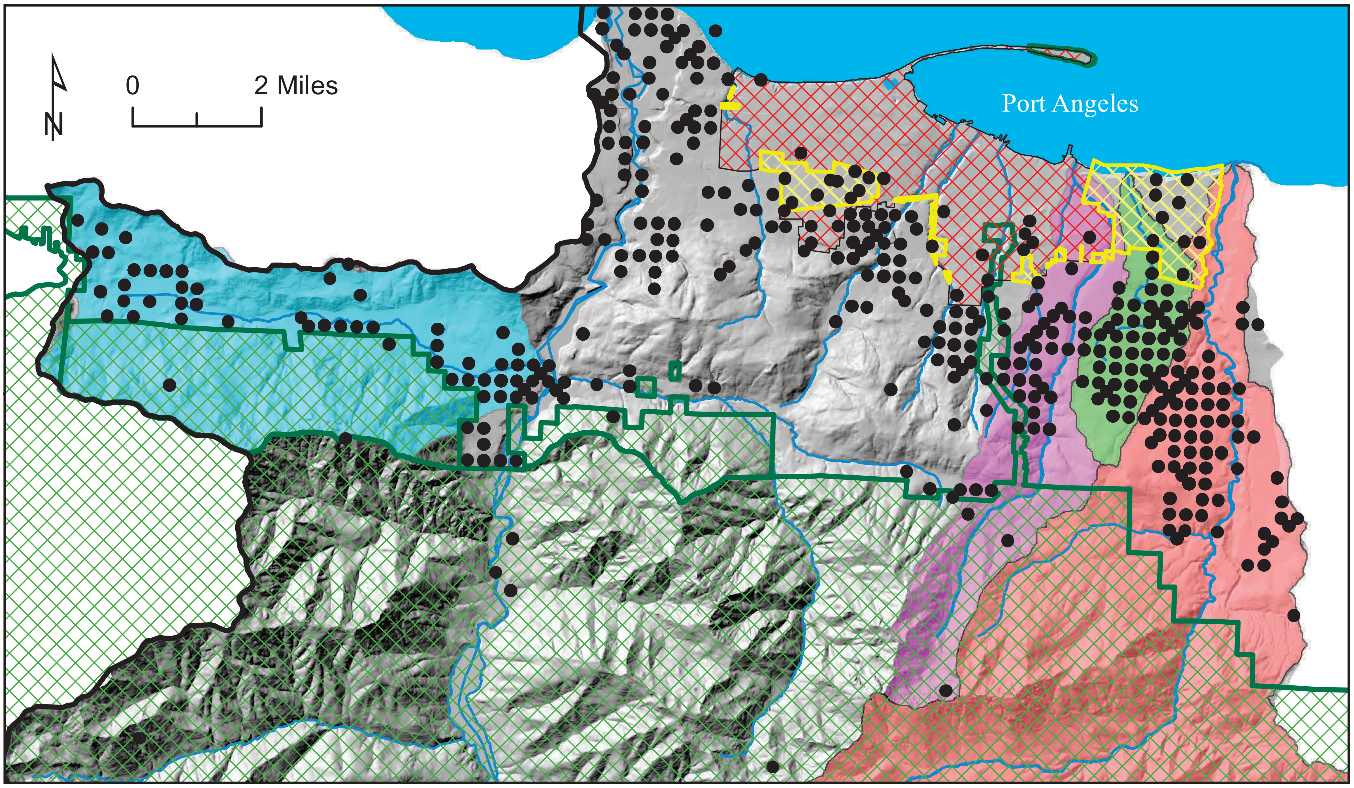
"The Morse Creek estuary, considered to have been an important contributor to the creek’s historic productivity, has been largely eliminated by development. The marine nearshore habitat at the mouth of Morse Creek also has been altered by historic railroad construction and armoring within the intertidal area, which has eliminated the shallow nearshore habitat to the west of Morse Creek" (Entrix Inc, 2005).

"Both the Mining Creek and Frog Creek watersheds are platted for urban development. Both are in the rain-on-snow zone in the Morse Creek watershed. Even if existing Critical Area Ordinances are enforced, new development will likely result in additional significant stormwater impacts (Joel Freudenthal, pers. comm., 2001)" (Entrix Inc, 2005).

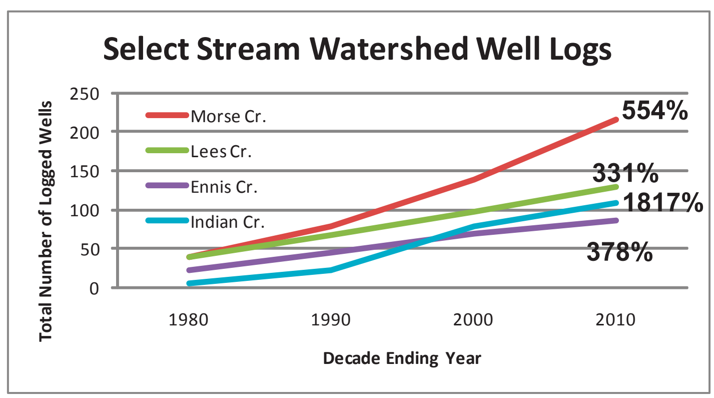
While some restoration is ongoing, more is needed to recover stocks. Future growth must be mitigated prudently to prevent increased impairment.

Exempt Wells Within WRIA 18 Area of Concern

Between 1986 and 2006, the number of exempt wells in this Area of Concern (AOC) increased by 275% while population in Clallam County grew by 28%. With the population forecast to grow by as much as 31% by 2026, the increase in the number of wells in a small developable area will negatively impact the watershed and nearshore environment.



The growth in population is causing a disproportionate growth in the number of logged wells. This unconstrained sprawling growth in exempt wells is threatening freshwater and marine habitat for salmon, shellfish and related species.



Note: Percentage values shown are growth since 1980.
Source: WAECY Well Log, WADNR NDMPL

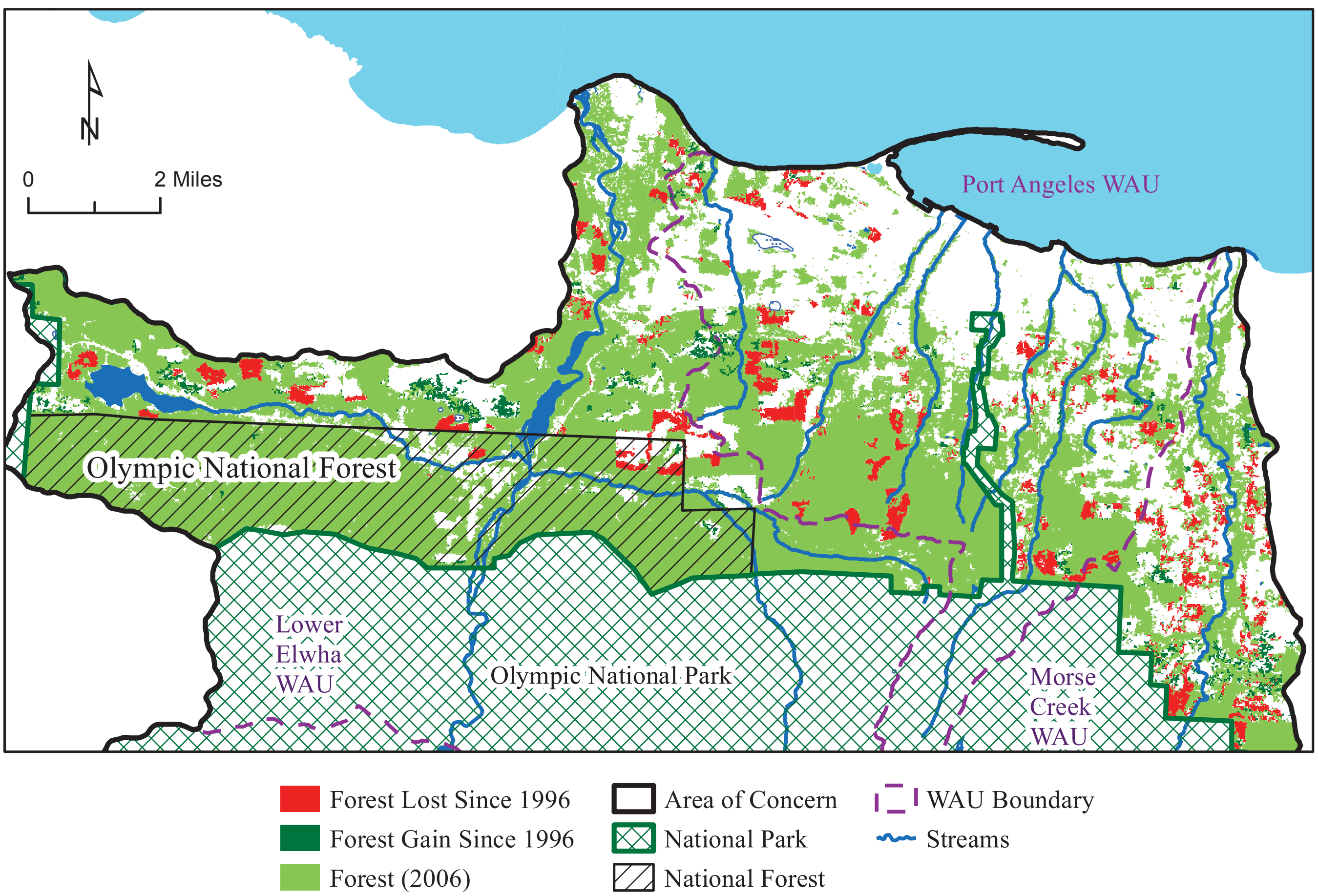
The Morse Creek, Port Angeles and Lower Elwha Watershed Administrative Areas (WAU) are mostly held in government, municipal and tribal management, with less than 15% in private/other ownership. All of the private/other land is in the lower reaches of the respective watersheds. In this AOC, Washington State Department of Ecology (WAECY) identified 200 wells prior to 1986; between 1986 and 2006 another 549 wells were added. With limited area available to accomodate growth, well density could double, if the population grows as forecast. In addition to the increase in the number of wells, the average depth is increasing. Prior to 1986, well depth averaged 114 feet; by 2006 new well depth averaged 145 feet. Shallow water wells withdraw water from the same aquifers that replenish wetlands, recharge streams, and supply fresh water to marine nearshore habitats that are vital to salmon and shellfish.

Forest Cover Loss Continues

About 5% of the forest cover was removed between 1996 and 2006 and the trend is to see more loss if protective actions are not taken. Managing forestland conversions to reduce long-term effects is a "Desired Condition and Outcome" component of the WRIA 18 Watershed Plan.

Downstream of the Olympic National Park, lies an area of approximately 90 square miles encompassing portions of the Lower Elwha, Port Angeles and Morse Creek Watershed Administrative Units. In 1996, 65.2% of this area was forested, but due to timber harvesting and some land conversions, ten years later only 62% of the area is forested, representing a loss of 5% or 2.84 square miles of forest cover. 34.2% of the 2.84 square miles of forest cover lost is currently zoned for non-forestry uses, indicating a permanent loss of forest cover. More recently, from 2006 to 2011, an additional three square miles (2,489 acres) of forest cover was removed during timber harvest operations.

"County forest lands are being permanently and irreversibly lost through conversion to other uses such as residential development. When forest lands are converted to other uses, important forest functions are impaired. Impervious surfaces accelerate runoff and erosion, degrading water quality and fish habitat. Wildlife habitat is lost, as are wildlife corridors" (Clallam County Code 31.02.130).



Source: NOAA CCAP 1996 & 2006, WADNR NDMPL & WAU

Summary

The Lower Elwha Klallam "Area of Concern" (AoC) focused on the western portion of WRIA 18, east of the Elwha River to Morse Creek watershed. The Elwha River was not considered in this chapter due to the river's large restoration efforts currently under way, including the removal of the two dams. So, the Lower Elwha Klallam wanted to focus this chapter on the number of small independent drainages (i.e. Morse Creek) which flow directly into the Strait of Juan de Fuca. In this area, the Klallam Indians were the first human inhabitants to the eastern Strait region, where villages and fishing camps most often were associated with stream mouths where they could take advantage of plentiful fish and shellfish resources. Federal lands comprise 76% of the 'area of concern' and combined with other government-managed lands, mostly by the Washington Department of Natural Resources, leaves only 16% of the area likely to see future population growth.

West of Morse Creek 71% of the shoreline is armored, isolating the nearshore habitat from the sediment source bluffs. In WRIA 18, only 1 of 305 surveys found forage fish west of Morse Creek compared to 81 surveys finding forage fish to the east. Along the shoreline of the city of Port Angeles, a 9,000-foot bulkhead was installed in the late 1950s to protect the city's industrial water line. This bulkhead disconnected the critical feeder bluff that is estimated to have formerly provided over 70% of the beach material to central Strait of Juan de Fuca beaches.

Port Angeles Harbor is impaired physically, chemically, and biologically. Anthropogenic impacts have closed historic shellfish tracts and contributed to the declines in shellfish and fish populations utilizing the Harbor. During the time period of 2006 to 2010, an annual average of 80 combined sewer outfall events occurred, releasing a mean of over 36 million gallons into the Harbor nearshore. Thirty-two percent of the combined sewer outfall events are caused by alleys draining directly to the sewage system and 40.5% of combined sewer outfall events are from groundwater entering an aging sewer system.

Impervious surface has increased in the Port Angeles area by 35% during the twenty year period from 1986-2006. It is projected by 2026; the amount of impervious surface will increase another 37% and when one considers the future population growth, the area is projected to move from a condition of 'impacting' to a 'degrading' status. The Chinook Recovery Plan relies on local planning, land-use policies, and provisions contained in the WRIA 18 Watershed Plan to protect critical habitat, but even with critical area ordinances, planned platted development areas outside of the urban growth area will contribute to impervious surface area increases.

During a twenty year period (1986-2006), the number of wells in the 'area of concern' increased by 275% while the population in Clallam County grew by 28%. Average well depth increased 21% indicating a potential lowering of the water table and a higher water withdrawal than recharge rate. With the population forecast to grow by as much as 31% by 2026, the management of the increase in the number of wells in the small developable area (downstream of the federal lands) is critical. Without an active growth management strategy, this increase in population and the associated wells will have a negative impact on the watershed and nearshore environment.

Morse Creek is one of the main independent drainages in and around the city of Port Angeles, lying just east of Port Angeles, it is perhaps historically the most significant salmon stream in the Eastern Strait sub-region, excluding the Elwha and Dungeness Rivers. Currently, Morse Creek has a seriously impaired floodplain with 37% being zoned for development from utility right of ways to single-family homes. When one looks downstream of the Highway 101 crossing, which has been diked on both banks; about 49% of the floodplain has been zoned for similar development. The lowest two miles of Morse

Creek have been most affected by a combination of land development, channelization, diking and armoring, road and other floodplain constrictions, and riparian vegetation removal.

Within the AoC and downstream of the Olympic National Park 5% of the forestlands were lost between 1996 and 2006. Forest cover loss impairs forest functions important to the salmonid lifecycle. Loss of forest cover can accelerate runoff and erosion; decreasing water infiltration, increasing stream temperatures, degrading water quality and fish habitat. Forecast population growth within the AoC will lead to increased housing pressure within Port Angeles, its adjacent urban growth area and in rural areas nearby. If this growth is not managed appropriately, additional, unnecessary forest cover loss will occur with resulting harmful impacts to salmon health and recovery.

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State of Our Watersheds Report
Lummi Watershed

Our elders used to tell us salmon is good medicine. It's part of our schelangen – our way of life. Now the salmon is in trouble, so our way of life is in trouble.

– MERLE JEFFERSON, LUMMI NATION

Lummi Nation

The Lummi people were among the original inhabitants of Washington's northernmost coast and southern British Columbia.

For thousands of years, they have worked, struggled and celebrated life on the shores and waters of Puget Sound.

The Lummi Nation is a self-governing nation within the United States and one of the largest tribes in Washington state with more than 5,000 members. The tribe manages nearly 13,000 acres of tidelands on the Lummi Reservation.

Degraded Habitat Limits Salmon Recovery

The Nooksack River watershed, which comprises approximately 832 square miles, is the largest drainage in Water Resources Inventory Area (WRIA) 1. Located in northwestern Washington, the watershed encompasses most of northern and western Whatcom County, part of Skagit County, and extends into British Columbia. The Nooksack River watershed has remained largely rural and has one of the higher quality estuaries in Puget Sound.

Since the mid-1800s, salmonid habitat has been severely degraded by forestry and agriculture practices that constitute the primary land uses within the basin. Nearly all of the lower mainstem and delta forests had been converted to agricultural land by the 1930s. Since 1950, land-use conversion has been primarily for commercial, residential, urban and industrial development.

Water quality and quantity continue to be challenged by forestry and agricultural practices, along with the population growth now being experienced within the watershed. The area's population is projected to increase by more than 50 percent by 2022, which presents one of the largest threats to salmon recovery efforts.

Technical analyses identified seven significant habitat limiting factors for the salmonid production from the Nooksack River:

1. Instability of channel in the upper and middle portions of the North and South Forks;
2. Increased sediment stemming from natural and human causes, and how that sediment is transported through the system;
3. Loss of logs and other structures that create pools and rearing habitat;
4. Bank armoring;
5. Fish passage barriers;
6. Changes in river flow and temperature; and
7. Changes along the marine shoreline in Bellingham Bay and adjacent in nearshore areas.

A Lummi Natural Resources crew installs a logjam in Nesset's Reach on the South Fork Nooksack River. The project used existing wood and helicoptered in additional logs to build eight logjams, which are designed to create deep covered pools in cool water, which is the habitat that salmon prefer.

Native spring chinook salmon in the South Fork Nooksack River are dangerously close to extinction. Over the years, the loss of streamside vegetation has removed shade and reduced in-river woody debris. Water that is too warm can reduce survival of salmon eggs and can also result in disease or death.

Steps to Restore Harvestable Population

The identified goal for WRIA 1 is to recover self-sustaining salmon runs to harvest levels that will support fisheries. In establishing this goal, the WRIA 1 Salmonid Recovery Board acknowledged that this will require protecting existing good habitat and natural stream processes and maintaining critical salmon habitat. This was to be achieved by guiding the majority of future development into designated urban areas and managing rural growth so there are minimal impacts to current habitat conditions.

The overall WRIA 1 habitat recovery approach was structured into seven key strategies:

1. Remove significant barriers to high-quality habitat;
2. Restore habitat in the forks, mainstem and major tributaries;
3. Ensure floodplain management protects and enhances fish habitat;
4. Protect good habitat through Local Critical Areas Ordinances and Shoreline Management Programs;
5. Protect and improve instream water flows for fish;
6. Identify priority estuaries and nearshore areas for protection and restoration; and
7. Restore conditions in lowland tributaries and independent tributaries to the Fraser River and Strait of Georgia.

Restoration Projects Face Funding Shortage

Implementation of the WRIA 1 Salmonid Recovery Plan is lagging behind the pace originally anticipated during plan development. Restoration work has progressed with numerous capital projects focused on restoring fish habitat and passage.

However, WRIA 1 has faced significant funding shortages for restoration projects, limiting implementation progress. Progress also has lagged on implementing the regulatory and incentive programs to protect and restore salmonid habitat and habitat forming processes.

Numerous Shoreline Management Plans within WRIA 1 are in the process of being updated and action on regulatory gaps such as exemptions for construction of single-family residences and agriculture still need to occur.

At the 5-year mark, a review of key environmental indicators for the Nooksack River watershed indicates a continued decline in salmon habitat quality and quantity.

Nooksack River instream wood abundance remains at historical lows. Archival data suggest that instream wood was historically very abundant in the Nooksack River. Construction of engineered logjams is a significant part of the recovery strategy as instream wood provides channel stability, habitat diversity and key habitat quantity.

There is an estimated 103 miles of mainstem river chinook habitat in the Nooksack River system, and the WRIA 1 Salmonid Recovery Plan recovery thresholds for abundance of instream wood are only being met in 1% of that habitat. Active logjam construction remains necessary to improve instream wood abundance in the Nooksack River system.

The WRIA 1 Salmon Recovery Plan (2005) points to watershed density of forest roads as one indicator of watershed health. Streams and stream habitat degradation have been associated with road densities greater than or equal to 2 miles of road length per 1 square mile of watershed area. In the upper Nooksack watershed, there are more than 1,376 miles of forest roads currently mapped, and forest road densities exceed 2 miles of road length per 1 square mile of watershed area in more than 65% of the upper Nooksack's watershed area.

To reduce the impacts of road densities, a total of 458 miles of road will need to be either abandoned, orphaned, or maintained with no drainage problems. An estimated 399 miles or 87% of those closures and/or repairs are scheduled to occur through the Road Maintenance and Abandonment Plans (RMAP) required for state and private forests.

Lummi tribal technicians plant western red cedar, Sitka spruce and willow in the Nooksack delta. The native plants will help create wetland and upland buffer habitat where fish and wildlife can breed, feed, rear and migrate. The rapid growth of the willow will shade out invasive weeds such as reed canary grass.

The Lummi Nation is enhancing nearly 2,000 acres of habitat in the Nooksack and Lummi river deltas as part of a tribal wetland and habitat mitigation bank. Eventually, credits in the bank will be sold or transferred to developers who are required to mitigate for unavoidable adverse effects their projects might have on wetlands and associated buffer areas.

Instream Flow Rules Fail to Protect Water for Fish

Low summer flows on the Nooksack River continue to degrade salmonid spawning and rearing habitat through loss of habitat connectivity, reduced habitat volume, stranding of juveniles and higher stream temperatures.

The WRIA 1 watershed instream flow rules were set in 1986 to "protect and preserve" instream resources from low flow exceedances. One of the primary human causes of salmon limiting stream flows in the lower Nooksack basin is the continued ditching and draining of wetlands that removes the natural storage of winter precipitation from the landscape. Extensive agricultural drainage activity bypasses storage in the system and moves water off the landscape during the spring months. As a result, water is not in the system during the summer months to maintain instream flows.

Contributing to this problem is the growth in exempt wells. The number of exempt wells has expanded 270% since 1986, from an estimated 3,294 wells to an estimated 12,195 wells. The majority of this increase (77%) occurred in basins either seasonally closed or closed year-round to water withdrawal.

From 1986 to 2009, flows in the Nooksack River failed to meet instream flow rule requirements 72% of the time during the July-September flow period. This circumstance and trend is contrary to the strategy to protect instream water flow for fish.

Wetlands, Estuaries Targets for Restoration

The habitat recovery approach for WRIA 1 prioritized wetland restoration in lowland tributaries on the Nooksack River and other independent tributaries that flow into the Strait of Georgia. For the lower mainstem Nooksack, the suggested target by the WRIA I Salmon Recovery Plan is a return to historical wetland conditions. This objective requires changes in agricultural land management in the lower Nooksack River floodplain.

Presently, the lower mainstem floodplain is a single threaded river through cropland, hay fields and drainage ditches, whereas historically, the Nooksack River floodplain was dominated by off-channel wetland habitat.

There were 4,754 acres of wetland to 741 acres of channel in 1880. Currently, the lower mainstem is estimated to have less than 10% of its historical wetland area.

In some areas of the lower mainstem, there has been a documented loss of channel length, which equates to a loss of fish habitat. For example, Collins and Sheikh (2002) documented a 35% reduction in channel length over the 1880 to 1938 period between River Mile (RM) 15 and RM 19. This equates to a reduction in channel length from 5.4 miles to 4 miles in the reach.

Estuary habitat within the Nooksack River has experienced both growth and decline.

The Nooksack River estuary is relatively healthy and has some of the more pristine and diverse estuarine habitat remaining in the Puget Sound. It remains one of the higher quality estuaries in Puget Sound. The Nooksack delta also is one of the fastest developing sedimentary features in the Puget Sound region as it has continued to prograde into Bellingham Bay.

Agricultural land conversion, starting in the mid-1920s, and associated seawall construction, tidal barriers, draining and diking reduced historic estuarine habitat by an estimated 3,163 acres in the Lummi Bay side of the estuary. Continued sediment deposition throughout the Bellingham Bay side has resulted in an additional 1,171 acres of estuarine habitat. The result is a net loss of 1,992 acres or 40% of historic estuarine habitat. Considering the relatively healthy state of the Nooksack estuary, protecting and restoring the remaining habitat is a priority of the recovery plan.

Approximately 58% of the adjacent nearshore natural shoreline within WRIA 1 has been modified to protect human infrastructure and development. Such industrial or residential development can directly contribute to degraded marine water quality and environmental conditions through stormwater discharge, failing septic systems and runoff of agricultural wastes.

Degrading water quality and fecal coliform levels continue to threaten shellfish harvest within the region. Primary fecal coliform pollution sources for shellfish beds relied on by Lummi tribal members for ceremonial, subsistence and commercial harvest include livestock and failing septic systems in the upstream watersheds. Current conditions for shellfish harvest are satisfactory for many areas, but future conditions remain uncertain with continued population growth within the region.

As an example, chronically poor water conditions in Drayton Harbor since 2004 have resulted in a 70% reduction in shellfish harvest opportunity, as approved area for harvest has been cut from 1,600 to 575 acres and repeated closures due to fecal condition have left shellfish harvest open only 84% of the time.

Looking Ahead

The regulatory approach within WRIA 1 is employing a "No Net Loss" strategy that requires a strong enhancement and voluntary effort to successfully recover a degraded watershed and estuary.

For this strategy to be successful, the accompanying regulatory framework must protect the existing habitat as improvements in habitat quality and quantity are realized through voluntary effort and directed capital enhancement projects.

This is not occurring within WRIA 1 as salmon and shellfish habitat quality and quantity is continuing to decline. In addition, the funding for enhancement activities has been insufficient to keep pace with development pressure.

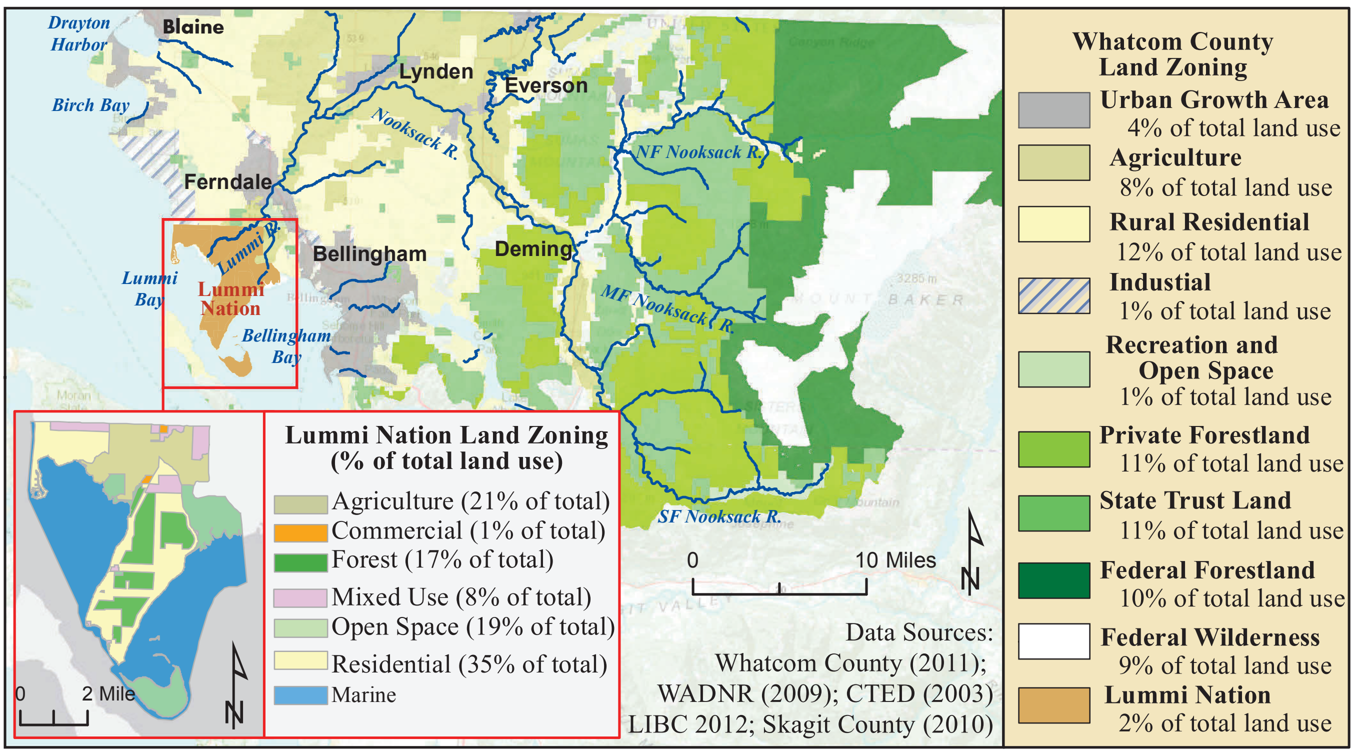
Regulatory reform is required as the current framework clearly is not providing adequate protection.

Harlan James, policy representative for the Lummi Nation, prepares to return the remains of the first salmon to the water following the tribe's First Salmon Ceremony.

The Lummi Nation -- WRIA 1 (Mountains to the Sea)

WRIA 1 is 1410 square miles in area: 832 square miles of WRIA 1 is in the Nooksack River watershed, the largest single watershed in the WRIA. Forty-nine square miles of the Nooksack watershed is in Canada. It has three main forks: the North, Middle, and South that originate in the steep high-elevation headwaters of the North Cascades and flow westerly descending into flats of the Puget lowlands.The North and Middle Forks are glacial rivers and originate from Mount Baker. The South Fork is a snow/rain fed river and originates from the non-glaciated slope of theTwin Sisters peaks. The Middle Fork flows into the North Fork upstream of where the North Fork confluences with the South Fork to form the mainstem Nooksack River. The mainstem then flows as a low-gradient, low-elevation river until discharging through the Lummi Nation and into Bellingham Bay. Historically, the Nooksack River alternated between discharging into Bellingham Bay, and flowing through the Lummi River and discharging into Lummi Bay (Collins and Sheikh 2002).

The Nooksack River has five anadromous salmon species: pink, chum , Chinook , coho, sockeye; and three anadromous trout: steelhead, cutthroat and bull trout (Williams et al. 1975; Cutler et al. 2003).

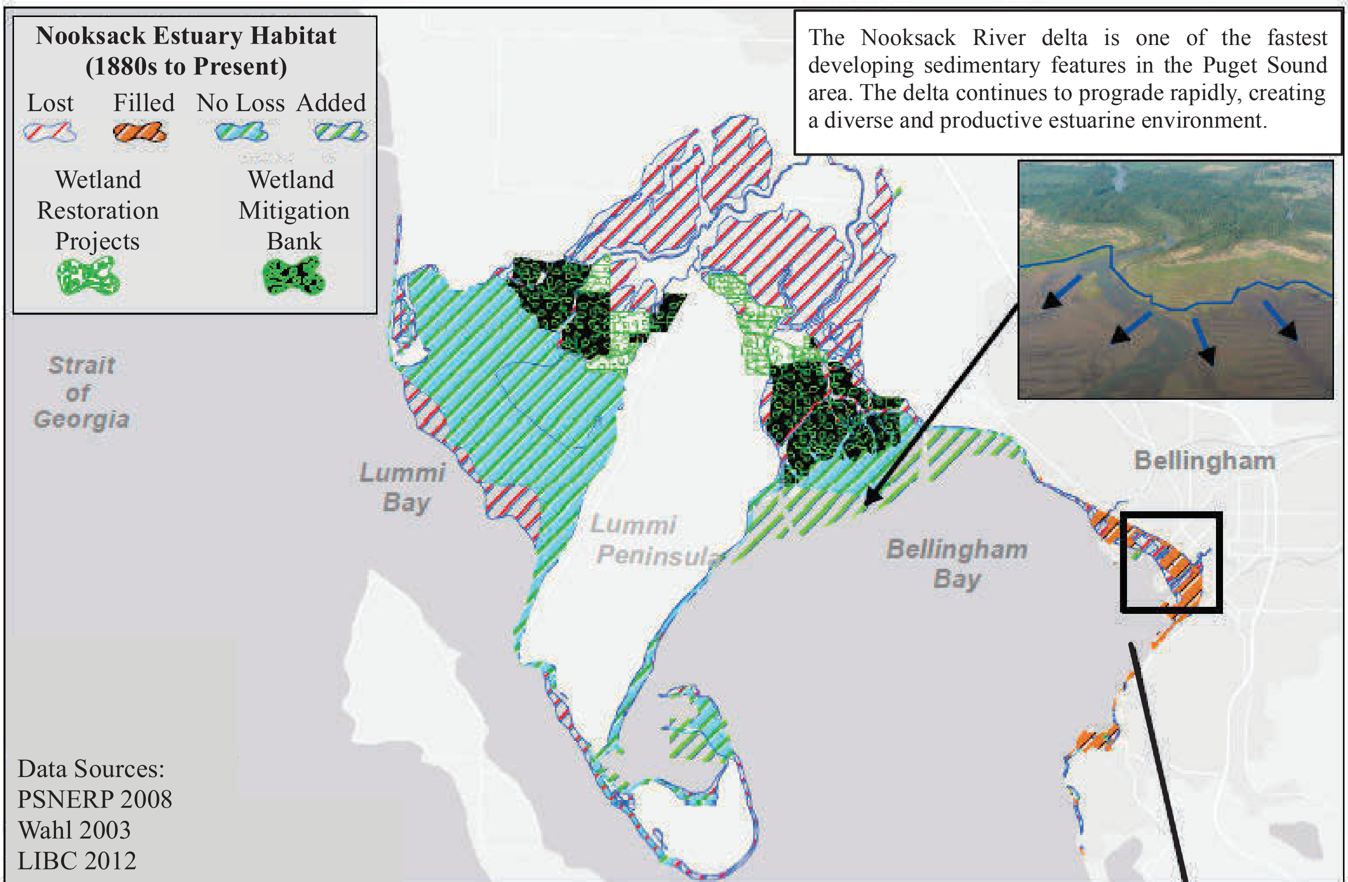


The Lummi are an aboriginal people who have fished, hunted, and gathered throughout their usual and accustomed grounds and stations and their traditional areas since time immemorial. Living in a region with many resources, the Lummis developed vibrant communities and a rich culture. By the mid-19th century, Euro-American settlers began to convert the landscape to accommodate faster rates of resource extraction and the historic life of the Lummi was forever changed.

Euro-Americans began settling the area in the mid-1800s primarily for the forest resources, with some arriving for opportunities in prairie farming and mining. Lowland clearing for agriculture began in earnest by the 1890s and by 1925 nearly all of the lower mainstem and delta forests had been denuded (WRIA 1 SRB 2005; Smelser 1970). Since 1950, land-use conversion has primarily been for commercial, residential, urban and industrial development (Smith 2002).

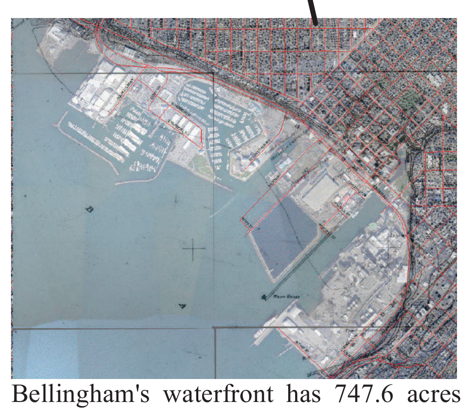
Lummi Nation Protects Wetlands in Lummi and Bellingham Bays

In the early 1900s, agricultural land conversion and associated sea wall construction, draining and diking significantly reduced historic subaerial estuarine habitat (Bortleson et al. 1980). Since then, sediment deposition throughout the Nooksack River delta has expanded historic intertidal estuarine habitat. According to the WRIA 1 Salmon Recovery Plan, the Nooksack River estuary is presently one of the healthiest and most pristine in the Puget Sound. Considering the healthy state of the Nooksack estuary,the Recovery Plan recommends continued protection and strategic restoration of the estuary.



For several thousand years, the Nooksack alternatively flowed through the Lummi River into Lummi Bay, and through the Nooksack River into Bellingham Bay (Bortleson et al. 1980). Around 1860, a large log jam changed the outlet course of the Nooksack River from the Lummi River to the Nooksack River. The new course of the river was very beneficial to sawmillsin Bellingham Bay, and considerable effort was exerted to keep it there (Deardorff 1992). Between 1926 and 1934, a dike separating the two rivers was built, and the Nooksack River has continued to discharge into Bellingham Bay ever since (Deardorff 1992).

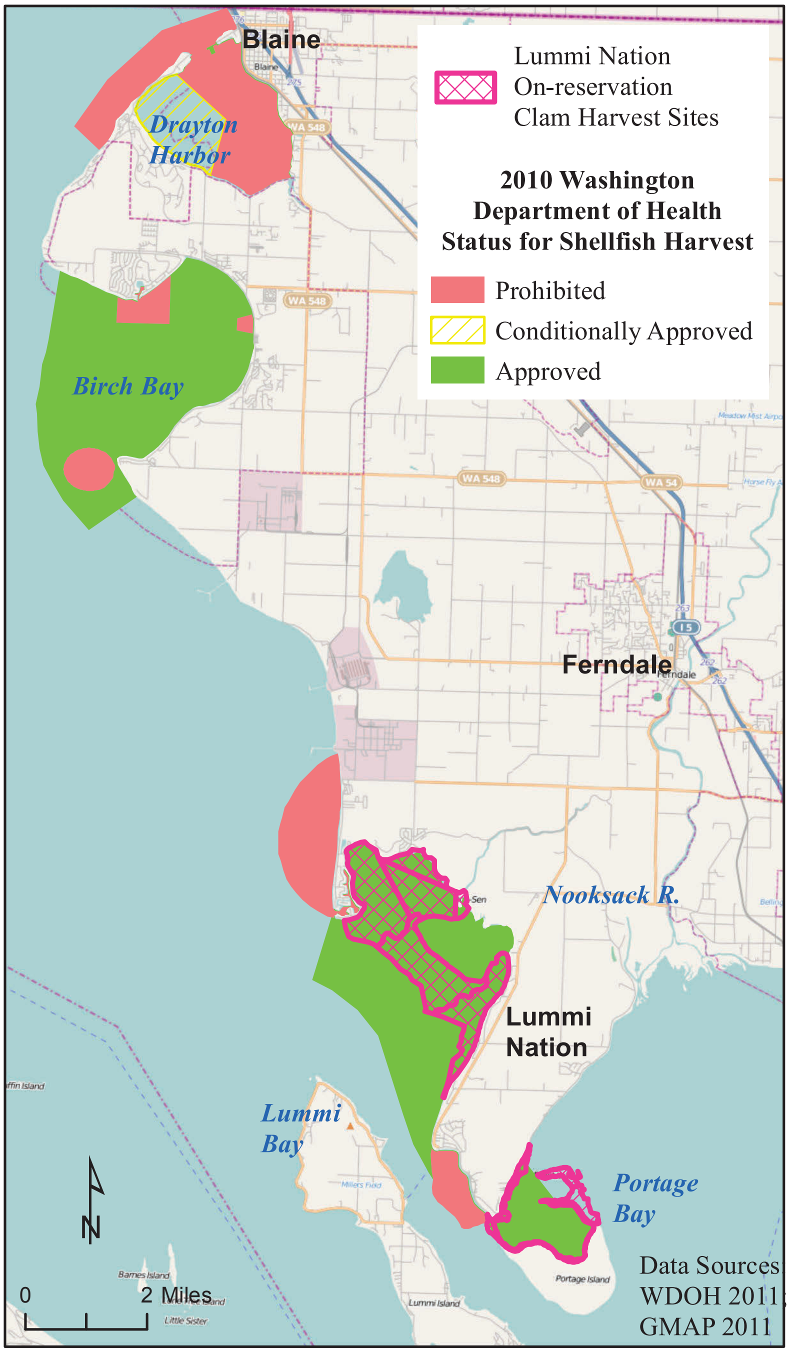
The long natural history of the Nooksack River alternatively discharging in both the Lummi and Bellingham Bay created a large wetland footprint in both estuaries. The Lummi Indian Nation is developing a wetland mitigation bank and restoration program that will protect and restore around ~2,750 acres of wetland habitat into the future.



Bellingham's waterfront has 747.6 acres of armoring, dredging and fill material impacts along the waterfront, with fill (453.3 acres) the majority of the impact (Wahl 2003). The city's shoreline provides substantially degraded habitat for anadromous salmon.

Current Conditions for Lummi Shellfish Harvest Favorable Future Conditions Remain Uncertain

In consultation with the Lummi Nation and under the Shellfish Consent Decree (Order Regarding Shellfish Sanitation, United States v. Washington [Shellfish], Civil Number 9213, Subproceeding 89-3, Western District of Washington, 1994), the Washington Department of Health (DOH) is responsible to the federal Food and Drug Administration (FDA) to ensure that the National Shellfish Sanitation Program (NSSP) standards for certification of shellfish growing waters are met on the Reservation. Primary fecal coliform pollution sources for shellfish beaches include livestock and failing septic systems located within the upstream watershed. Every time the State has to close shellfish beds, the Lummi's federal Treaty right to harvest shellfish is jeopardized. Currently shellfish harvest is "approved" by the Washington State Departmennt of Health in most of Lummi, Birch, and Portage Bays. In Drayton Harbor, however, shellfish harvest remains either prohibited" or "conditionally approved" due to continued high levels of fecal coliform bacteria.

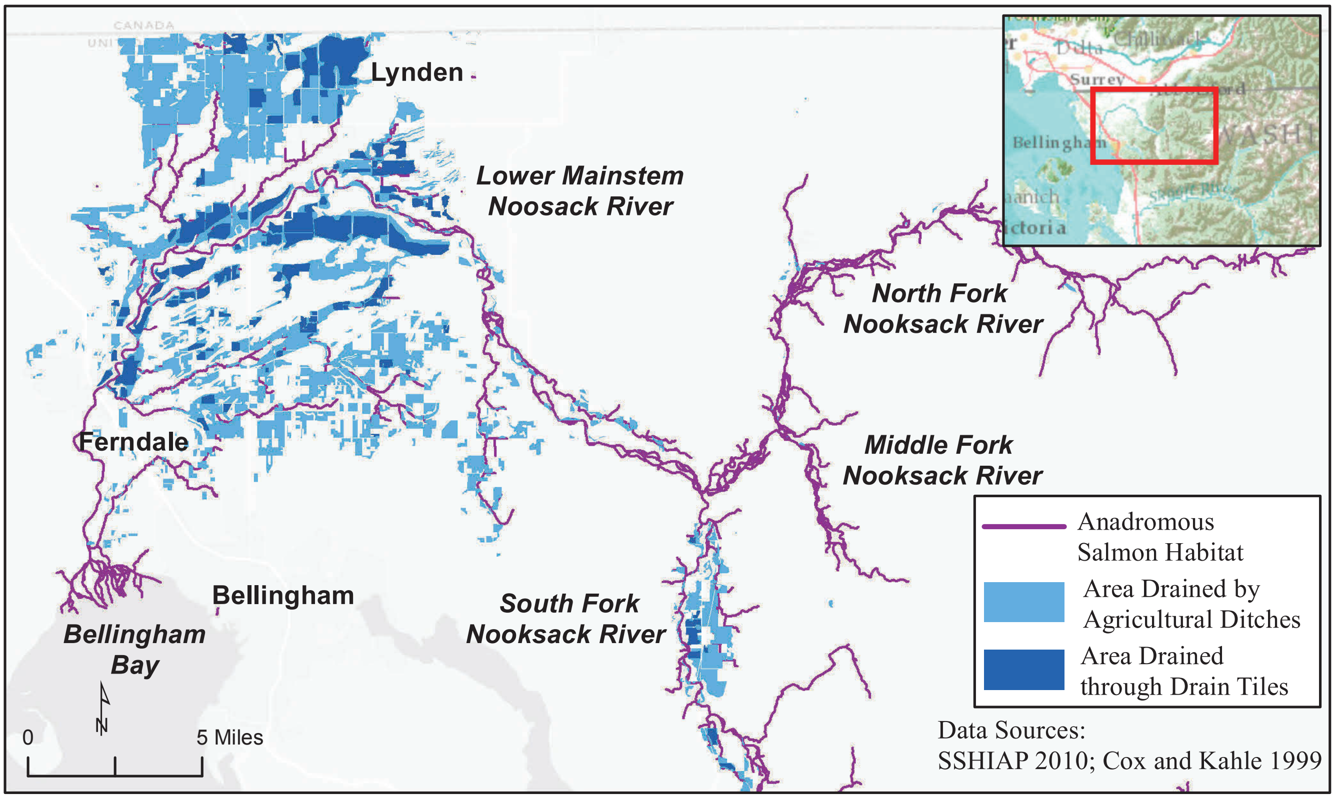


Bivalve shellfish have been prominent in the Lummi diet and culture since time immemorial. The Lummi and the Tribes of western Washington have treaty rights dating back to the 1850s guaranteeing them continued commercial, ceremonial, and subsistence harvest of shellfish in their usual and accustomed areas. Increased harvest pressure and degraded water quality have substantially reduced the shellfish available for Lummi to harvest and their ability to exercise the Treaty Rights guaranteeing them a sustainable shellfish harvest.

Shellfish growing areas are managed according to the requirements of the National Shellfish Sanitation Program, which is administered by the Food and Drug Administration. Since 1982, water quality has been monitored throughout shellfish growing areas to ensure compliance, and numerous efforts to control fecal coliform pollution have been implemented. While current conditions are favorable for Lummi's shellfish harvest in Portage and Lummi bays, fecal coliform levels in the Nooksack River have steadily increased in recent years and there remains a level of uncertainty as to how long favorable conditions will continue.

Ditching and Draining of Wetlands Has Resulted in Decreased Summer Low Flows in the Nooksack River

According to the WRIA 1 Salmonid Recovery Plan, human-caused decreases in the magnitude of low stream flows is limiting the area of wetted habitat available to salmon in the Nooksack River system. Additionally, low streamflows impede upstream migration of prespawners, reduce the intragravel flows needed for regulation of temperature and dissolved oxygen, and increase the risk of terrestrial predation on juvenile salmon in shallower water along stream banks (WRIA 1 SRB 2005). In addition to out of stream diversions for agricultural, industrial, and municipal supply purposes, one of the primary human causes of salmon-limiting stream flows in the lower Nooksack basin is the continued ditching and draining of wetlands which removes the natural storage of winter precipitation from the landscape (WRIA 1 SRB 2005).

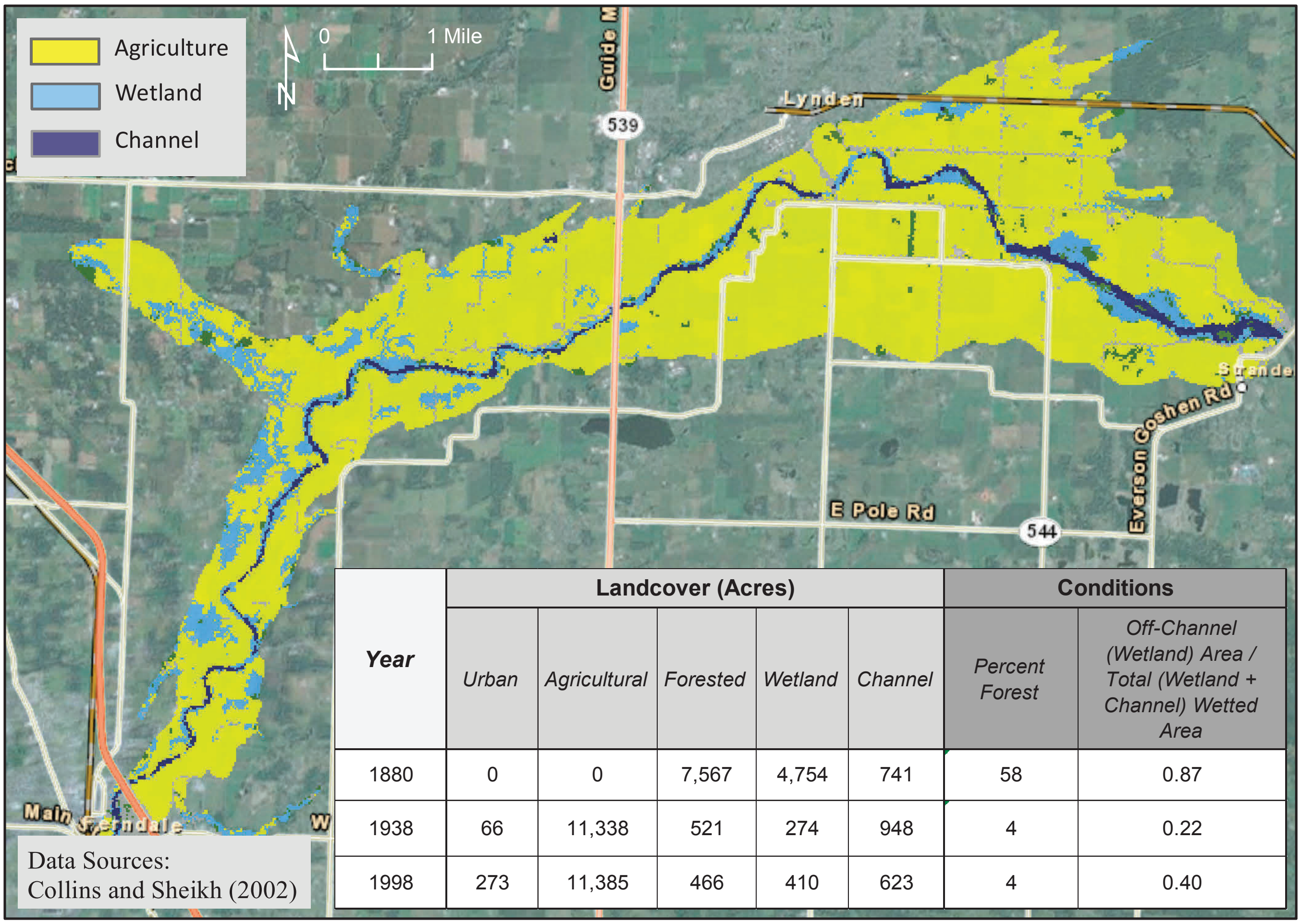


Prior to the arrival of Euro-Americans, the lowland areas of the Nooksack River and independent coastal drainages were covered in dense forest primarily composed of red alder (Alnus rubra) and Western Red Cedar (Thuja plicata) (Collins and Sheikh 2002). By 1925 the native forest landscape had been almost completely logged and cleared (Smelser 1970). By 1938 the cleared landscape had been almost entirely converted to agriculture (Collins and Sheikh 2002).

Because most of the landscape was poorly drained, numerous surface drainage ditches and subsurface tile drains were installed to remove surface water and shallow ground water to allow greater agricultural use of the land (Cox and Kahle 1999). Overall, the drainage systems work and water is removed from the landscape relatively rapidly compared to historic conditions. Although the drainage modifications allow for soil preparations and planting to occur earlier in the growing season than would be possible without the drainage, once the water leaves the landscape and flows downstream, it is no longer available to support instream flow during the low flow months of the summer. In essence, the drainage bypasses the storage that once existed in the forests and wetlands that once occupied the landscape.

Wetland Restoration Needed on Agricultural Lands in the Lower Nooksack River Floodplain

The WRIA 1 Salmonid Recovery Plan recommends a return to historical wetland conditions in the lower mainstem Nooksack (WRIA 1 SRB 2005). Historically in the Nooksack floodplain, off channel wetland habitat dominated wetted habitat area. In 1880, there were 4,754 acres of wetland to 741 acres of channel. By 1938, nearly 4,500 acres (95%) of off-channel wetland area had been cleared, drained and converted to agriculture, and wetlands were only 22% of total wetted habitat area. As of 1998, the lower mainstem still had less than 10% of its historical wetland area. In addition to wetland losses, straightening natural meandering of the Nooksack River for easier navigation and management has resulted in lost channel length and reduced area of wetted channel habitat. For example, from 1880 to 1938, channel length was reduced by 35% between Rivermile (RM) 15 and RM 19 (Collins and Sheikh 2002).



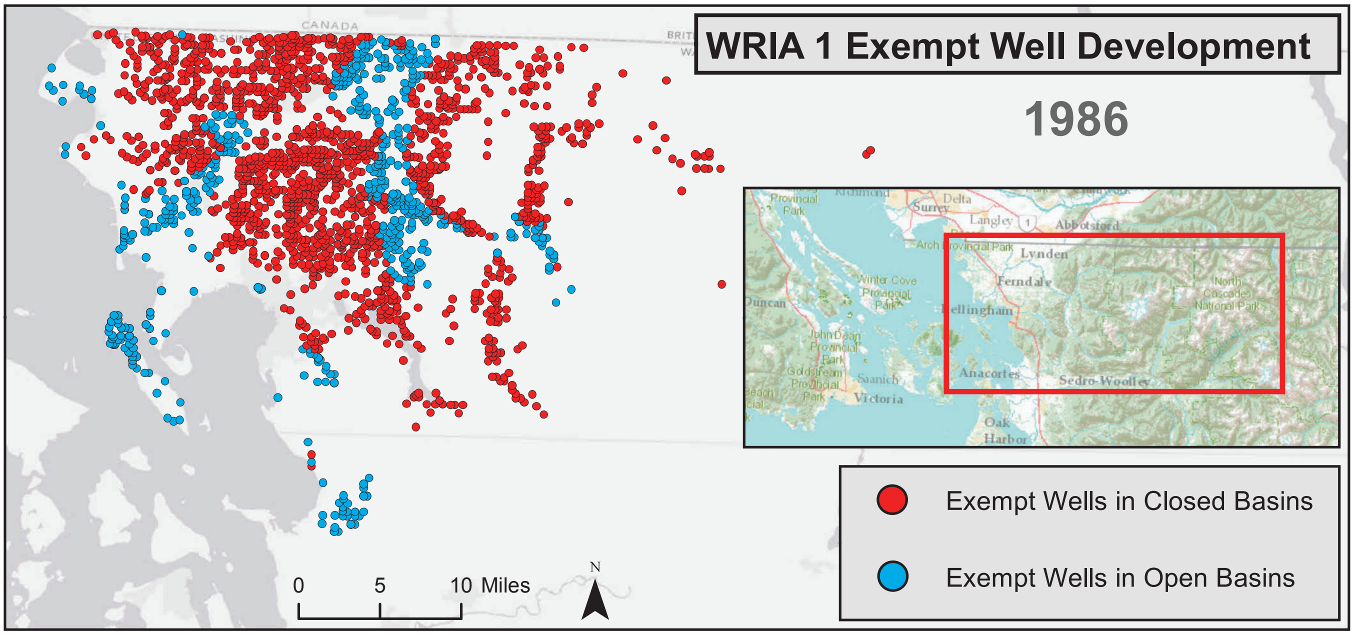
Year	Landcover (Acres)					Conditions	
	Urban	*Agricultural*	*Forested*	*Wetland*	*Channel*	*Percent Forest*	*Off-Channel (Wetland) Area / Total (Wetland + Channel) Wetted Area*
1880	0	0	7,567	4,754	741	58	0.87
1938	66	11,338	521	274	948	4	0.22
1998	273	11,385	466	410	623	4	0.40

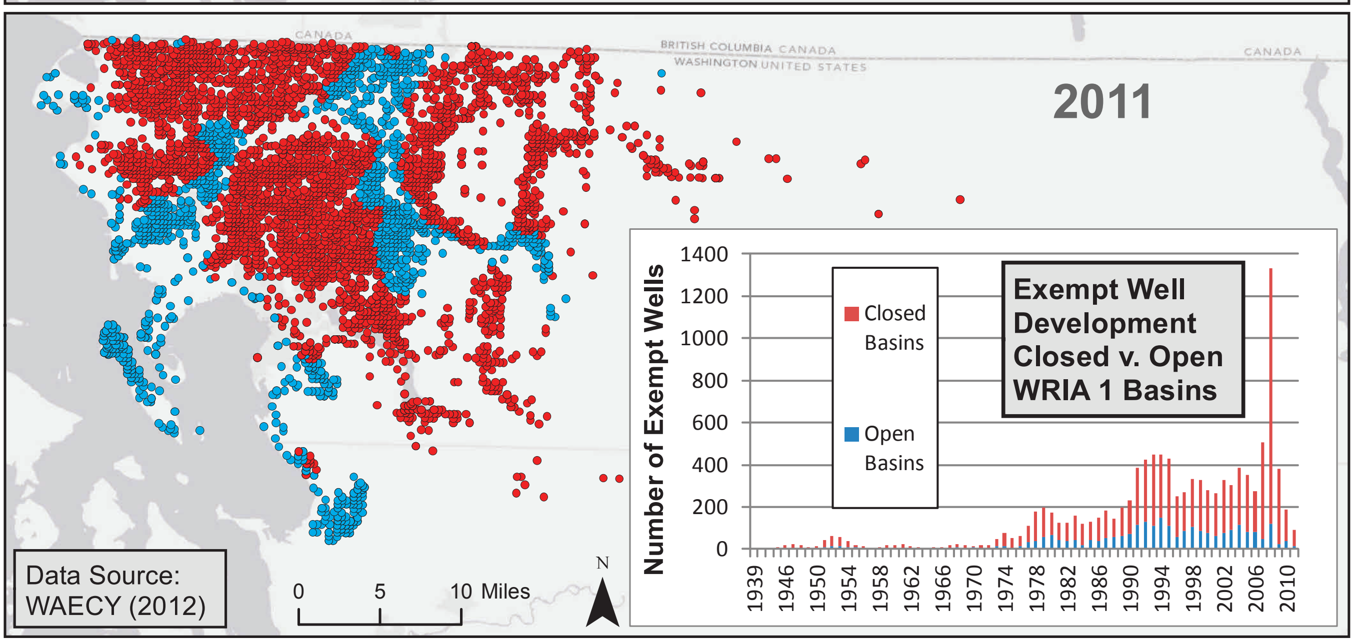
Data Sources:
Collins and Sheikh (2002)

The lower mainstem of the Nooksack River historically meandered through a complex of wetlands and beaver dams. Now, the lower mainstem floodplain is single threaded river through cropland, hay fields, and drainage ditches. The lower mainstem has suffered the greatest loss of habitat area and function from historical conditions, and the losses have been especially costly for rearing juvenile Chinook. In addition, productivity of pre-spawning migrant, over-winter rearing, and over-summer rearing life stages are all limited by the loss of historic off-channel wetland habitat in the lower mainstem (WRIA 1 SRB 2005). While not the most limiting factor to Chinook recovery, all Nooksack stocks of Chinook are affected by conditions in the lower mainstem. Restoration of floodplain wetland conditions in the lower mainstem toward historic conditions remains a long-term goal of the Recovery Plan (WRIA 1 SRB 2005).

Exempt Well Development Expands in WRIA 1 While Instream Flow Rules Continue to be Violated

Since 1986, exempt wells in WRIA 1 have increased 270% from an estimated 3,294 wells to an estimated 12,195 wells. Approximately 77%, of that increase has been in basins either seasonally closed or closed year-round to water withdrawal. From 1986 to 2009, flows in the Nooksack River failed to meet instream flow rule requirements 72% of the time during the July-September flow period (Essington et al. 2012).

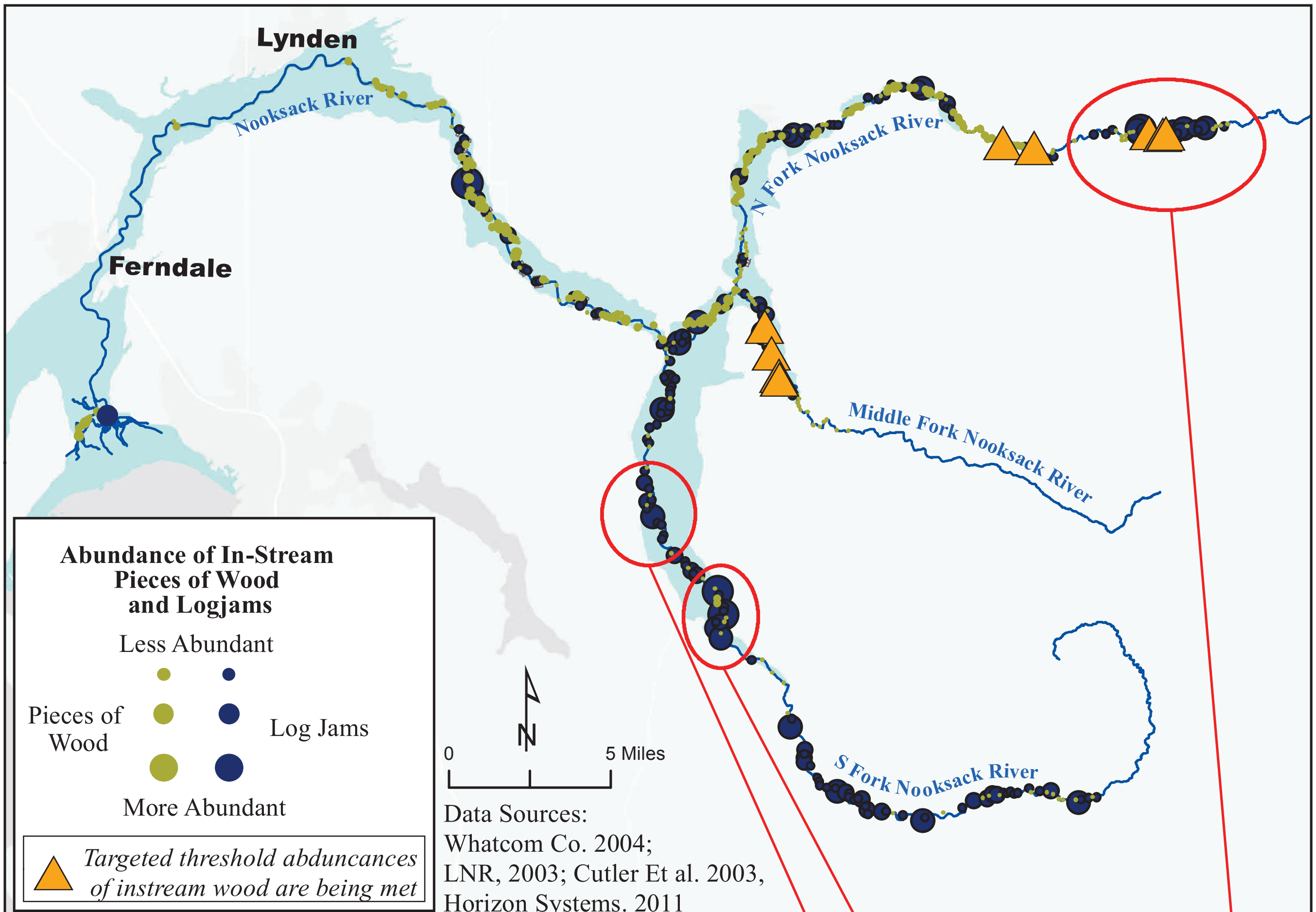




According to the WRIA 1 Salmonid Recovery Plan, not meeting instream low flows in streams results in loss of habitat connectivity, reduced habitat volume, stranding of juvenile salmon, higher stream temperature, and general decrease in water quality. The WRIA 1 watershed instream flow rules were set in 1986 to "protect and preserve" instream resources from low flow exceedances. As displayed in the map and table above, permit exempt wells have continued to be developed in WRIA 1 since 1986. While legal under State water law, continued exempt well development in basins targeted for limited or no additional withdrawal under the State flow rule is in direct conflict with the guidance of the Salmonid Recovery Plan, which recommends reducing out of stream uses in sub-basins impacted by low instream flows.

Nooksack River Needs Continued Active Engineered Logjam Restoration To Restore Wood to the Channel

According to the WRIA 1 Salmonid Recovery Plan, instream wood has a role in channel stability, habitat diversity and overall habitat quantity and quality, all limiting habitat factors to Chinook Recovery (WRIA 1 SRB 2005). Based on GIS measured lengths from 2003, there is an estimated 103 miles of known Chinook fish distribution in the mainstems of the Nooksack River system. The WRIA 1 Salmonid Recovery Plan recovery thresholds for abundance of instream wood are only being met in 1% of that habitat.

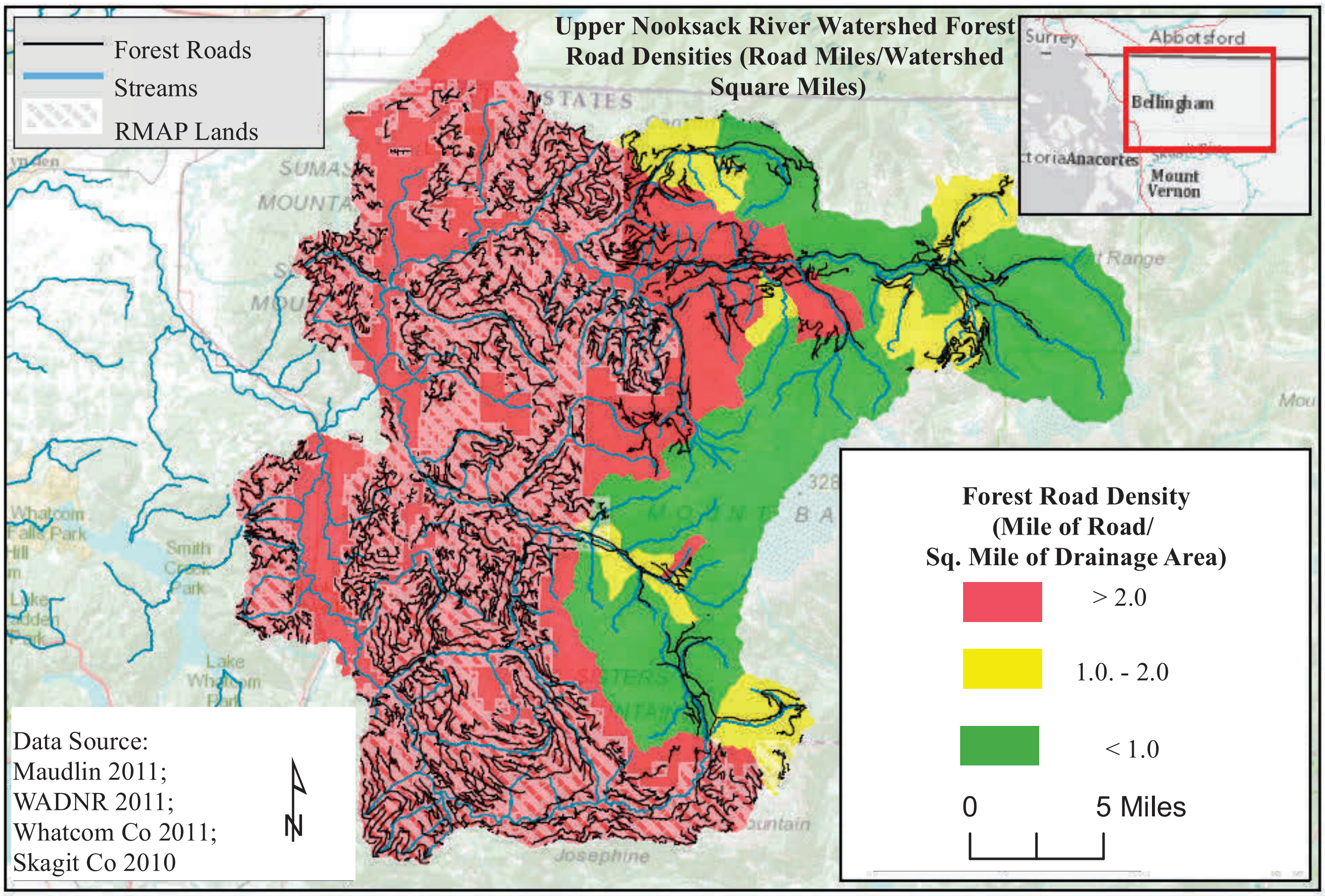


Man-made or Engineered Logjams on both the North Fork Nooksack River and the South Fork Nooksack River have been a significant and successful component of the WRIA1 Salmon Recovery Plan.

Archival data suggests that instream wood was historically very abundant in Puget Sound river systems, including the Nooksack River (Collins and Sheikh 2002). Settlers' descriptions from the 1800s of logjams 3/4 of a mile long are not uncommon (Collins and Sheikh 2002). The combination of land-clearing, riparian forest logging, splash damming, and instream wood removal for navigation have all combined to leave the Nooksack River currently with a relatively low abundance of instream wood. The lower mainstem continues to be managed for flood control and navigation. There is little to no accumulation of in-stream wood between Lynden, WA, and the delta of the river. The upper mainstem and the forks have a relative abundance of instream wood, but still very low compared to historic levels. The relatively higher levels of wood instream in the upper watershed is in part attributable to the engineering and construction of logjams. Since riparian forests are still dominated by young, small diameter trees, active logjam construction remains necessary to improve in-stream wood abundances in the Nooksack River system(WRIA 1 SRB 2005).

Forest Road Maintenance and Abandonment Key to Improving Upper Nooksack River Water Quality

The WRIA 1 Salmonid Recovery Plan (2005) points to watershed forest road density as one indicator of watershed health. Streams and stream habitat degradation have been associated with road densities greater than or equal to 2 miles of road length per square mile of watershed area (NOAA 1996). There are more than 1,376 miles of forest roads currently mapped in the upper Nooksack watershed, and forest road densities exceed 2 miles of road length per square mile of watershed area in over 65% of the upper Nooksack's watershed area. To decrease road densities under 2 miles of road length per square mile of watershed area in the upper Nooksack watershed, a total of 458 miles of road will need to be either abandoned, orphaned, or maintained with no drainage problems. An estimated 399 miles of those closures and/or repairs are scheduled to occur by way of the Road Maintenance and Abandonment Plans (RMAP) required for state and private roads.



No alteration of the human landscape has a greater and more far reaching effect on aquatic habitat than roads (NRC 2003). The majority of forest roads in the Upper Nooksack basin are on private industrial and state lands. All of these fall under the RMAP mandate and were originally scheduled to be repaired by 2016. An extension has been granted, and private industrial and state forestland owners can apply to have RMAP work completed by 2021. RMAP road repair has not been tracked so the current status of road condition is not clear.

It is expected that RMAP repairs will improve water quality in the upper Nooksack River watershed by fixing road drainage problems. Considering the role improved water quality plays in Chinook recovery, it is important that forestland owners try to complete their RMAP repairs by the originally negotiated date of 2016.

Summary

WRIA 1 and Whatcom County have seen great economic growth since the late 1800s but not without environmental cost. Water quality continues to decline, water quantity continues to decline, lands remain cleared of forests, wetlands have been filled and drained, channel lengths have been shortened, and fish and wildlife continue to suffer great losses in habitat quality and quantity. To change these trends will require more than just site-scale restoration of fish and wildlife habitat. Watershed health has to be restored.

- The Nooksack River and Lummi River estuaries have some of the most pristine habitat remaining in the Puget Sound. The Lummi Nation is creating a wetland mitigation bank and implementing land acquisition and restoration projects that will protect and restore the estuaries into the future.

- From 1986 to 2009, based on USGS stream gage flow measurements at Ferndale, WA, the Nooksack River failed to meet State set minimum instream flows 72 percent of the time during the July-September low flow period. While low flows have continued to decline in the Nooksack River, much of historic wetland area in the lower mainstem basins remains ditched or tile drained for agriculture, and the development of exempt wells has continued to increase.

- The productivity of pre-spawning migrant, over-winter rearing, and over-summer rearing life stages are all limited by the loss of historic off-channel wetland habitat in the lower mainstem (WRIA 1 SRB 2005). As agriculture is far and away the dominant land use in the lower Nooksack floodplain, to restore off-channel habitats will require changes in the current paradigm of agricultural land management within this area.

- To reach the WRIA 1 Salmonid Recovery Plan suggested threshold for forest road density in the forks subbasins of the Nooksack river watershed, a total of 458 miles of road will need to be either closed or otherwise repaired. An estimated 399 miles of those closures and/or repairs are scheduled to occur by 2021 through the Road Maintenance and Abandonment Plans (RMAP) required for state and private roads.

- Every time shellfish beds are closed due to pollution from upstream sources, the Lummi's Federal Treaty right to harvest shellfish is jeopardized. Currently shellfish harvest is "approved" by the Washington State Department of Health in most of Lummi, Birch and Portage Bays. In Drayton Harbor, however, shellfish harvest remains either "prohibited" or "conditionally approved" due to continued high levels of fecal coliform bacteria.

- There is an estimated 103 miles of mainstem river Chinook habitat in the Nooksack river system, and the WRIA 1 Salmon Recovery Plan thresholds for abundance of instream wood are only being met in 1.2 miles of that habitat. The areas of desired abundance in the North Fork are in part a result of active restoration and the construction of engineered logjams.

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State of Our Watersheds Report
Makah Nation

My ancestors referred to their hunting and fishing grounds and beach as topats*. They have names for every rock in their* topat*. They were individual stewards of each* topat *and if a rock was overturned, you turned it back over.*

– RUSSELL SVEC, MAKAH NATION

The Makah Nation

Located on the northwest tip of the lower 48 states, the Makah always have utilized the bounty of the sea and the forests. From seals to salmon to whales, the sea was – and still is – a large part of the livelihood of the Makah.

Within their territory, the Makah had many summer and permanent villages. The five permanent villages – the Wa'atch, Tsoo-Yess, Diaht, Ozette and Ba'adah – were located in forests and on beaches. In the early 1800s, these villages were home to between 2,000 and 4,000 Makah.

The Makah are highly skilled mariners, coming from a long line of ancestors who used sophisticated navigational and maritime skills to travel the rough waters of the Pacific Ocean and the Strait of Juan de Fuca to hunt whales and seals as well as travel.

In 1855, the Makah, represented by 42 tribal dignitaries, negotiated and signed a treaty with the United States retaining their right to whale and hunt, fish and gather as they always had.

Today, tribal headquarters are located in Neah Bay, Wash.

Recovering Habitat Means Prioritizing and Restoring

The Makah's Area of Concern includes many independent streams that flow from the foothills of the northern Olympic Mountains along the northwest corner of the Olympic Peninsula. This area encompasses Water Resource Inventory Area (WRIA) 19 and the northern portion of WRIA 20. The largest watersheds are the Sekiu, Hoko, Clallam, Pysht, Tsoo-Yess, Ozette and Lyre Rivers.

Beginning in the late 1800s, this region was heavily logged, with severe consequences to the health of the watersheds and salmon habitat. Today, the region is predominantly rural; commercial forestry remains its primary land use.

The restoration strategy developed for the Area of Concern consists of maintaining and improving the ecosystem productivity and genetic diversity for all salmonid species by protecting highly productive habitats and populations, and restoring impaired habitat and depressed populations.

The approach is to prioritize habitat restoration, protection and enhancement activities with regard to the specific habitat conditions of each individual watershed.

The short-term focus is on habitat restoration activities such as:

- Large woody debris placement;
- Riparian planting;
- Fish barrier culvert removal;
- Nearshore fill removal; and
- Conservation easements.

Long-term habitat recovery focuses on the restoration and protection of habitat-forming processes. Insufficient time has elapsed to assess the progress toward the goals and objectives of this habitat recovery strategy. Only general conditions and trends can be highlighted.

The Makah Tribe restored this blockage of important coho rearing habitat by pulling the culverts and removing cement and fill from a tributary of the Tsoo-Yess River.

Properly Functioning Fish Habitat at a Premium

Timber harvest rotation within the watersheds has led to significant reductions in hydrologic maturity. Loss of forest cover continues to be an issue. Excluding federal land, this region experienced an 18% decrease in forest cover from 1996-2006. The Hoko watershed saw a 38% decrease in forest cover and the Sekiu watershed experienced a 44% decrease. Loss of forest cover can alter instream flow, increase sedimentation and reduce natural recruitment of material that sustains in-channel large woody debris.

Excess sedimentation is a major limiting factor for the Hoko watershed, which sources from roads and clear-cuts. The Sekiu River has extensive sedimentation problems stemming primarily from high road densities and mass wasting sites. This sedimentation has led to debris flows that have incised the mainstem channel and removed large woody debris. Without restoration action, natural recovery from this scale of habitat disturbance will take several decades to mend.

Road density, maintenance, and abandonment issues are also a problem. Research has shown that fine sediment in salmon spawning gravels increased by 2.6-4.3 times in watersheds with more than 4.1 miles of roads per square mile of land area. This has a direct impact on overall watershed health and salmonid productivity. Federal guidelines characterize watersheds with road densities greater than 3 miles of road per square mile of watershed area as "not properly functioning," while "properly functioning conditions" are defined as less than or equal to 2 miles per square mile with few or no streamside roads.

Of the 10 watersheds within the Makah Area of Concern, nine have road densities in a "not properly functioning" condition. To address the aquatic habitat and fish passage issues caused by roads, most forestland owners are required, under the Washington State Forest and Fish law, to have a Road Maintenance and Abandonment Plan (RMAP), showing a schedule of repairs needed to upgrade road systems at stream crossings. Currently only 39% of the RMAP crossings have been repaired on private lands and only 30% have been repaired on state lands. In addition, in 2011 the Washington State Forest Practices Board approved an extension to the schedule date for implementation until 2021, allowing the impacts associated with these roads to continue to degrade salmon habitat for an additional five years.

Large woody debris creates fish habitat and enhances the quality of habitat in all sizes of stream. Past forestry practices and flood control measures have led to the loss of mature trees in riparian areas and streambeds, which has disrupted the natural habitat-forming processes within the region's watersheds.

Throughout the last century, and particularly in the last 60 or 70 years, large woody debris was removed from the Ozette River in the belief that it helped fish or would reduce flooding. This practice removed many of the functioning wood jams in the systems and presumably interrupted the riparian recruitment process, and the hydrologic and sediment regime. The lack of large woody debris in the Ozette River, in combination with other factors, has affected water quality, stream flow and habitat conditions such as pool depth, pool volume and cover.

80 Miles of Streams Designated as Impaired

Water quality and quantity remain at risk within the Makah Area of Concern. Approximately 80 miles of streams are listed as “impaired waters” by the Washington Department of Ecology. Of these 80 miles, 76 are listed as being temperature impaired. Increased monitoring of stream flow and water quality is an ongoing need within the Makah Area of Concern and is identified as a goal within both the WRIA 19 and WRIA 20 Watershed Management Plans.

The Tsoo-Yess River would be an ideal candidate as it is the largest watershed in the northern portion of WRIA 20 and provides habitat for fall chinook, chum and coho salmon, and winter steelhead. Approximately 2.6 miles of the 16 mile long Tsoo-Yess River are listed as “temperature impaired waters” by the Washington State Department of Ecology. Stream habitat and water quality conditions within the Tsoo-Yess watershed have been affected by water withdrawals and past forestry practices.

Large woody debris is uncommon and immediate natural recruitment potential is low because riparian vegetation and canopy consist of young stands of alder and conifers.

Stephanie Martin, habitat division manager for the Makah Tribe, helps set up a fish weir to count sockeye in the Ozette River.

Sharing Plans and Cooperation Key to Recovery

As co-manager of shared natural resources with the state, Makah is concerned with the communication and cooperation from Washington’s state agencies.

Ensuring that salmon habitat is protected is central to successfully and sustainably managing this trust resource. Problems still persist in coordinating habitat actions. For example, in 2007, a culvert failed on nearby private forestland. The Washington Department of Natural Resources moved forward with the landowner’s plan to abandon the road without communicating with the Makah Tribe. This prevented consultation and allowed the implementation of an abandonment plan that failed to utilize best management practices. The result was excessive sediment runoff into adjacent fish-bearing streams where fall chinook, chum, coho and winter steelhead are found. This is contrary to salmon recovery efforts and watershed recovery plans for the Tsoo-Yess River drainage.

Land exchanges of public forest for private timberlands have the potential to negatively impact treaty resources and tribal activities. Land transfers to private ownership within the Makah Area of Concern have a direct impact on tribe’s abilities to utilize the properties’ natural resources and have the real potential of isolating important monitoring sites to further use.

Historically, the Makah Tribe has utilized Washington Department of Natural Resources’ public lands to conduct research related to water quality, habitat, watershed health and salmon recovery. The transfer of these lands to private ownership could hamper or eliminate tribal access to collect cultural plants and animals, and conduct important research.

A current example is the proposed land exchange of parcels within the Big River basin, which lies within the Lake Ozette watershed. The land is within the tribe’s usual and accustomed areas and the protection of this land is critical to recovery of the local Lake Ozette sockeye salmon, which is listed as “threatened” under the Endangered Species Act. The land proposed to be traded has mature trees and includes a section of one of the only two tributaries where sockeye are known to spawn.

For fish habitat and stream health to improve in Makah's Area of Concern, more projects like this one on the Tsoo-Yess River need to be completed. Many streams have been deprived of habitat-forming woody debris for years as timber in the area is too small.

Looking Ahead

Although the watersheds within the Makah Area of Concern continue to sustain salmonid species, significant threats to fish habitat remain.

Land-use practices particularly associated with forestry activities and road maintenance continue to alter watershed processes, resulting in degradation of water quality, water quantity and stream channel complexity.

There is a need for greater communication and cooperation between natural resources managers to assure achievement of the goals set in the watershed recovery plans for the region.

Current habitat conditions and trends speak to the need for continued restoration efforts focused on degraded habitat and increased protection of existing properly functioning habitat.

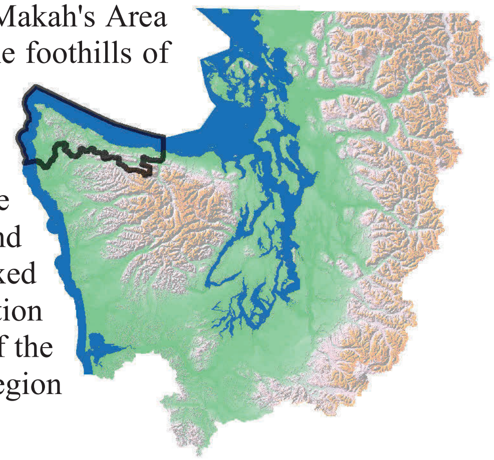
To improve habitat for salmon, significant progress must be made in restoring habitat and stream function with large woody debris placement, riparian planting and fencing, culvert barrier removal and conservation easements.

We are doing our part to buy what land we can in the areas of concern, but the threat of land transfers to other private ownership could isolate these lands from monitoring as well as collecting important cultural plants.

We will need improved communication and cooperation between the myriad of natural resources managers in the area to hold the line, much less improve, fish habitat.

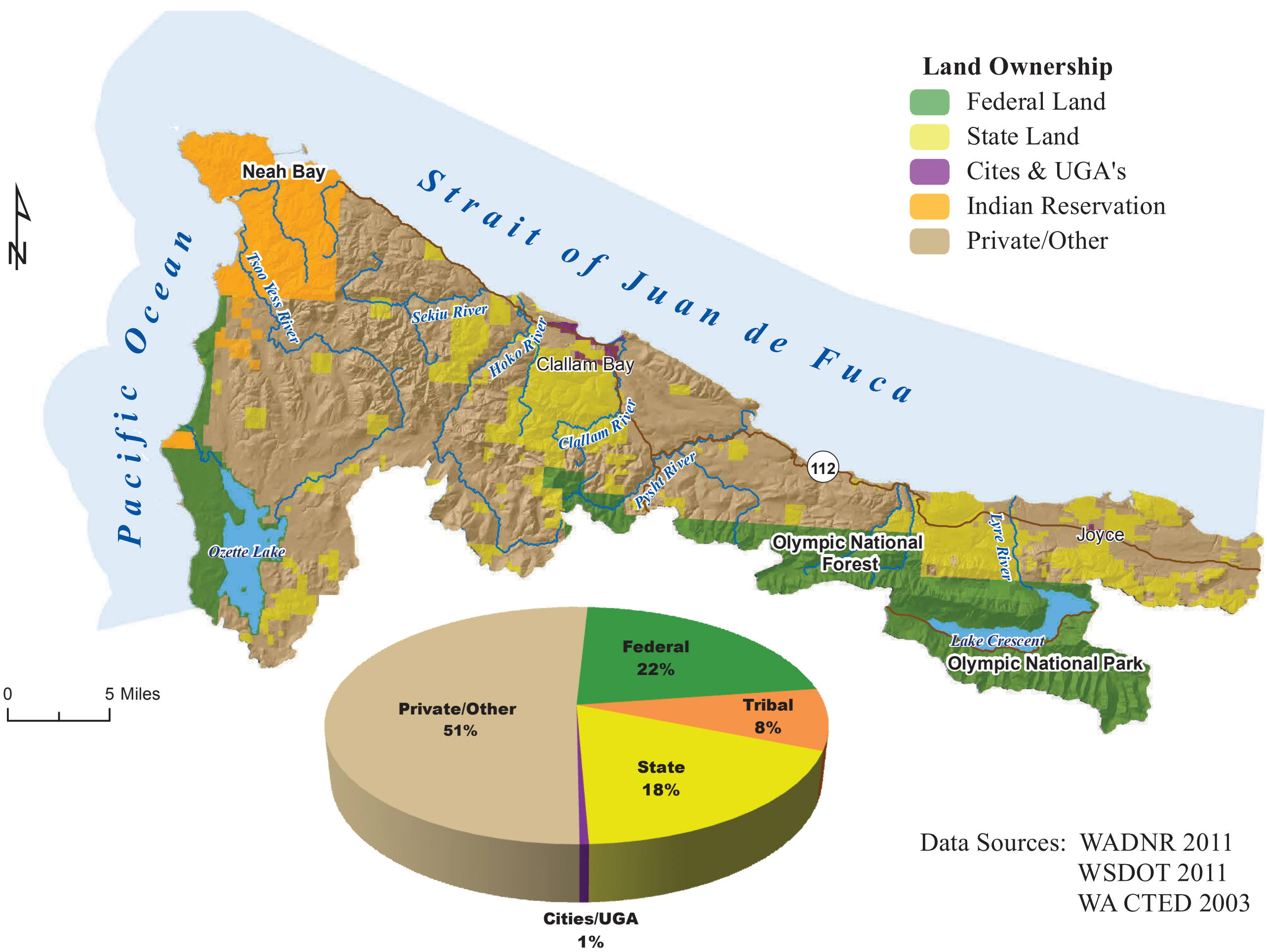
It is troublesome that important repairs to some of these problem road and stream crossings have been delayed with a five-year extension, meaning continued serious harm to these important streams. It is deceptive to think of the Olympic Peninsula as healthy for fish. In concert with climate change, current Land-use practices hasten the threat of extinction of the salmon that are a central part of the cultural identity of Makah people.

The Makah Nation - WRIA 19 and portions of WRIA 20



Located on the northwest corner of the Olympic Peninsula, the Makah's Area of Concern includes many independent streams that flow from the foothills of the northern Olympic Mountains and enter the shores of the Strait of Juan de Fuca. The largest watersheds are the Sekiu, Hoko, Clallam, Pysht, Tsoo Yess, Ozette and Lyre rivers. Easily weathered sedimentary rock, sandstones, and siltstones of the Twin River Formation occur in the western watersheds from, and including, the Pysht. Streams to the east of the Pysht have a mixed geology, including less erodible basalt from the Crescent Formation in headwaters, glacial outwash in the lower plain, and siltstones of the Twin River Formation to the west. The stream channels in the region change quickly to variations in flow and sediment inputs.

Chinook, coho, chum, sockeye, and winter steelhead occur in the area's watersheds, with the Ozette sockeye being listed as "threatened" under the Endangered Species Act. Traditionally flourishing off of land and sea, the Makah tribe had villages and fishing camps most often associated with stream mouths where they could take advantage of plentiful fish and shellfish resources. With the Point No Point and Makah treaties of 1854-55, the tribes agreed to cede their lands to the U.S. government in exchange for retaining their rights to hunt, fish and gather in their usual and accustomed areas. Beginning in the late 1800s, the Strait region has been heavily logged, with severe consequences to the health of its watersheds and salmon habitat. Today the region is predominantly rural, though industrial forest land use is widespread.

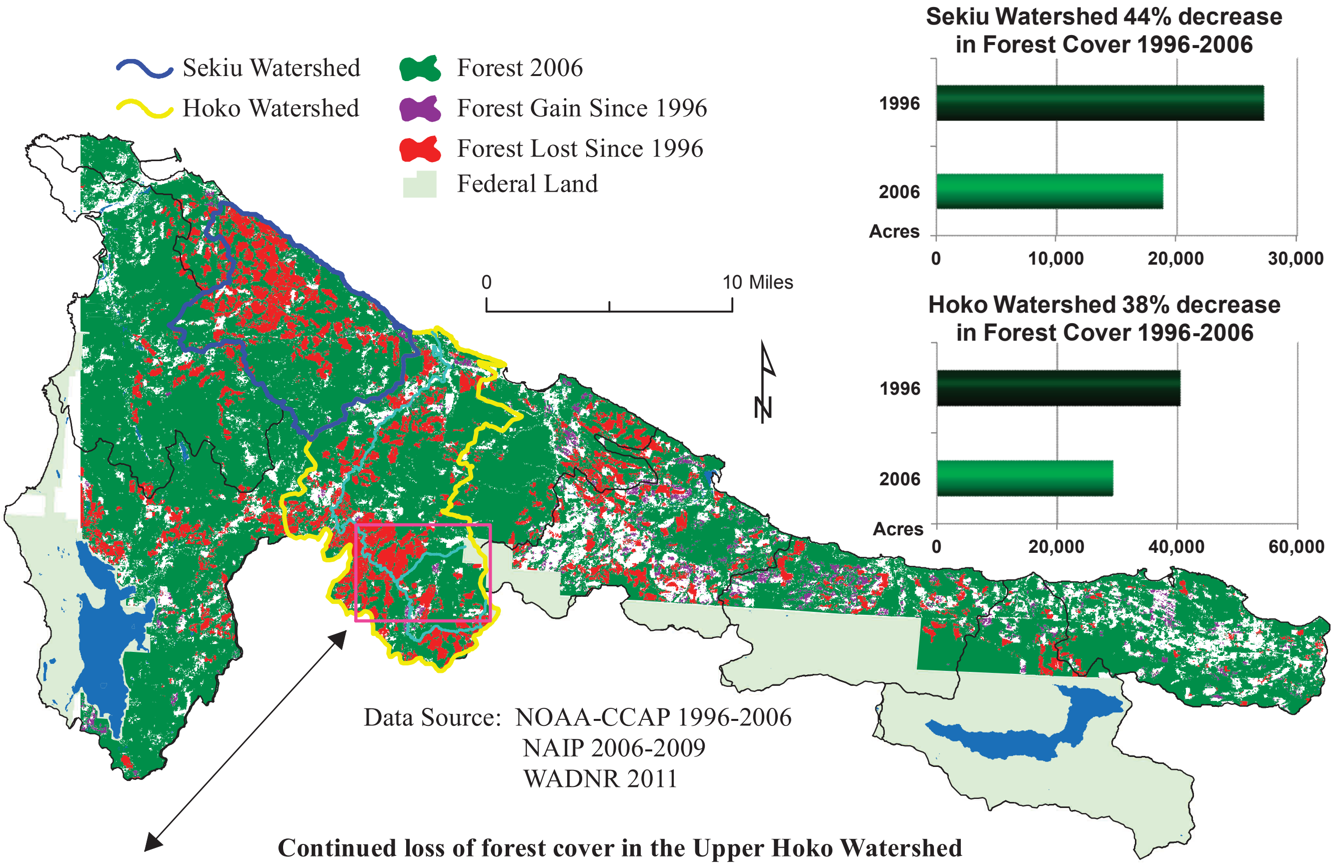


Data Sources: WADNR 2011
WSDOT 2011
WA CTED 2003

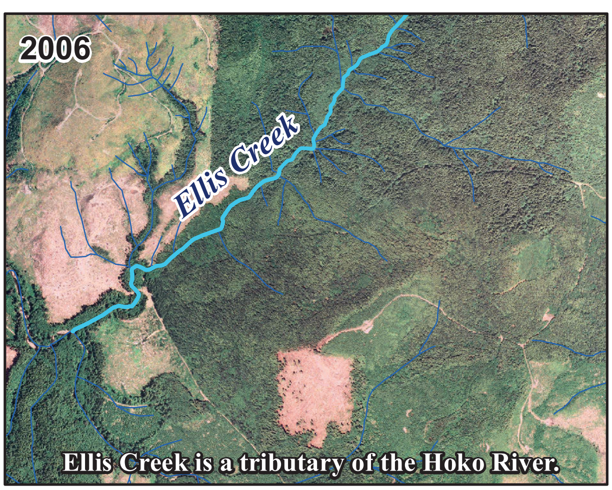
Loss of Forest Cover Continues

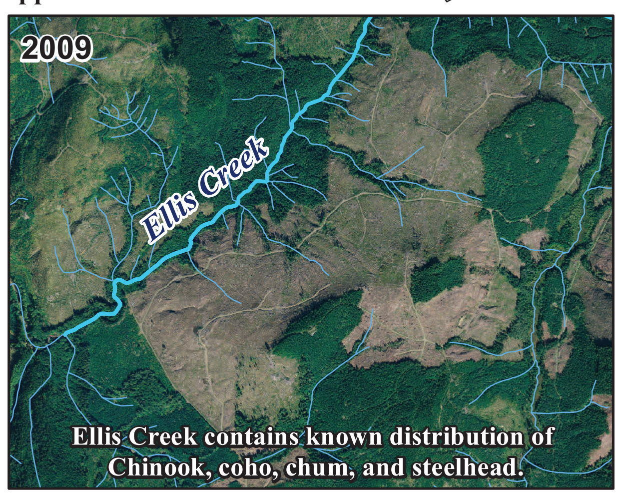
Excluding federal land, the Makah Area of Concern saw an 18% decrease in forest cover from 1996 to 2006. The Hoko watershed saw a 38% decrease in forest cover, while the Sekiu saw a 44% decrease.

The Hoko River is the largest watershed within WRIA 19. Nearly the entire Hoko watershed is subject to active forest management in the form of timber harvesting, with the entire basin having been harvested at least once (Hoko River Watershed Analysis Hydrology Assessment, 1995). Excess sedimentation is a major limiting factor for this watershed, with sources from roads and clearcuts. The sedimentation has led to channel instability and a change in substrate to less suitable spawning gravels. The Sekiu River has extensive sedimentation problems stemming primarily from high road densities and mass wasting sites. This sedimentation has led to debris flows that have incised the mainstem channel and removed large woody debris (LWD). The Sekiu River's mainstem provides critical rearing habitat as well as spawning habitat for all salmon species in this watershed.



Continued loss of forest cover in the Upper Hoko Watershed

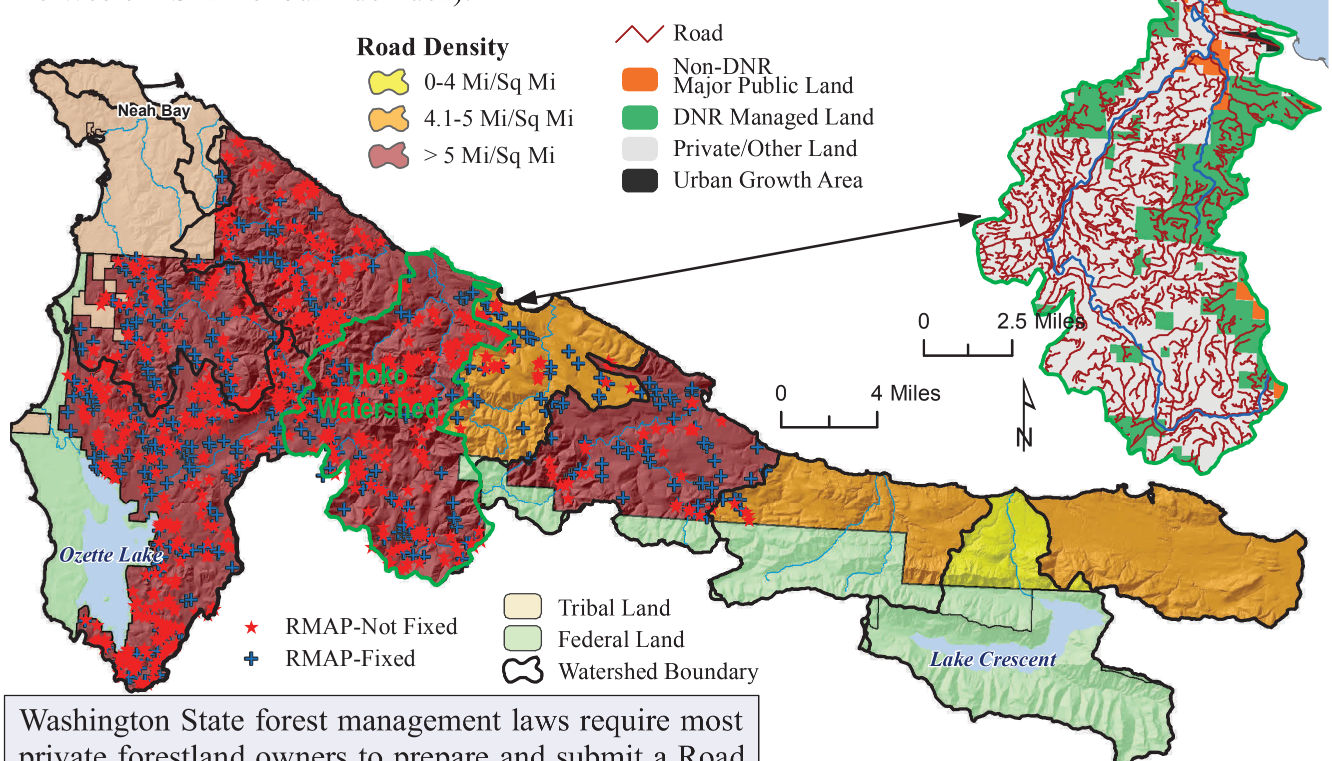




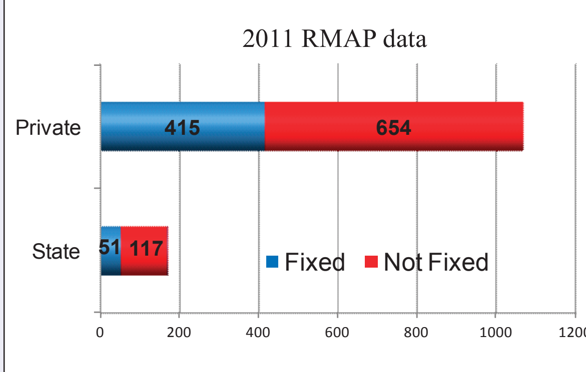
Road Density a Major Limiting Factor

Of the 10 watersheds within the Makah area of concern, 9 have road densities in a "not properly functioning" condition. The National Marine Fisheries Service 1996 guidelines for salmon habitat characterize watersheds with road densities greater than 3 miles of road per square mile of watershed area as "not properly functioning". Currently only 39% of the RMAP crossings have been repaired on private lands and only 30% have been repaired on state lands (WDNR, 2011).

Cedarholm et al. (1980) found that fine sediment in salmon spawning gravels increased by 2.6 - 4.3 times in watersheds with more than 4.1 miles of roads per square mile of land area. The National Marine Fisheries Service (1996) guidelines for salmon habitat characterize watersheds with road densities greater than three miles of road per square mile of watershed area (mi/sq mi) as "not properly functioning," while "properly functioning condition" was defined as less than or equal to two mi./sq. mi., with few or no streamside roads. In the Hoko basin, 330 landslides associated primarily with logging roads (40%) and clear-cuts (55%) have been identified since 1995, and 141 occurred between 1981-1993 after intense logging in the 1970-1980s (Salmon and Steelhead Habitat Limiting Factors in the Western Strait of Juan de Fuca).



Washington State forest management laws require most private forestland owners to prepare and submit a Road Maintenance and Abandonment Plan (RMAP). A RMAP is a forest road inventory and schedule for any repair work that is needed to bring roads up to state standards. A RMAP is prepared by the landowner and approved by WADNR. The Puget Sound Salmon Recovery planners assumed the RMAPs to be fully implemented and all stream crossings on private forest lands to be brought up to the minimum state standards by 2016. In 2011, the Washington State Forest Practices Board approved an extension to the due date for the completion of stream crossings improvements to 2021, allowing the impacts of these crossings to continue to degrade salmon habitat for another 5 years.

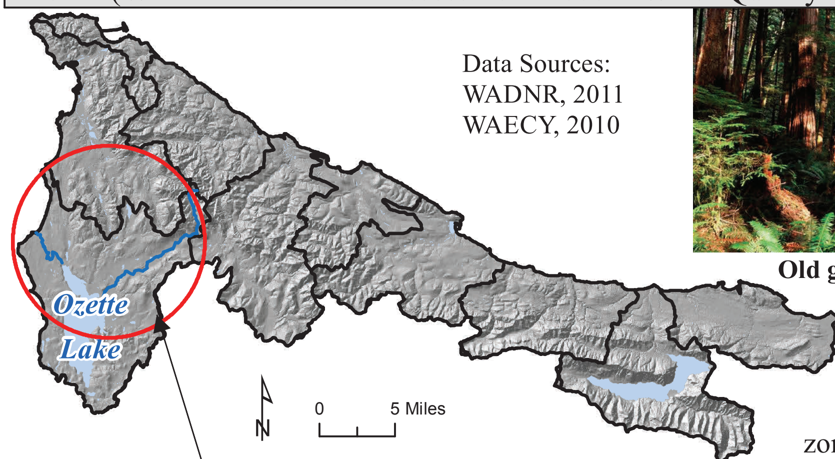


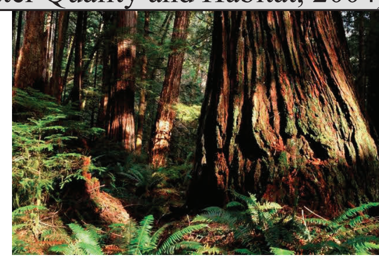
Data Sources: WADNR 2011; WSDOT 2010

Large Woody Debris (LWD) Lacking in the Ozette Watershed

Throughout the last century, and particularly in the last 60 or 70 years, LWD was removed from the Ozette River in the belief that it helped fish or would reduce flooding. LWD removal, in combination with other factors, has affected water quality (Hypothesis 2), Ozette River streamflow (Hypothesis 3), and Ozette River habitat conditions such as pool depth, pool volume, and cover (Hypothesis 4 - Lake Ozette Sockeye Recovery Plan Summary).

Large woody debris creates fish habitat and enhances the quality of habitat in all sizes of stream. Wood in streams serves both physical and biological functions. Physically, debris in streams influences channel hydraulics to form pools and other important rearing areas, stores sediment and organic matter, and influences water quality by providing thermal refugia. Biologically, LWD provides cover for fish from predators and refuge from high streamflow, in addition to offering organic processing. LWD slows the rate of sediment movement through the stream and functions to retain gravel for spawning habitat (WRIA 20 Technical Assessment Level I Water Quality and Habitat, 2004).



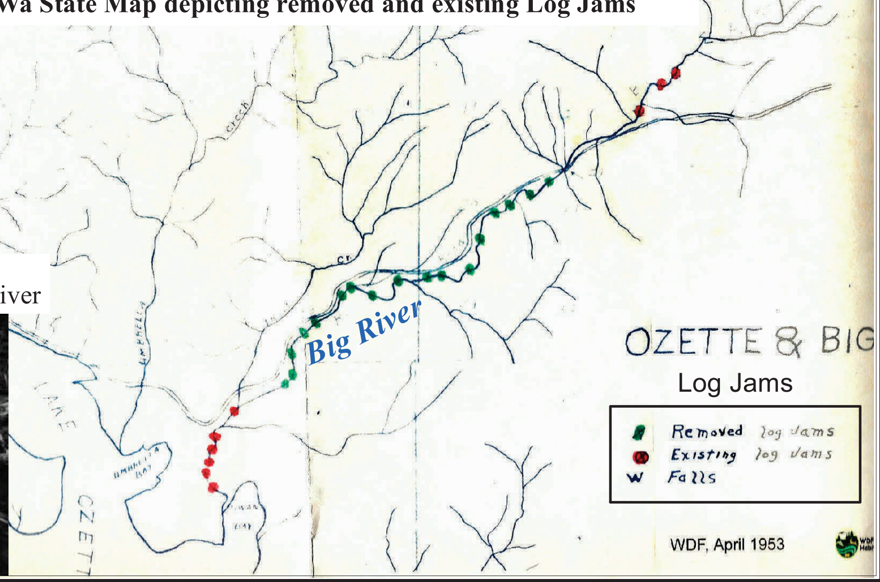


Old growth conifers

Red alders

LWD recruitment potential today is low because the old growth conifers that historically dominated the riparian zones have been largely replaced by red alder.

1953 Wa State Map depicting removed and existing Log Jams



Example of typical logjam removed from the Ozette River

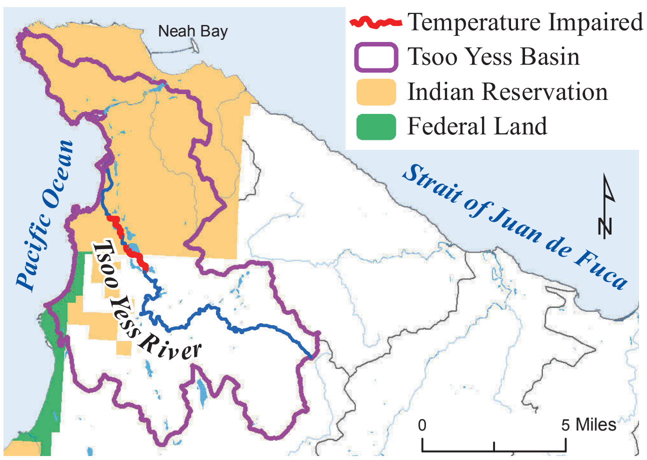
source: Kramer 1953

From the 1950s to 1980s, active removal of LWD occurred on Ozette and Big Rivers (Kramer, 1953). This practice removed many (26 large jams on the Ozette River in 1952 alone) of the functioning wood jams in the systems and presumably interrupted the riparian recruitment process, and the hydrologic and sediment regime. Loss of LWD in tributaries has undoubtedly destabilized channel morphology and potentially led to degraded water quality and spawning and rearing habitat (Haggerty, 2004 draft). Currently, levels of LWD are “poor” on the lower Big River.

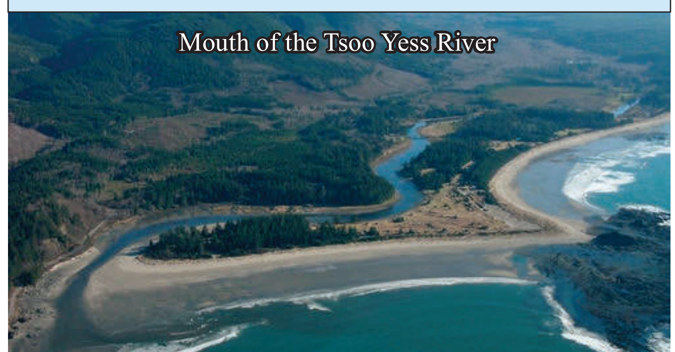
Water Quality on the Tsoo Yess River Needs Increased Monitoring

Approximately 2.6 miles of the 16-mile-long Tsoo Yess River are listed as "temperature impaired waters" by the Washington State Department of Ecology. The naturally low stream flows in this area have been deteriorated by water withdrawals. A WRIA 20 Watershed Management Plan "Stream Flow Data Action" is to establish additional stream flow gages within WRIA 20, but none have been established in the Tsoo Yess watershed.

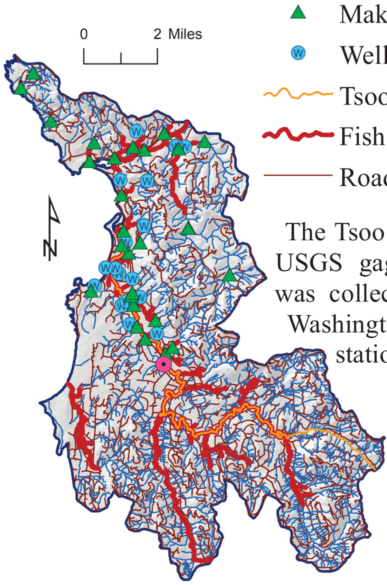
The Tsoo Yess River is the largest stream in the Tsoo Yess watershed, providing habitat for fall chinook, chum, coho salmon, and winter steelhead. It is 16.2 miles long with approximately 39 miles of tributaries entering the Tsoo Yess River and heads in low foothills, draining to the Pacific Ocean at Mukkaw Bay. Tidewater extends to river mile 6, and waterfalls block salmon access at river mile 13.8.



Except for the headwaters, the Tsoo Yess River gradient is less than 1% throughout its course, and water temperatures generally average from 42 degrees F (5.5 C) in January to more than 65 degrees F (18.3 C) in August. The state water quality standard for salmon migration, spawning, and rearing is 17.5 degrees C.



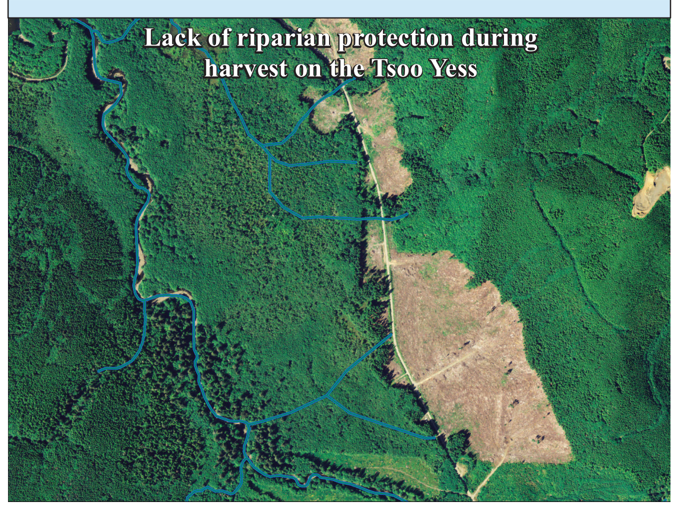
The Tsoo Yess River provides habitat for fall chinook, chum, coho salmon and winter steelhead. High water temperatures, low dissolved oxygen, and excessive sedimentation have been recorded in the Tsoo Yess River, all of which negatively impact the success of salmon in the stream. Naturally low flows during summer and early fall contribute to high stream temperatures and negatively affect salmonid migrations.



The Tsoo Yess basin has only one USGS gaging station where data was collected for 1976-1986. The Washington State ECY has no stations in this basin.

Data Source:
WADNR 2011
WAECY 2011
WSDOT 2010
USGS 2009
NAIP 2011

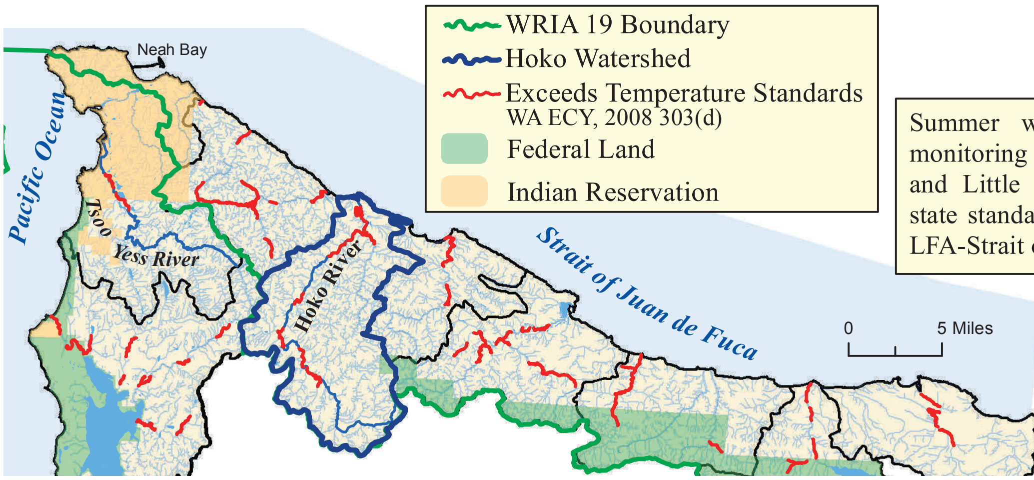
Generally, habitat quality of the Tsoo Yess River and its tributaries is poor. Large woody debris is uncommon and immediate natural recruitment potential is low because of past intensive logging practices in riparian areas. Riparian vegetation and canopy consist of young stands of alder and conifers (USFS, 2009). The removal of riparian canopy and resulting loss of riparian shade can contribute to elevated stream temperatures that affect fish.



Water Quality and Quantity Remain at Risk

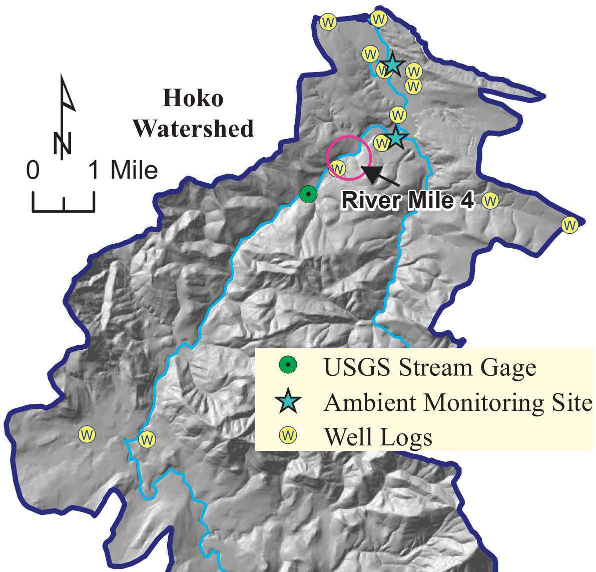
Approximately 80 miles of stream in the Makah Area of Concern are listed as "impaired waters" by the Washington State Department of Ecology. Of these 80 miles, 76 are listed as being temperature impaired. A major recommendation for water quality/quantity in WRIA 19 is to increase water quality monitoring and to include all salmon-bearing streams.

Elevated stream temperatures, turbidity, and low dissolved oxygen are conditions of known impairment in WRIA 19. The temperature problems are at least partially related to the below target shade levels in these same areas. The high temperatures reduce available rearing habitat for coho and steelhead, and possibly Chinook salmon (Smith, 2000).



Summer water temperatures at all monitoring stations in the mainstem and Little Hoko River exceeded the state standard of 16 degrees C.(Smith, LFA-Strait of Juan de Fuca).

Data Source:
WADNR 2011
WAECY 2011
NAIP 2011
WSDOT 2010
USGS 2009

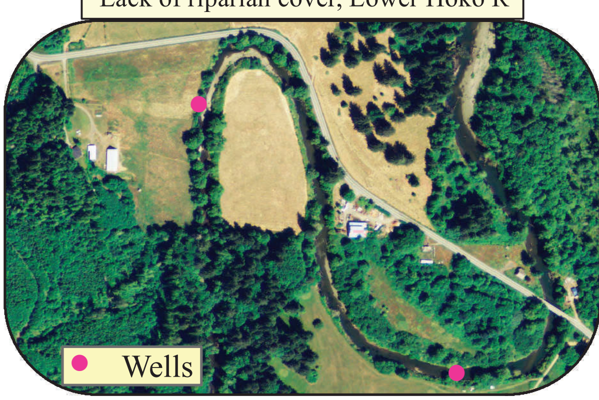


Although the Hoko basin is naturally susceptible to low water flows because of its low elevation and dependence on precipitation, human factors contribute to the problem. The infiltration gallery at river mile 4 serves as the water supply for the towns of Clallam Bay, Sekiu, as well as the Clallam Bay Correction Center. Low summer water flows are often a problem particularly for fall Chinook and sometimes for coho salmon (Currence, 1999).

Stream flow data is very sparse in WRIA 19. The USGS has operated a flow gage on the Hoko River since 1963, with a 10-year gap between 1974-1983.

	Hoko River Discharge - cubic feet per second		
	Calendar Year 2007	Water Year 2008	Water Years 1962-2008
Lowest Daily Mean	36 (July 17)	19 (Aug 17)	11 (Oct 10, 1987)
Annual 7-day minimum	39 (July 12)	21 (Aug 13)	11 (Oct 10, 1987)
(USGS data)			

Lack of riparian cover, Lower Hoko R



The Hoko watershed has been subject to forestry land use practices, and the change in age and type of forest cover is believed to be associated with increased frequency and severity of peak flows. In addition, flow velocities have increased due to reduced large woody debris loading, channelization, and incision. Water withdrawals for municipal drinking water use in the Hoko River watershed have led to reduced low-flow discharge rates during the summer (Smith, 1999).

Lack of Co-Management Coherency and Responsibilites

The Makah Tribe, as co-manager of its shared natural resources with Washington State, is concerned with the continued inconsistencies in communication from natural resource agencies. As an example, in 2007, when an RMAP culvert removal project was under way on private forestland, regulatory oversight was negligent. When Makah staff visited the project site, there were several WAC violations in addition to the lack of several specific project site requirements and permits.

Co-management is the process under which Washington State and the treaty Indian Tribes cooperatively exercise their authority as co-managers of the salmon resource. The co-management structure was created in 1984, in response to a U.S. Supreme Court decision upholding U.S. District Judge George Boldt's 1974 ruling in US v Washington (the "Boldt Decision") that the tribes have a treaty right entitling them to half of all harvestable salmon returning to their "usual and accustomed" fishing areas. The Boldt Decision also requires the state to maintain the habitat on which salmon depend.

At first glance, the work may look "okay," but why not give the resource the best, and legal chance to recover? The Makah Tribe would have liked to see some due diligence and Best Management Practices added to this project including disconnection of surface runoff from the stream, pulling back fill material and returning the slopes to their natural contour, better sediment control, and revegetating the slopes. Steep and large slopes are indicative of the Makah U&A forestlands. BMPs for riparian associated work should be delineated in a written plan and followed in the field with regulatory oversight. Road remnants on either side of the creek could be restored and replanted, as they are relatively impervious surfaces creating sediment-filled surfacewater runoff (see winter flow photo).

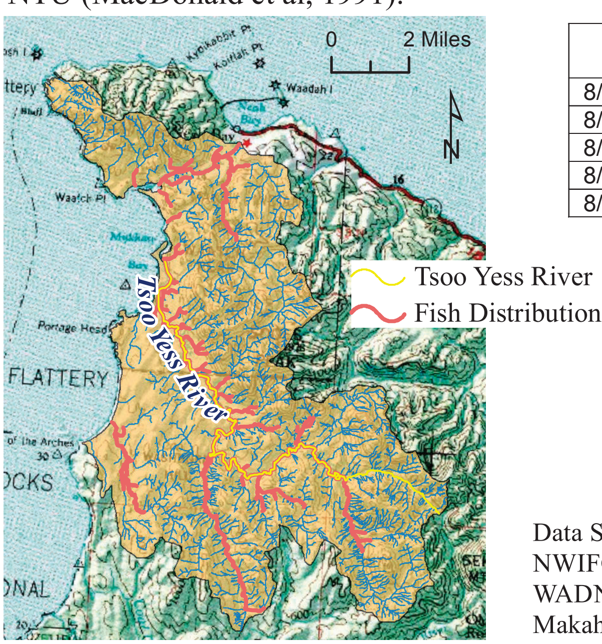
The culvert removal project was located on a tributary to the Tsoo Yess River where fall Chinook, chum, coho salmon and winter steelhead are found. It happened in 2007 on private forestland, with natural resource work completed in 2008. Sediment samples were taken both above and below the project after completion of work.

Failed culvert

High turbidity levels affect fish feeding and growth. The ability of salmon to find and capture food is impaired at turbidities from 25 to 70 NTU. Salmon growth is reduced and gill tissue damaged after 5 to 10 days of exposure to a turbidity level of 25 NTU (MacDonald et al, 1991).

Sediment samples after completion of work

Date	West Fork Above Project	West Fork Below Project	East Fork
8/19/2008	2.14 NTU	24.9 NTU	N /A
8/19/2008	1.49 NTU	52.9 NTU	N/A
8/19/2008	3.02 NTU	50.2 NTU	N/A
8/19/2008	5.44 NTU	85.8 NTU	N/A
8/24/2008	14.00 NTU	323.7 NTU	23.9 NTU



Data Sources:
NWIFC 2008
WADNR 2011
Makah Tribe 2011

The State of Washington Class AA stream standards suggest levels should not exceed 5 NTU

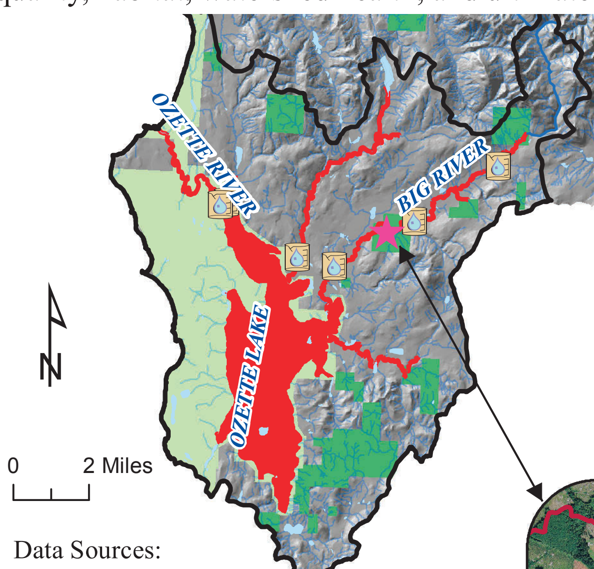

Winter Flow Capacity Concerns

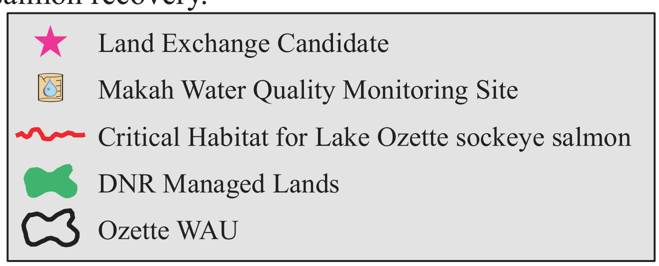
WA State DNR Land Exchanges to Private Timber Companies Impact Makah Resources

The WA State DNR Land Exchanges have a direct impact on Makah Tribe's abilities to utilize the properties' natural resources and have the real potential to isolate important monitoring sites from future use.

The Makah Tribe's natural resources are in jeopardy due to the lack of cooperation and understanding by the Washington State Department of Natural Resources. Historically, the Makah Tribe has utilized DNR public lands to conduct research related to water quality, habitat, watershed health, and salmon recovery. The exchange of lands from State ownership to private ownership could hamper or eliminate tribal access to these lands to collect cultural plants and animals and to conduct important research.

A current example is the proposed land exchange of parcels within the Big River basin, which lies within the Lake Ozette watershed. The land is within Makah Tribal Usual and Accustomed (U&A) areas and the health and protection of this land is critical to recovery of the local Lake Ozette Sockeye salmon, which is listed under the Endangered Species Act. The land proposed to be traded has mature trees and includes a section of one of the only two tributaries that Sockeye are known to spawn in. The Makah Tribe has historically accessed this land and is currently conducting research related to water quality, habitat, watershed health, and ultimately salmon recovery.

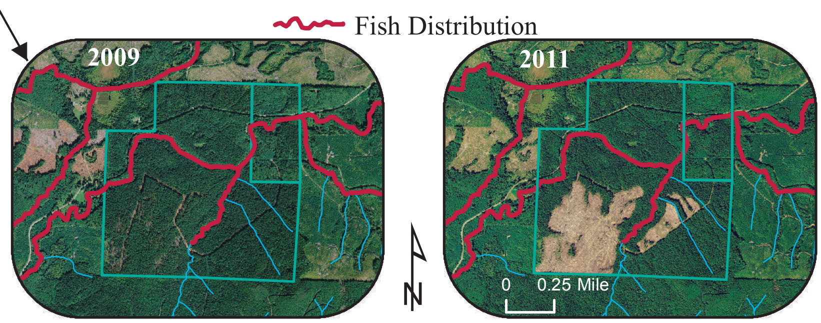




Data Sources:
WADNR 2010
NAIP 2009-2011
Makah Tribe 2011
NOAA NMFS, 2008
NWIFC, SSHIAP 2010

Logging of these exchanged parcels could hamper recovery by:

- Increasing sediment deposition in freshwater habitat
- Causing a decline in large woody debris recruitment
- Increasing floods and low water flows
- Increasing water temperatures



Habitat restoration and protection requirements that would help to mitigate much of the effects of logging, such as minimum width riparian zones, may not be adhered to. The Makah have concerns about the parcels being harvested pursuant to the less protective rules governing private timber harvest versus the harvest under the State Lands' Habitat Conservation Plan (HCP).

Possible ways in which the State could resolve these land exchange issues:

- Sale transaction documents would include a Letter of Agreement outlining the Makah's right of access, conformance to the HCP riparian zone management, etc.
- Provide for perpetual easement to the Tribe for access to gaging stations and research sites
- DNR could retain a perpetual right of access to easement
- DNR could exclude parcels from the exchange
- DNR could consider selling/leasing to the Tribe

Summary

Located on the northwest corner of the Olympic Peninsula, the Makah's Area of Concern includes waters flowing into, and the shorelines of, the Pacific Coast and the Strait of Juan de Fuca. This includes portions of WRIA 19 and WRIA 20, with the Hoko River being the largest watershed within WRIA 19, and the Ozette being the largest in WRIA 20. Decreases in forest cover, high densities of logging roads, 60-70% of potential fish barriers associated with forest practice roads remaining, and continued habitat degradation are all factors in the state of watersheds in the Makah Area of Concern.

Of the 10 watersheds within the Makah area of concern, nine have road densities in a "not properly functioning" condition. Washington State forest management laws required most private forest landowners to submit a Road Maintenance and Abandonment Plan (RMAP). An RMAP is a forest road inventory and schedule for any repair work that is needed to bring roads up to state standards. Repair projects include locations which contain collapsed culverts, fish passage barriers, and excess sedimentation sources associated with logging roads. Current data shows all of these non-point source pollution site locations, and that 60% of private lands and 70% of state lands sites have not been fixed, and yet extensions for the RMAP completion deadline continue to be awarded.

Fine sediment in salmon spawning gravels increased by 2.6 - 4.3 times in watersheds with more than 4.1 miles of roads per square mile of land area. Excess sedimentation is a common limiting factor, with sources from roads and clearcuts. The sedimentation has led to channel instability and a change in substrate to less suitable spawning gravels and mass wasting sites. This sedimentation has led to debris flows that have incised the mainstem channel and removed large woody debris (LWD).

Sedimentation is also a significant constituent to water quality degradation in WRIA 20. Documentation suggests sedimentation plays a key role in effects on egg mortality at Lake Ozette sockeye spawning beach sites and increased water temperatures in Ozette River, which is a stressor for adult migration. Loss of LWD in tributaries has undoubtedly destabilized channel morphology and potentially led to degraded water quality and spawning and rearing habitat. LWD removal interrupted the riparian recruitment process and the hydrologic and sediment regime, resulting in lower overall lake level and likely contributing to loss of beach spawning access for sockeye. Reimplementation of LWD would benefit both river and beach spawning sockeye; however, there is much resistance against this.

Approximately 80 miles of stream in the Makah Area of Concern are listed as "impaired waters" by the Washington State Department of Ecology. Of these 80 miles, 76 are listed as being temperature impaired. Sedimentation and below target shade levels are likely constituents of this, but also the naturally low stream flows in this area are worsened by water withdrawals. Elevated stream temperatures and turbidity, and low dissolved oxygen, are conditions of known impairment in WRIA 19 that negatively impact the success of salmon in the streams.

Currently, the Makah Tribe engages in the Lake Ozette Steering Committee and local lead entities for WRIA 19 and 20. The Makah Tribe works independently and cooperatively with state and federal agencies to monitor stream flow in the U&A. The USGS has operated a flow gage on the Hoko River since 1963, with a 10-year gap between 1974-1983. A major recommendation for Water Quality/Quantity is to increase water quality monitoring and to include all salmon-producing streams.

The Makah Tribe remains active in monitoring and implementing on-the-ground restoration projects throughout the U&A. Future collaboration with state, federal, private and tribal entities for continued

monitoring efforts and on the ground restoration projects are anticipated. Progress by state agencies toward fulfillment of proper processes and duties with due diligence is sought.

The Makah Tribe has been working under the Timber, Fish and Wildlife Agreement (TFW) since its inception in 1987 which later resulted in implementation of the Forests and Fish Report (FFR) in 1999. This agreement allowed funding allocation to the 26 tribes in Washington State to participate in the development and monitoring of the new Washington State Forest Practice Rules, which outline FFR requirements. The FFR modified riparian timber harvest prescriptions in order to provide greater riparian and aquatic protection for streams and rivers while meeting the requirements of the Endangered Species Act and Clean Water Act. This included new rules regulating harvest in riparian areas, more stringent road building requirements and increased wetland protection, while still providing a fair economical outlook for the timber industry in Washington State. After the Makah Tribe's review of the state of our watersheds, we can't help but ask, "Is this process working toward proper restoration of our freshwater systems and the recovery of our salmon species?"

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State of Our Watersheds Report Green-Duwamish River, White-Puyallup River, and Lake Washington Basins

We are the salmon people. For generations, salmon have sustained our way of life. Now we must sustain the salmon.

– PHIL HAMILTON, MUCKLESHOOT FISH COMMISSION

The Muckleshoot Tribe

The Muckleshoot Indian Tribe is a federally recognized Indian tribe whose membership is composed of descendants of the Duwamish and Upper Puyallup people who inhabited Central Puget Sound for thousands of years before non-Indian settlement. The Tribe's name is derived from the native name for the prairie on which the Muckleshoot Reservation was established. Following the Reservation's establishment in 1857, the Tribe and its members came to be known as Muckleshoot, rather than by the historic tribal names of their Duwamish and Upper Puyallup ancestors. Today, the United States recognizes the Muckleshoot Tribe as a tribal successor to the Duwamish and Upper Puyallup bands from which the Tribe's membership descends. Like all native people of Western Washington, Muckleshoot ancestors depended on fish, animal, and plant resources and traveled widely to harvest these resources.

Village groups were linked by ties of marriage, joint feasting, ceremonies, commerce, and use of common territory. Downriver people intermarried with other groups along the Sound, while people on the upper reaches of the drainages also intermarried with groups east of the Cascade Mountains. This network of kinship tied together ancestral Muckleshoot villages within the Duwamish watershed, extended across watersheds and the Cascade crest, giving Muckleshoot ancestors access to fishing, hunting and gathering sites throughout a broad area extending from the west side of Puget Sound across the Cascade crest.

Areas depicted do not necessarily correspond to Muckleshoot Usual & Accustomed fishing grounds and stations.

History of the Basins

The Green-Duwamish, Puyallup-White, and Lake Washington basins in Central Puget Sound continue to support important salmon and steelhead runs despite dramatic habitat alteration and ecosystem decline. However, the abundance and potential production of natural origin salmon has declined sharply. By the early 1900s, navigation and flood control projects split apart the former 1,700-square-mile river basin that included the Green, White, and Cedar rivers and lakes Washington and Sammamish as its tributaries. The White River was diverted into the Puyallup River. The Black River, the historical outlet of Lake Washington and the Cedar River, was eliminated and a new outlet was constructed through the Chittenden Ship Canal and Locks.

The Cedar River was diverted into Lake Washington, permanently extinguishing chum and pink salmon runs unable to migrate through the lake. By the 1940s, the Duwamish estuary marsh and tidelands were filled to create Seattle's industrial port, and the Cedar, White, and Green rivers were dammed. Streams, wetlands, and floodplains were drained, channelized, or confined and the conversion of forest to asphalt began.

Today, the majority of lowland areas are urbanized. Only a small fraction of marine shorelines remain in a natural condition. Now, more than 2 million people live in these basins.

The scarcity of properly functioning freshwater and marine habitat in Central Puget Sound basins means that hatchery fish produced from local brood stock will continue to remain essential for salmon harvest and conservation. In these basins, the Puget Sound Chinook Recovery Plan goal of self-sustaining and harvestable salmon populations is not likely achievable in the foreseeable future. Until enough high quality habitat is reestablished so that much greater numbers of salmon can successfully complete their life cycle, the benefit of hatchery fish to population abundance will outweigh any potential genetic or ecological risks. Without support from hatchery fish, run sizes will dwindle rapidly to unfishable "museum" levels or even extinction given the severity of habitat limitations. At the same time, without sufficient habitat, even hatchery fish may not be sustainable over time.

A Muckleshoot tribal gillnet boat on Elliot Bay underneath the Seattle skyline at sunrise.

Habitat Recovery Continues Despite Recovery Plan

Effective habitat protection and restoration efforts are necessary to sustain future salmon runs in these basins regardless of natural or hatchery origin. Local governments in WRIAs 8, 9, and 10 have prepared habitat plans under the Puget Sound Chinook Recovery Plan approved by NMFS in 2005. Significant efforts are being made by the WRIA groups to implement the projects and measures identified in these plans. While some projects are completed, implementation has been limited by funding and other constraints. Even with full funding, however, the ability of these habitat plans to produce a net gain in habitat quality and quantity is uncertain given the impacts of ongoing development and population growth, the small cumulative geographic extent of the proposed actions, and a reliance on voluntary or inadequate habitat protection measures.

The plans identify restoration projects that, while important, are generally small on an individual and cumulative scale relative to watershed needs. In many cases, the potential to fully recover natural habitat processes in restoration projects is constrained by conflict with adjacent land use, recreation, flood control, water supply, or other demands.

Despite significant efforts by the WRIA groups, habitat continues to be lost and degraded. A recent status report commissioned by NMFS to track Puget Sound Recovery Plan implementation found that, while salmon plan harvest limits had been followed, habitat for Chinook is still declining in Puget Sound (M.M. Judge, 2011). The status report concluded that habitat protection needs improvement despite the adoption of the Shoreline Management Act, Growth Management Act, and Forest Practices Act, with forestland conversion and impervious surface area growing by 2 -3% from 2001-2004. Despite critical areas ordinance rules, riparian areas in priority watersheds in the Lake Washington-Cedar-Sammamish Watershed Habitat Plan continued to lose forest cover and gain impervious surfaces with a 5.5% gain in rural areas and 10.6% gain inside Urban Growth Boundaries between 2005 and 2009 (Vanderhoof, J. et al. 2011).

The Lake Washington-Cedar-Sammamish Chinook Salmon Conservation Plan (WRIA 8) contains habitat protection and restoration measures with objectives to maintain or restore watershed processes, functional migration corridors and high-quality refuge habitats, land use and planning recommendations, and public outreach and education. The plan identified 165 high-priority projects for implementation in the first 10 years of the plan. In the first 5 years, 23 of the 165 projects have been completed while 48 are currently active.

Some of the measures in the Green River Salmon Habitat Plan (WRIA 9) are proceeding, although implementation has been hindered by funding shortfalls and staffing capacity. The plan established goals to protect and restore physical, chemical and biological processes and freshwater, marine and estuarine habitats; protect and restore habitat connectivity where feasible; and protect and improve water quality and quantity conditions to support healthy salmon populations. The Puget Sound Chinook Recovery Plan 2011 Implementation Status Assessment prepared for NMFS (M. Judge, 2011) noted that the WRIA 9 planning group has “the disadvantage of attempting to achieve recovery in one of the most highly altered, diked, degraded and urbanized watersheds in Puget Sound.” As elsewhere in Central Puget Sound, restoration opportunities in WRIA 9 are challenged by high land costs, conflicting land use, and site availability. The individual and cumulative scale of the habitat plan restoration projects is generally small. For example, the projects identified in the plan that target estuary transition zone habitat (a high-priority action) would restore a total of less than 40 acres, with a long-term goal of just 173 acres.

Patrick Reynolds, left, and Martin Fox, Muckleshoot biologists, survey a pool for salmon habitat on the Green River in Auburn.

Pierce County serves as the lead entity for the Puyallup-White WRIA 10 salmon recovery habitat plan. Key strategies include levee setbacks, floodplain reconnection, creation of off-channel habitat, restoration of estuary and marine nearshore habitat, and protection and restoration of key tributaries, along with programmatic actions such as a Flood Hazard Reduction Plan and Shoreline Master Plan updates. While some projects have been completed, the WRIA group reports that they are not on pace to meet 10 year goals (M. Judge, 2011).

Restoration Progress Slow

Although only one indicator of habitat conditions, a review of recovery progress and trends at the 5-year mark of the Lake Washington, Green-Duwamish, and White River habitat plans indicated mixed results.

Coordination and alignment of the regulatory and programmatic efforts of jurisdictions with the goals and objectives of the recovery plans has not occurred. For example, Shoreline Master Programs governing land use and habitat protection have yet to be updated and made consistent with habitat recovery strategies (WDOE website 3/3/2011).

Despite its value to salmon, large woody debris placement in rivers is restricted to accommodate recreation. Progress with restoration efforts has been slow and few projects have been able to begin to restore characteristic natural riparian and floodplain habitat processes.

At the same time, federal agencies have not adequately met their own responsibilities for salmon habitat. Examples include continued delays in fish passage improvements at U.S. Army Corps' dams Mud Mountain, Howard Hanson, and the Ballard Locks; weak permit terms and conditions for federal actions affecting ESA Critical Habitat; sediment releases and other unmitigated operational fish habitat impacts at Howard Hanson and Mud Mountain dams, and the Corps of Engineers' levee maintenance standards under Public Law 84-99 that require cutting trees on levees despite Clean Water Act listings and Critical Habitat designations.

A ship moves through the U.S. Army Corps of Engineers' Ballard Locks as two smolt passage flumes (foreground) provide the only safe passage route to sea for juvenile salmon from the Lake Washington system. More fish passage improvements are needed, including replacement of 100-year-old lock valve machinery with new equipment to facilitate slower lockage fills that help reduce smolt mortality associated with navigation at the Locks.

Problems with Water Flow, Pollution and Temperatures

Impacts to water quality and quantity continue to be of great concern in WRIAs 8, 9, and 10, with approximately 193 miles of stream being listed as impaired waters by the Department of Ecology. Another 42 stream miles are assumed to have maximum water temperatures that exceed State standards established for protection of salmonids. Temperatures in the Lower Green River are frequently in the range of sub-lethal effects and at times exceed lethal thresholds. Low flow problems are documented along 602 miles of streams in WRIAs 8, 9, and 10. The number of private permit-exempt wells continues to rise along with land development, with a 58% increase in WRIAs 8 and 9 occurring between 2004 and 2010 and a 49% increase in WRIA 10.

Extensive urban, industrial, commercial, and residential development has greatly increased impervious land cover in these watersheds. Impervious surfaces are strongly correlated with degraded stream health and lost salmon production as a result of increased peak flows, erosion, pollution loading and water temperatures; and decreases in pools, woody debris, and gravel quality, and benthic or prey diversity. Available data indicates a 89-square-mile increase in impervious surface area in WRIAs 8, 9, and 10 between 1986 and 2006.

Adult coho are highly sensitive to stormwater runoff containing toxic pollutants, especially copper, pesticides, and hydrocarbons originating from roads and from urban and residential landscapes. Based on a predictive model developed by NOAA, more than half of the 481 stream miles of the known coho distribution in WRIAs 8 and 9 are expected to have elevated pre-spawning mortality (PSM) rates of 5% or greater, with 141 miles at 35% PSM or greater.

Healthy, properly functioning riparian areas require adequate vegetation, accessible floodplains and the presence of large woody debris. Levees and revetments degrade almost 100 miles of river bank or 49% of the total mainstem river miles accessible to salmon in the Green, Lake Washington, and Puyallup-White basins. Riparian shade is severely deficient along the lower Green River as well as in other stream areas. The size and amount of large woody debris in the Green, White and Cedar rivers continues to be extremely low compared to natural conditions, with the exception of the upper Muckleshoot Indian Reservation reach of the White River. Instream wood levels in the Cedar and Green rivers are estimated to be 89% to 95% below NMFS' criteria for properly functioning conditions for salmon habitat (NMFS 1996).

Degraded Shoreline, Nearshore Challenges Habitat Restoration

The Lake Washington-Cedar-Sammamish Chinook Recovery Plan recognizes the need to restore degraded shoreline habitats in Lake Washington and Lake Sammamish. These shorelines are lined with 4,097 docks and piers, and an estimated 82% of Lake Washington is bulkheaded. These structures replace or degrade Chinook rearing habitat, creating migratory obstacles and ideal habitat for predators such as bass and cutthroat trout. A voluntary approach to address this conservation issue has produced minimal results to date.

Nearshore marine habitat is critical to juvenile salmon for growth and survival during the transition to the Pacific Ocean.

Of the 119 miles of marine shorelines in WRIAs 8, 9, and 10, less than five miles is in a natural condition unaltered by bulkheading or riprap. These values fall far short of the objectives indentified in the recovery plans and the levels necessary to ensure sustainable fish populations into the future. Greater progress is needed in implementing the habitat plans to enhance nearshore areas in Central Puget Sound.

Population growth and development impacts in the Green-Duwamish, Lake Washington, and White-Puyallup basins will continue to challenge the effectiveness of salmon conservation and recovery efforts. Trends suggest that loss of critical habitat will continue even as restoration projects are being implemented. Updating and revising the regulatory framework which serves to protect salmon habitat must occur if the goal of securing sustainable salmon populations is to be realized. Climate change and invasive species present serious additional challenges that will require new approaches and funding sources.

Muckleshoot tribal fisherman land sockeye at Rainier Beach in Seattle.

Adult salmon mortality due to poor fish passage at the Mud Mountain Barrier Dam on the White River. A new dam and fish trap is needed to replace the century-old barrier dam and a 1940s-era fish trap used to capture and transport fish around the 432-foot-high U.S. Army Corps of Engineers' Mud Mountain flood control dam located 5 miles upstream.

Looking Ahead

Habitat priorities for the next 5 years are to halt ongoing habitat declines through greater enforcement of habitat regulations by state, local, and federal agencies and an increased rate of habitat restoration. Specific priority objectives include (1) obtain fish passage improvements at the Ballard Locks including replacement of the Stoney Gate Valves to protect smolts, and replacement of the Mud Mountain Barrier Dam and fish trap; (2) complete riparian corridor plans to improve shade and salmon rearing habitat in the Green River including alternatives to the US Army Corps of Engineers levee maintenance standards; (3) protect and restore freshwater and marine shorelines, and floodplain habitat areas; (4) advance projects that restore groundwater inflows to Sammamish River tributaries to reduce summer water temperatures; and (5) legislation to prevent drilling exempt wells where municipal water supplies are available.

Land use and population analysis has identified a linkage between prespawn mortality and stormwater runoff. Adult coho are highly sensitive to toxic pollutants in stormwater runoff from urban and residential landscapes, such as copper, pesticides and hydrocarbons. Based on a NOAA model, more than half of the 481 stream miles used by coho salmon in the Muckleshoot Tribes' area of concern are predicted to have pre-spawning mortality rates (PSM) of 5 percent or higher. Of these, 141 miles are predicted to have rates greater than 35 percent.

Healthy riparian areas require adequate vegetation and large woody debris. The watershed recovery plans call for managing riparian buffers to secure functional stream corridors. The quality and quantity of instream wood in the Green and Cedar rivers (a tributary to Lake Washington) continue to be extremely low compared to natural conditions, due to land use and river management. Estimates of the size and amount of existing instream wood in the Green and Cedar rivers were found to be 89% to 95% less than NMFS criteria required for properly functioning conditions for salmon habitat (NMFS 1996).

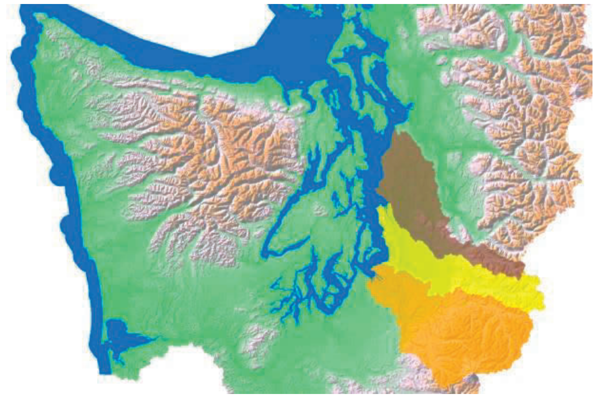
The Lake Washington recovery plan recognizes the need to address degraded shorelines in both Lake Washington and Lake Sammamish. Over-water structures and bank modifications have disrupted the migration and rearing of chinook salmon. The shores of Lake Sammamish and Lake Washington are lined with 4,097 docks, piers, and an estimated 82 percent of Lake Washington has been bulkheaded. These structures are obstacles to migration and are ideal habitat for predators of juvenile Chinook, such as small mouth bass and cutthroat trout. Since 2005, a voluntary approach to address this conservation issue has produced limited results.

Nearshore habitat and vegetation are critical to juvenile salmon for rearing, refuge from predators, transitioning to saltwater habitat and migrating to the open ocean. Greater progress is required in the implementation of the habitat recovery plans to enhance these areas within the watershed. Of the 119 miles of marine shoreline in WRIAs 8, 9, and 10, only 5 percent remains in a natural condition without bulkheads or riprap. Almost 36 miles of the Green River is degraded by levees and revetments; which is 60 percent of the total mainstem river accessible to salmon.

Population growth and development within the Green and Lake Washington watersheds will continue to challenge salmon recovery efforts. Trends indicate that we'll lose critical habitat even as restoration projects are implemented.

Updating and revising regulations that are supposed to protect salmon habitat must occur if salmon populations are to be sustained into the future.

Muckleshoot Indian Tribe Chapter (Lake Washington, Green-Duwamish, & White-Puyallup River Basins)



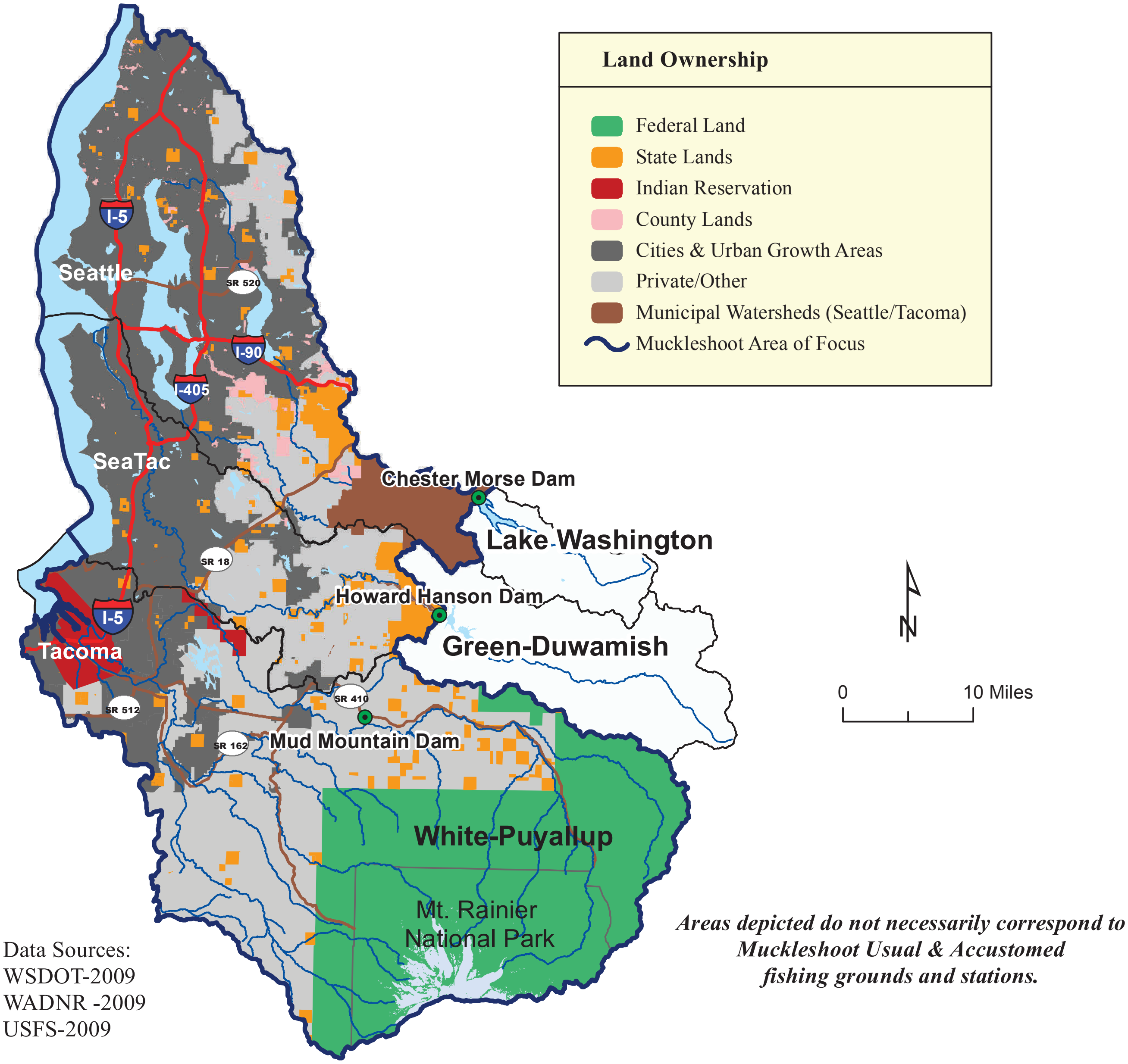
The Muckleshoot Indian Tribe's geographic area of focus includes all of WRIA 8, 9 and 10. In this Chapter, the Tribe's focus is on the White-Puyallup River basin, and on the Lake Washington (WRIA 8) and Green-Duwamish River (WRIA 9) basin areas downstream of the Chester Morse and Howard Hanson dams, in order to highlight the status of salmon habitat at lower elevations largely below forest management areas. Anadromous salmonids in these areas include Chinook, coho, sockeye, chum, pink salmon, steelhead and bull trout.

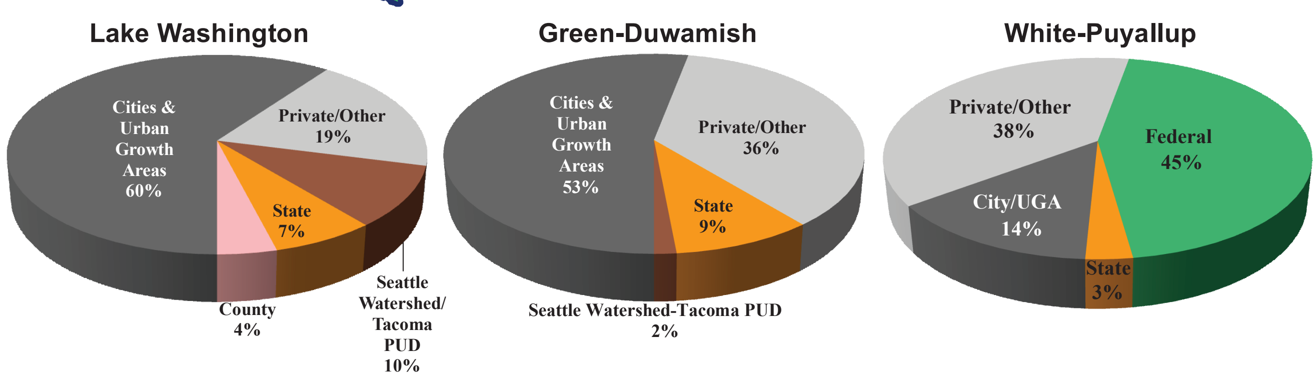
The Green-Duwamish River Basin was historically 1,736 square miles and included the White and Cedar rivers. The Cedar and White rivers were diverted in the early 1900s, reducing the basin area to 556-square-miles. The Green River's flow regime is altered by flood control and storage at Howard Hanson Dam and by water withdrawals. Approximately 98% of historic intertidal marsh and flats have been replaced with commercial and industrial development. The basin supports more than 500,000 people. About 30% of the basin lies within Urban Growth Area boundaries.

The 686-square-mile Lake Washington Basin includes the Cedar and Sammamish rivers and the lakes Sammamish, Union, and Washington. Major alterations include channelization of the Sammamish River, and the construction of the Lake Washington Ship Canal and the Ballard Locks. The basin is heavily urbanized, leading to highly modified stream hydrology and shorelines. With 25 cities and 1.4 million people, Lake Washington is the most populated basin in Puget Sound with 55% of its land area inside Urban Growth Area Boundaries.

The White River drains a 494-square-mile basin that originates on several glaciers on Mount Rainier. The river flows approximately 68 miles from its origin to its confluence with the Puyallup River at Sumner. Most of the upper White River is managed for timber production and has been intensively logged since 1945, leading to slope stability problems and increased sediment loads in non-glacial tributaries. (M. Judge, 2011) The U.S. Army Corps' Mud Mountain Dam blocks adult fish migration and the river's flow and sediment regime are heavily altered by flood control activities at the dam. From 1911 until 2004, Puget Sound Energy diverted up to 2,000 c.f.s. from the White River into the Lake Tapps reservoir, depleting river flows on the Muckleshoot Indian Reservation and devastating salmon and steelhead populations. A 1986 settlement with the Muckleshoot Tribe required that the diversion meet a minimum instream flow. Hydropower diversion ceased in 2004, and in 2007, an agreement was reached with the Cascade Water Alliance that further limits water diversion to Lake Tapps. The basin includes Commencement Bay, which is highly altered and contaminated from past industrial discharges and urban runoff.

Land development, and hydrologic and channel modification have severely diminished the potential for natural salmon production in these basins. Much of the habitat loss and degradation is not likely to be reversed, and new growth continues to add impacts. As a result, hatcheries continue to play a crucial role in providing salmon for tribal treaty and other harvest, and in maintaining the abundance of naturally spawning fish. Nonetheless, habitat protection and restoration remain essential in order to sustain future salmon populations regardless of hatchery or natural origin.

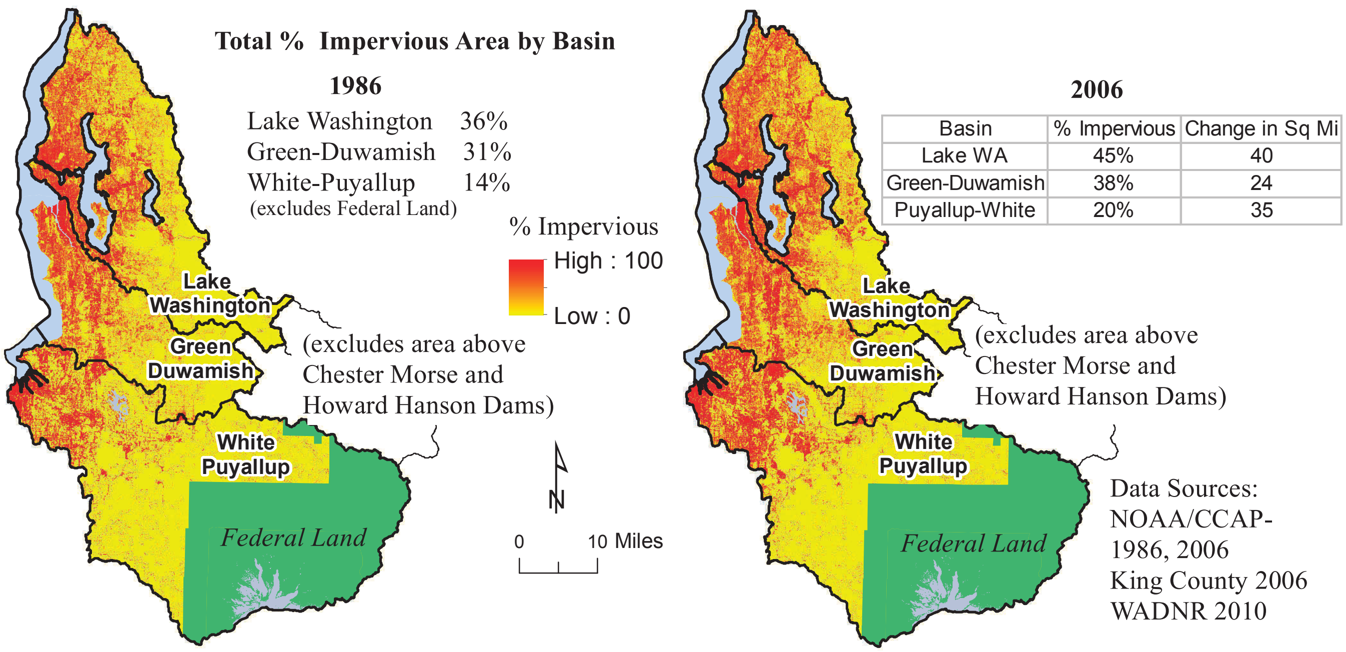




Impervious Surface Continues to Increase

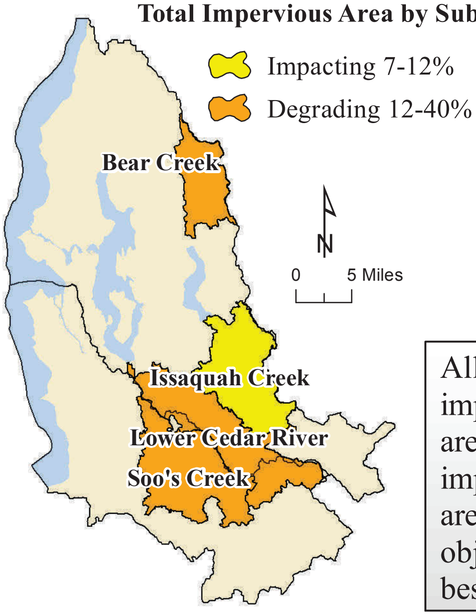
Puget Sound Chinook salmon habitat plans recommend projects to minimize increases in impervious surfaces and promote low impact development. From 1986 to 2006, the Lake Washington, Green-Duwamish, and Puyallup-White basins saw an increase in impervious surface of 24%, 25%, and 47%, a total of 89 square miles. Despite Critical Areas rules, impervious surfaces within riparian areas rose by 5.5% in rural areas and 10.6% in Urban Growth Areas in Lake Washington's high priority subbasins, between 2005 and 2009 (WRIA 8 State of Salmon and the Watershed, 2010).

Impervious surfaces are areas covered with roads, parking lots, roofs and other surfaces that do not allow water to soak into the ground. Total impervious area in a watershed is a general predictor of biological and hydrological conditions (Schueler, 1994; Alberti et al, 2007). Studies in western Washington have found that when impervious surfaces reach 10 - 20% of a watershed, stream stability decreases, flooding and scour increase, large wood decreases, gravel and water quality decrease, macro-invertebrate diversity decreases (Booth and Jackson, 1997; Booth et al., 2002; May, 1996), and loss of aquatic system functioning is likely irreversible (Booth and Jackson, 1997). Impairment can begin as low as 7 to 12% imperviousness (Spence et al, 1996; Snohomish Co., 2005).



Basin	% Impervious	Change in Sq Mi
Lake WA	45%	40
Green-Duwamish	38%	24
Puyallup-White	20%	35

Total Impervious Area by Subbasin (%)



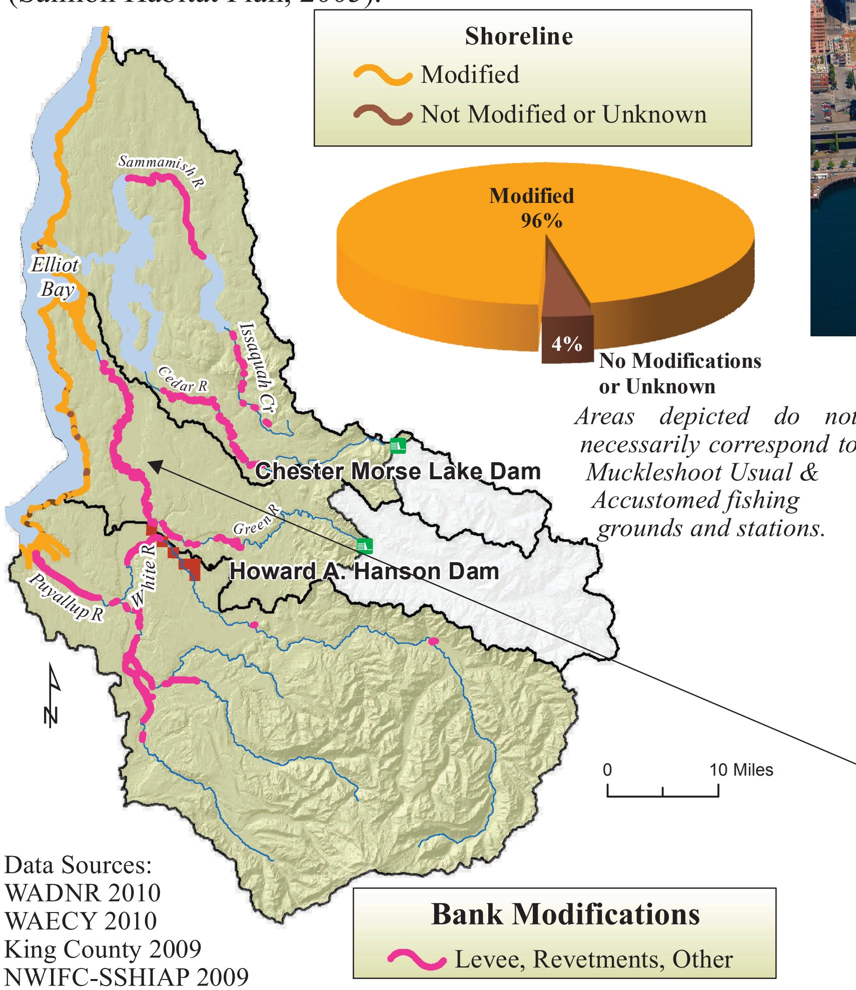
Effective watershed protection and restoration requires maintaining forest cover in at least half of the basin, aggregated around streams and wetlands with intact riparian buffers; less than 20% impervious surface areas with stormwater infiltrated to the ground; riparian protection zones that minimize clearing, road, and utility crossings; and no construction on steep or unstable slopes (Booth et al, 2002; Alberti et al, 2007).

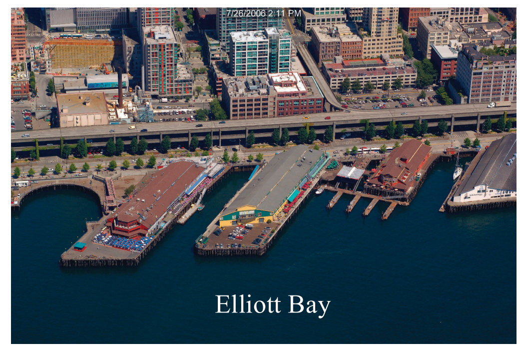
All four of the subbasins depicted have seen an increase in impervious surface area since 1986. Bear Creek, considered a core area in the WRIA 8 Chinook Habitat Plan, saw an increase in impervious surface from 17% to 27%. Issaquah Creek, another core area, saw an increase of impervious surface from 7% to 12%. A key objective in the Chinook Salmon Conservation plan is to protect the best remaining habitat and processes which includes these subbasins.

Shoreline Modifications Limit Fish Rearing Habitat in Fresh and Marine Waters

Salmon produced in Lake Washington, Green-Duwamish, and White-Puyallup basins lack nearshore habitat for juvenile rearing, transitioning to saltwater, and for migration to the Pacific Ocean. Of the 119 miles of marine shoreline, less than five miles are undeveloped or free of bulkheads, riprap, and other structures. According to the Habitat Work Schedule (Jan 2011) only two nearshore restoration projects have been completed with one levee removal started in WRIAs 8 and 9, and one levee setback completed in WRIA 10.

Extensive development along marine shorelines has resulted in loss of productive marine aquatic habitat and vegetation. Bulkheads and seawalls have filled shallow water habitats, resulting in reduced rearing area, food supply, and cover from predators, and has isolated the aquatic environment from natural sediment sources such as feeder bluffs that sustain beach habitats. In Elliott Bay, piers shade shallow water habitat, which reduces habitat productivity and may alter salmon migration patterns (Salmon Habitat Plan, 2005).





Elliott Bay


Floodwall

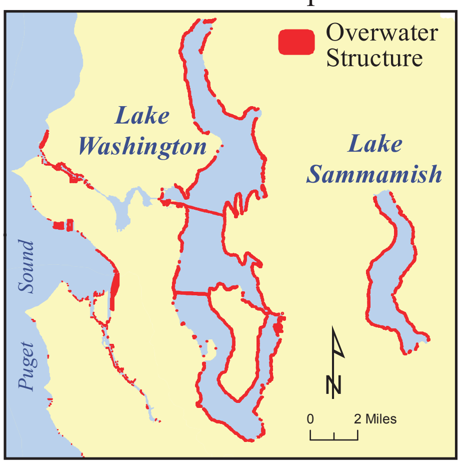

Green River Levee

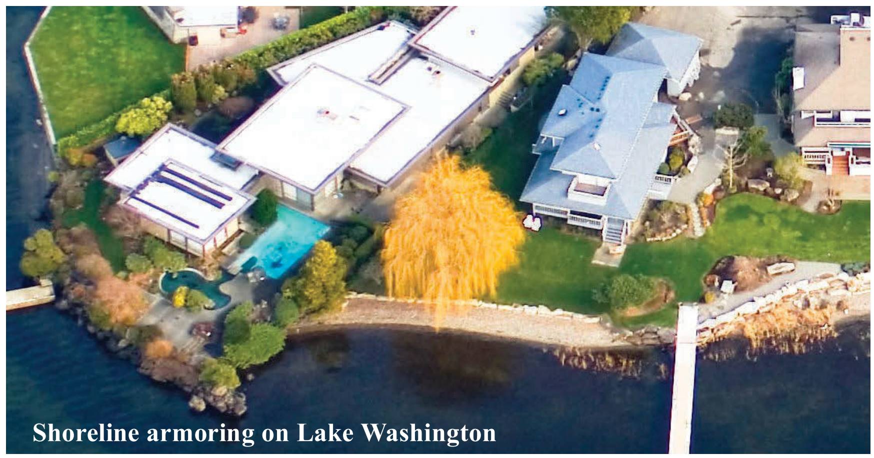
Levees and revetments degrade 36 miles of riparian areas in the Green-Duwamish River, 24 miles in the Lake Washington basin, and 48 miles in the White-Puyallup, amounting to 49% of the total large mainstem river length accessible to salmon. Floodplain development, levees, and revetments have diminished the capacity and productivity of the Green-Duwamish ecosystem for salmon compared to historical conditions. Plans to set back levees to restore floodplain habitats are currently limited in location. Since 2005, the Army Corps of Engineers has enforced policies that restrict vegetation on levees as a requirement for federal funding of levee repairs. In 2009 alone, 461 trees were cut down in the Green River to comply with the Corps' policies (King County DNRP, 2010). Tree removal continues despite Clean Water Act 303-(d) listings for temperatures and dissolved oxygen, a critical habitat designation for Puget Sound Chinook and steelhead, and a lack of evidence that vegetation threatens levee safety.

Overwater Structures Impact Shoreline Habitat in Lake Washington

Overwater structures and bank alterations on Lake Washington and Lake Sammamish interfere with the rearing and migration of juvenile Chinook salmon. The lakeshores are lined with 4,097 docks and piers, and an estimated 82% of Lake Washington has been bulkheaded. The Salmon Recovery Plan calls for a reduction in the number and coverage of overwater structures in the Lake Washington basin and to replace bulkheads and riprap. According to the Habitat Work Schedule, three projects to remove bulkhead on Lake Washington have been completed and no docks have been removed.

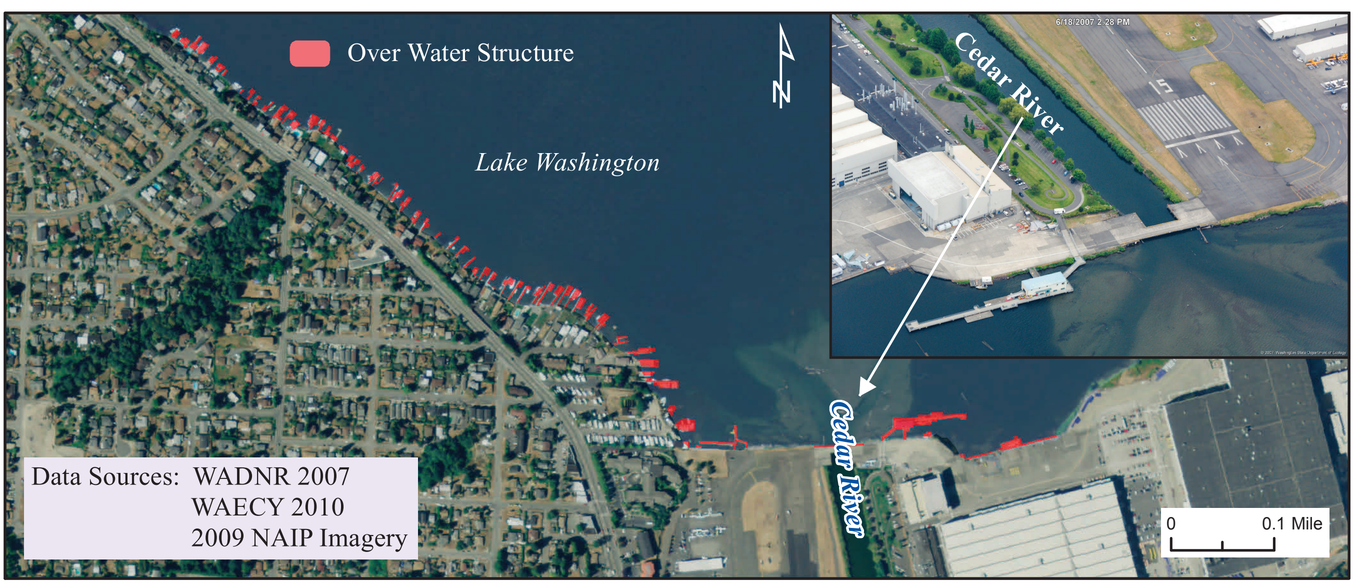
Docks, piers, and bulkheads provide ideal habitat for ambush predators such as smallmouth bass and cutthroat trout, and are avoided by rearing Chinook. Extensive armoring reduces the amount of gentle sloping shorelines that small juvenile Chinook salmon use from January to May (Tabor and Piaskowski, 2002). Migrating Chinook smolts are also observed to avoid these structures, moving into deeper water where they are more vulnerable to off-shore predators (Celedonia et al, 2006). The perimeter around docks and piers in Lake Washington nearly doubles the natural shoreline length to 163 miles. This longer swimming distance exposes outmigrating Chinook to increased predation, and may delay saltwater entry until midsummer when fish passage efficiency at the Ballard Locks drops due to warm water temperatures.





Shoreline armoring on Lake Washington

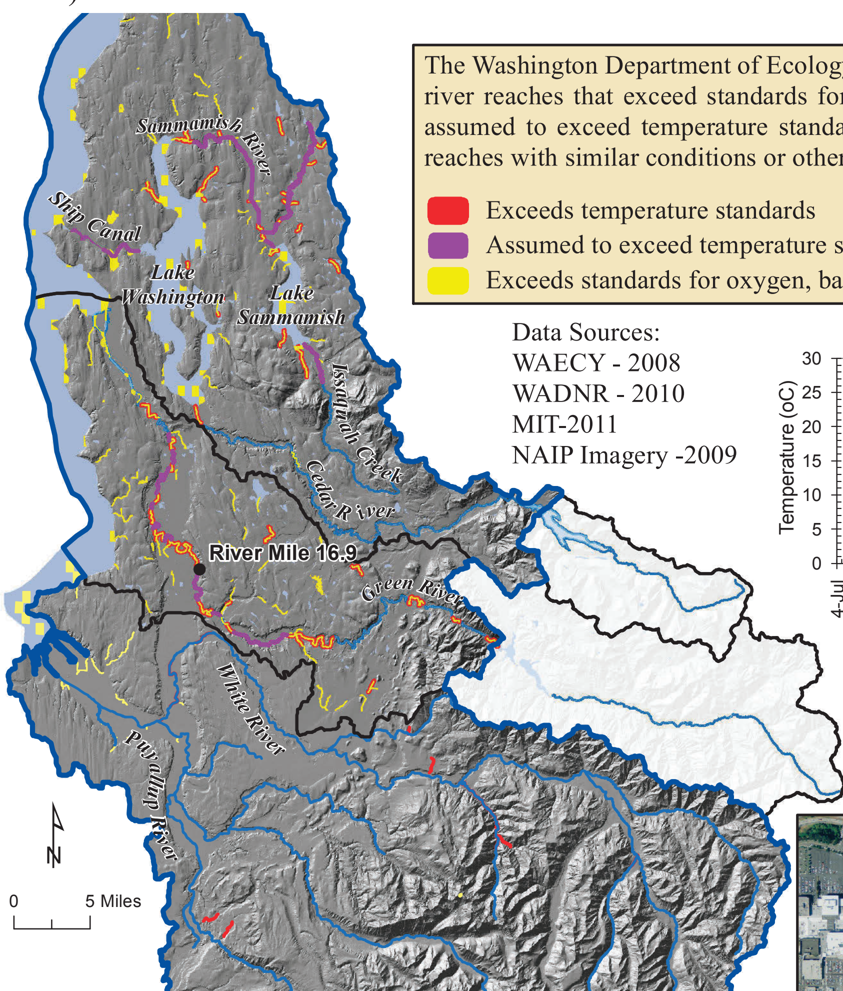
Chinook juveniles leave the Cedar River entering Lake Washington in late winter and spring, and inhabit water less than a meter deep. Most are found in the south end of the lake near the mouth of the Cedar River where they encounter numerous docks and bulkheads. Restoring natural shorelines in the south end of Lake Washington would be beneficial for Chinook but opportunities are limited. (see photo)



Water Quality Conditions Need Corrective Actions

Approximately 193 miles of stream in WRIAs 8, 9, and 10 are listed as "impaired waters" by the Washington State Department of Ecology. An additional 42 miles in WRIA's 8 & 9 are assumed to exceed water temperature standards for fish based on adjacent impairments or other data. Despite near-lethal temperatures and an agreed strategy to "establish and enforce riparian buffers along rivers, streams..." (Shared Strategy for Puget Sound, 2005), more than 461 trees and hundreds of shrubs have been removed from the lower Green River since 2005 to comply with US Army Corps' maintenance policies for federally subsidized levees. Between 2005 and 2009, riparian forests declined by 1.5% in rural areas and by 3.4% in urban growth areas in Lake Washington's high-priority subbasins (Vanderhoof, J. et al, 2011).

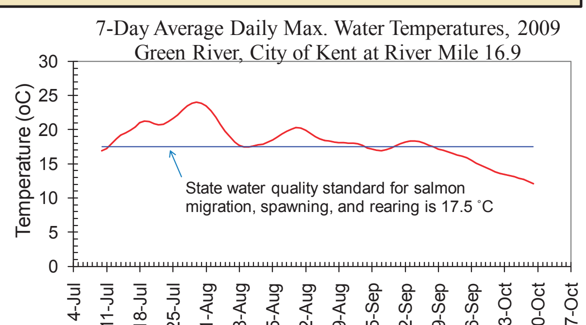
Water temperature and dissolved oxygen are known to be a significant limiting factor for both juvenile and adult salmon (Williams et al, 2001, Kerwin and Nelson, 2000). The Lake Washington Ship Canal, the sole migration route for salmon to and from Lake Washington, routinely reaches temperatures of 21-23+ degrees C by July each year. Summer temperatures in the Lower Green River often reach 7-day average daily maximums greater than 23˚C. A major cause is poor riparian conditions. Shade levels generally range from zero to 20% of natural system potential (King County Shade Assessment Report, 2005).



The Washington Department of Ecology's 2008 Water Quality Assessment identifies river reaches that exceed standards for fish (WAECY, 2008). Additional areas are assumed to exceed temperature standards for fish based on proximity to impaired reaches with similar conditions or other data sets.

- Exceeds temperature standards
- Assumed to exceed temperature standards
- Exceeds standards for oxygen, bacteria, toxics

Data Sources:
WAECY - 2008
WADNR - 2010
MIT-2011
NAIP Imagery -2009



Areas depicted do not necessarily correspond to Muckleshoot Usual & Accustomed fishing grounds and stations.

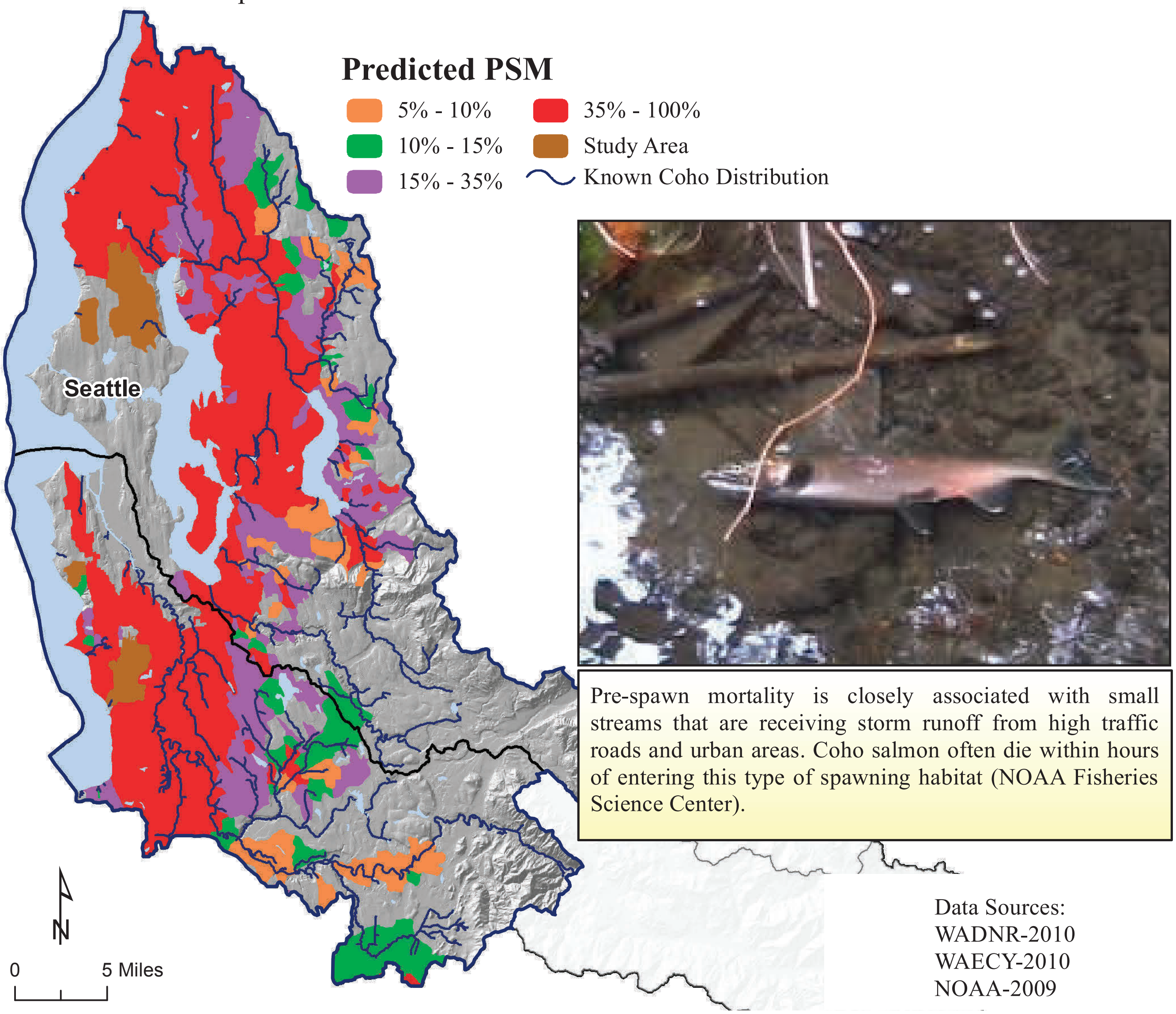
Lack of riparian shade

Loss of riparian vegetation, altered stream flows, and pollution from adjacent land uses limit fish production and survival in much of the Green-Duwamish, Lake Washington, and White-Puyallup basins. While some efforts by local jurisdictions have been made, more action is needed to improve water quality and avoid further degradation.

Stormwater Runoff Implicated in Coho Pre-Spawning Mortality

One of the Lake Washington/Cedar-Sammamish Watershed Chinook Salmon Conservation Plan objectives includes the protection, maintenance and restoration of water quality and natural hydrologic processes (stormwater and instream flows). To date, little has been accomplished to relieve the impacts of stormwater runoff.

Adult coho salmon have been shown to be highly sensitive to stormwater runoff containing toxic pollutants from urban and residential landscapes, such as copper, pesticides, and hydrocarbons. NOAA and USFWS researchers have developed a model to predict areas of coho pre-spawning mortality (PSM) in Puget Sound using spatial analyses of land use and coho PSM data (Nathaniel Scholz, NW Fisheries Science Center). Based on their model, 269 stream miles or 56% of known coho distribution in the Green- Duwamish and Lake Washington basins are predicted to have a PSM rate of 5% or more, with 141 miles predicted to have 35% - 100% PSM. Coho PSM in unaffected streams is generally less than 1% (J.W. Davis, USFWS). The same researchers concluded that copper-containing stormwater from urban landscapes can cause sensory deprivation and increase predation mortality of coho juveniles. In a related experiment, deformities and low growth were observed in coho hatchlings incubated in untreated urban creek water compared to treated water from the creek.

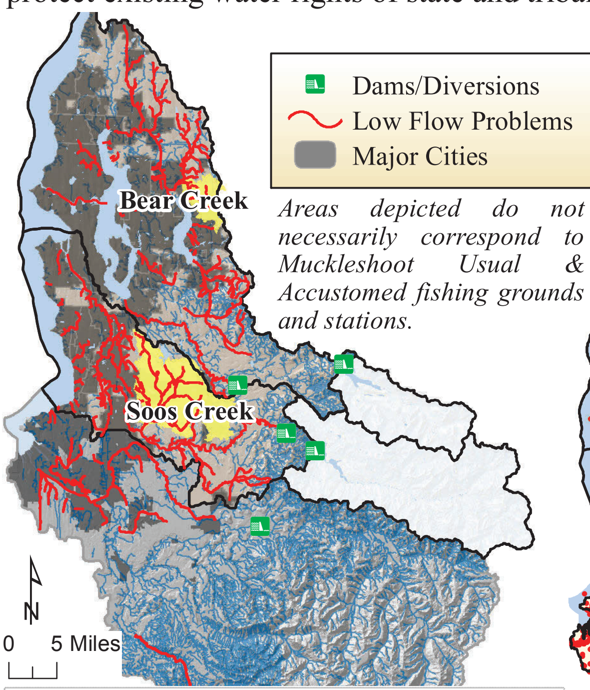


Pre-spawn mortality is closely associated with small streams that are receiving storm runoff from high traffic roads and urban areas. Coho salmon often die within hours of entering this type of spawning habitat (NOAA Fisheries Science Center).

Low Flows Decreasing as Water Resource Development Continues

The 2005 Lake Washington and Green-Duwamish Salmon Conservation Plans call for the maintenance of adequate stream flows. A total of 482 miles of streams in these basins are identified as having low stream flow problems (Lombard and Somers, 2004), while the Puyallup-White have 120 miles. Ground and surface water extractions are estimated to be 37% of the current summer low flows in the Green-Duwamish River Basin (NHC, 2005). In the Lake Washington and Green-Duwamish basins, exempt wells have increased by 58% since 2004, and 49% in the Puyallup-White.

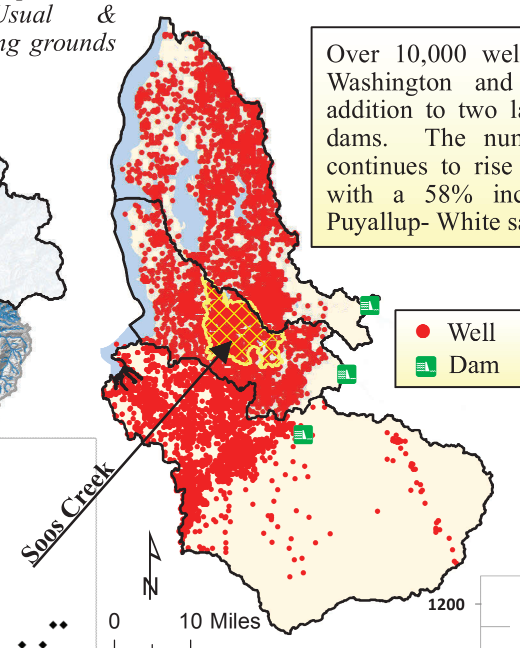
Low stream flows are one of many factors that contribute to low productivity and abundance of Chinook and other salmon. Low flows reduce the available habitat for rearing, migration, and spawning and contribute to warm water temperatures. Instream flows in the Cedar, Green and White river mainstems have been protected and restored through tribal settlement agreements with municipal water suppliers. Many important tributary streams, however, currently lack protection and restoration. Greater enforcement of water rights laws, a halt in the proliferation of exempt wells, and greater use of conservation, source exchange, and other strategies are critically needed for salmon habitat and to protect existing water rights of state and tribal fish hatcheries.



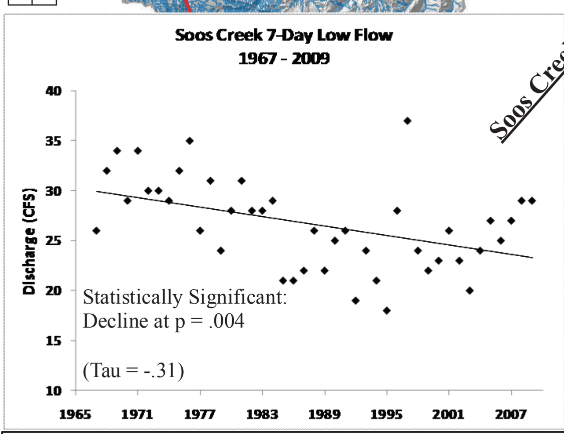
Areas depicted do not necessarily correspond to Muckleshoot Usual & Accustomed fishing grounds and stations.

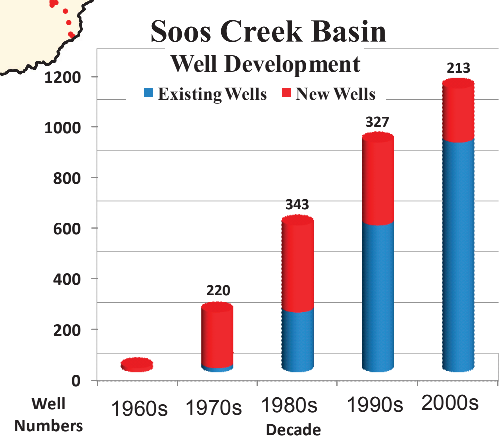
Summer low flows in the Bear Creek drainage have been reduced by 39% (Kerwin, 2001). Private and municipal well extractions in the Soos Creek subbasin were estimated to equal 52% of the current summer low flow (NHC, 2005), reducing habitat for Chinook, coho, and steelhead.

Over 10,000 wells currently exist in the Lake Washington and Green-Duwamish basins, in addition to two large municipal water diversion dams. The number of exempt wells drilled continues to rise as land development proceeds with a 58% increase since 2004, while the Puyallup- White saw a 49% increase.



Data Sources:
WAECY - 2008/10
WADNR - 2010
King County - 2006
Muckleshoot Tribe - 2011



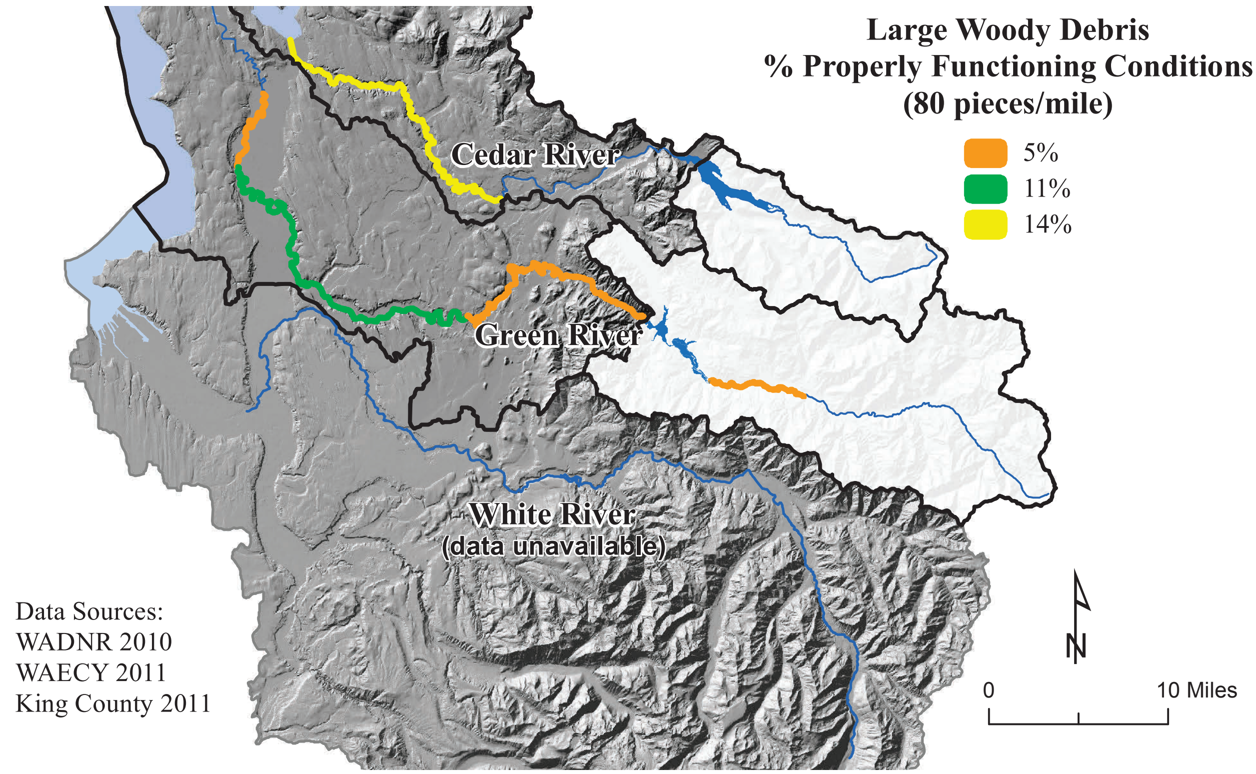


Summer-Fall flows in Big Soos Creek show a statistically significant decline that coincides with development of municipal and private wells in the subbasin.

Streams Lack Large Wood and Important Natural Habitat Features

The Lake Washington, White-Puyallup, and Green-Duwamish salmon habitat plans call for a focus of action to restore sources of large woody debris (LWD), install LWD to restore pool habitat and to protect existing large woody debris. The amount of instream wood in the Green, White, and Cedar rivers is extremely low compared to natural conditions as a result of land use and river management. Estimates of LWD in the Green and Cedar rivers meeting NMFS size and frequency criteria are 89% to 95% below the levels necessary for "properly functioning conditions" for salmon habitat (NMFS, 1996). Data on LWD in the White River is currently unavailable.

The potential to restore large woody debris to improve salmon habitat in the Green-Duwamish and Lake Washington basins is restricted by land use and also by policies that address river recreation safety. The Cedar, Green, and Sammamish rivers are all designated by King County as “Recreational Waterways” where wood placement is restricted and the removal, lopping, or repositioning of wood deemed hazardous to boaters commonly occurs.



Large woody debris provides essential cover and shelter for fish, and helps to form pools, store sediment, and maintain the complex instream habitat required by salmon.

When large woody debris levels are low, fish habitat productivity is diminished.

Riparian areas function properly when adequate vegetation, landform and large woody debris are present.

Summary

The watersheds of the original Green-Duwamish river basin are the most populated and modified watersheds in Puget Sound. Since the original tributaries of the Green-Duwamish River including the Black and White rivers and Lake Washington were diverted for flood control and navigation, thousands of acres of original forest, wetlands, marshes, and floodplain habitats have been converted to urban or other uses. The hydrologic regimes of the Green, White, and Cedar rivers have been altered by large reservoirs and dams, while most tributaries experience damaging peak flows and reduced summer flows as a result of urbanization and groundwater extraction.

Ongoing land development continues to increase impervious surfaces both in and outside of Urban Growth Area boundaries from 2006 levels. Between 1986 and 2006, impervious surfaces rose by 24% in Lake Washington basin (an increase of 40 square miles), by 25% in the Green-Duwamish basin (an increase of 24 square miles), and by 47% in the Puyallup-White (an increase of 35 square miles). Despite Critical Areas rules, impervious surfaces within riparian areas rose by 5.5% in rural areas and 10.6% in Urban Growth Areas in Lake Washington's high priority subbasins, between 2005 and 2009 (WRIA 8 State of Salmon and the Watershed 2010).

Approximately 193 miles of stream in the Lake Washington and Green-Duwamish, and Puyallup-White basins are listed as having impaired water quality by the Washington State Department of Ecology. Based on other information, an additional 42 miles are known or assumed to have high water temperatures. Maximum summer temperatures in the Lower Green River are in the range of those with lethal and sublethal effects for adult and juvenile salmon (21 -23+ ˚C). A total of 482 miles of streams in WRIA's 8 and 9 alone are documented to have low flow problems, with an additional 120 miles in the Puyallup-White. Ground water extractions in the Soos and Bear creek systems have contributed to reduced summer and fall flows available for Chinook, coho, and steelhead. Permit exempt wells continue to be drilled as more land is developed.

Of the 119 miles of marine shorelines, only about 5% in WRIAs 8, 9 and 10 remain natural or unaltered by bulkheads or riprap. Levees and revetments degrade approximately 60 miles of riverbank in the Green-Duwamish and Lake Washington basins representing 49% of the total large mainstem river length accessible to salmon. An additional 48 miles of levees and revetments exist in the Puyallup-White. Overwater structures and bank modifications likely disrupt the growth, migration and survival of Chinook salmon fry and smolts in lakes Washington and Sammamish. Lake shore areas used by Chinook are lined with 4,097 docks, piers, and an estimated 82% of Lake Washington shoreline has been bulkheaded.

Based on a model by NOAA and USFWS researchers, over half of the 481 stream miles of known coho distribution in the Lake Washington and Green-Duwamish basins are predicted to

have elevated pre-spawning mortality rates (PSM) due to polluted stormwater runoff from heavy use roads, with 141 miles predicted to have greater than 35% PSM.

At present, the potential for fish habitat improvement using large woody debris (LWD) is limited by land use and concerns about river recreation safety. The quantity and size of LWD in the Green, White, and Cedar rivers is extremely low compared to natural conditions. Estimates of wood in the Green and Cedar rivers meeting NMFS size and frequency criteria are 89-95% below the levels necessary for Properly Functioning Conditions for salmon habitat (NMFS 1996).

Extensive development has severely diminished the potential for natural salmon production in these basins. Much of the habitat loss and degradation is unlikely to be reversed. As a result, hatcheries continue to play a crucial role in providing salmon for tribal treaty and other harvest, and in maintaining the abundance of naturally spawning fish. Nonetheless, habitat protection and restoration remain essential to sustain future salmon populations regardless of hatchery or natural origin.

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State of Our Watersheds Report
Nisqually River Watershed

We have to have hope. I think of the destruction of our fisheries, each time we see it wear away. I also think that we have to have hope, salmon are too much a part of us.

**–GEORGIANA KAUTZ,
NISQUALLY TRIBE**

The Nisqually Tribe

The Nisqually people have lived in the watershed for thousands of years. According to legend, the Squalli-absch (ancestors of the modern Nisqually Indian Tribe), came from the Great Basin and erected their first village in a basin now known as Skate Creek, just outside the Nisqually River Watershed's southern boundary. Later, a major village would be located near the Mashel River.

The Nisqually have always been a fishing people. The salmon has not only been the mainstay of their diet, but the foundation of their culture as well. The Nisqually Tribe is the prime steward of the Nisqually River fisheries resources, and operate two fish hatcheries: one on Clear Creek and one on Kalama Creek.

In the 1855 Treaty of Medicine Creek the Nisqually Tribe reserved their right to fish, hunt and gather in their traditional areas. Because of that agreement, the federal government is obligated to protect those treaty-reserved resources.

This report will focus on the Nisqually River basin and surrounding marine waters.

Degradation of the Nisqually River Watershed

The Nisqually River Basin is one of the least developed watersheds in south Puget Sound and also has the largest undeveloped delta in Puget Sound. The watershed encompasses a broad range of land uses and jurisdictions: rural communities; national and state parks and forests; public and private timberlands; municipal hydropower dams and reservoirs; farmlands; the Nisqually Indian Reservation; Fort Lewis Military Reservation; and the Nisqually National Wildlife Refuge.

It is the only Puget Sound watershed with its headwaters in a National Park and its estuary in a National Wildlife Refuge. Development has largely occurred in the lower reaches and elevations of the watershed. Habitat degradation was identified as one of the primary reasons for the decline of Nisqually Chinook, stemming from hydroelectric dams, forest practices, agricultural development, and urbanization (PSSRP 2005).

Rachel Simmons, left, and Eddie Villegas, both Nisqually Indian Tribe members, help restore salmon habitat along Ohop Creek, a tributary to the Nisqually River.

Nisqually River Salmon Recovery Plan

Nugie Kautz hoists a chinook salmon during the tribes fall fishery.

The Nisqually Chinook Recovery Plan adopted a habitat strategy to protect, enhance and restore prioritized habitat in the basin. Recovery actions were prioritized to:

- Protect and secure habitat that supports the existing core population;
- Enhance that habitat; and
- Restore habitat associated with secondary or lost population segments (NCRP 2001).

Based on these priorities and an analysis of current productivity within each stream reach of the watershed, restoration and preservation priorities were focused on the estuary and nearshore marine environments and within the freshwater habitats, the mainstem, as well as the Mashel and Ohop subbasins (NCRP 2001).

Consequently, the habitat actions identified for the Nisqually watershed within the Puget Sound Salmon Recovery Plan were:

- Restore estuary and nearshore marine environments;
- Restore and preserve the Nisqually River mainstem;
- Restore and preserve the Ohop Creek and the Mashel River subbasins;
- Protect and restore key mainstem tributaries; and
- Evaluate the effects of water well withdrawals (PSSRP 2005).

Making progress with Restoration, Protection

Review of habitat recovery progress and trends at the 5-year mark of the Nisqually Chinook Recovery Plan reveals significant progress and success has been realized (Judge 2011). Restoration work has been largely completed in the estuary and mainstem river areas. Recovery efforts have restored 902 acres in the estuary and have only 33 acres remaining.

In the mainstem river, 73.6% of the river has been protected through acquisitions and commitments by public land owners to manage their lands to protect habitat (Tacoma Power, Centralia City Light, Fort Lewis, State Parks, Wildlife Refuge, Nisqually Tribe, etc.). In the Ohop Creek area, one mile of riparian habitat has been restored with five miles left to complete. In the Mashel River, they have restored 1.5 miles and have 1.9 miles remaining. The Nisqually is on pace to achieve their 10-year goals if additional funding can be secured to complete the identified remaining work (Judge 2011).

Still with this success in recovering the riverine and estuary areas, the inability to protect the nearshore areas remains a concern. Significant portions of the Nisqually delta shoreline and that of the nearshore area have been modified or developed to the detriment of fish habitat and production.

The nearshore area near the Nisqually delta has armoring for 40 percent of its length, 54 percent of the Geographically Significant Units (GSU) and 69 percent of sediment source GSU within this area have some measure of armoring (PSNERP 2010).

Shoreline modification and armoring impedes or completely precludes beach nourishment interrupting natural sediment dynamics causing: reduced sediment input and transport, loss of riparian fringe habitat, reduced estuarine area and connectivity, filling over of upper intertidal beaches and degradation of water quality due to introduction of contaminants. The importance of protecting estuarine habitat in south Puget Sound is underscored by the Nisqually delta restoration monitoring project that found over 25 percent of all coded-wired tagged juvenile Chinook captured in the Delta originated from basins outside of the Nisqually system (Ellings and Hodgson 2007).

This raises the concern about the biological adequacy of the goal of "No Net Loss" of the remaining unmodified marine nearshore areas and estuarine habitat in Puget Sound. Successful recovery of Nisqually Chinook and other Puget Sound stocks will require the ability to protect existing habitats and enhancing ecosystem functions as well as nearshore habitat throughout Puget Sound.

A Nisqually Tribal crew constructs logjams along the Mashel River near Eatonville. The logjams serve the dual purpose of restoring salmon habitat while also protecting a nearby public park from eroding. The Mashel River is a vital chinook spawning tributary to the Nisqually River and its restoration is a vital step in the Nisqually Chinook Recovery Plan.

Future Challenges, Population Growth, Groundwater Demands

Population growth within the Nisqually watershed is increasing pressure on water quality and quantity in the lower watershed. Impervious surface area increases with population growth, causing a disruption of both the ground and surface water ecology if unchecked. Impervious surface causes increases in stream temperatures; decreases in stream biodiversity; and contributes to pollutants in storm water runoff.

Based in current trends, without proper management and resource protection, the forecast is for impervious surfaces to increase to impacting levels within 15 years throughout the lower watershed. This trend is consistent with water removals as measured by exempt well permits. There has been a 77 percent increase of exempt wells in the Nisqually Watershed, with most occurring in the middle portion of the watershed. This area controls some of the most important and productive freshwater stream reaches for salmon in the Nisqually watershed.

Unchecked growth and it concomitant increase in groundwater demand will reduce aquifer volume and thus the outflow to the streams, wetlands, lakes and saltwater nearshore vital to salmon.

Continued population growth and associated impacts within the Nisqually watershed is the largest threat to maintaining and protecting the basin's existing habitat quality and quantity. Over time a greater focus and effort will be required on conservation measures and restoration activities to offset impacts from this anticipated growth.

This forecast growth when translated into associated impervious surface changes indicate that without proper management and resource protection measures habitat conditions will be degraded in the lower Nisqually watershed. Such trends indicate that land-use regulation reform will be required and continued funding of habitat restoration activities necessary in order to achieve the agreed upon recovery goals.

Upgrading the current regulatory framework which serves to protect marine and freshwater salmon habitat must occur, if salmon recovery goals are to be realized. In particular, the Shoreline Management Act, the Growth Management Act, and the hydraulic code all need to be revised to prevent the continued degradation of critical freshwater and marine nearshore habitats. Successful recovery of the freshwater system is rendered meaningless if the marine nearshore habitat vital to salmon is lost to development.

Looking Ahead

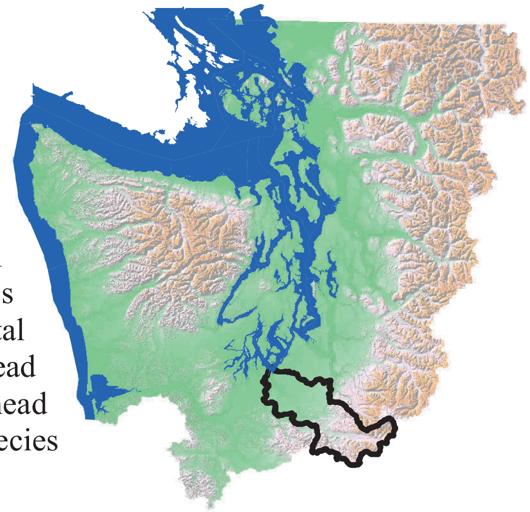
Over the next five years, the success of the Nisqually watershed based recovery efforts will be dependent on several elements, all critical to our near-term and ultimately our long-term success:

- Securing the funding necessary to complete the aggressive and comprehensive restoration of the Ohop Creek system;
- Assisting the town of Eatonville in renovating their stormwater systems, including the continuation of their LID programs;
- Securing an alternative source of potable water that is not connected to the base-flow of the Mashel River, and;
- Regulatory reforms that prevent degradations and make restoration possible.

Finally, monitoring these activities and supporting our innovative adaptive management strategy are key to allowing managers to respond to new information and changing circumstances.

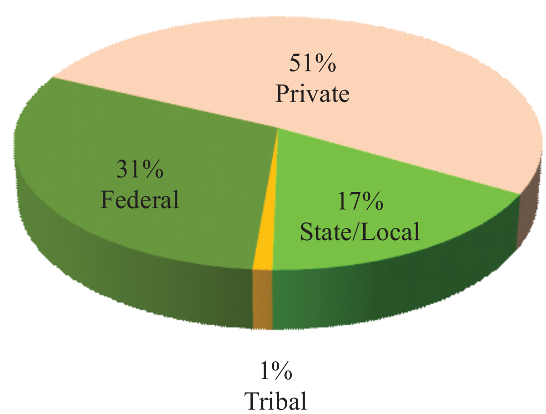
Florian Leischner, habitat biologist with the Nisqually Tribe, observes a dike being removed from the Nisqually River estuary in 2011.

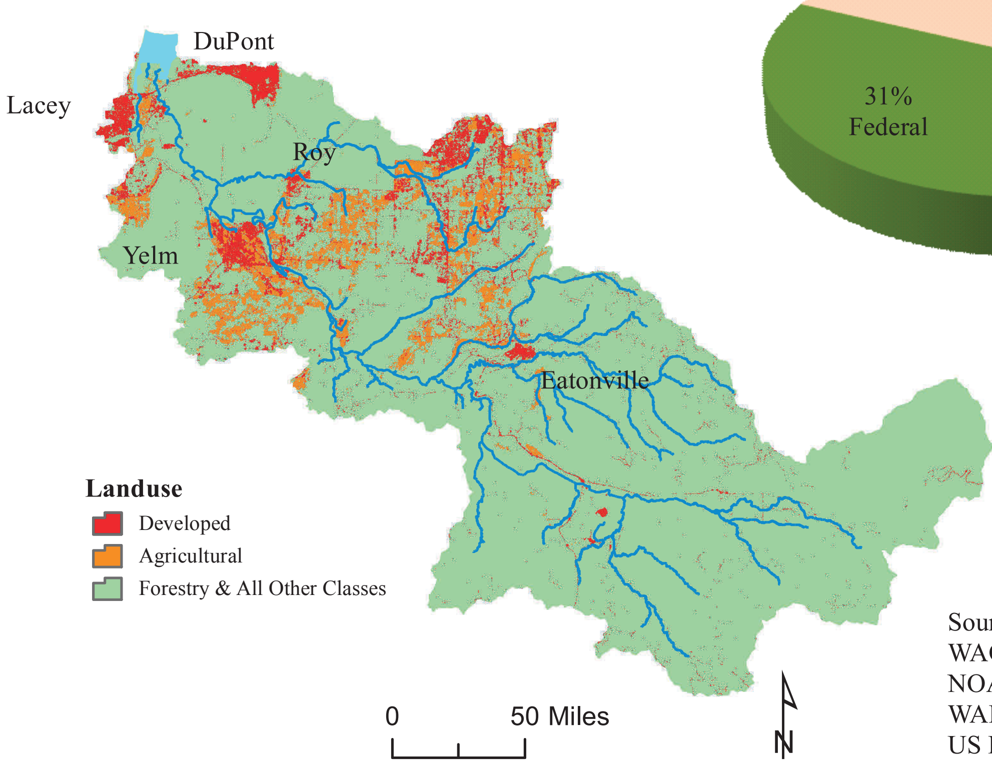
Nisqually Tribe (Nisqually Watershed)



The Nisqually River Basin (WRIA 11) and the surrounding marine waters are the ancestral home of the Nisqually Indian Tribe. The basin includes the Nisqually River, which originates from five separate glaciers on Mt. Rainier, including the Nisqually Glacier, with a total drainage area of 720 square miles. Landuse within the basin varies from agriculture in the valley bottom to forestry in the uplands, with increasing urban uses in several key areas in the watershed. Salmonid species existing within the basin include Chinook, coho, chum, coastal cutthroat, pink, steelhead, and bull trout. Chinook and steelhead are listed as depressed under SaSI 2002, with Chinook, steelhead and bull trout listed as threatened under the Endangered Species Act.

Five urban centers currently have boundaries within the Nisqually watershed (Lacey, DuPont, Eatonville, Roy, and Yelm) comprising 8.9 square miles of area. The planned Urban Growth Areas (UGA) within the watershed adds the potential of another 14.2 square miles of use, for a total of 23.1 square miles or an increase of 160%. Developed land within the Nisqually watershed has increased by 20% between 1986 and 2006. Agricultural land increased by 10% during the same time, while forest and related lands decreased by 2%. During the same period of time, population within the watershed increased by 27,000. Based upon the Office of Financial Management (WAOFM) population forecasts, the watershed population could increase by as much as another 46,000 by 2026.



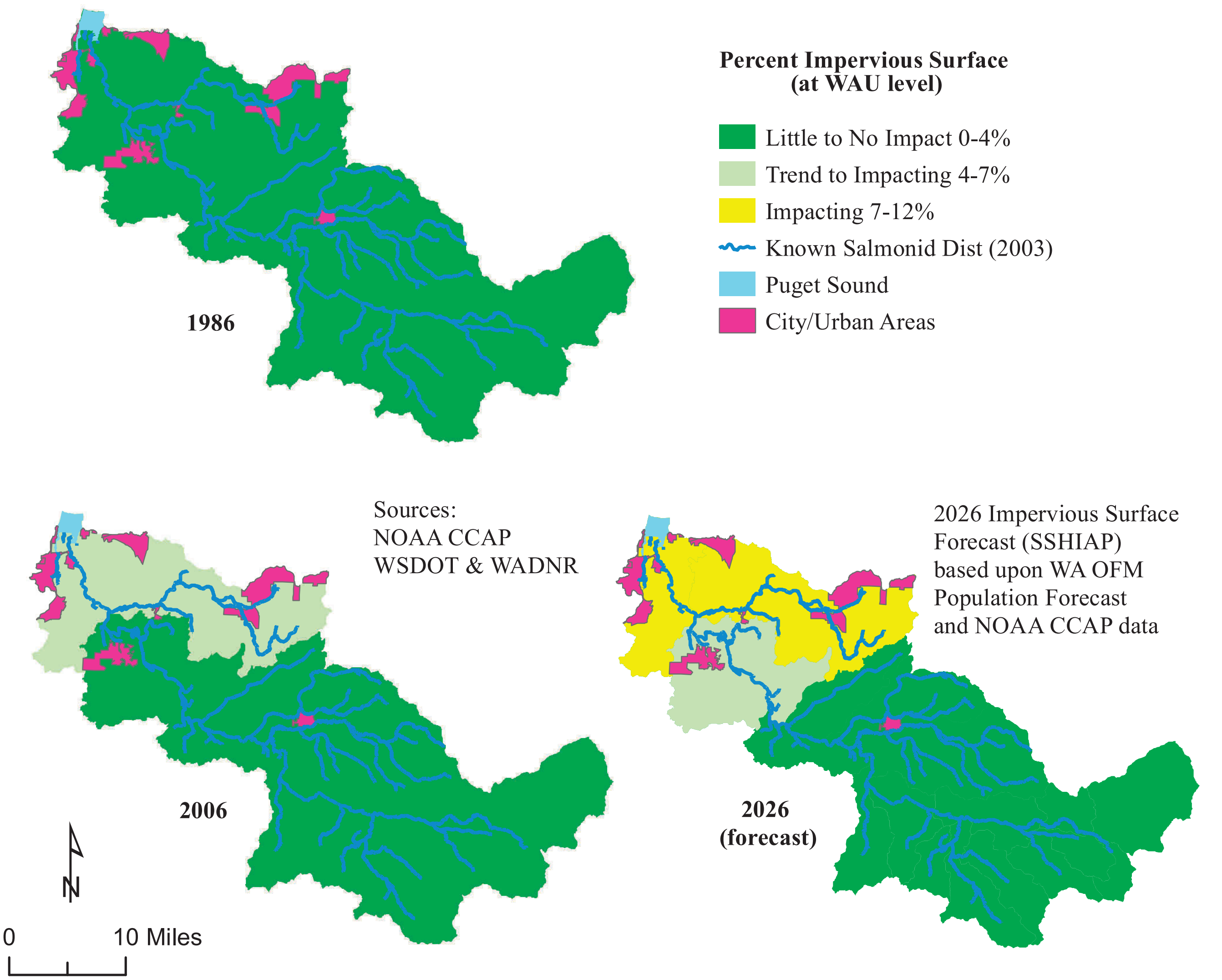


Sources:
WAOFM 2007 Pop Forecast
NOAA CCAP 2006 LULC,
WADNR, WSDOT, WAECY,
US BLM, and Univ. of WA

Population Growth and Increased Impervious Surfaces on Lower Nisqually Watershed Water Quality and Habitat

By 2026 three WAUs, in the lower portion of the watershed, are projected to have over 4% impervious surface levels, with two of the three in an "Impacting" state (7-12%).

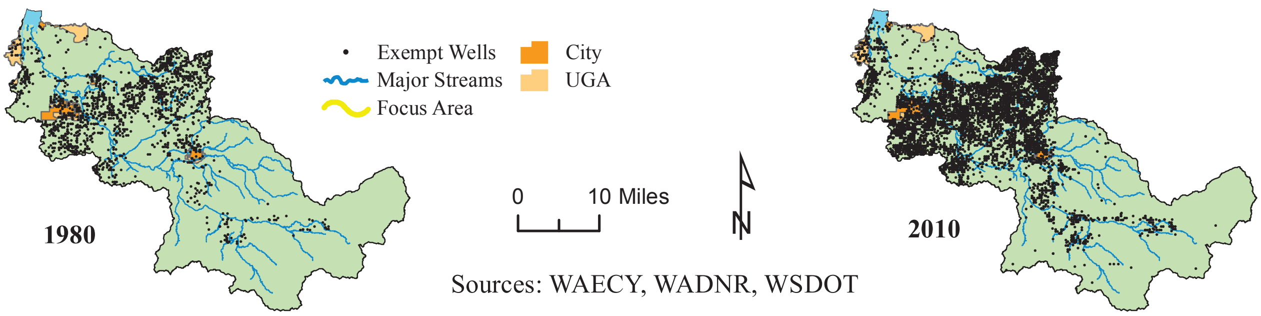
As the population continues to increase, so will the impervious surface area, causing a disruption of both the ground and surface water ecology. This disruption will negatively impact the ecosystems dependent upon the proper function of the hydrologic cycle. "Tributary watersheds important for chinook (Mashel and Ohop) are mostly managed for forest products in the upper portions of their drainage areas. Our analysis identified a concern that, in the future, portions of these watersheds may convert to a higher percentage of urban or rural-residential use" (Nisqually Chinook Recovery Plan, 2001).



Impervious surface causes increases in stream temperatures, decreases in stream biodiversity, as evidenced by reduced numbers of insect and fish species, and contributes to pollutants in stormwater runoff, which can contaminate local aquatic systems (Schueler, 2003). Currently, the Nisqually watershed is in relatively good condition, but there is a trend as population continues to grow within the watershed that the impervious surface will likewise increase. Without proper management and resource protection the forecast is for impervious surfaces to have grown to an “impacting” level within 15 years.

Permit Exempt Wells in Nisqually Basin

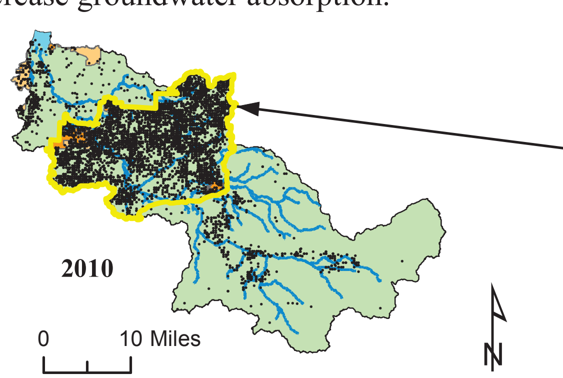
There has been a 77% increase of exempt wells in the Nisqually Watershed, with most (87%) occurring in the middle portion of the watershed, including the town of Eatonville and the cities of Roy and Yelm. Population growth leading to a high percentage of urban or rural-residential use is an identified concern in this watershed's Chinook recovery plan.

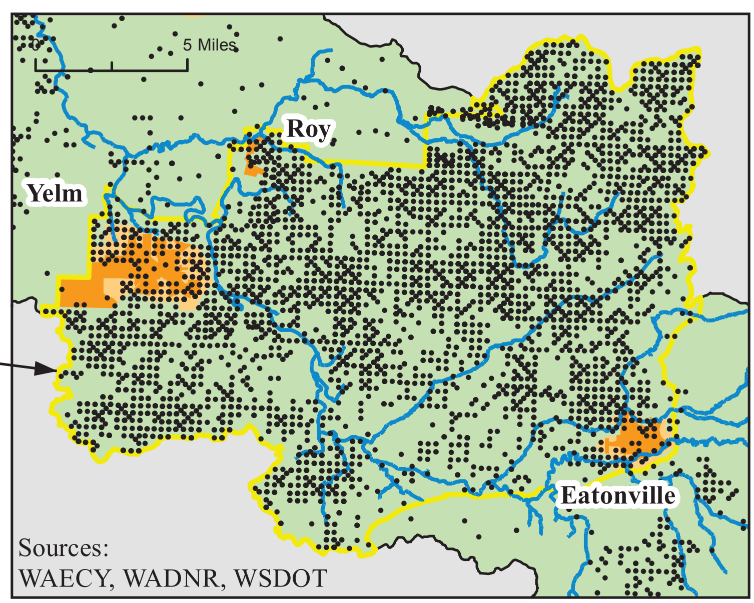


Population growth within the Nisqually watershed, both in the past and in the near future, will have increased demands on groundwater resources. Without implementation of the Nisqually Watershed Management Plan, salmon at all life stages will be threatened in both fresh and saltwater habitats.

The upper extent of the Nisqually watershed consists of mostly steep (>30%) slopes and tends to be either held in government or forestland ownership, thus restricting rural growth. A large block of land in the lower extent of the watershed consists of Joint Base Lewis-McChord (JBLM) and the Nisqually Indian Reservation. Between the upper and lower extents is a focus area of 230 square miles with mostly flat to gently sloping land, three urban areas (Eatonville, Roy & Yelm) and 87% of the watershed's exempt wells (see map below). This focus area of the watershed has seen the majority of rural growth in the past and is most likely to contain most of its future growth. This area controls some of the most important and productive freshwater stream reaches for salmon in the Nisqually watershed. Unchecked growth and its concomitant increase in groundwater demand will reduce aquifer volume and thus the outflow to the streams, wetlands, lakes and saltwater nearshore vital to salmon.

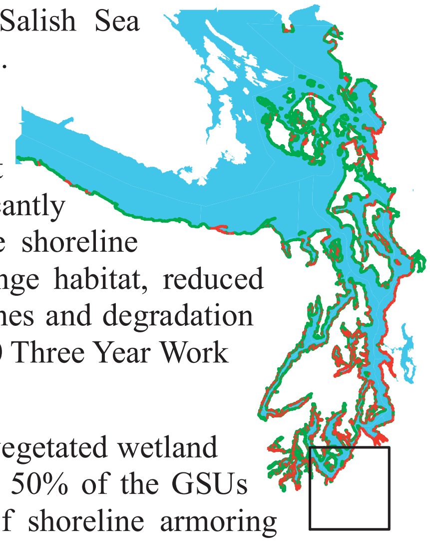
The Nisqually Indian Tribe is working with the cities of Lacey, Olympia and Yelm to change their groundwater source to a deeper, more sustainable aquifer with less direct impact to surface waters. This change in extraction source will restore groundwater inputs to local surface waters within the McAllister watershed. The Tribe has enacted a Groundwater Protection Zone regulation on their reservation to reduce groundwater withdrawals in the vicinity of the Nisqually River and has been performing restoration work within the watershed to increase groundwater absorption.





Nearshore Impairment Near The Nisqually Delta

The nearshore area near the Nisqually delta (see graphic below) has armoring for 40% of its length. 54% of the "Geographically Significant Units" (GSU) and 69% of sediment source GSUs within this area have some measure of armoring (which is at a higher rate than the whole of Puget Sound).



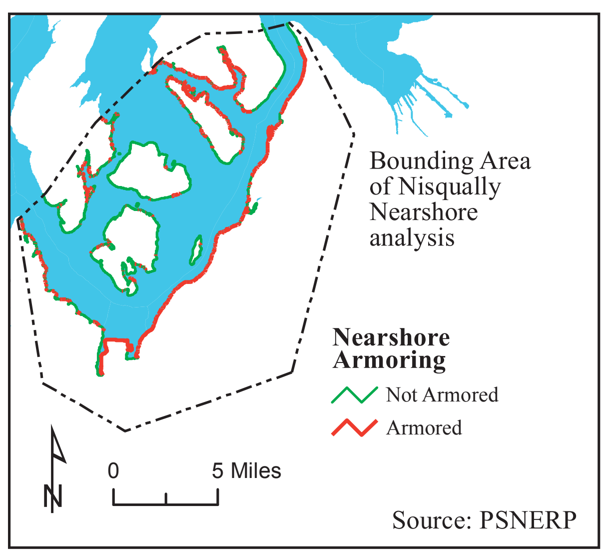
The Nisqually is one of several watersheds contributing to the Salish Sea ecosystem (Puget Sound, the Straits of Juan De Fuca and Georgia). This nearshore ecosystem is a vital environment sustaining aquatic health and those that depend upon its biota. "Due to extensive development activities over the last century on many of the Puget Sound shorelines, many key nearshore processes have been significantly degraded or lost. Impairments to habitat-forming processes on the shoreline include: reduced sediment input and transport, loss of riparian fringe habitat, reduced estuarine area and connectivity, filling over of upper intertidal beaches and degradation of water quality due to introduction of contaminants" (Nisqually 2010 Three Year Work Program).

"Across all tidally influenced areas of Puget Sound ... 82 percent of vegetated wetland area has been lost" (Puget Sound Partnership Science Panel, 2008) 50% of the GSUs identified by PSNERP within Puget Sound have some measure of shoreline armoring (NWIFC, 2011).

"Shoreline armoring impacts the nearshore by decreasing tidal area and by altering nearshore sediment, water, organic matter, and wave energy conditions." (Strategic Needs Assessment Report, PSNERP, Jan 2010) Armoring affects salmon by reducing prey density, increasing predation, and changing migration patterns that cause a decline in growth and lower survival rates (PSNERP TR, 2006-06).

Monitoring that followed restoration work at the mouth of the Nisqually river has generated the following findings in its first year:
1.) Over 25% of all coded-wire tagged juvenile Chinook captured in the Delta originated from basins outside of the Nisqually (Ellings and Hodgson, 2007).
2.) "..all of the hatchery and wild adults that survived to return to the river were ones that stayed in the estuary for an extended period of time as juveniles" (Yil-me-hu Winter, 2010/2011).

"Our primary concern is that while we are making significant forward progress in protection and restoration of habitat in the Nisqually watershed we seem to be losing habitat rapidly in the Puget Sound nearshore" (Nisqually 2010 Three-Year Work Program).



Summary

There has been tremendous work performed in this watershed to protect existing habitat, recover damaged habitat, mitigate harmful conditions and plan for future progress. Much of this success has been through the work, leadership, coordination and support of the Nisqually Indian Tribe and the Nisqually River Council, their members and parent organizations. Reliable and sufficient funding has been their greatest restriction inhibiting further progress within the watershed.

The largest threat to the Nisqually watershed is population growth and its related effects. Population growth within the watershed in the twenty years between 1986 and 2006 increased 48%. The forecasted population growth between 2006 and 2026 is an additional 55%. While the cities (partly or completely) within the watershed have absorbed some of this past growth, the majority of population increase has been distributed in suburban and rural areas.

There is a correlation between population growth and the landscape. During the same time population increased 48%, over 5,500 wells were completed (61%). The majority of these wells were shallow wells drawing from the same aquifers that recharge rivers, wetlands and the nearshore environment. Also waters withdrawn by the cities of Olympia and Lacey are not returned to the watershed, but are discharged somewhere else through their wastewater treatment facilities.

During the same period of time total impervious surface area within the watershed increased by 113%. As impervious surface area increases, a disruption of both the ground and surface water ecology occurs. This disruption negatively impacts the ecosystems dependent upon the proper function of the hydrologic cycle.

Water naturally discharges from aquifers at a rate which is controlled to a large extent by the amount of recharge. When more water is extracted from an aquifer than is being recharged, aquifer volume is reduced and the natural outflow from the aquifer is decreased until the outflow and aquifer level balances with the input. Increased impervious surface area blocks aquifer recharge and contributes to pollutants in stormwater runoff, which can contaminate local aquatic systems. Reduced aquifer volume (caused by reduced infiltration/recharge and/or water withdrawals) reduces stream/wetland recharge and results in increased temperature, reduced flow/volume and freshwater input to the marine shoreline and nearshore environment that is vital to shellfish, juvenile salmon and biota they each depend upon.

Shoreline modifications occur throughout Puget Sound, with over 33% of the shoreline length being modified. The majority of modifications occur as shoreline armoring. Shoreline modifications inhibit the natural physical function of the shoreline and thus negatively impact the proper functioning of the nearshore environment. While the Nisqually watershed has only a small associated shoreline, Tribal monitoring results clearly indicate that the salmon from the Nisqually system utilize the nearshore environment throughout much of the Puget Sound and thus all of the sound's nearshore environment is important to the survival of the Nisqually Chinook salmon.

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State of Our Watersheds Report
Nooksack River Basin

The Nooksack Tribe has a long history of natural resources management and we have reduced our fisheries for more than 20 years. We need to take immediate action toward salmon recovery because abundances are low and habitat conditions are degraded. We must prevent further degradation and lay the building blocks for natural habitat to enable the recovery of native salmon stocks.

**-BOB KELLY,
CHAIRMAN,
NOOKSACK TRIBE**

The Nooksack Indian Tribe

The Nooksack Indian Tribe is a recognized tribe under the Point Elliott Treaty of 1855 and has about 2,000 enrolled members.

Traditionally, the Nooksack people occupied the watershed of the Nooksack River from the high mountain area surrounding Mount Baker to the salt water of Bellingham Bay, and extended into Canada north of Lynden and in the Sumas area.

The primary Nooksack area was the Nooksack River watershed from near its mouth to the headwaters surrounding Mount Baker, plus most of the Sumas River drainage south of the present international border.

On the basis of shared descent or marriage ties, most Nooksacks traditionally fished the Fraser, Skagit and Samish rivers. Similarly, the resources of Birch Bay and Semiahmoo Bay would have been accessed through these kin ties before these areas were abandoned by their native people in the early to mid 19th century.

Nooksack is a place name that translates to "always bracken fern roots," illustrating close ties to the land and the resources that continue to give strength to Nooksack people.

Salmon Productivity Diminished by Land Use

The Nooksack Basin has remained largely rural, with one of the higher quality estuaries in Puget Sound.

Salmon habitat has been severely degraded by forestry and agriculture practices that constitute the primary land uses within the basin. Water quality and quantity continue to be challenged by these activities along with the population growth being experienced within the watershed.

The area's population is projected to increase more than 50% by 2022, which presents one of the largest threats to salmon recovery efforts.

Technical analysis identified seven significant habitat limiting factors for salmon production:

1. **Channel instability in the upper and middle portions of the North and South Forks;**
2. **Increased sediment from natural and human causes, and its movement through the system;**
3. **Loss of logs and other wood that create pools and rearing habitat;**
4. **Bank armoring;**
5. **Fish passage blockages;**
6. **Changes in stream flow and temperature; and**
7. **Changes along the marine shoreline in Bellingham Bay and adjacent nearshore areas.**

A crew places woody debris in the South Fork Nooksack River to construct a logjam. Water temperatures are too high for salmon in the South Fork. The Nooksack Tribe installed the logjams to help create deep pools for salmon residing in water cooled by tributaries or groundwater.

Recovery Plan Lags Behind Intended Pace

The protection and restoration strategy pursued for the Nooksack basin seeks to protect existing fish habitat and restore damaged habitat and habitat-forming processes.

Local governments committed to address the threat of projected human population growth by guiding growth into designated urban areas and managing rural development to minimize impacts to current habitat conditions.

Specifically, the Water Resource Inventory Area (WRIA) 1 Salmon Recovery Board structured the overall habitat recovery approach into seven key strategies:

1. Remove significant barriers to high quality habitat;
2. Restore habitat in the forks, mainstem and major tributaries;
3. Ensure floodplain management protects and enhances fish habitat;
4. Protect good habitat through local critical areas ordinances and shoreline management programs;
5. Protect and improve instream water flows for fish;
6. Identify priority estuaries and nearshore areas for protection and restoration; and
7. Restore conditions in lowland tributaries and independent tributaries to the Fraser River and Strait of Georgia.

Implementation of the WRIA 1 Salmonid Recovery Plan is lagging behind the pace originally anticipated during plan development. Restoration work has progressed with numerous capital projects focused on restoring chinook habitat. However, WRIA 1 has faced significant funding shortages for restoration projects, limiting implementation progress. Progress also has lagged on implementing the regulatory and incentive programs to protect and restore salmon habitat and habitat forming processes.

There still remains one shoreline management plan in WRIA 1 in the process of being updated and action still needs to occur on regulatory gaps such as exemptions for construction of single-family residences and agriculture. Effectiveness monitoring still needs to occur on all shoreline management plans within WRIA 1.

Salmon Recovery Priorities for Next Five Years

I. Conserve and rebuild Nooksack spring chinook populations.

1. Responsibly co-manage fisheries and shellfish harvest to meet recovery objectives, using federal, state and local harvest management forums.
2. Implement the hatchery programs for North Fork/Middle Fork Nooksack spring chinook and South Fork Nooksack spring chinook, including the captive brood rearing program.

II. Protect and restore habitat and habitat-forming processes.

1. Implement priority habitat restoration projects.
   - Continue implementation of instream habitat restoration in priority areas (North Fork, Middle Fork, South Fork).
   - Expand riparian restoration and orphaned road abandonment efforts.
   - Restore fish passage at the Middle Fork Diversion Dam.
   - Expand restoration planning to the Lower Nooksack River.
   - Develop and implement mechanisms (outreach, incentives, regulations) to increase access to river-adjacent lands for channel migration, flooding, and restoration.
2. Ensure land use regulations adequately protect habitat and habitat-forming processes.
   - Develop greater transparency and accountability in local land-use decisions across jurisdictions to improve implementation effectiveness.
   - Review and provide feedback on permits for forest practices, land development and other activities with potential to affect salmon.
   - Work with federal/state/local governments on updates to regulations, policies, and procedures to ensure such updates provide adequate protection (e.g. Title 17: Flood Damage Prevention Ordinance, HPA).
   - Adopt adequate Channel Migration Zones for Nooksack River watershed.
3. Select, adopt and restore instream flows throughout the Nooksack River watershed and WRIA 1.

III. Research, monitoring and adaptive management.

1. Finalize WRIA 1 Salmon Recovery Monitoring and Adaptive Management plan.
2. Continue and expand habitat and salmon population status and trend monitoring.
3. Expand project and program (e.g. land-use regulations, harvest and hatchery programs) implementation/compliance and effectiveness monitoring.
4. Fill key information gaps.
   - Evaluate the importance of estuarine and nearshore areas to Nooksack chinook.
   - Develop a temperature model for South Fork Nooksack.
   - Quantify contribution of wetlands to baseflow and temperature in the lower South Fork Nooksack.
5. Adaptively manage WRIA 1 salmon recovery program to ensure adequate trajectory toward recovery goals.
6. Develop a strategy for addressing likely impacts from climate change.

Shellfish Priorities

I. Protect and restore shellfish harvest opportunities.

1. Complete and implement Drayton Harbor TMDL.
2. Improve compliance and transparency in decision-making on critical areas ordinances on agricultural lands.
3. Ensure land-use regulations adequately protect shellfish beds.

II. Assess and monitor factors affecting shellfish beds.

1. Continue to evaluate sources of bacteria in Drayton Harbor and Birch Bay watersheds.
2. Continue monitoring shellfish beds throughout WRIA 1 for fecal coliform.

Water Issues, Forest Roads Affect Recovery

At the 5-year mark, a review of key environmental indicators for the Nooksack River indicates a continued decline in water quality and quantity that are essential to salmon recovery.

Water quality problems have increased with the WRIA in terms of listed 303(d) category 5 sites for fecal coliform, temperature and dissolved oxygen since 2004. The loss of forest cover and continued degradation of riparian buffers has continued to be a problem. This is especially acute on agricultural lands. In the lower South Fork Nooksack Valley, less than a third of the agricultural zone land within 164 feet (50 meters) of salmon-bearing waters is forested. This is substantially less than the 70% riparian function target set forth in the recovery plan.

Low summer flows continue to degrade salmon spawning and rearing habitat. The WRIA 1 Salmonid Recovery Plan set a target for the natural variation of the average annual 60-day low flow to be less than 20% from year to year. From 2005 to 2010 the inter-annual low flow variation was 24%; while this is slight improvement compared to the entire period of record (28% since 1966), 5 years is too short a period to know if the improvement will continue. Another additional water quantity concern is that agriculture dominates water uses within the Nooksack basin. It's estimated that up to 50% of the current agriculture uses are not permitted.

Approximately 58% of the adjacent nearshore natural shoreline within WRIA 1 has been modified to protect human infrastructure and development. Such industrial or residential development can directly contribute to degraded marine water quality and environmental conditions through stormwater discharge, failing septic systems, and runoff of agricultural wastes. The chronically poor water conditions in Drayton Harbor are a clear example of just how devastating watershed activities can be to the health of the marine environment.

Since 2004, shellfish harvest opportunity has been reduced by 70%, as approved area for harvest has been cut from 1,600 to 575 acres and repeated closures due to fecal contamination have left shellfish harvest open only 84% of the time.

There has been an apparent decrease in forest road densities in the upper Nooksack River watershed. Road maintenance and abandonment work has occurred on 24% of the forest roads in the upper watershed, which has reduced road density from estimated historical levels. Still, 29% of the forest roads are un-abandoned or unmaintained and the condition of 47% of the forest roads in the upper watershed remains unknown. Further monitoring is required to evaluate the effectiveness of the ongoing road maintenance and abandonment efforts on improving the overall health of the affected subbasins and watershed.

The North Fork Nooksack River rises north of Mount Shuksan in the western part of North Cascades National Park. It flows generally west, passing north of Mount Baker. For most of its course, the North Fork is paralleled by Mount Baker Highway.

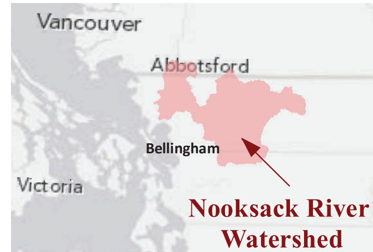
Looking Ahead

The regulatory approach within WRIA 1 is employing a "No Net Loss" strategy of ecological function from baseline conditions. Salmon recovery, however, will require strong voluntary restoration efforts to successfully recover a degraded watershed and estuarine conditions.

Unfortunately, water quality and quantity conditions within the Nooksack River watershed are continuing to decline. Available funds for restoration and enhancement activities are limiting and not keeping pace with development pressure. Regulatory reform is required as the current framework clearly is not providing adequate protection.

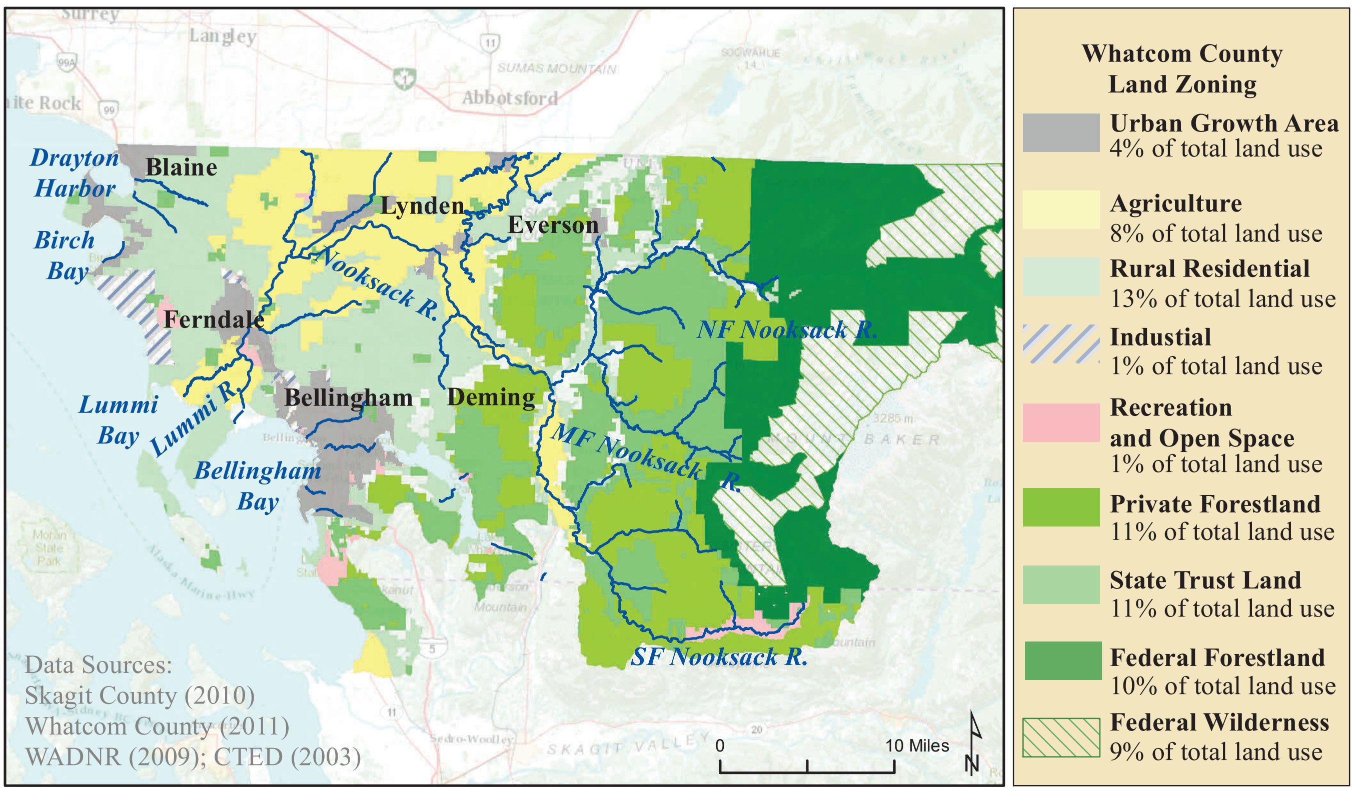
At the 5-year mid-point of the habitat recovery plan for the Nooksack River Watershed: water quality problems have increased; the natural variation of the average annual 60-day low flow is still above the targeted value; and riparian forested canopy coverage within the watershed virtually remains unchanged.

The Nooksack Tribe -- WRIA 1 (Nooksack River)



The Nooksack River watershed is 832 square miles, the largest drainage in WRIA 1, and the fourth largest drainage in the Puget Sound. It has three main forks: the North, Middle, and South that originate in the steep high-elevation headwaters of the North Cascades and flow westerly descending into flats of the Puget lowlands. The North and Middle Forks are glacial rivers and originate from Mount Baker. The South Fork is a snow- and rain-fed river and originates from the non-glaciated slope of theTwin Sisters peaks. The Middle Fork flows into the North Fork upstream of where the North Fork confluences with the South Fork to form the mainstem Nooksack River. The mainstem then flows as a low-gradient, low-elevation river until flowing into Bellingham Bay. Historically, the Nooksack River alternated between flowing into Bellingham Bay, and flowing through the Lummi River, and into Lummi Bay.

The Nooksack has five species of anadromous salmon: pink, chum, Chinook , coho, and sockeye; and three of anadromous trout: steelhead, cutthroat and bull trout. (Williams Et al. 1975; Cutler Et al. 2003).

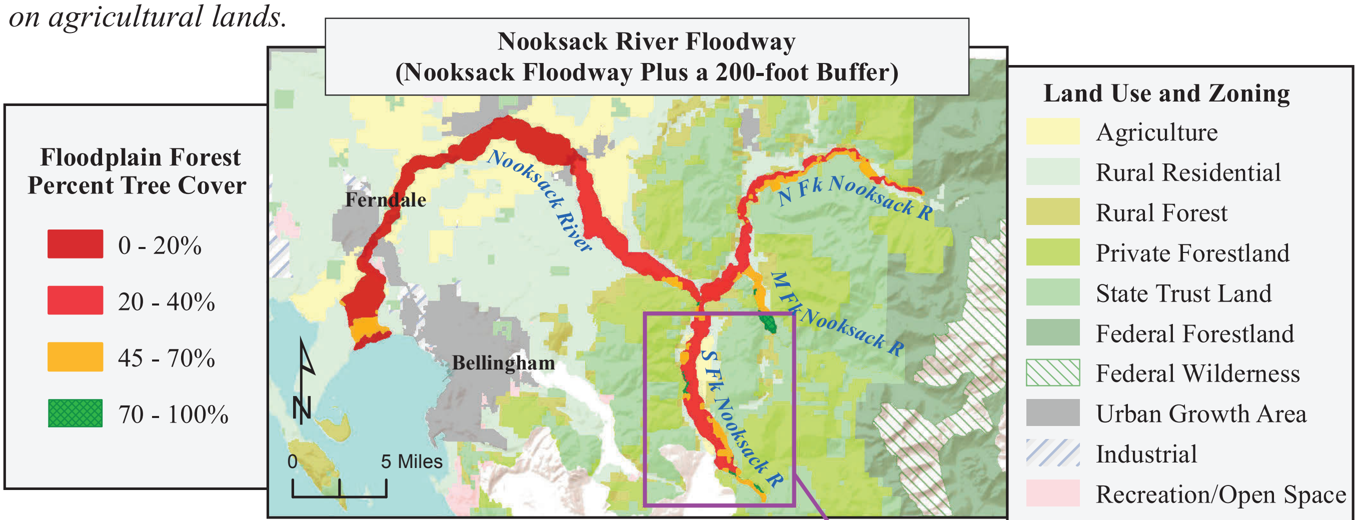


Euro-americans began settling the area in the 1850s primarily for the logging resources, with some arriving for opportunities in prairie farming and mining. Lowland clearing for agriculture began in earnest by the 1890s and by 1925, nearly all of the lower mainstem and delta forests had been converted to agricultural land (WRIA 01 SRB 2005; Smelser 1970). Since 1950 land-use conversion has primarily been for commercial, residential, urban and industrial development (Smith 2002).

While the Nooksack Tribe's ancestral home extends beyond the boundaries of the Nooksack watershed into watersheds adjacent, the Nooksack basin is central to the ancestral home as well as present home of the Nooksack Tribe. The Nooksack Tribe's reservation is located along the Nooksack River in the town of Deming, downstream from the confluence of the South and North Fork Nooksack Rivers; trust lands extend upstream to the lower reaches of the forks and downstream towards Everson, as well as to the Sumas watershed.

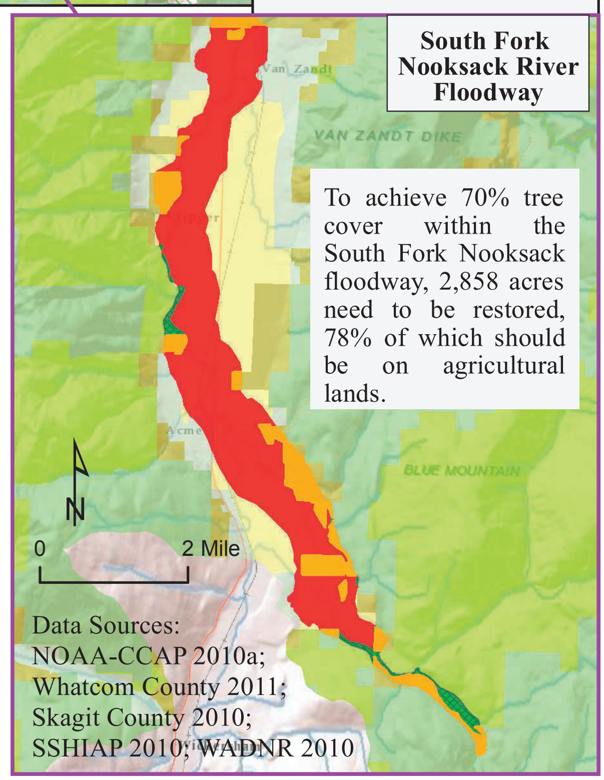
Lack of Tree Cover in Nooksack River Floodway Continues to Limit Chinook Habitat

The Salmon Recovery Plan targets >70% riparian functional attributes present as a preferred future condition (PFC) for streams in WRIA 1. If riparian functional attributes are interpreted as riparian forest cover, the Nooksack floodway is not properly functioning as a riparian environment. Forest cover in the Nooksack River floodway was 28% in 2006, having decreased from 29% in 1992. More than 63% of the land inside of the Nooksack River floodway is zoned agriculture. Only 25% of this land is currently forested. For a PFC of 70% tree cover within the floodway, 11,175 acres of forest need to be restored. Based on current floodplain zoning and forest cover rates, 76% of reforestation should occur on agricultural lands.



Total Acres of Floodway Forest within Each Land use Zone in the Nooksack River watershed

Land Use and Zoning Type	*Forest Acres*	*Non-Forest Acres*	*Acres Needing Reforestation to Reach 70% Forest Cover*
Agriculture	3,373	13,727	8,597
Rural Forest	1,798	1,696	647
Rural Residential	974	1,710	905
State Trust Land	719	772	325
Private Forestland	680	550	181
Urban Growth Area	37	528	359
Recreation and Open Space	46	246	159
Federal Forestland	27	15	2
TOTAL	*7,653*	*19,245*	*11,175*

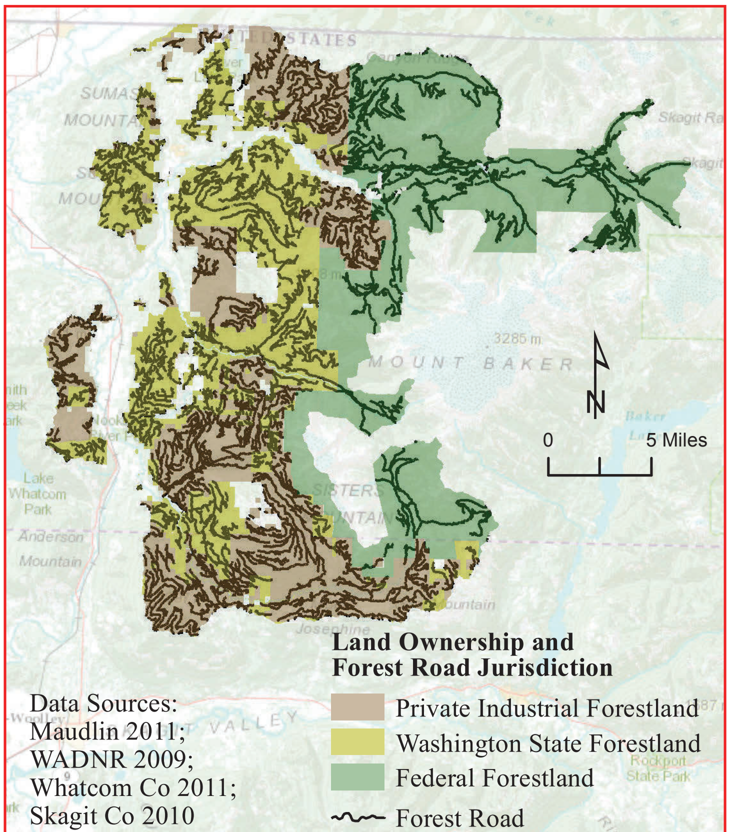


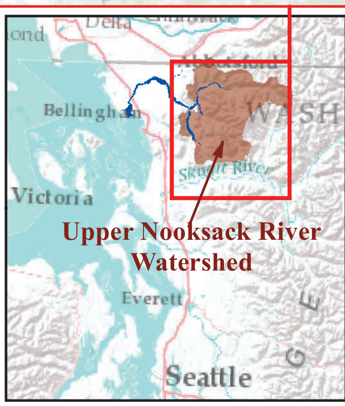
South Fork Nooksack Early Chinook rely on the lower South Fork Nooksack River for 36% of their spawning habitat and 19% of their overall freshwater habitat (WRIA 1 SRB, 2005). A properly functioning floodplain forest with at least 70% forest cover from mature trees is critical to Chinook habitat by providing shade to regulate stream temperatures, large woody debris to help form pools, and cover and root structure to help stabilize stream banks (WRIA 1 SRB, 2005).

Forest Road Maintenance and Abandonment Key to Improving Upper Nooksack River Water Quality

The WRIA 1 Salmon Recovery Plan (2005) points to watershed density of forest roads as one indicator of watershed health. Streams and stream habitat degradation have been associated with road densities greater than or equal to 2 miles of road length / 1 square mile of watershed area (NOAA, 1996). There are more than 1,376 miles of forest roads currently mapped in the North Fork, Middle Fork, and South fork sub-basins of the Nooksack watershed, and forest road densities exceed 2 miles of road length / 1 square mile of watershed area across 65% of the Forks sub-basins. To reach 2 miles of road length / 1 square mile of watershed area in the Forks sub-basins, a total of 458 miles of road will need to be abandoned, orphaned, or maintained with no drainage problems. An estimated 399 miles of those closures and/or repairs are scheduled to occur through the Road Maintenance and Abandonment Plans (RMAP) required for state and private roads.

Upper Nooksack River Watershed Forest Road Densities (Road Miles/Watershed Square Miles)





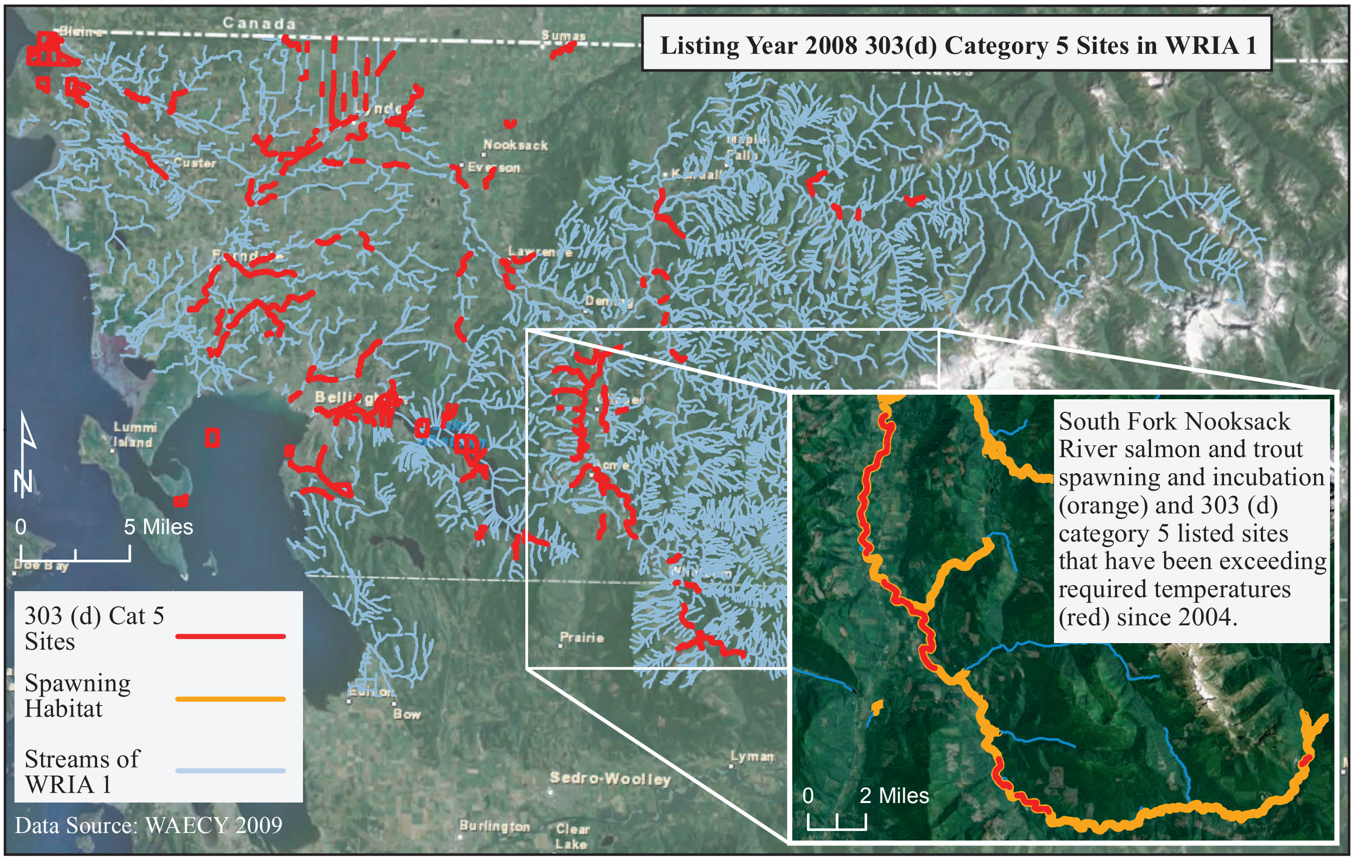
No alteration of the human landscape has a greater and more far-reaching effect on aquatic habitat than roads (NRC 2003).The majority of forest roads in the Upper Nooksack basin are on private industrial and state lands, All of these fall under the RMAP mandate and were originally scheduled to be repaired by 2016. An extension has been granted, and private industrial and state forestland owners can apply to have RMAP work completed by 2021. The current status of RMAP road repair has not been comprehensively tracked, so the current status of road condition is not clear.

It is expected that RMAP repairs will improve water quality in the upper Nooksack River watershed by fixing road drainage problems. Considering the role improved water quality plays in Chinook recovery, it is important that forestland owners try to complete their RMAP repairs by the originally negotiated date of 2016.

Forest Road Jurisdiction	Total Forest Road Miles in the Forks Subbasins of the Upper Nooksack
Private Industrial	596
State Lands	470
Federal Lands	310

Water Quality Problems Are Increasing throughout the Waterbodies and Streams of WRIA 1

In 2008, there were 261 individual 303(d) category 5 listed sites within 88 streams and waterbodies in WRIA 01 requiring Total Maximum Daily Load (TMDL) monitoring and reporting. The number of individual sites, streams and waterbodies listed has increased in WRIA 1 for every year the State Department of Ecology has reviewed water quality since 1998. The WRIA 1 Salmonid Recovery Plan (2005) points to water quality as a factor limiting Chinook production. Specifically, elevated levels of harmful bacteria, rising stream temperature, and lower levels of available oxygen. The increase in TMDL listings suggests water quality conditions are continuing to decline, thus remaining a limiting factor to Chinook salmon production.



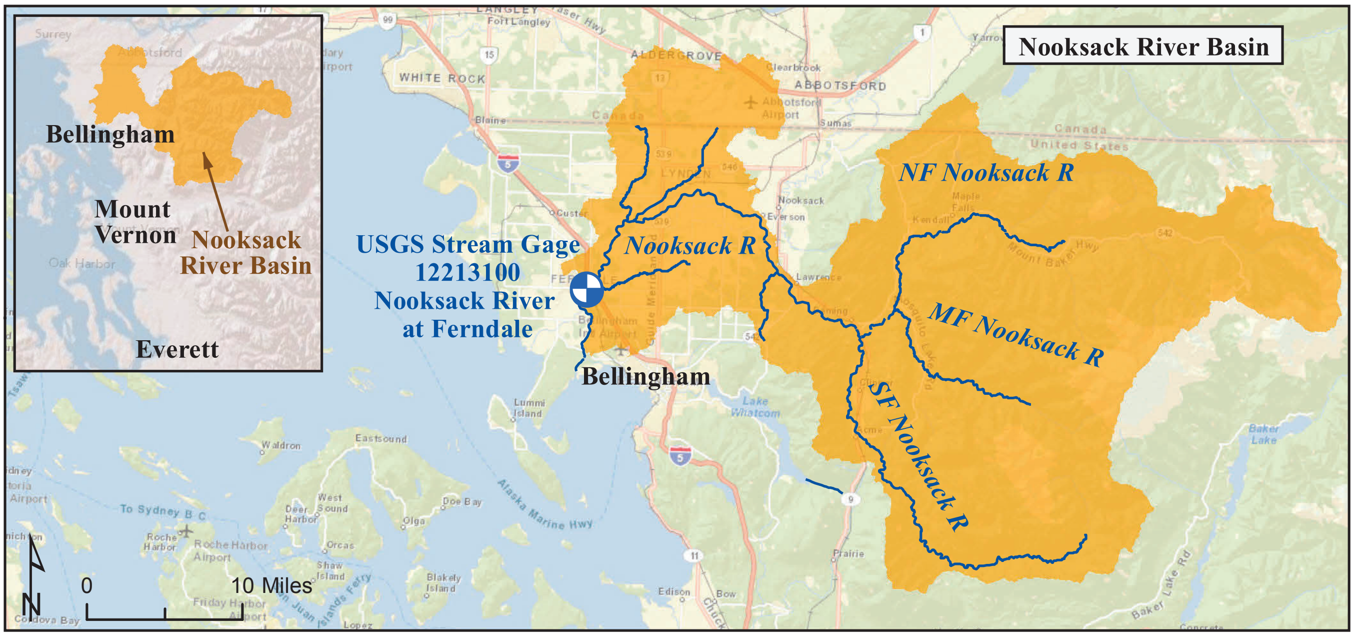
WRIA 01 Washington State 303(d) Listed Streams and Waterbodies that fail Water Quality Standards and Require a Total Daily Maximum Load (TMDL) Plan

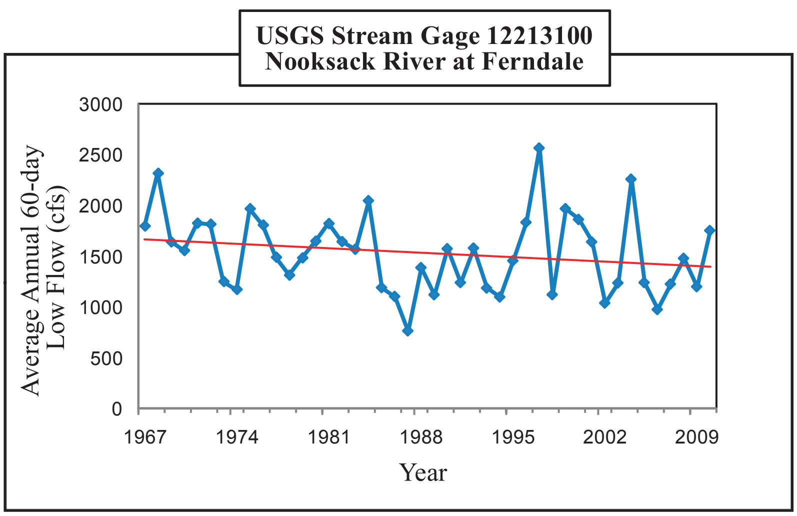
Listing Year	Total Count of Streams and Waterbodies	Total Count of Individual Sites	*Fecal Coliform Sites*	*Temperature Sites*	*Dissolved Oxygen Sites*
1998	46	82	*35*	*14*	*26*
2004	57	170	*46*	*50*	*35*
2008	88	261	*66*	*52*	*105*

In 1998 there were two 303(d) listed sites, totaling around three miles of stream length, on the South Fork Nooksack River that required a TMDL for temperature. By 2004, there were 14 listed sites, totaling around 23 miles of stream length, on the South Fork Nooksack River that required a TMDL for temperature. In 2008, all of the 2004 temperature listings for the South Fork remained, and continued to require a TMDL. This is especially troubling for the spawning and incubation of the South Fork Chinook, a Puget Sound stock that is currently in critical condition.

Low Summer Flows on the Nooksack River Continue to Limit Anadromous Salmon Habitat

A sustained decrease in the magnitude of low flows in the Nooksack River basin has been exacerbating stream temperatures, which may hinder upstream migration of spawning salmon, limiting watered habitat area and increasing predation of juvenile salmon. In response, the WRIA 1 Salmonid Recovery Plan suggested for a Properly Functioning Condition (PFC) for 60-day low flow to be met, there can be no more than a 20% year-to-year difference in 60-day low flow averages. From 1966 to 2010 the year to year variation was 28%, exceeding the conditions sought in the Recovery Plan. Equally as critical, the amount of water available during low flow has been in decline since 1966.





Most of the Nooksack watershed's precipitation arrives during the winter months when water demands are the lowest. During the summer, there is little rain and many streams and rivers are dependent on groundwater inflow. This means that groundwater and surface water are least available when water demands are the highest (WAECY, 2011).

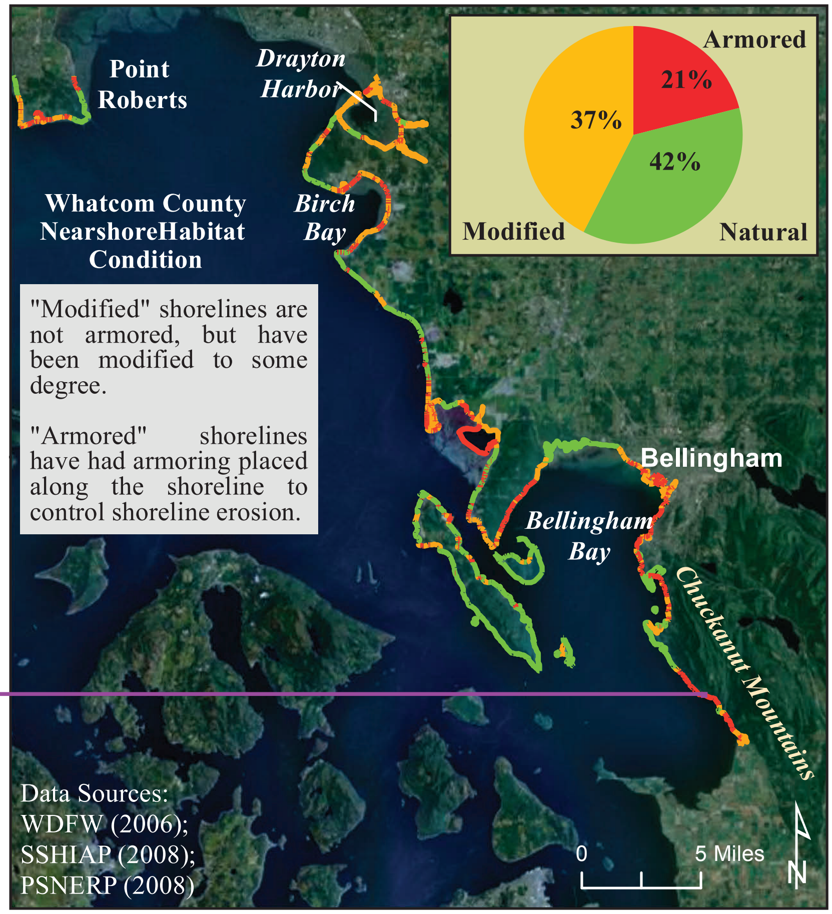
Agriculture dominates ground water and surface water uses in the mainstem Nooksack basin. In this region, irrigation for agriculture increased by 380% from the late 1950s to the mid-1980s. While much of this area is closed to future water allocation during the low flow period, it is estimated that up to 50% of current agriculture uses are unpermitted (Whatcom County, 2005).

Nearshore Habitat in Whatcom County Modified to Protect Human Infrastructure and Development

From the southern end of the Chuckanut Mountains to Point Roberts, approximately 58% of the nearshore's natural shoreform has been modified or armored to protect railroads, roads, agriculture, coastal residences, and coastal communities such as the city of Bellingham.

Protecting the Railroad

Approximately 32 miles of the nearshore shoreform between Colony Creek and Point Roberts has been armored. Close to eight miles (25%) of that armoring is associated with the railroad running along the Whatcom County shoreline.



Artificial Shorelines and Cities

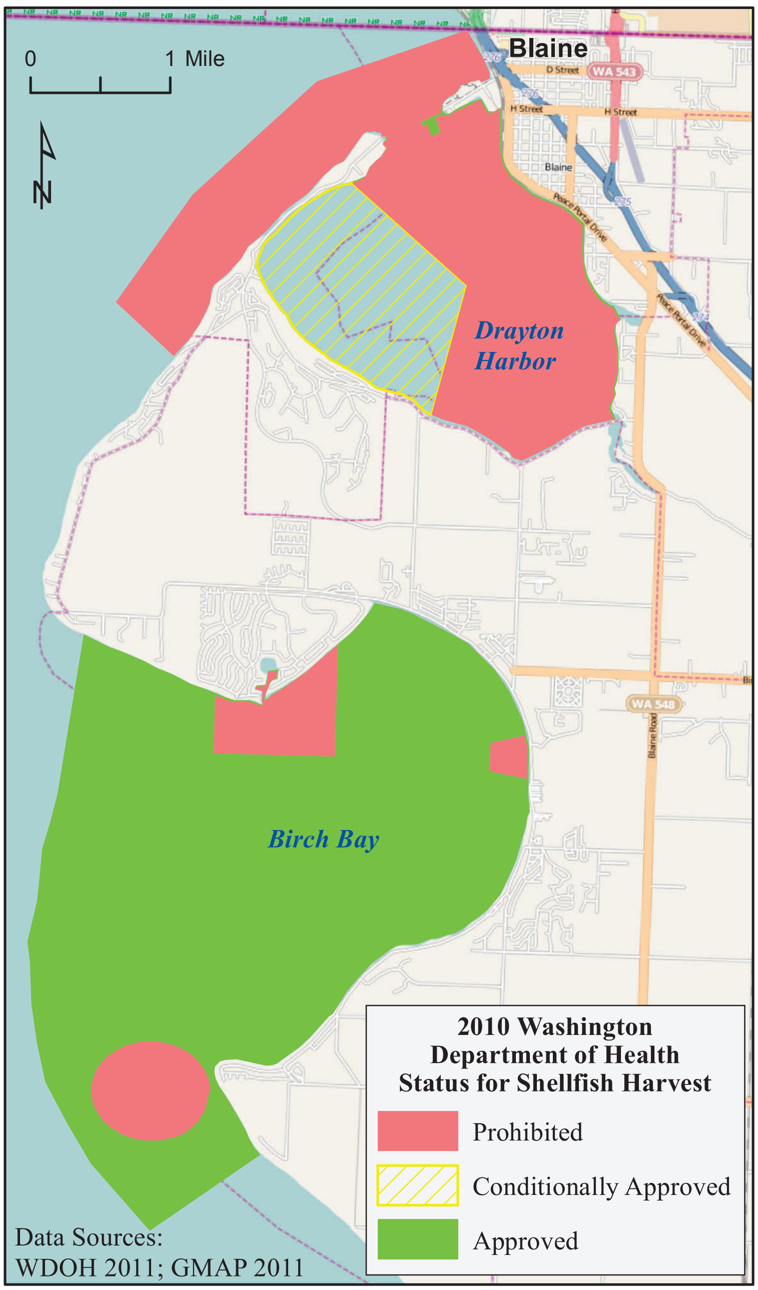
There has been a 2980% increase in artificial shoreform since the late 19th Century. The majority of this increase is associated with the city of Bellingham's industrial waterfront and marina.

Change in Shoreform Length for WRIA 1 (PSNERP 2009)

Shoreform	Historic Length (Miles)	Current Length (Miles)	%-Change
Bluff-Backed Beach	48.96	44.28	-9.56
Delta	62.37	29.16	-53.24
Artificial	0.89	27.44	2980.35
Barrier Beach	23.94	23.65	-1.21
Rocky Platform	23.90	21.12	-11.61
Open Coastal Inlet	12.97	9.63	-25.70
Pocket Beach	4.41	3.51	-20.36
Plunging Rocky Shoreline	3.05	2.69	-12.01
Barrier Estuary	0.69	1.68	142.31
Barrier Lagoon	6.07	0.42	-93.05
Closed Lagoon Marsh	3.03	0.00	-100.00

Current Conditions for Nooksack Shellfish Harvest Mixed Future Conditions in Birch Bay Remain Uncertain

Every time the State has to close shellfish beds in either Drayton Harbor or Birch Bay due to high levels of fecal coliform, the Nooksack Tribe's federal Treaty right to harvest shellfish is jeopardized. From 1999 through 2003, the State Department of Health (DOH) closed all of Drayton Harbor due to high counts of fecal coliform. Since 2004, DOH has had to reduce harvest opportunity by 70%, as approved area for harvest has been cut from 1,600 to 575 acres, and repeated closures have left harvest open 84% of the time. Birch Bay has remained mostly open to shellfish harvest, however, in 2003, Birch Bay was listed as "threatened" by DOH, and in 2009 access to portions of the bay were prohibited due to elevated fecal coliform inputs from the Terell Creek watershed. Results from 2011 monitoring of Birch Bay show that fecal coliform levels do not exceed regulated levels in the marine area, but do show exceeding levels of fecal coliform in Terell Creek and many of the other fresh water inputs to Birch Bay (Whatcom, 2011). With such high fecal levels in the freshwater draining into Birch Bay, it is unclear how long the marine environment will remain unpolluted and open to shellfish harvest.



The Nooksack Tribe and the Tribes of western Washington have treaty rights dating back to the 1850s guaranteeing them continued commercial, ceremonial, and subsistence harvest of shellfish in their usual and accustomed areas. Increased harvest pressure and degraded water quality have substantially reduced the shellfish available for Nooksack to harvest and their ability to exercise the Treaty Rights guaranteeing them a sustainable shellfish harvest.

Shellfish growing areas are managed according to the requirements of the National Shellfish Sanitation Protocol, which is administered by the Food and Drug Administration. Since 1982, water quality has been monitored throughout the state to ensure compliance, and numerous efforts to control fecal coliform pollution have been implemented. The results in Drayton Harbor and Birch Bay are mixed. Drayton remains highly polluted with a very restricted shellfish harvest, and Birch Bay is relatively unpolluted with a less restricted shellfish harvest.

Potential fecal pollution sources in Drayton Harbor and Birch Bay include humans, livestock, pets, seabirds, marine mammals and urban wildlife. Humans and livestock are thought to be key potential sources of fecal pollution, but a better understanding of their relative contributions and contributions of other sources remains critical to future control of the problem.

Summary

WRIA 1 and Whatcom County have seen great economic progress since the late 19th century, but not without environmental cost. Water quality continues to decline, water quantity continues to decline, lands remain cleared of forests, and fish and wildlife continue to suffer great losses in habitat quality and quantity. To change these trends will require more than just site-scale restoration of fish and wildlife habitat, it will require a full integration of environmental cost into future land-use and economic planning. For site-scale habitat restoration to succeed, watershed health must be restored.

- From 1966 to 2010, the year to year variation was 28%, exceeding the PFC sought in the Salmon Recovery Plan. Equally as critical, the amount of water available during low flow has also been in decline since 1966. Most of future water allocation has already been closed, but the estimated 50% of current agricultural uses that are unpermitted remains a challenge to improving low stream flows for salmon.

- Forest cover in the Nooksack River floodway was 28% in 2006, having decreased from 29% in 1992. This is interpreted as well off the properly functioning condition (PFC) of 70% riparian function as suggested in the WRIA 1 Salmonid Recovery Plan (Whatcom County, 2005). Based on current floodplain zoning and forest cover rates, 76% of reforestation to restore riparian function in the floodplain should occur on agricultural lands.

- From the southern end of the Chuckanut Mountains to Point Roberts, approximately 58% of the nearshore's natural shoreform has been modified or armored to protect railroads, roads, agriculture, coastal residences, and coastal communities.

- From 1999 through 2003, the State Department of Health (DOH) closed Drayton Harbor due to high counts of fecal coliform. Since 2004, DOH has had to reduce harvest opportunity by 70%, as approved area for harvest has been cut from 1600 to 575 acres, and repeated closures have left harvest open 84% of the time. While listed as "threatened" in 2003, Birch Bay remains largely safe for shellfish harvest. High levels of fecal pollution into Birch Bay from Terell Creek and other freshwater inputs leaves the future condition of Birch Bay shellfish harvest in question.

- In 2008, there were 261 individual 303(d) category 5 listed sites within 88 streams and waterbodies in WRIA 1 requiring Total Maximum Daily Load (TMDL) monitoring and reporting. The number of individual sites, streams and waterbodies listed has increased in WRIA 1 for every year the State Department of Ecology has reviewed water quality since 1998. The increase in TMDL listings suggests water quality conditions are continuing to decline, thus remaining a limiting factor to Chinook salmon production.

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State of Our Watersheds Report
Port Gamble

We are in the middle of challenging times. Our natural resources are facing many threats – a multitude of ESA listings and decreasing populations for subsistence and commercial salmon species, and increasing shoreline development and human population growth. In addition, we're dealing with new threats, such as climate change and ocean acidification. We are struggling to manage, conserve, enhance and protect our declining and threatened salmon populations. Restoration and recovery efforts are more important than ever before as we realize the realities we face of new threats and a critical need for immediate action.

– PAUL MCCOLLUM
PORT GAMBLE S'KLALLAM TRIBE
NATURAL RESOURCES DIRECTOR

The Port Gamble S'Klallam Tribe

The Port Gamble S'Klallam Tribe is part of the Klallam Band of Indians that have resided throughout the Strait of Juan de Fuca, Hood Canal and Port Gamble Bay for generations. They are party to the Point No Point Treaty of 1855, when tribes ceded their traditional lands to the U. S. government.

The northern Hood Canal and WRIA 17 watersheds have remained largely rural and forested with a natural resources-based economy focused on shellfish harvesting, commercial forestry, commercial fisheries, tourism, and agriculture. Major land use impacts on salmon habitat have occurred from floodplain and shoreline development, road construction and past logging practices.

This report will focus on the WRIA 17 basin and surrounding marine waters, which is only a portion of the area that the Port Gamble S'Klallam Tribe works in and manages.

Degradation of Water Resource Inventory Area 17

At the 5-year mark, a review of key environmental indicators for the northern Hood Canal and WRIA 17 recovery planning area reveals a continued decline in water quality and quantity, as well as shoreline habitat conditions.

Water extractions are impacting surface flow and fish usage. The number of well logs have increased nearly 280% in WRIA 17 from 1980 to 2010. This results in lower streamflows and increased water temperature, all of which has a negative impact on salmon habitat and the ecological functions of numerous fish-bearing streams within the focus area.

Correspondingly, the population growth and associated increase in the impervious surface area also has a negative impact on water quality. Impervious surface areas cause an increase in stream temperature, decreases in stream biodiversity, and contribute to pollutants in stormwater runoff, which can contaminate local aquatic systems (Schueler, 2000).

Sensitive stream habitat elements may be lost when 10% of the watershed is covered by impervious surface area. Five of the watersheds in the planning area are over 10%. Between 1986 and 2006, the impervious surface area increased from 5.7% to 6.8%. Expectations are that these trends will only continue as the population is expected to grow by another 175,000 people between 2010 and 2030 (OFM, 2007).

Sherrie Ducan of Ridolfi, Inc. takes a sediment sample to be tested for contaminants on Point Julia. The land has been affected by years of pollution and the tribe is conducting investigations on how to clean it up.

Hood Canal Water Quality Also at Risk

The Port Gamble S'Klallam Tribe is monitoring both plankton levels and water quality since plankton are the most basic level of the food chain for the marine ecosystem.

Similarly, water quality within Hood Canal is continuing to decline, with an increasing frequency of hypoxia events and growing list of impaired and threatened waterways due to temperature, fecal coliform and dissolved oxygen issues.

Between 2006 and 2010, three observed fish kill events occurred as low dissolved oxygen levels affected large portions of the water column. Human-sourced nitrogen loading increases the risk of these fish kill events happening (Newton, 2010) and is a growing threat to recovery efforts for salmonid, such as mid-Hood Canal Chinook and Summer Chum.

Nearshore habitat loss remains a concern in Hood Canal and the eastern portion of Strait of Juan de Fuca. About 45% of the shoreline in this area has been modified or armored. These alternations interrupt the natural sediment dynamics of the shoreline (e.g. sand and gravel movement), leading to potential degradation or elimination of spawning habitat of key forage fish.

Almost 45% of inventoried sand lance and surf smelt spawning habitat and 51% of inventoried herring spawning areas have been modified within the focus area. These species represent key prey items for larger predator fish and wildlife in a marine food web. A healthy and abundant marine food web is essential to recovering and sustaining the area's salmonid populations.

Landowners Critical to Recovery Efforts

The recovery strategy pursued for the focus area has been the protection and restoration of shoreline and estuary habitat. Landowner involvement and incentives for good stewardship were seen as a critical components of this effort as most of the land adjacent to these critical areas is in private ownership.

The existing regulatory protection tools have been viewed as adequate for recovery "if watershed development occurs as expected and current regulations are maintained or improved and adequately implemented" (PSSRP 1999). Development pressure is testing this assumption.

Port Gamble S'Klallam staff and tribal members count strands of eelgrass near Port Ludlow, as part of the NaGISA project, a global effort to inventory and monitor coastal biodiversity. On a local scale, the data collected will help the tribe track changes to the nearshore over time as well as better understand the region's habitat diversity.

Port Gamble S'Klallam natural resources technician Julianna Sullivan counts perch caught in the beach seine net. The tribe is conducting a juvenile salmon/forage fish study in mid-Hood Canal and Admiralty Inlet, helping biologists better understand what resides in the nearshore environment.

Technical analysis has identified significant habitat limiting factors for decline of the region's salmonid populations as:

- **Estuarine habitat loss and degradation;**
- **Loss of channel complexity from loss and recruitment of large woody debris;**
- **Scouring from high water flows in the winter months and low flows in the summer months;**
- **Floodplain modifications and loss of wetlands; and**
- **Sediment aggradation (PSSRP 1999).**

Looking Ahead

Greater focus and effort is required on conservation measures and restoration activities to offset these negative habitat trends. Enhancement and restoration efforts in the focus area are not on pace to achieve the identified 10-year goals due to a lack of funding, staff capacity and landowner expectations (Judge 2011).

Landowner participation was seen as essential to recovery success, but the political climate and property right concerns have led to a slower pace on this component of the recovery strategy (Judge 2011).

Additionally, upgrading the regulatory framework that serves to protect salmon habitat must occur if the underlying assumption to meet all the recovery goals is to be realized – that existing habitat will be protected from loss (SSFPG 1999). Obviously, the 1999 recovery goals of keeping impervious cover areas maintained at or within the 10% threshold and rural growth rate of 1.08% have not been realized.

The Kitsap, Jefferson, Clallam, and Mason County's Shoreline Master Programs that govern land-use activities and habitat protection in the nearshore, estuarine, and river system require further calibration to achieve habitat protection and salmon recovery goals. A monitoring program on habitat status and trends should be implemented in conjunction with this regulatory reform to determine if observable differences can be detected as a result of implementation of new land use regulations.

The Port Gamble S'Klallam Tribe is trying to secure healthy and sustainable salmon populations as well as access to them, for future generations with very limited resources.

The tribe has placed most of its energy into nearshore work, including acoustic, beach seine and tow-netting studies to better understand the early marine life history. The tribe is looking at associated limiting and/or constraining factors with juvenile salmon and forage fish relating to their nearshore habitat use, dependence and impacts from the large areas of altered shorelines.

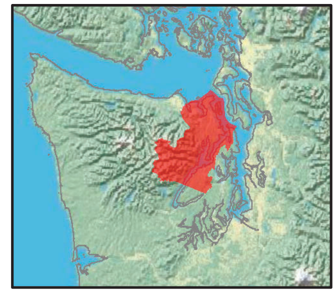
The tribe plans to continue working collaboratively with many other groups to get better data and more informed restoration in local rivers and streams, with mid-Hood Canal systems being the priority, the Dosewallips River in particular.

For the next five years, the tribe will be increasing its efforts to develop better research and monitoring, especially for the early marine life history of juvenile salmon and forage fish as they move out of Hood Canal and Admiralty Inlet, to help inform better recovery actions, development regulations and conditions for permits.

Intensive studies will also be conducted in the Dosewallips River to get more accurate smolt and adult outmigration and escapement data as well as more informed restoration actions for that watershed.

Port Gamble S'Klallam habitat biologist Hans Daubenberger lowers a SONAR device into Port Gamble Bay. The torpedo-shaped device is used to assess the nearshore environment in Hood Canal and Admiralty Inlet. It is part of a study that will prioritize nearshore habitat restoration projects; determine what species are living where throughout Puget Sound waters; and learn more about habitat conditions in the nearshore environment.

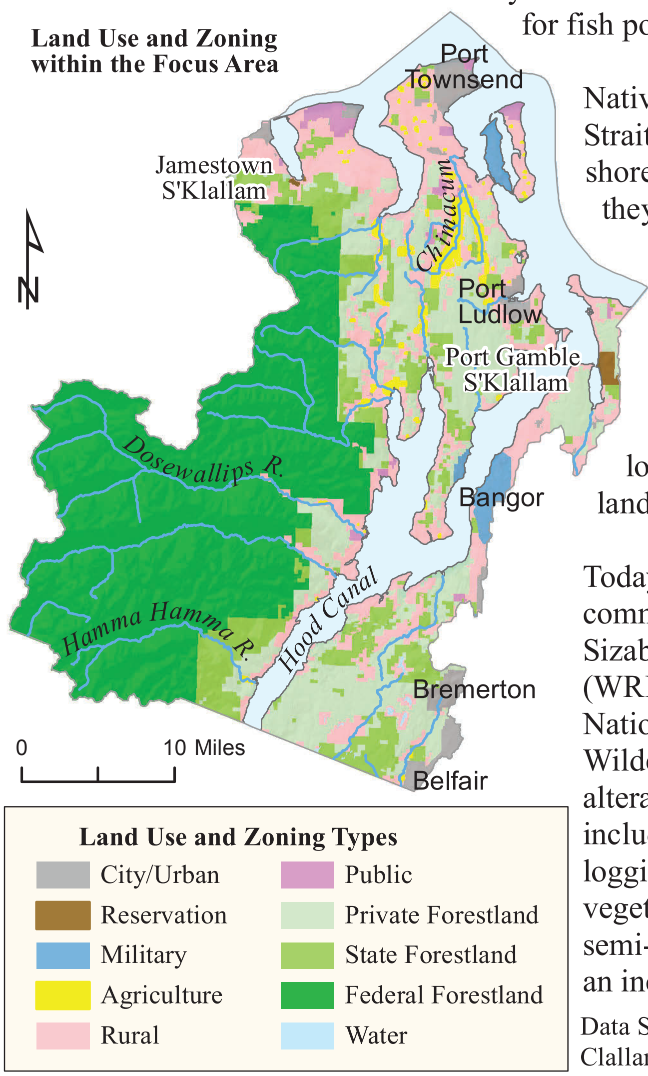
Port Gamble S'Klallam Tribe



The Focus Area for the Port Gamble S'Klallam Tribe report encompasses the northeast corner of the Olympic Peninsula in the rain shadow of the Olympic Mountains, south to the Hamma Hamma watershed. The area includes many smaller watersheds that drain the low elevation terrain of the Kitsap Peninsula and the steep eastern slopes of the Olympic Mountains into the Hood Canal, Admiralty Inlet and the Strait of Juan de Fuca. The Focus Area is made up of portions of four counties: Kitsap, Jefferson, Clallam and Mason.

Geologic features in the landscape were created from a combination of seismic uplift, glaciation, and fluvial processes. These past and current forces have had important consequences for the evolution of coastal shoreline features, stream drainages, and headwater wetlands, many of which provide important spawning and rearing habitats in the nearshore for forage fish species and salmonids, including the Endangered Species Act (ESA) Threatened Hood Canal/Eastern Strait Summer Chum and the Puget Sound Chinook.

Many streams in the Focus Area have natural periods of low flows and may go dry during the summer months when precipitation is sparse. This tendency renders streams particularly vulnerable to human impacts on the habitat, such as riparian vegetation removal and water extractions. While these streams may not flow year-round, they provide important spawning habitat for fish populations, including coho and fall chum.



Native American people in the Hood Canal and eastern Strait region had villages and fishing camps along the shorelines and near the mouths of major streams where they could take advantage of plentiful fish and shellfish resources. After the Point No Point Treaty of 1855, the Skokomish (traditionally the Twana) and S'Klallam tribes ceded their lands to the United States government and several Indian Reservations were established. Euro-Americans had begun settlements around sawmills in the region to continue logging the old-growth timber that dominated the landscape.

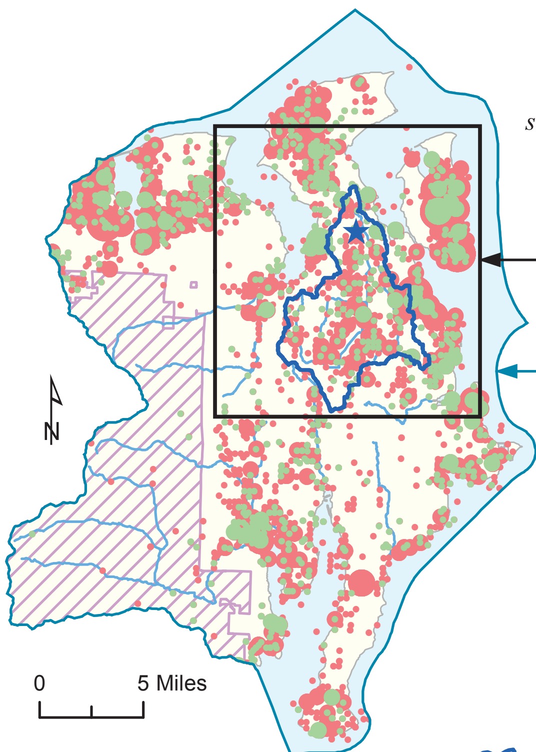
Today the area is largely rural and forested, with communities relying on logging, fishing, and recreation. Sizable portions of Water Resource Inventory Areas (WRIAs) 16 and 17 are contained within the Olympic National Park or United States Forest Service (USFS) Wilderness Areas and are protected from major habitat alterations. Major land-use impacts on salmon habitat include floodplain and shoreline development, roads, and logging (especially in steep forested terrain). Today the vegetation is primarily early to mid-seral forest, though semi-rural residential and urban development encompasses an increasing portion of the landscape.

Data Sources: Mason County, 2009; Kitsap County, 2006; Clallam County, 2010; Jefferson County, 2007; WADNR, 2009

Water Extractions Impact Surface Flow and Fish Usage

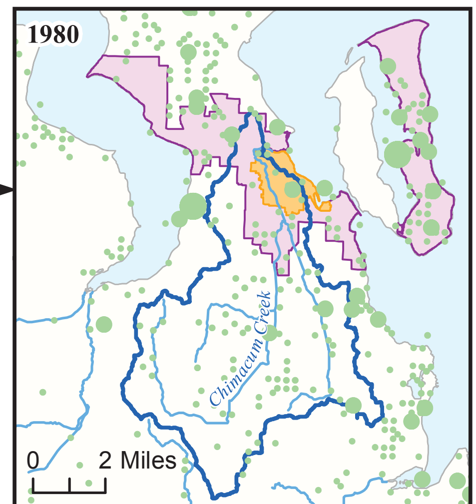
The number of well logs has increased nearly 280% in WRIA 17 between 1980 and 2010. Wells extract ground water that contributes to streams, resulting in lower instream flows and increased water temperatures. Climate change is projected to increase summer air temperatures and prolong the stream low flow period during the salmon spawning season, intensifying the detrimental effects of water extractions on freshwater salmon habitat.

"Ground water and surface water are one resource": changes to one will impact the other (Winter, 1998). Exempt wells are entitled to withdraw 5,000 gallons of water each per day, potentially impacting the instream flow of Chimacum Creek (WAECY, 2007). Salmonid species, including Summer Chum, require adequate stream flows to access suitable spawning habitats and to maintain other quality habitat attributes such as appropriate water temperatures and stream substrate (Parametrix, 2000). The summer low flow period is expected to get longer and stream temperatures to increase due to climate change (CIG, 2009), amplifying the effects of groundwater extractions on freshwater habitats that salmon require for survival. Conservation of freshwater resources for instream and human uses is one of the five primary objectives in Puget Sound Partnership's Action Agenda (PSP, 2009).

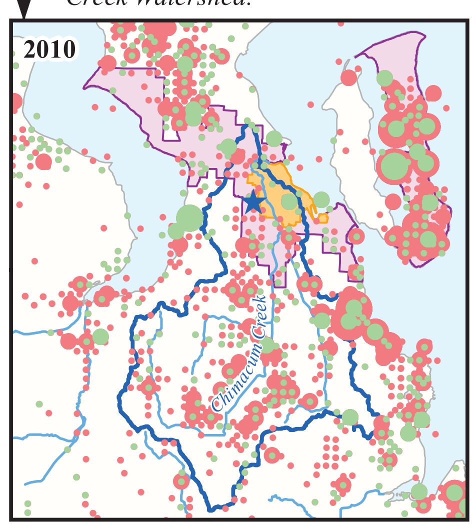


Summer Chum were successfully reintroduced to Chimacum Creek in 1996 (HCCC, 2005).

Increase of Wells in the Chimacum Watershed



The number of well logs has increased nearly 280% in WRIA 17 between 1980 and 2010, and over 300% in the Chimacum Creek Watershed.



Tri-Area UGA
Quimper Water System
Chimacum Creek Watershed Boundary
Federal Land
Stream

Total Number of Wells

	By 1980	By 2010
1 - 3		
4 - 10		
11 - 15		
16 - 30		

Well Log Data Source: WAECY, 2010

Sparling Well

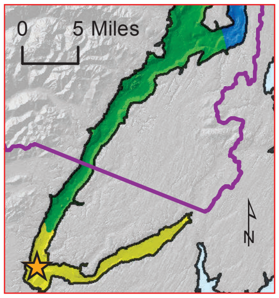
The Sparling Well provides most of the water for the Jefferson County PUD #1 Quimper Water System, which includes the Tri-Area UGA (WAECY, 2007).

Chimacum Creek depends on groundwater inputs for much of its surface flow during the dry summer months, with some reaches gaining up to 50% of their flow from ground water (Simonds et al, 2004).

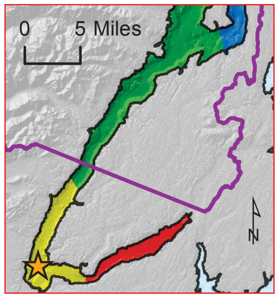
Low Dissolved Oxygen Causes Fish Kills in Hood Canal

Hood Canal is predisposed to low dissolved oxygen (DO) under natural conditions. Additional nutrient inputs increase the amount of algae in the system, causing a decrease in DO as the algae decay. Three observed fish kill events occurred between 2006 and 2010 as low DO levels affected large portions of the water column, trapping fish and other organisms in water that did not have enough oxygen. Hood Canal DO continues to be a key planning issue for the Mid Hood Canal Chinook Recovery Plan (WDFW, 2005).

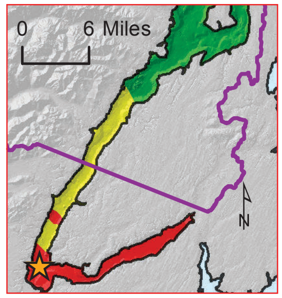
March 2006



May 2006



July 2006

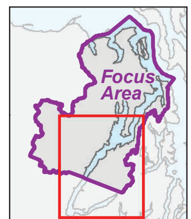


Focus Area Boundary

Potlatch Center Station

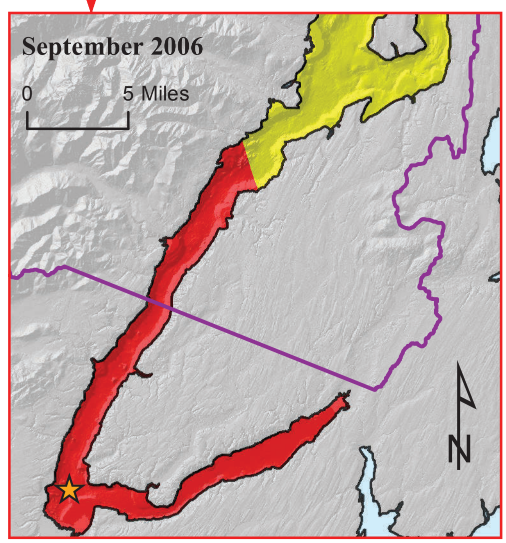
Dissolved Oxygen at 20m below surface

0-3 mg/L
5-7 mg/L
3-5 mg/L
7-10 mg/L



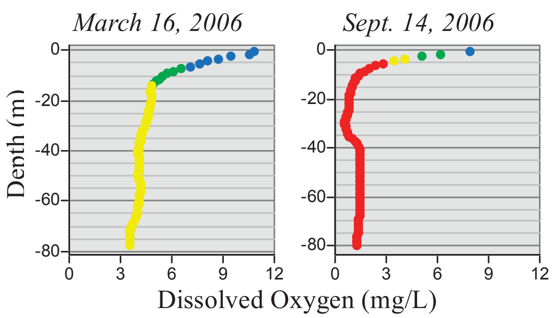
These maps model the levels of DO at 20 meters below the water surface throughout Hood Canal that led up to the fish kill event of September, 2006.

September 2006



Natural and human nitrogen inputs, ocean inputs, and the climate contribute to the low levels of dissolved oxygen (DO) in the Hood Canal (Newton et al, 2007). Many fish species experience stress at DO concentrations below 3-5 mg/L and may be severely stressed and die at concentrations of 1-2 mg/L (Newton et al, 2007). As a consequence of low DO, salmonids in Hood Canal may not be able to find food and quality habitat, resulting in reduced growth and increased mortalities (HCCC, 2005).

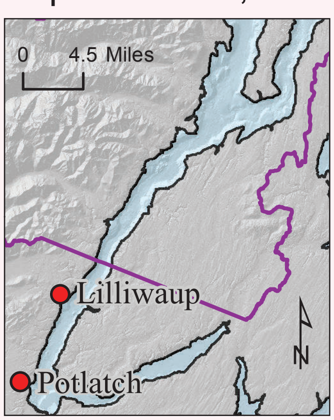
Potlatch Center Station



On September 14, DO levels were less than three mg/L in the water column from five meters below the water surface to the canal floor at Potlatch Center Station. (HCDOP, 2006)

Data Sources: HCDOP Cruise Data, 2006

September 21, 2010: Hood Canal Fish Kill



A fish kill occurred in Hood Canal from Lilliwaup to Potlatch at the end of September, 2010. The low oxygen levels throughout 2010 were a result of poor seasonal flushing of Hood Canal during the Fall of 2009, likely linked to ocean and weather conditions (Newton, 2010). Hood Canal is a system that is very susceptible to periodic fish kills; additional oxygen depressions from human nitrogen loading increase that risk (Newton, 2010).

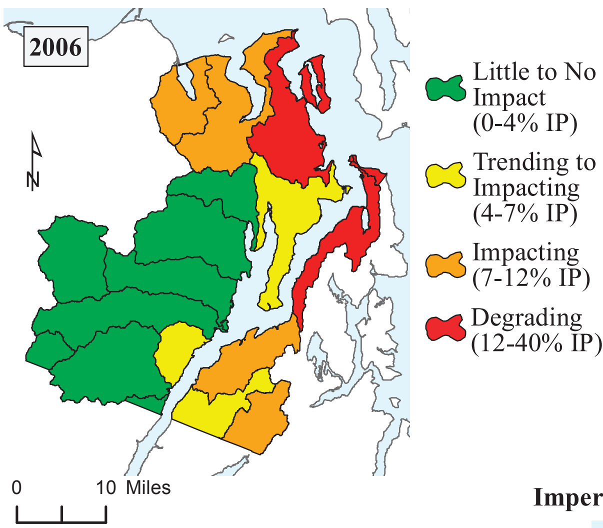
Pacific Sanddab, one of many casualties of the 2010 fish kill

Photo: R. Figlar-Barnes, Skokomish NR

Population and Impervious Surface Impact Water Quality

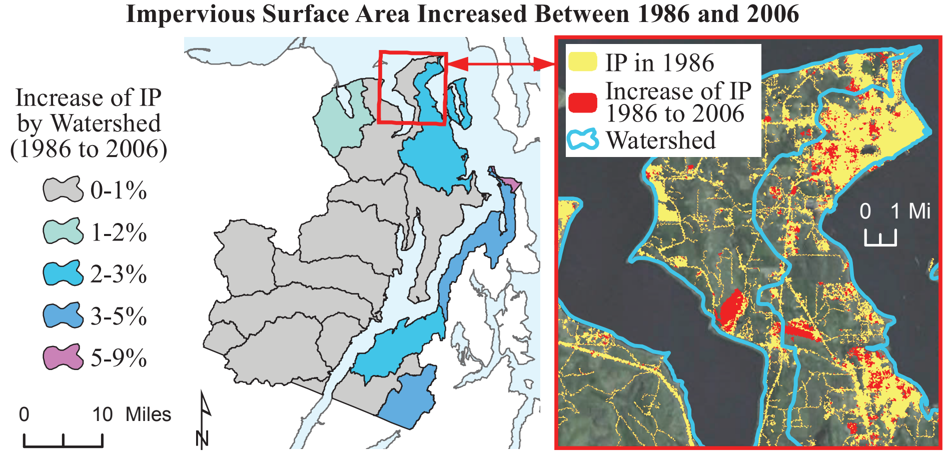
High population densities lead to large amounts of impervious surfaces, including roads and other infrastructures, negatively impacting the local watersheds and resulting in loss of salmon habitat. Sensitive stream habitat elements may be lost when 10% of the watershed is covered by impervious surface area (IP). The total Focus Area IP increased from 5.7% to 6.8% between 1986 and 2006. Five watersheds had over 10% IP in 2006.

Watershed Degradation from Impervious Surface Area (IP%)



Any level of human disturbance has an impact on watershed processes. Impervious surface area is well documented as a coarse measure of human impact on watershed scale hydrology and biology (Alberti et al, 2007; Booth et al, 2002; Booth and Jackson, 1997). Sensitive stream habitat elements are lost when a watershed reaches 10% IP and many stream quality indicators have poor conditions at IP of 25 to 30% according to the Hood Canal and Strait of Juan de Fuca Summer Chum Recovery Plan (HCCC, 2005). Each watershed will have a different reaction to a given amount of IP; thresholds serve only to generalize the continuum of degradation that accrues as IP increases and forest cover is lost (Booth et al, 2002).

Impervious Surface Area Increased Between 1986 and 2006



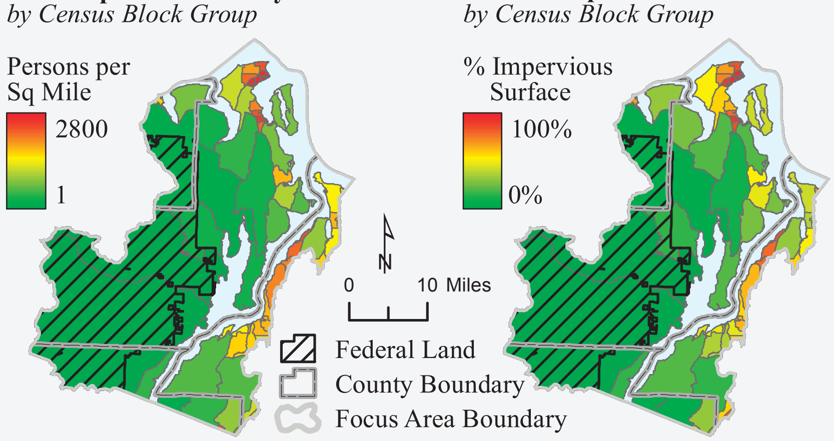
Impervious surface area causes increases in stream temperatures, decreases in stream biodiversity, and contributes to pollutants in stormwater runoff, which can contaminate local aquatic systems (Schueler, 2000).

Data Sources:NOAA CCAP, 2010; WAOFM SAEP, 2010; WADNR, 2009; WADNR, 2006; WAECY, 1999

Impervious Surface Area Increases with Population Growth

2006 Population Density *by Census Block Group*

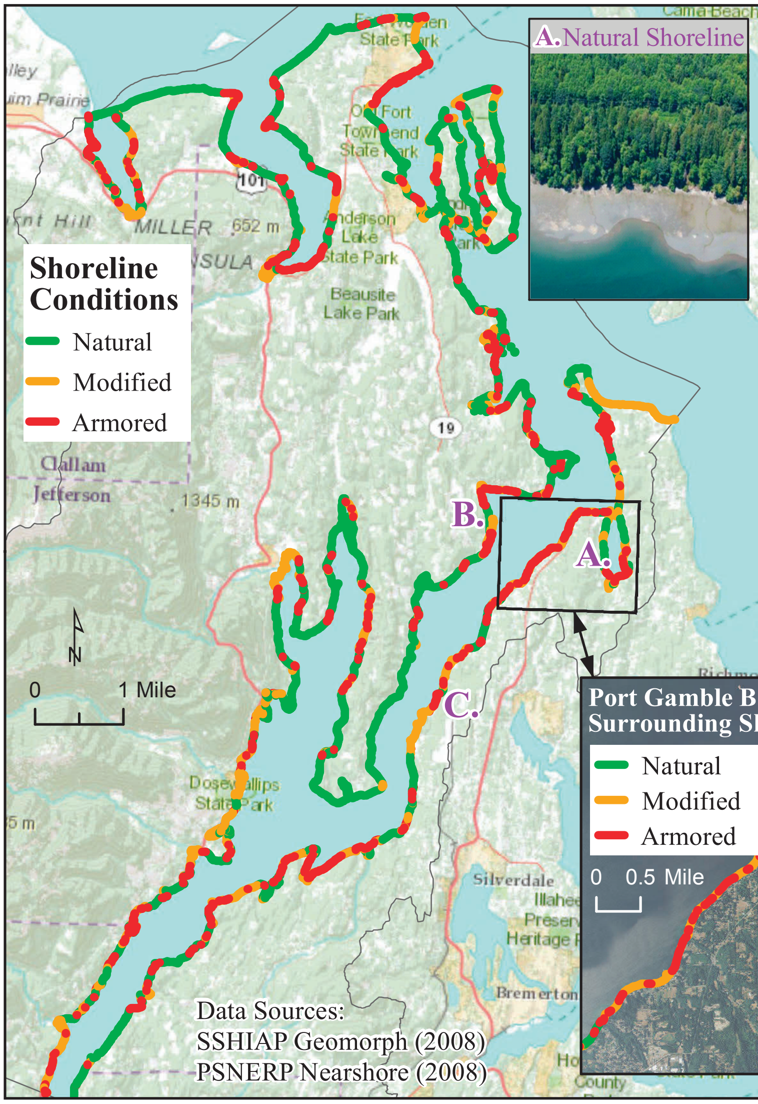
2006 % Impervious Surface *by Census Block Group*

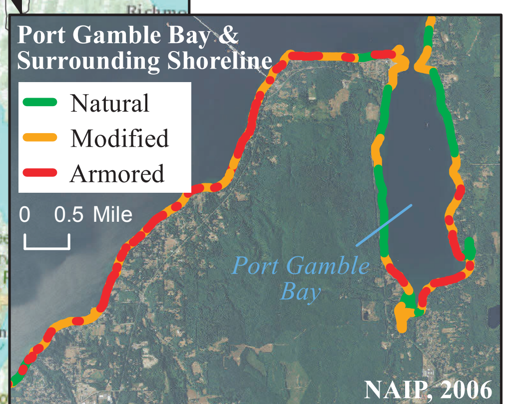


Areas with high population densities also have large amounts of impervious surfaces. Clallam, Jefferson, Kitsap and Mason Counties are projected to have a total increase in population of over 175,000 people between the years of 2010 and 2030; over 100,000 of those people are projected to be in Kitsap County (WAOFM, 2007).

Nearshore Habitat Loss in Hood Canal & Strait Region

About 45% of shoreline in the Port Gamble Tribe's focus area has been modified or armored. In the area around Port Gamble Bay, armoring and modifications encompass 74% of the shoreline. The Action Agenda (Puget Sound Partnership, 2009) has identified habitat alteration as a threat to Puget Sound, including armored shorelines (such as docks and bulkheads) which cover beaches that produce valuable plant life and native nearshore species that provide food for salmon, such as the ESA Summer Chum.





Shoreline alterations such as jetties and rockwalls interrupt the flow of sand on beaches. Docks and bulkheads cover beaches so that plant life and fish species cannot produce in these areas (PSP, 2009). Data collected on shoreline conditions in the Hood Canal and part of the Strait of Juan de Fuca show that 57% is natural, 30% is modified and 13% is armored (Figure 1). However, when focusing on the area around Port Gamble Bay, a known productive area for salmonids and forage fish, it is noted that 74% of the area is either modified or armored (Figure 2).

Figure 1

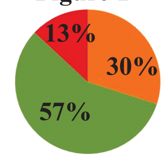
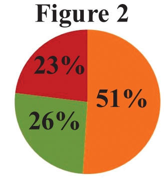
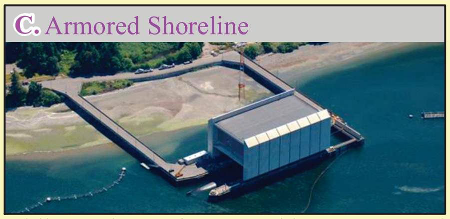


Figure 2



B. Modified Shoreline

C. Armored Shoreline



Oblique photos from Washington Coastal Atlas, 2006

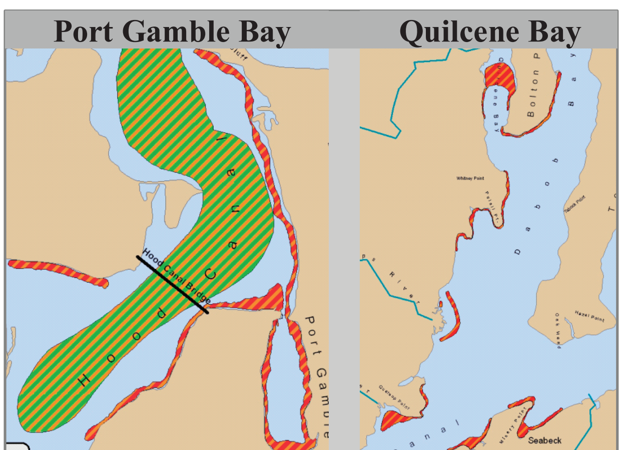
No portion of the Hood Canal has been more radically altered than the southern Hood Canal (Hirschi, 2003). In contrast, Point Julia has the most frequently used and most heavily accessed spit complex on Hood Canal and maintains natural functions and values (Hirschi, 2003).

The Port Gamble Bay area and surrounding shoreline has a significant amount of forested area upland of the bay that is not developed. 50% of this area is covered in sediment source beaches, of which 70% is either modified or armored (Geomorph, 2008). According to Hirschi et al. (2003), shorelines in the reservation section of the drift cell are little changed, with significant wooded bluffs contributing sediment supply to the spit at Point Julia as well as overhanging shade for outmigrating salmon and large wood structures in the nearshore.

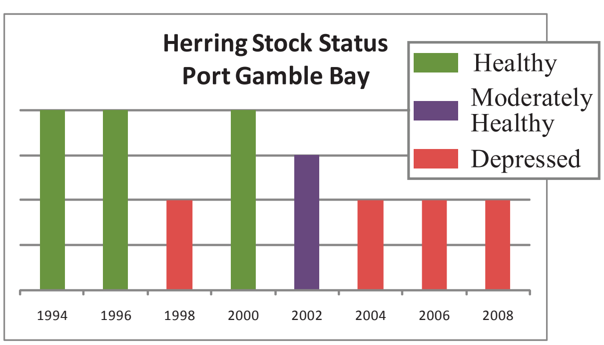
Pacific Herring (*Clupea pallasi*) Spawning Habitat Conditions: Regionally and in Port Gamble Bay

In the Port Gamble Tribe's focus area, 51% of the herring spawning areas inventoried were either modified or armored. Port Gamble Bay and Quilcene Bay, which contain two of the largest Pacific Herring stocks in Puget Sound, have lost considerable spawning habitat due to shoreline alterations. According to studies since the 1970s, Port Gamble Bay herring stocks have decreased from a status of healthy to depressed.

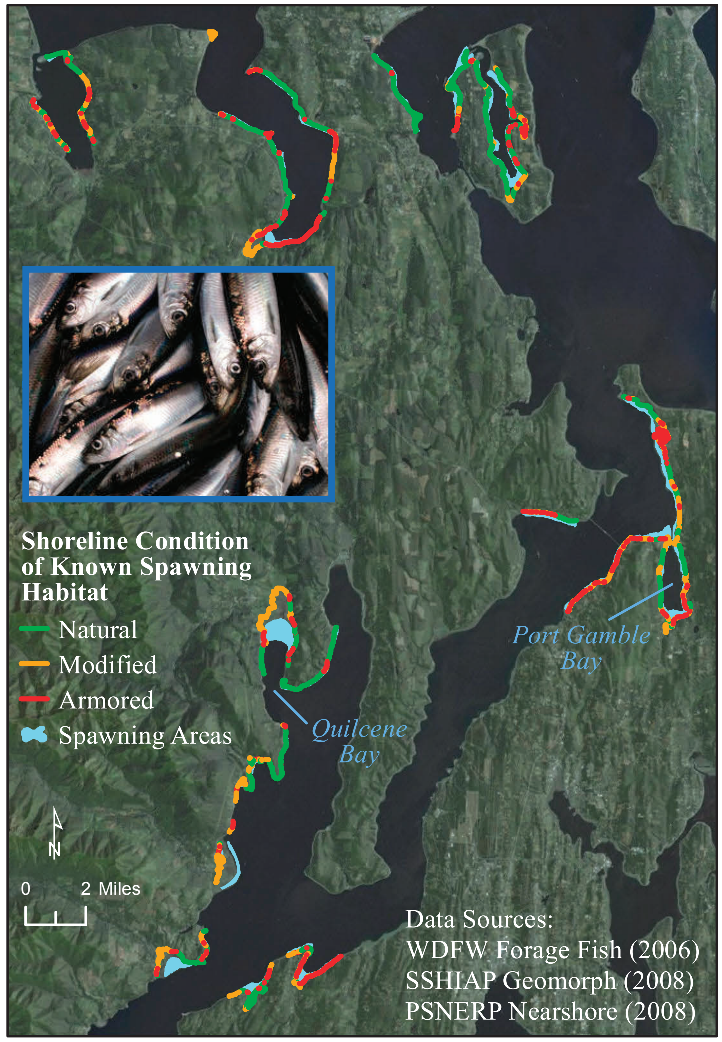
Pacific Herring, vital forage fish, are an important component of the marine ecosystem and are a valuable indicator of the overall health of the marine environment. Herring were included in the 1974 "Boldt Decision" defining Native American fishing rights. They serve as an important bait fish for tribal fishermen. Herring are generally known to prefer nearshore areas containing vegetation, and bay inlets. Inventoried known spawning areas along the shoreline show that 49% of the shoreline remains natural, 36% is modified, and 15% is armored. Research indicates that priority habitat lies in sheltered bays (Pentilla, 2007).



These bays are two of the largest known herring spawning areas in Puget Sound (Stick and Lindquist, 2009).
Pre- spawning Area Spawning Area



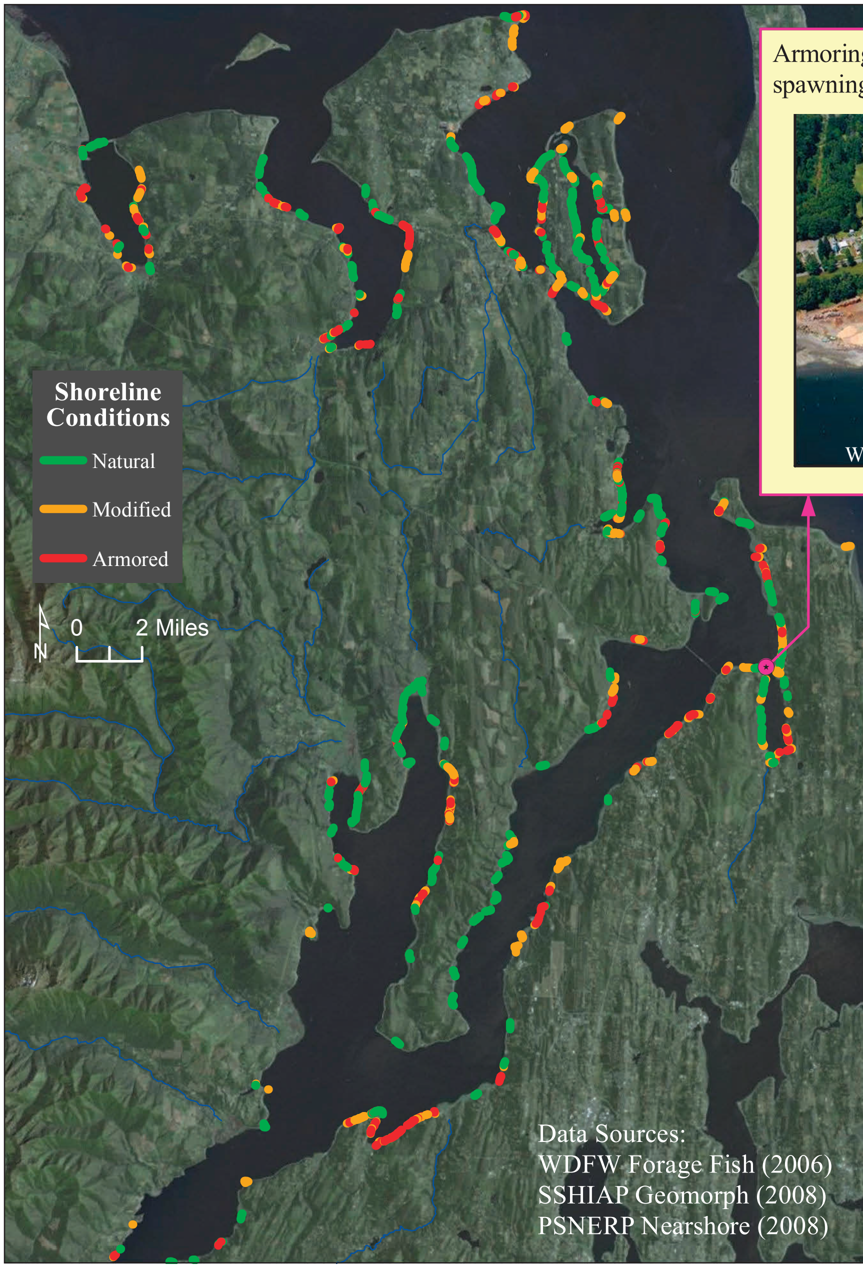
Data derived from WDFW Status Report, 2008



Judging from the distribution of herring, not all vegetated shorelines are equally attractive to herring. About 10% of shoreline in the Puget Sound has been selected in sheltered bays (Pentilla, 2007). Although research is still ongoing, since the 1970s Port Gamble Bay and Quilcene have been among the largest stocks of herring in the entire Puget Sound (Stick & Lindquist, 2009). The graph at left depicts spawning levels of the Port Gamble Bay stock trending toward decline over the last 14 years from healthy to depressed (Stick & Lindquist, 2009). There is concern that development and other anthropogenic impacts within these bays could continue the decline.

Sand Lance (Ammodytes hexapaterus) and Surf Smelt (Hypomesus pretiosus) Spawning Habitat Conditions

Almost 45% of inventoried Sand Lance and Surf Smelt spawning habitat in the Port Gamble Tribe focus area has been modified, and of that, 13 % has been armored. Armoring and modification interrupts the movement of gravel and sand to these beaches and could negatively affect spawning habitat as a consequence.



Armoring and modification impacts nearshore spawning habitats for forage fish in Port Gamble Bay.

Forage fishes are small, schooling fishes that are key prey items for larger predatory fish and wildlife in a marine food web (Pentilla, 2007). Sand Lance is recognized as being one of the key elements of a juvenile Chinook's nearshore diet (Duffy, 2010).

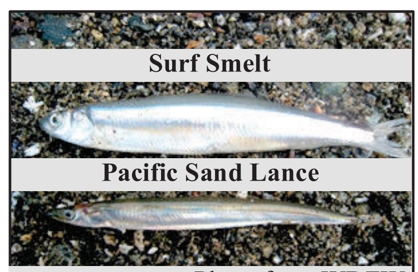
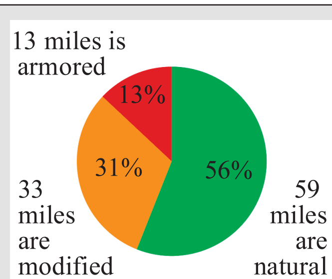


Photo from WDFW

A very large proportion of the shoreline of this basin has been altered in various ways by human activities, to the possible detriment of these species. Sand Lance and Surf Smelt spawn on upper intertidal beaches consisting of sand and gravel. Shoreline modification and development can negatively affect spawning sites (Pentilla, 2007).

WDFW Documented Forage Fish Spawning

This pie chart reveals the proportion of armoring and modification in known forage fish spawning areas along shorelines, which can affect the natural sediment dynamics of spawning beaches and potentially impact the habitat for these fish.



Summary

Hood Canal and the eastern Strait of Juan de Fuca are home to salmonids and shellfish—resources that are culturally and economically important to the Port Gamble S'Klallam Tribe. Although sizeable portions of the Tribe's focus area are contained within the Olympic National Park or USFS wilderness, much of the shoreline and floodplain areas are heavily impacted by land use, roads, and historic logging.

Increased water extraction has proved to be an issue in this area. Wells are extracting ground water that would normally contribute to local streams. This is resulting in lower instream flows and increased water temperatures. It is projected that climate change will increase summer air temperatures and prolong the stream low flow period, which will intensify the detrimental effects on freshwater salmon habitat. Population growth also impacts the precious resources of this area. Data has shown that human population densities can lead to higher amounts of impervious surfaces, resulting in negative impacts such as habitat loss and depleted or degraded natural resources in this area. Sensitive stream habitat elements can be lost when only 10% of the watershed is covered by impervious surfaces. Although Hood Canal is predisposed to low dissolved oxygen (DO) under natural conditions, the added nutrient inputs increase the amount of algae in the system. This causes a decrease in DO as the algae decay, and has resulted in three observed major fish kill events that occurred between 2006 and 2010.

Another key reason for habitat decline is the increased development along shorelines. Approximately 45% of shoreline in the Port Gamble Tribe's focus area has been modified or armored. In the area around Port Gamble Bay, armoring and modifications encompasse 74% of the shoreline. The Action Agenda (Puget Sound Partnership, 2009) has identified habitat alteration as a threat in the Puget Sound, including armored shorelines (such as docks and bulkheads) which cover beaches that produce valuable plant life and native nearshore species that provide food for salmon. Not only have nearshore processes been affected, but also forage fish species, such as Pacific herring, sand lance, and surf smelt have lost important spawning and rearing grounds because of shoreline modification and armoring. Fifty-one percent of the herring spawning areas inventoried were either modified or armored. Port Gamble Bay and Quilcene Bay, which contain two of the largest Pacific herring stocks in Puget Sound, have lost considerable spawning habitat due to shoreline alterations. According to studies since the 1970s, Port Gamble Bay Pacific herring stocks have decreased from a status of healthy to depressed.

The Summer Chum Salmon Recovery Plan has a goal to recover and obtain delisting for the Summer Chum Salmon populations in these areas. Although the Port Gamble Tribe has spent countless hours on restoring lost habitat and collecting critical data to monitor key species such as the Hood Canal Summer Chum and Pacific herring, habitat trends show that a net loss and degradation of critical habitats still continues. The Port Gamble S'Klallam Tribe has been increasing its interaction with its neighbors in the North Kitsap area, making it known that they are concerned about issues related to growth, water, habitat, and land use. They are tracking the rising issues of climate change and have been researching its impacts on Port Gamble Bay and surrounding areas. By participating in local processes and working with members of the surrounding communities, the Tribe is taking its rightful place as a responsible citizen and custodian of the natural resources surrounding their home. They are willing to work with watershed partners toward the goal of achieving salmon recovery.

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State of Our Watersheds Report
Puyallup River Basin

It's the tribes that are putting the fish back in the waters. It's our people doing that to make sure our livelihood will carry on, that our children will have this opportunity to get into a boat and go fishing so they can eat what they need.

– NANCY SHIPPENTOWER-GAMES,
PUYALLUP TRIBE OF INDIANS

The Puyallup Tribe of Indians

The Puyallup Watershed was one of the earliest areas to be settled by Euro-Americans in the Puget Sound region. Consequently, it was also one of the first watersheds in Puget Sound to experience the full impacts of industrial, urban and agricultural development.

This development and conversion of floodplain, uplands and forestlands has completely altered the hydrologic conditions within the watershed to the detriment of salmonid production.

The Puyallup are fishing people. They lived on food provided by the fisheries since time immemorial. It was not until after the *U.S. v. Washington* court decision that they were able to exercise their rights to the fishery.

History of the Puyallup River Basin

The Puyallup River is the only river in the state where early flood protection measures included formation of a concrete channel. Intense timber harvest and forest road density within unstable drainages has lead to high sediment input, frequent slope failures and channel instability. Economic activity within the watershed is largely focused on heavy and commercial industry, marine shipping, military base operations, lumber mills, urban development, commercial forestry, energy production and agriculture.

The identified leading factors for decline are loss of fish access to spawning and rearing habitat, lack of estuarine and nearshore habitat, impaired riparian functions and conditions, loss of flood plain processes and off-channel habitat, sediment transport, flow regime alteration and water quality.

Habitat recovery planning has involved many forums including CERCLA/RCRA/NRDA issues in the industrial tideflats/POT area since 1980, various planning efforts under WAC 400-12 (non-point rule), as well as more recent processes ; one conducted within the Shared Strategy Process and the other by the fishery co-managers. As part of the Puget Sound Shared Strategy process, Pierce County developed a habitat recovery plan using EDT modeling with the participation of the Puyallup Tribe and Washington Department of Fish and Wildlife. White River and Puyallup River chinook recovery plans had already been developed by the co-managers in earlier watershed recovery planning processes. Efforts are ongoing between the co-managers and Pierce County to integrate these respective plans within an all-H context.

More than three years ago the Puyallup Tribe of Indians reconnected a historic river channel to the Puyallup River, restoring important habitat for baby salmon.

Good habitat for young salmon was created when the 17-acre Sha Dadx wetland wetland was reunited with the river through a large box xculvert under the main river dike. The tribe is protecting properties adjacent to the wetland with a new dike. Most of the lower Puyallup is closely constrained by dikes, making the damage of winter floods worse on salmon.

Three key strategic habitat protection and restoration priorities were identified in the Shared Strategy process for the Puyallup Watershed:

1. **Restoration of estuary habitat and floodplain connectivity in the lower Puyallup, lower White and lower Carbon Rivers;**
2. **Increased protection and restoration of tributaries which have relatively high productivity, including South Prairie Creek, Boise Creek, Greenwater River, Huckleberry Creek, and the Clearwater River; and**
3. **Changes in flow management for Mud Mountain Dam PSE bypass, removal and amelioration of migration barriers associated with the Electron Dam.**

For more than a decade the Puyallup Tribe of Indians has been trying to jump-start natural salmon production in the upper Puyallup watershed.

Each year the tribe raises hundreds of thousands of juvenile chinook in an earthen rearing pond on Rushingwater Creek, a tributary to the Puyallup River as it flows through the foothills of Mount Rainier. The tribe places young chinook in the pond until they acclimate to the creek, and then releases them.

For almost 100 years, a low-lying dam prevented chinook and other salmon from accessing the last 30 miles of habitat in the watershed. But when a fish ladder was built around the dam, the tribe started taking steps to boost natural salmon production in the upper watershed.

Compared to the rest of the watershed, which has been significantly harmed by development, the upper watershed's salmon spawning and rearing habitat is relatively undisturbed.

Implementing a Conservation & Recovery Plan

Assessment of habitat recovery progress is complicated because specific habitat category and geographical priorities were not included in the Salmon Habitat Protection and Restoration Strategy developed for the Puyallup Watershed in 2004. Various governmental and non-governmental entities are actively engaged in restoration work within the watershed. Numerous capital projects have been completed within the watershed in the last five years to address some aspect of the actions identified within the Salmon Habitat Protection and Restoration Strategy or the recovery plans for the White River and Puyallup River chinook. However, few have directly addressed the watershed's key strategic habitat protection and restoration priorities, which underscore the need to harmonize restoration efforts. The need for this action is only further emphasized by the findings of a programmatic review that funding and project sponsor capacity remains a major factor in limiting efforts to address the three key habitat protection and restoration priorities listed above.

Review of habitat recovery progress and trends at the five-year mark of the Puyallup River Habitat Protection and Restoration Strategy reveals mixed results. Restoration slowly is beginning to focus on the three key habitat protection and restoration priorities. However, assessment of habitat conditions and trends indicates that salmonid habitat within the Puyallup Watershed continues to degrade. Population growth within the Puyallup Watershed has led to an increase in impervious surface of 47% from 1986 to 2006. Population growth within the watershed results in more water removals, greater volumes of wastewater, more septic systems and more sources of nutrients entering surface waters. Increases in impervious surfaces negatively impact stream health and consequently reduce salmonid productivity in critical spawning and rearing areas, such as South Prairie Creek. This tributary to the Carbon River is considered one of the most productive reaches used by chinook for spawning habitat within the watershed and its impervious surface area is now categorized as tending to impact stream health.

Growth, Weak Regulations Threaten Water Resources


The Puyallup Tribe celebrates its annual First Salmon Ceremony to honor the first salmon caught in a fishery.

Population growth and current land-use regulations continue to negatively affect water quality and quantity within the Puyallup Watershed. Since 2008, there has been no improvement in water quality and aquatic habitat conditions within the watershed. For this time period, the average grade for Pierce County streams has been a "C" on a scale of A-F, with the water quality and aquatic habitat conditions considered "fair." More than 60 miles of streams in the Puyallup Watershed are listed as "impaired waters" by the Washington Department of Ecology, with a majority of the streams suffering from a combination of high fecal coliform levels, low dissolved oxygen levels and other water quality impacts. Summer low flows are part of these other water quality impacts. Summer flows have continued to decline within the watershed since 1980, in spite of prohibitions on new surface water withdrawals and the establishment of minimum flow requirements. These declines in flow levels have occurred even though there was above average precipitation during this time. The growth in exempt wells is considered a contributing factor to this summer low flow issue; exempt wells now exceed 4,745 within the Puyallup Watershed.

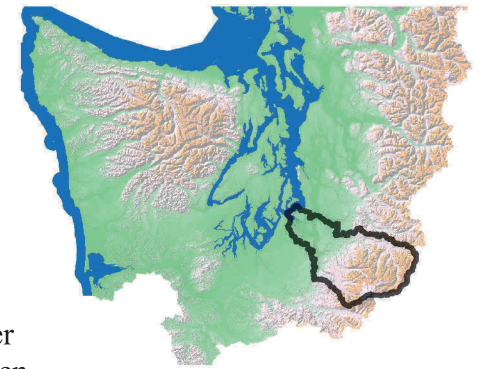
Significant modification and loss of nearshore, estuary and mainstem habitat has occurred in the Puyallup Watershed and adjacent area. Nearshore and estuarine habitats provide food and refuge for juvenile salmon as they prepare for their journey to the ocean, but flood control projects, Port of Tacoma activities and urbanization have resulted in severely degraded conditions and significantly reduced the amount of functioning habitat. Of the 36 miles of marine shorelines adjacent to the Puyallup River, about 7% are undeveloped and free of bulkheads, riprap, or other structures. Only about 3%, or 177 acres, remain undeveloped of the estimated 5,900 estuary acres that historically existed at the head of Commencement Bay. Of the 303 miles of known fish distribution in the Puyallup Watershed, 48 miles of river or 96 total miles (counting both sides of river) are contained within a levee and revetment system. Levee setback and estuarine habitat creation are the most beneficial types of actions needed for recovery of chinook stocks within the Puyallup system.

Looking Ahead

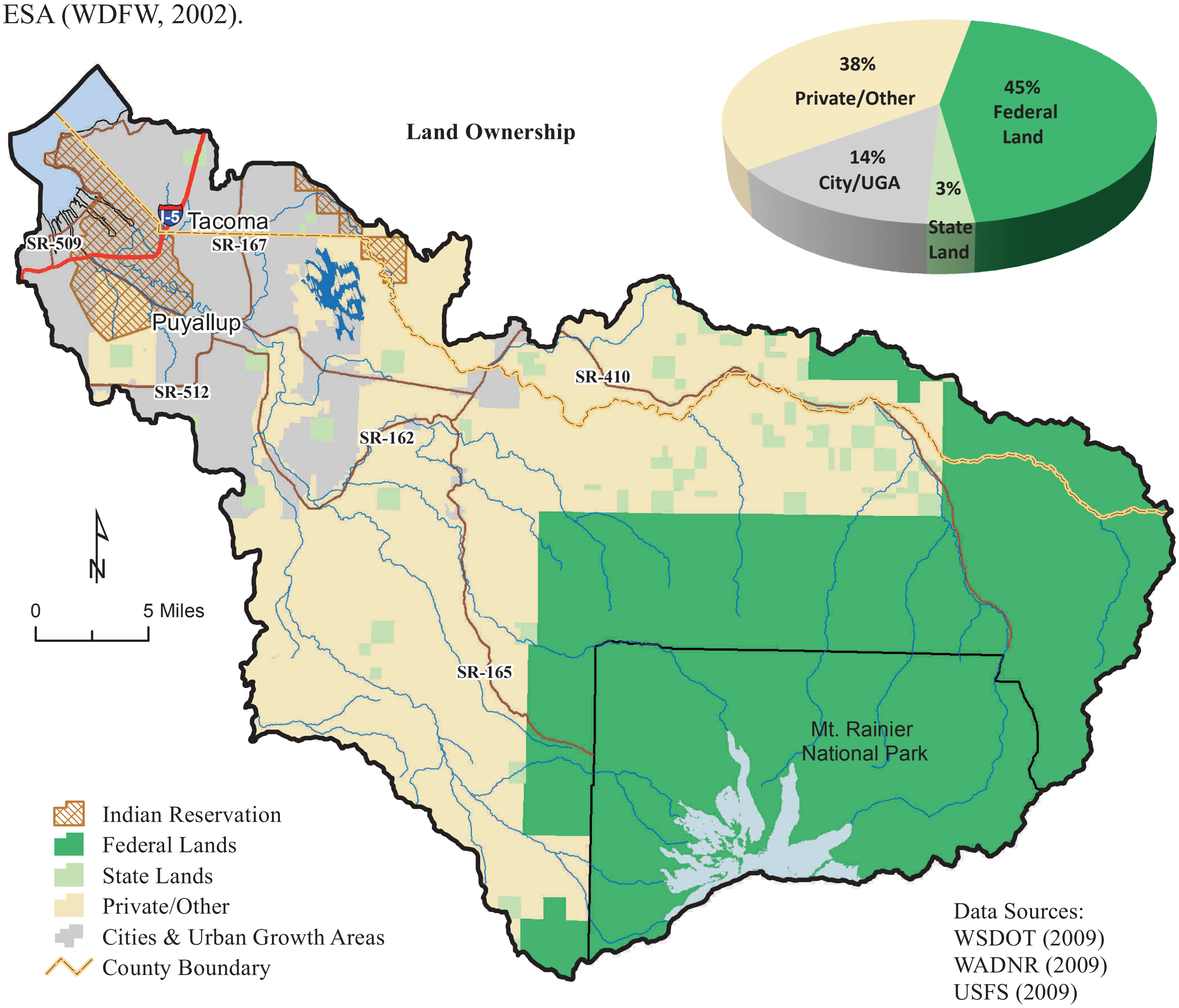
The projected population growth and associated economic development for the Puyallup Watershed will continue to challenge salmon conservation and recovery efforts. Current trends indicate that land-use regulation reform is required and continued funding of habitat restoration activities is necessary in order to achieve recovery goals. The continued decline in water quality and quantity remains the biggest impediment to recovery. Additional funding support is required to complete the development of an integrated, comprehensive strategy for recovery across all H's (habitat, harvest, and hatcheries). The greatest challenge remains securing the funding necessary for the large, multi-year restoration projects required to conduct levee setbacks and estuarine habitat creation.


Each year the Puyallup Tribe raises millions of chinook at its Clark Creek hatchery that benefit both tribal and non-tribal fishermen.

Puyallup Tribe of Indians (Puyallup River Basin)



The Puyallup River Basin (WRIA 10) includes the White, Puyallup, and Carbon Rivers, which have their origins in the glaciers of the northwestern slopes of Mt. Rainier. The Puyallup River Basin flows to Commencement Bay at the Port of Tacoma, the third largest port in the western U.S. Historically, the drainage did not always include the White River until 1906 when the White was diverted from the Green River to the north into the Puyallup for flood control purposes, which effectively doubled the flow in the lower Puyallup River. The basin drainage area is about 1,065 square miles, and has over 700 miles of river and streams. The Puyallup basin has been substantially altered from its historic condition and is currently contained within a revetment and levee system throughout its lower 26 miles (Kerwin, 1999). Salmonid species existing within the basin include Chinook, coho, chum, coastal cutthroat, pink, steelhead, bull trout and the occasional sockeye. Chinook are listed as critical and pink and steelhead are listed as depressed under SaSI 2002. Chinook and bull trout are both listed as threatened under ESA (WDFW, 2002).

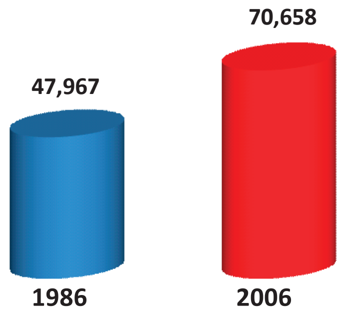


Impervious Surface and Population Continue to Increase

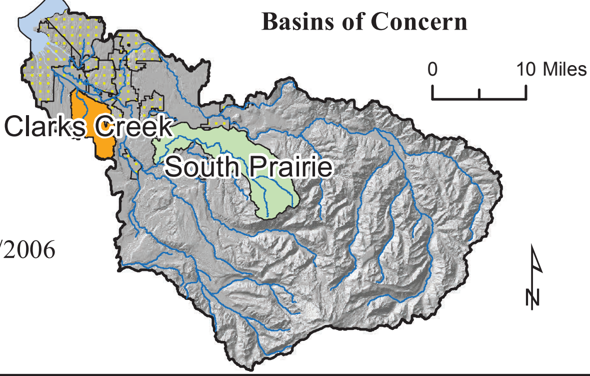
The Puyallup River Basin saw an increase in impervious surface of 47% from 1986-2006. The South Prairie Creek mainstem is identified as a high priority for protection, meaning that further degradation would have a large negative effect on Chinook performance in that system (Salmon Habitat and Protection and Restoration Strategy March 2008). From 1986 to 2006, South Prairie Creek Basin's impervious surface increased from 4% to 5.5% ("little to no impact" in impervious surface to "trend to impacting"). Clarks Creek contains critical habitat for Chinook Salmon. This basin saw an increase in impervious surface from 40 to 62%. The health of this creek and its sustainability are in jeopardy.

The Puyallup River Basin has an estimated 2010 population of 419,660 in incorporated communities and unincorporated Pierce and King Counties. It includes the state's third largest city, Tacoma, with a population estimate of almost 200,000 for 2010. Increased population pressure and development, with the conversion of forested areas to impervious surfaces, is the major factor affecting water quality in the region (Puget Sound Partnership, 2008a). Greater numbers of people in the region result in greater volumes of wastewater, more septic systems, and more sources of nutrients entering surface waters. As a result of development, once forested land has been replaced with buildings, roads, and lawns.

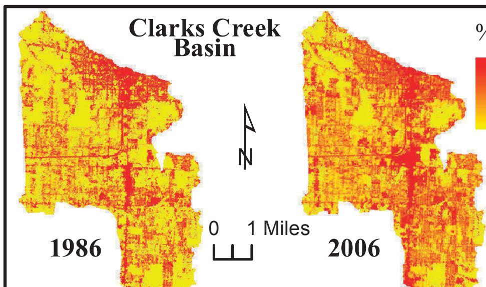
Puyallup River Basin
Acres Impervious Surface



Data Sources:
NOAA-CCAP -1986/2006
WADNR - 2009
WAECY - 2008
WAOFM -2011

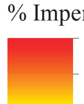


Clarks Creek Basin

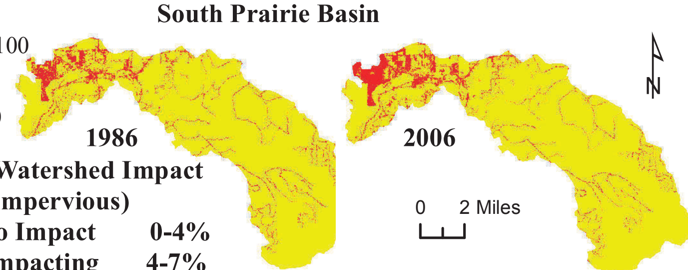


40% Impervious **62% Impervious**

Population 2000 = 59,453
Estimated Population 2010 = 71,500



South Prairie Basin



4% Impervious **5.5% Impervious**

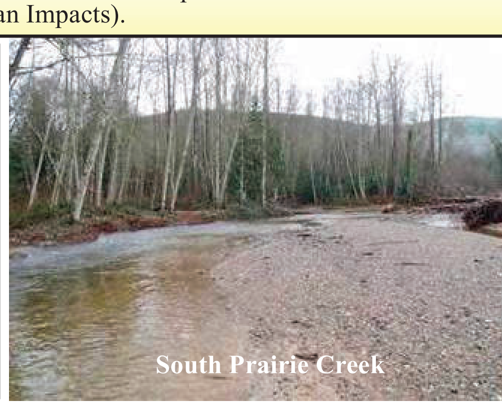
Population 2000 = 25,145
Estimated Population 2010 = 27,780

Degree of Watershed Impact (% impervious)

Little to No Impact	**0-4%**
Trend to Impacting	**4-7%**
Impacting	**7-12%**
Degrading	**12-40%**
Severely Damaged	**>40%**

Incremental degradation is most rapid during the first stages of urbanization (0% < impervious surface < 10% in a watershed). Any watershed with less than 5% impervious surface will have high quality habitat to consider for preservation (Salmon Recovery Urban Impacts).

Clarks Creek supports the highest salmon spawning densities of any incorporated area in the watershed. Clarks Creek provides critical habitat for Chinook salmon. Within the creek can also be found coho, chum, cutthroat, and steelhead salmon. Over-growing plants, stormwater runoff pollution, fecal coliform and low levels of dissolved oxygen all plague Clarks Creek.



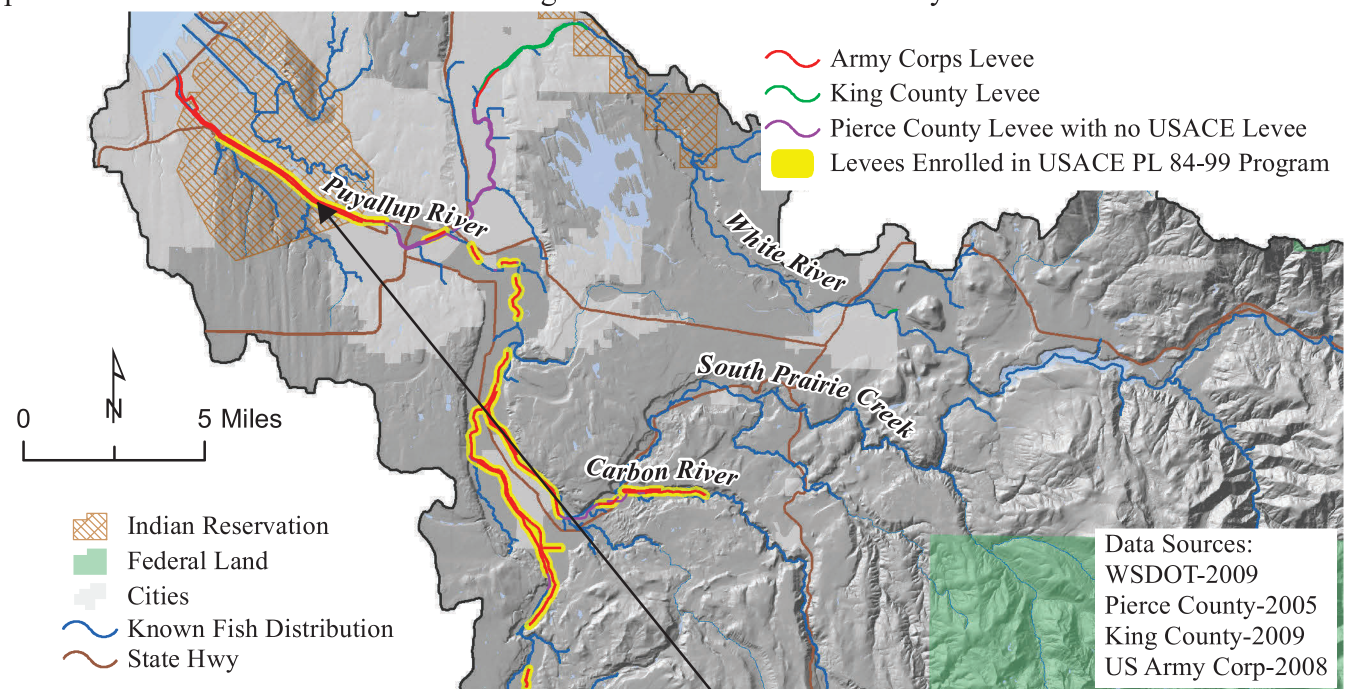
South Prairie Creek

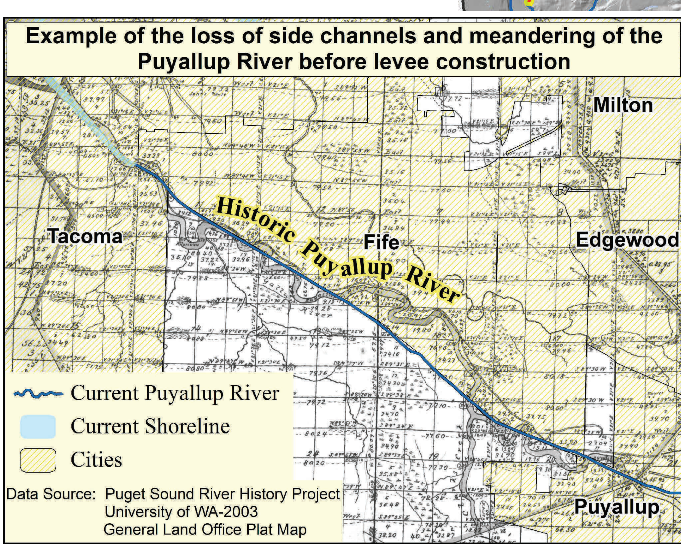
South Prairie Creek, a major tributary of the Carbon River, is considered one of the most productive reaches used by Chinook for spawning habitat that is available for natural salmonid production in the basin (Salmon Conservation Plan, 2005). South Prairie Creek is temperature-impaired and has not seen water temperatures improve since the TMDL was completed in 2003.

Levees and Revetments

Levee setbacks and estuarine habitat creation are the most beneficial types of actions needed for recovery of Chinook in WRIA 10 and will be a high priority (Salmon Habitat Protection and Restoration Strategy 2008). To date in the Puyallup River Basin, one levee setback has been completed and six setback levee projects are in some stage of development (feasibility, design, permitting) as well as a Levee Setback Feasibility Study that was completed in 2008.

Of the 303 miles of known fish distribution in the Puyallup Basin, 48 miles are contained within a levee and revetment system. Of these 48 miles, 36 are covered by US Army Corps of Engineers Disaster Operations Public Law 84-90 Flood Control and Coastal Emergency Act (PL 84-90). Once a levee segment falls under PL84-99 jurisdiction, any repair work or maintenance that is deemed emergency is exempt from consultation, temporal closures associated with fish windows, mitigation and compliance with WDFW's Integrated Streambank Protection Guidelines. Channelization and levees have reduced river processes that form pools, side channels and other habitat features used by salmonids. The construction of the revetments and levees and their maintenance has decreased the contribution of prey organisms to the river by precluding functioning riparian vegetation habitats. Additionally, they have precluded the recruitment of small and large wood from areas most likely to contribute this material.



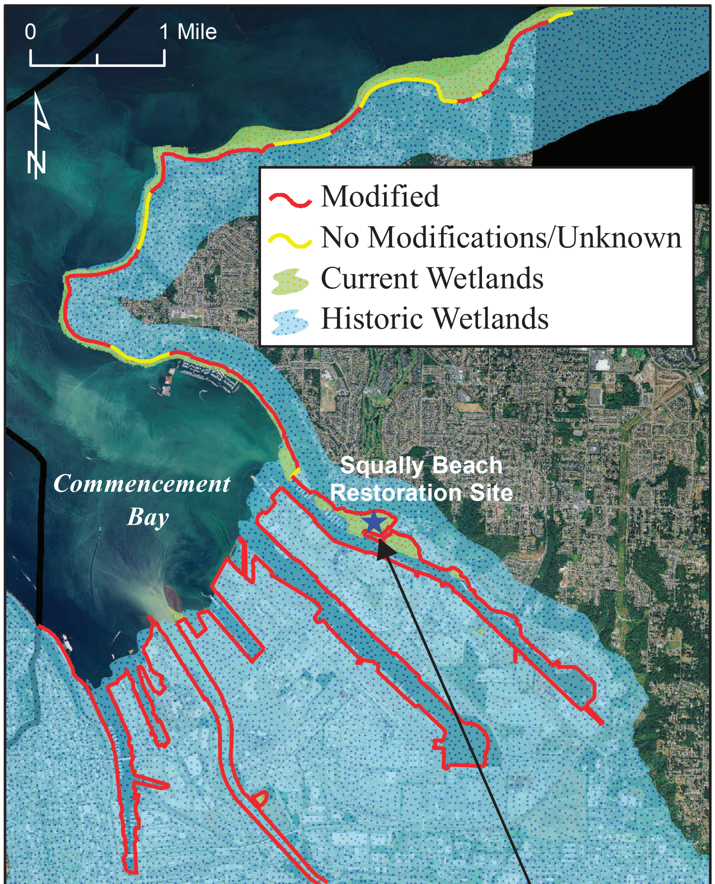


Part of the levee system on the Puyallup River

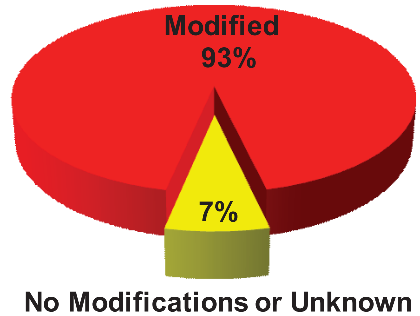
Nearshore and Estuary Habitat Lacking

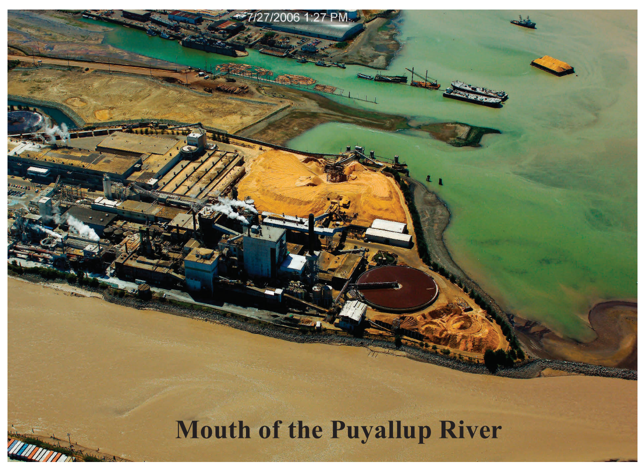
Of the 36 miles of marine shorelines, about 7% are undeveloped and free of bulkheads, riprap, or other structures. Out of more than 5,900 acres of estuary habitats that historically existed at the head of Commencement Bay, only about 3% remain due to dredging, filling and activities associated with development. The 2010 three-year work program update shows three nearshore projects in the conceptual stage, one in the scoping stage, one in the feasibility phase, and two being monitored.

Nearshore and estuarine habitats provide food and refuge for juvenile salmon as they prepare for their journey to the ocean, but flood control projects, Port of Tacoma activities, and urbanization have resulted in severely degraded conditions and have significantly reduced the amount of functioning habitat. Contaminated sediments which have further limited the nearshore/estuarine habitat have resulted in additional reductions in Chinook productivity.



Shoreline Modifications

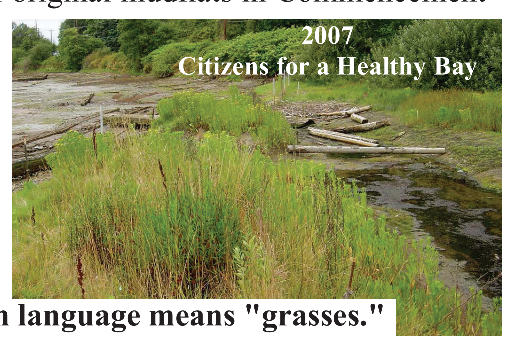




Mouth of the Puyallup River

Data Sources: 2009 NAIP, WAECY 2006
SSHIAP 2009, PSNERP 2008

The overall objective of the ***"Squally Beach Restoration Site"*** is to restore an intertidal area to full function in order to support juvenile salmon and bottom-dwelling organisms important to the food chain. The project site is located near the middle of the Hylebos Waterway on property owned by the Puyallup Tribe. The site is situated adjacent to the largest area of original mudflats in Commencement Bay. The site contains salt marshes and low-gradient mudflats. The project restores approximately 0.66 acres of intertidal habitat.

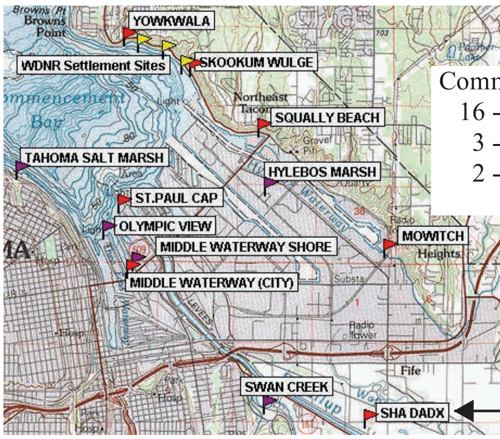


"Squally Beach Restoration Site," which in the Salish language means "grasses."

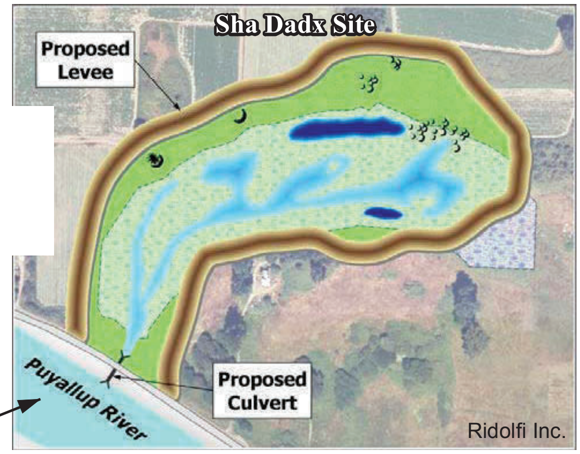
Restoration Projects Post, Current, Planned

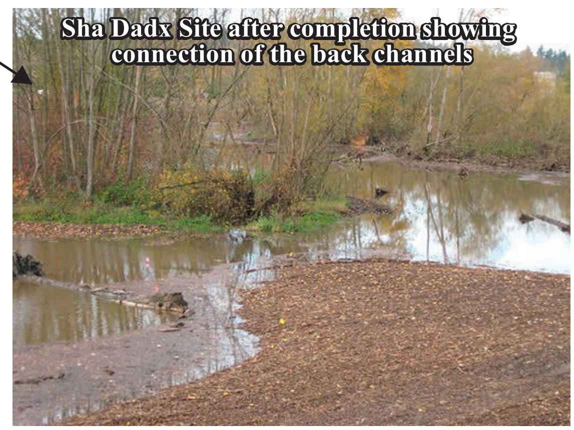
According to the Habitat Work Schedule, 63 projects are either in the conceptual, proposed, active, or completed stage as of June 2011. Of the 30 completed projects, none are Salmon Habitat Protection & Restoration for WRIA 10 Strategic Near-term Priorities, however, two projects are in the "Active" stage.

The Commencement Bay Area Superfund Site has projects funded by National Resource Damage Assessment (NRDA) where 16 restoration projects have been completed. The Commencement Bay natural resource trustees have developed a baywide restoration plan and are designing and building a series of habitat restoration projects using funds, property, and in-kind services obtained through damage claim settlements.



Location of Several of the Commencement Bay Restoration Sites





The ***Sha Dadx*** project created off-channel habitat and riparian buffers with a connection to the Puyallup River. A culvert under North Levee Road was installed to connect the Puyallup River to constructed pools and channels in an abandoned oxbow system. The off-channel habitat covers approximately 12 acres inside the levee with approximately two acres of riparian edge buffer. The project improves habitat for juvenile salmonids by increasing areas for rearing and foraging and by enhancing conditions for important prey resources such as resident fish and terrestrial insects.

Habitat Work Schedule - June 2011

Project	Completed	Active
Culvert Removal	10	0
Land Acquisition	5	1
Large Wood Debris (LWD)	0	4
Road Abandonment	2	1
Revegetation	1	0
Knotweed Removal	0	1
Restoration	4	2
Levees	1	5
Studies	7	0

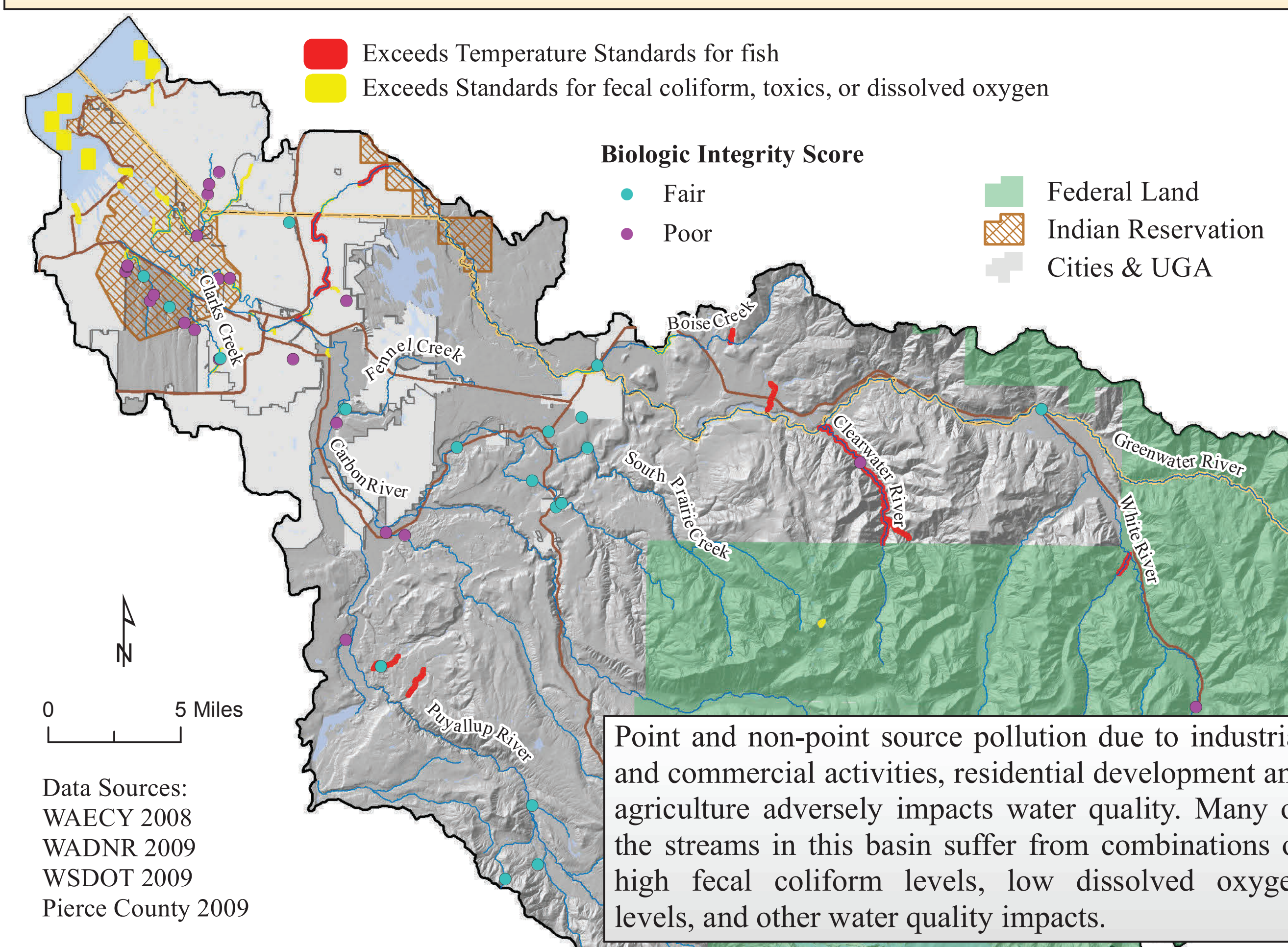
The ***Sportsmans Club Oxbow*** Project reestablished fish access to an existing oxbow lake on the lower Puyallup River using a concrete culvert structure with an internal fish ladder. The fish passage structure replaced the existing barrier culvert that conveys water under the levee from the oxbow into the Puyallup River. The oxbow will provide over 18 acres of important off-channel rearing habitat for juvenile salmonids, including coho salmon, Chinook salmon, steelhead, and sea-run cutthroat trout.

Water Quality Has Not Improved

From 2008, the Puyallup basin has seen no overall improvement in its water quality and aquatic habitat conditions. The average grade for Pierce County streams in water years 2008-2010 was "C" on a scale of A-F, with the water quality and aquatic habitat conditions considered "fair."

Since the mid 1990s, university scientists, water resource managers, and volunteers have used the multimetric B-IBI to evaluate the biological condition of Pacific Northwest streams with benthic macroinvertebrates (Fore et al, 1996, in press; Karr and Chu, 1999a; King County, 1996; Kleindl, 1995). Benthic macroinvertebrates are particularly well suited for biomonitoring: they are diverse and abundant, sensitive to human disturbance, and are excellent indicators of stream condition in that they are key components of the aquatic foodweb, often long-lived, and not migratory or artificially stocked (Fore et al, 1996, Rosenberg and Resh, 1993, Vannote et al, 1980). The loss of biological integrity within salmon spawning grounds equates to a loss of salmon. If a stream's biological condition is degraded (as reflected by the condition of the benthic macroinvertebrate population), it is safe to conclude that the stream will not support healthy salmon or other fish populations. The decline of healthy salmon spawning and rearing habitat has been identified as one major cause of the decline of wild salmon populations. Of the 41 sampling sites in the Puyallup Basin, none had a rating of excellent or good.

The Washington Department of Ecology's 2008 Water Quality Assessment identifies river reaches that exceed standards for fish (WAECY, 2008)



Point and non-point source pollution due to industrial and commercial activities, residential development and agriculture adversely impacts water quality. Many of the streams in this basin suffer from combinations of high fecal coliform levels, low dissolved oxygen levels, and other water quality impacts.

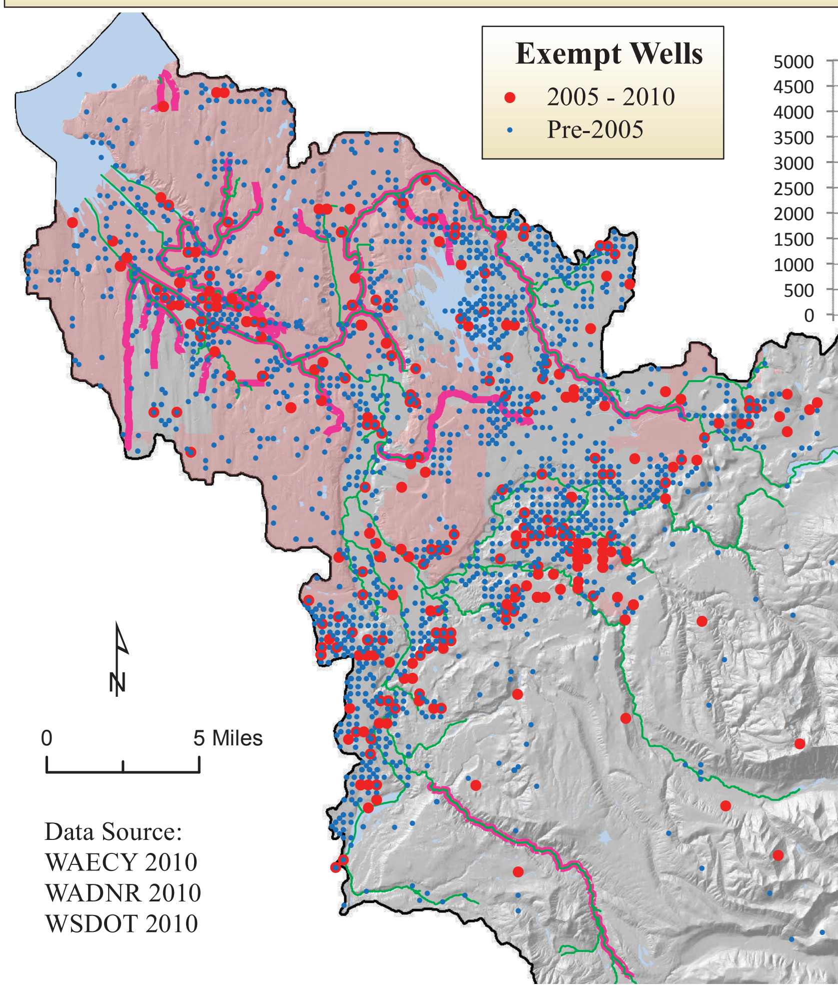
Over 60 miles of stream in the Puyallup Basin are listed as "impaired waters" by the Washington State Department of Ecology. Of the 41 biological integrity sampling sites in the Puyallup Basin, 19 had a rating of fair, while 22 had a rating of poor.

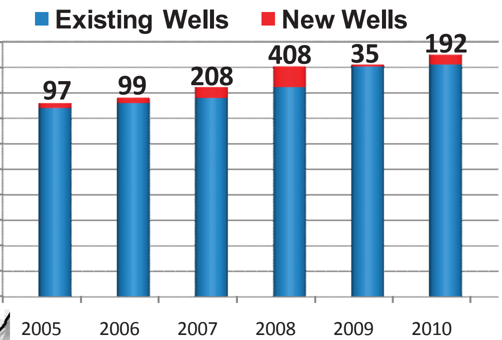
Low Flows Continue to Decline

Since 1926, the Puyallup River stream flows have shown a continuous decline especially during critical flow periods despite the establishment of instream flows in 1980. The decline is due to groundwater withdrawals and land-use changes.

Instream flow rules, which allocate specific flow and timing regimes in rivers and river systems, are meant to legally account for the ecological requirements that may have previously been unconsidered. The Washington Department of Ecology (WAECY) and Department of Fish and Wildlife (WDFW) have developed instream flow rules to "protect and preserve instream resources" (Washington State Department of Ecology, 2004) that include fish and fish habitats, water quality, wildlife, aesthetics, and recreation. A watershed assessment in 1995 conducted by WAECY indicated there has been a decrease in low flows over the last 20 years despite above average precipitation and prohibitions on new surface water withdrawals.

The Puyallup Basin contains over 4,745 exempt wells and 120 miles of stream with low flow issues.





Summer low flows have declined continuously since at least 1980 in spite of the closure for new surface water withdrawals and the establishment of minimum flow requirements. Low flows have dropped even though there was above average precipitations.

The 1980 Ecology regulation prohibited all new surface water withdrawals from the White River, Hylebos and Wapato Creeks and many tributaries to the Puyallup River. Nevertheless, flows in the Puyallup River have continued a long decline. Low flows can reduce the amount of habitat available for spawning and rearing, they can eliminate access to valuable habitats, they can dewater incubating eggs, they can affect the timing and success of both juvenile and adult migrations, they can reduce food sources by reducing invertebrate populations, and they can increase stressors by degrading water quality (increasing temperatures and reducing dissolved oxygen) (Steward & Associates, 2004).

Summary

The Puyallup River Basin (WRIA 10) includes the White, Puyallup, and Carbon Rivers, which have their origins in the glaciers of the northwestern slopes of Mt. Rainier. The Puyallup River Basin flows to Commencement Bay at the Port of Tacoma, the third largest port in the western U.S. The Puyallup Basin has been substantially altered from its historic condition and is currently contained within a revetment and levee system throughout its lower 26 miles.

From 2008, the Puyallup Basin has seen no overall improvement in its water quality and aquatic habitat conditions. The Pierce County Surface Water Health Report Card provides a system for rating and grading the health of Pierce County streams. The Surface Water Management Division uses multiple assessment methods to monitor surface water health over time. Data and associated grades can vary significantly from year to year, so collecting data over a long period is important. The average grade for Pierce County streams in water years 2008-2010 was "C" on a scale of A-F, with the water quality and aquatic habitat conditions considered "fair.” The Washington State Department of Ecology’s 303(d) list comprises those waters that are in the polluted water category for which beneficial uses – such as drinking, recreation, aquatic habitat, and industrial use – are impaired by pollution. Over 60 miles of stream in the Puyallup Basin are listed as "impaired waters" by the Washington State Department of Ecology. Since the mid-1990s, university scientists, water resource managers, and volunteers have used the multimetric B-IBI to evaluate the biological condition of Pacific Northwest streams with benthic macroinvertebrates. Of the 41 B-IBI biological integrity sampling sites in the Puyallup Basin, 19 had a rating of fair, while 22 (54%) had a rating of poor. Many of the streams in this basin suffer from combinations of high fecal coliform levels, low dissolved oxygen levels, temperature, and other water quality impacts.

The Puyallup River Basin (WRIA 10) had an estimated 2010 population of 419,660 in incorporated communities and unincorporated Pierce and King Counties. It includes the state's third largest city, Tacoma, with a 2010 population estimate of almost 200,000. Greater numbers of people in the region result in greater volumes of wastewater, more septic systems, and more sources of nutrients entering surface waters. The Puyallup River Basin saw an increase in impervious surface of 47% from 1986-2006. Increased population pressure and development, along with the conversion of forested areas to impervious surfaces, are the major factors affecting water quality in the region. Increased impervious surfaces (and stormwater loading from population increases) change watershed hydrologic and channel geomorphic characteristics significantly.

Of the 303 miles of known fish distribution in the Puyallup Basin, 48 miles are contained within a levee and revetment system. Channelization and levees have reduced river processes that form pools, side channels and other habitat features used by salmonids. Of these 48 miles, or 96 total miles (counting both sides of river), 36 are covered by US Army Corps of Engineers Disaster Operations Public Law 84-90 Flood Control and Coastal Emergency Act (PL 84-90). Once a levee segment falls under PL84-99 jurisdiction, any repair work or maintenance that is deemed emergency is exempt from consultation, temporal closures associated with fish windows, mitigation and compliance with WDFW's Integrated Streambank Protection Guidelines.

Since 1926, the Puyallup River stream flows have shown a continuous decline, especially during critical flow periods, despite the establishment of instream flows in 1980. The 1980 Ecology regulation prohibited all new surface water withdrawals from the White River, Hylebos and Wapato Creeks, and many tributaries to the Puyallup River. Nevertheless, flows in the Puyallup River have continued a long decline, mainly due to groundwater withdrawals and land-use changes. The Puyallup basin contains over

4,745 exempt wells and 120 miles of stream with low flow issues. Even though there has been above average precipitation since 1980, surface low flows have continued to drop.

Of the 36 miles of marine shorelines, about 7% are undeveloped and free or bulkheads, riprap, or other structures. Out of more than 5,900 acres of estuary habitats that historically existed at the head of Commencement Bay, only about 3% remain due to dredging, filling and activities associated with development. Nearshore and estuarine habitats provide food and refuge for juvenile salmon as they prepare for their journey to the ocean, but flood control projects, Port of Tacoma activities, and urbanization have resulted in severely degraded conditions and have significantly reduced the amount of functioning habitat. Contaminated sediments which have further limited the nearshore/estuarine habitat have resulted in additional reductions in Chinook production.

Some progress is being made in restoring and protecting habitat in the Puyallup Basin, however the pace of restoration and protection is slow. Unfortunately, the pace of implementation is limited by funding availability. The WRIA 10 and WRIA 12 combined allocation of both SRFB and PSAR funding has been between $2.0-3.0 million annually. The 10-year project list, with twenty projects throughout the watershed, had an estimated cost of $66.5 million (which did not include acquisition costs). Clearly, the average annual funding available is not sufficient to implement the project list within a 10-year timeframe.

Projects Completed in 2009:

- Hauff Property restoration
- Olympic View Triangle – Commencement Bay
- Maury Creek Fish Passage Project

Projects Funded in 2009:

- Calistoga Setback Levee (Acquisition and Design Phases)
- South Prairie Creek Japanese Knotweed Control – Phase 1 (RM 0-10)
- Setback Levees in and near City of Sumner Jurisdiction (White River - 24th
- Street; Puyallup River - Sumner Setback left bank) (Design Phase)
- Clearwater LWD Project (Construction Phase)
- Puyallup River Setback Levee at South Fork (RM 17.8-18.4) (Acquisition Phase)

New Projects on 2010 3-Year List:

- Sequalitchew Estuary Reconnection
- Narrows and Sequalitchew-Steilacoom Feeder Bluff Reconnection
- Salmon Creek Culvert Replacement
- Puget Creek Restoration Society – SYTI Program (Outreach and Education)

Updated Projects on 2010 3-Year List:

- Titlow Estuary Restoration
- Chambers Bay Estuarine and Riparian Enhancement
- Chambers Beach Reconstruction and Riparian Enhancement

(Data Source: Puyallup-White and Chambers-Clover Creek Watersheds (WRIA's 10 & 12) 2010 Three Year Work Program Update Narrative to Three-Year Project List)

Also visit Habitat Work Schedule at http://hws.ekosystem.us/ for additional information on restoration projects in WRIA 10.

Greater strides must be taken in managing water resources and improving water quality in concert with habitat restoration in the Puyallup Basin. New habitat projects must be wetted with adequate quantities of clean water. Resources need to be brought to bear on making sure this happens. Some age old problems remain: restoration of instream flows, enforcement of TMDLs (or other mechanisms in its place to improve water quality), absence of TMDLs for water quality parameters that adversely affect fish, absence of water resource management prescriptions in temperature TMDLs, and absence of continuous monitoring or monitoring for toxics/stormwater.

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State of Our Watersheds Report
Quillayute River Basin

Habitat projects are vital to restoring the salmon fishery. We have successfully partnered on projects in the past but we need many more into the future.

**– MEL MOON,
NATURAL RESOURCES DIRECTOR,
QUILEUTE TRIBE**

Quileute Tribe

The Quileute Tribe is located in LaPush, on the shores of the Pacific Ocean, where tribal members have lived and hunted for thousands of years.

Although the village of LaPush is only about 1 square mile, the tribe's original territory stretched along the shores of the Pacific from the glaciers of Mount Olympus to the rivers of rain forests.

Much has changed since those times, but Quileute elders remember the time when the people challenged *kwalla*, the mighty whale. They also tell the story of how the *bayak,* or raven, placed the sun in the sky.

Large Watershed Has Significant Subbasins

The Quileute Tribe's Area of Concern includes the northern portion of Water Resources Inventory Area (WRIA) 20, from Lake Ozette to the Goodman Creek Watershed.

The largest watershed within the Area of Concern is the Quillayute River with its four major subbasins: the Dickey, Sol Duc, Calawah and Bogachiel rivers. This part of the coastal region is a temperate rainforest with abundant waterfall with an annual rainfall that can reach 140 inches.

It is heavily forested with relatively low impervious cover from development and small population centers. The region's economy is primarily natural resource-based with commercial forestry, fisheries, tourism and agriculture the leading sectors.

Limiting factors for salmonid production identified within this watershed are:

- A significantly altered estuary and armored banks;
- Increased sedimentation and water flow;
- Reduced levels of large woody debris; and
- Loss of hydrologic maturity.

Despite these, the salmonids of the Quillayute Basin do not have Endangered Species Act status, and this may be attributed in part to extensive restoration over the past 15 years, as a result of four watershed analyses in the 1990s.

These federal/state/private timber-operated processes, which were part of the Timber/Fish/Wildlife program but ended with the Forests and Fish Act (when they became optional), accomplished several purposes.

They assessed fish status, channel conditions and sediment load factors; identified where timber harvest would pose risks to salmon and how to prevent or reduce these; and developed lists of restoration projects. They were the basis of the state's limiting factors analysis of 2000 for this WRIA. Perhaps equally important, as collaborative efforts between federal, state, private and tribal managers, they forged working relationships that still exist today, carrying over into new programs dealing with salmon habitat and management.

Quillayute Watershed Salmon Recovery Plan

The WRIA 20 Watershed Plan included many of the same parties as the WSAs, with the addition of interested members of the public. Adopted in 2008, it sought (as one part of four statutory goals regarding streams) to protect fish habitat by recommending compliance with existing riparian protection regulations and through public education.

The plan values the presence of stable salmon stocks, recognizes the need to protect commercial viable populations from pressure of reduced water supply and establishes the objective to improve the abundance of healthy stocks, as well as restore those stocks already experiencing reduced populations. The overarching habitat goal was to maintain the viability of anadromous salmonid runs in all streams in WRIA 20. The approach focuses on establishment of instream flow rules, basin hydrology, water quality and sediment transport, stream channel complexity, riparian areas, noxious weed control, fish passage and access. This group tried to include broad endorsement of water quality monitoring. However, that remains a subject for individual discussion with each landowner as to access.

Since 1999, Quileute has been a part of local Lead Entities (LE), a state program for salmon habitat restoration/recovery, first with North Olympic Peninsula LE, and when the west end was severed from it, the new North Pacific Coast LE, which began in 2007. Each year the LE updates its restoration strategy and prioritized project list, relying on participants for local information. For every year, the restoration strategy is to maintain and improve ecosystem productivity and genetic diversity for all WRIA 20 salmonid species, by protecting highly productive habitat and populations, and restoring impacted habitat and populations with the potential to recover. Progress toward these goals has lagged through limited available restoration funding and delays in regulation implementation. Both the Washington Department of Ecology and U.S. Environmental Protection Agency articulated the belief that implementation of the Forest Practice Rules under Forests and Fish Report should:

- Significantly advance forest practices in Washington state;
- Improve water quality in the short term; and
- Allow water quality standards to be met in the long term.

However, in 2011, full implementation of this regulatory package was delayed by the Washington State Forest Practices Board until 2021.

Culverts, Road Density Are Main Restoration Issues

Commercial forestry is the major economic activity within WRIA 20 and has a significant impact on forest cover within the Quileute Area of Concern.

Loss of forest cover can alter instream flow, increase sedimentation and reduce natural recruitment of material that sustains in-channel large woody debris.

Between 1998 and 2010, about 33% of the private forestland and 15% of the state-owned forestland were harvested. An estimated 35 square miles of forest cover was lost between 1996 and 2006. It is estimated that the 15% of forest cover removed in designated "non-forest" areas was permanently lost.

This places a greater reliance on the restoration of degraded riparian habitat and reintroduction of large woody debris in stream channels to achieve the Watershed Management Plan's goal of restoring properly functioning riparian processes.

Similarly, the road construction and density associated with commercial forestry can negatively affect fish habitat by increasing erosion and sediment loading, and by changing channel morphology.

If not properly constructed or maintained, culverts at road crossings can become fish barriers. It is estimated that culverts partially or fully block more than 168 miles of stream habitat in the Quileute Area of Concern, with a significant proportion of these barriers being privately owned culverts.

The West Fork and East Fork Dickey watersheds have the greatest number of these barrier culverts. In addition, stream health also is negatively affected by road density. Stream degradation occurs at a higher probability when forest road densities exceed 2 miles per square area. All basins within the Area of Concern are above this density level, except the South Fork Calawah.

Road maintenance and abandonment criteria have been developed to address these issues, but the deadline for compliance has been delayed until 2021, thereby allowing the continuation of these impacts for this time period.

Changes in watershed or basin hydrology and instream flow also may cause loss of fish habitat. The trend of increasing peak flows has been shown to make streams less productive. Peak flows for the Calawah River from 1975 to 2010 show an increasing trend, while the mean low flows show a decreasing trend. Both trends would indicate that salmon habitat and other aquatic ecosystem functions are not being protected. The ability of aquatic systems to provide adequate water for fish is critical for fish survival and productivity. Development of instream flow rules was identified as one goal of the WRIA 20 Watershed Management Plan. In anticipation of data needed for instream flow rules, the group identified streams in need of gauging and sought funding for them unsuccessfully, before state funding for the Watershed Program ended.

Eradication of Knotweed Takes Years of Effort

Quileute fisheries technician Archie Black sprays a specialized weed killer on knotweed in the Bogachiel River watershed as part of the tribe's multi-year effort to remove knotweed from the Quillayute River system.

Invasive knotweed control is a goal of the WRIA 20 Watershed Management Plan and its removal within the Quillayute Watershed was identified as a top priority salmon restoration project by the Quileute Tribe.

Invasive knotweed (*Polygonum spp*) species are non-native plants widely distributed in the riparian zone of the Quillayute Watershed. These plants are a problem because they are known to displace native species and alter riparian vegetative communities.

Through local partnerships and grant funding, Quileute Natural Resources largely has eradicated knotweed from the riparian zones of the Dickey, Calawah and Sol Duc drainages, while the removal from Bogachiel River and the Quillayute mainstem is ongoing.

Quileute fisheries technicians Beau Adamire (holding chinook) and Ruben Flores gather Sol Duc River summer chinook for the tribe's broodstocking program.

Looking Ahead

Current trends indicate that continued funding of habitat restoration activities is necessary to achieve the identified salmon restoration goals for WRIA 20. Upgrading of the regulatory framework that serves to protect salmon habitat must occur if the underlying assumption to all the recovery goals is to be realized: that existing habitat will be protected from loss. The current regulatory framework clearly has not provided adequate protection of the water quality, instream flow and riparian habitat within the Area of Concern.

Quileute Natural Resources continues to work with government and private partners on improvements to salmon habitat, most recently with Clallam County, revising its Shoreline Management Plan, and through ongoing TFW meetings and ID teams (forest practices) with the state.

Staff members continue to participate in the Lead Entity process and the Regional Recovery Process (a fusion of four coastal lead entities), developing strategies for recovery and participating in the grant process.

The greatest need is continued funding, since habitat restoration is an ongoing process (culvert, bridge and road maintenance as one example). Funding also is needed for staff programs to monitor, assess, and develop plans for needed restoration and/or protection.

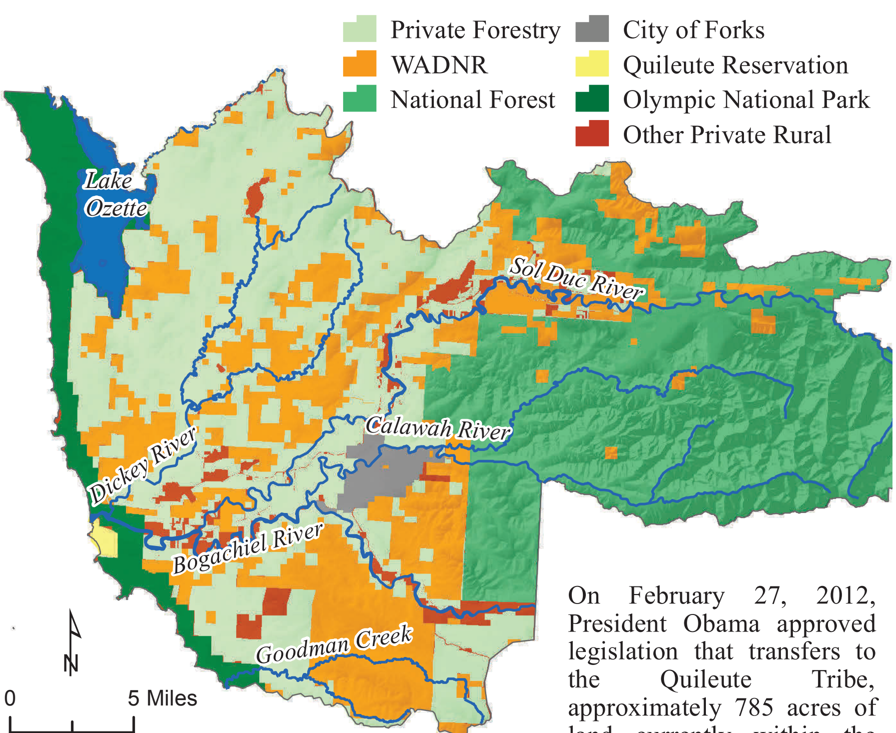
Water quality monitoring through federal and state programs is a vital part of salmon habitat protection and will need continued support as well.

For more information about the efforts of the Quileute Natural Resources program please visit *www.quileutenation.org/natural-resources*.

Quileute Tribe
(Lake Ozette, Quillayute, and Goodman Creek

The Quileute Tribe's Usual and Accustomed fishing area (U&A) includes the northern portion of WRIA 20, from Lake Ozette to the Goodman Creek watershed. The largest basin in the area is the Quillayute, with four major subbasins: the Dickey, Sol Duc, Calawah, and Bogachiel Rivers. The Quillayute River, a broad low gradient river, flows westerly from the confluence of the Sol Duc and Bogachiel rivers and enters the Pacific Ocean at LaPush. The Dickey River enters the Quillayute River near the mouth. A number of smaller independent streams, such as Cedar Creek and Goodman Creek, also drain into the Pacific Ocean.

Land Ownership and Use



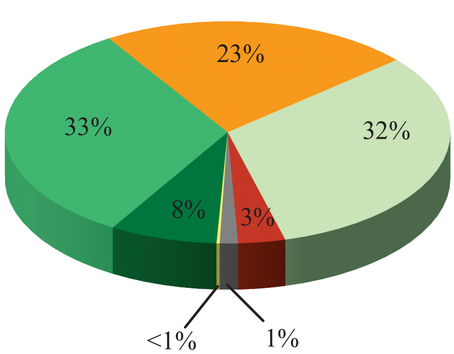
Data: Clallam County (2010);
Jefferson County (2009);
WSDOT (1998, 1999a, 1999b, 2010a, 2010b);
WADNR (2007, 2011)

On February 27, 2012, President Obama approved legislation that transfers to the Quileute Tribe, approximately 785 acres of land currently within the Olympic National Park. The new Reservation boundary is not shown on this map.

Stream flows in the area are generally provided by abundant rainfall, one of the highest in Washington State. A part of the basin lies in the Olympic National Park, which has been protected from timber harvest and other major human impacts, but those lands outside the Park, which include the US Forest Service, Washington Department of Natural Resources (WADNR), and private timberland, are subject to timber harvest. The area remains heavily forested with relatively low impervious cover.

The area supports Chinook, coho, sockeye, chum, and pink salmon as well as steelhead and cutthroat trout (McHenry et al. 1996, Smith 2000). Chum and pink salmon are infrequent and not managed by the Quileute Tribe (Roger Lien, Quileute Tribe).

Percent Land Ownership and Use

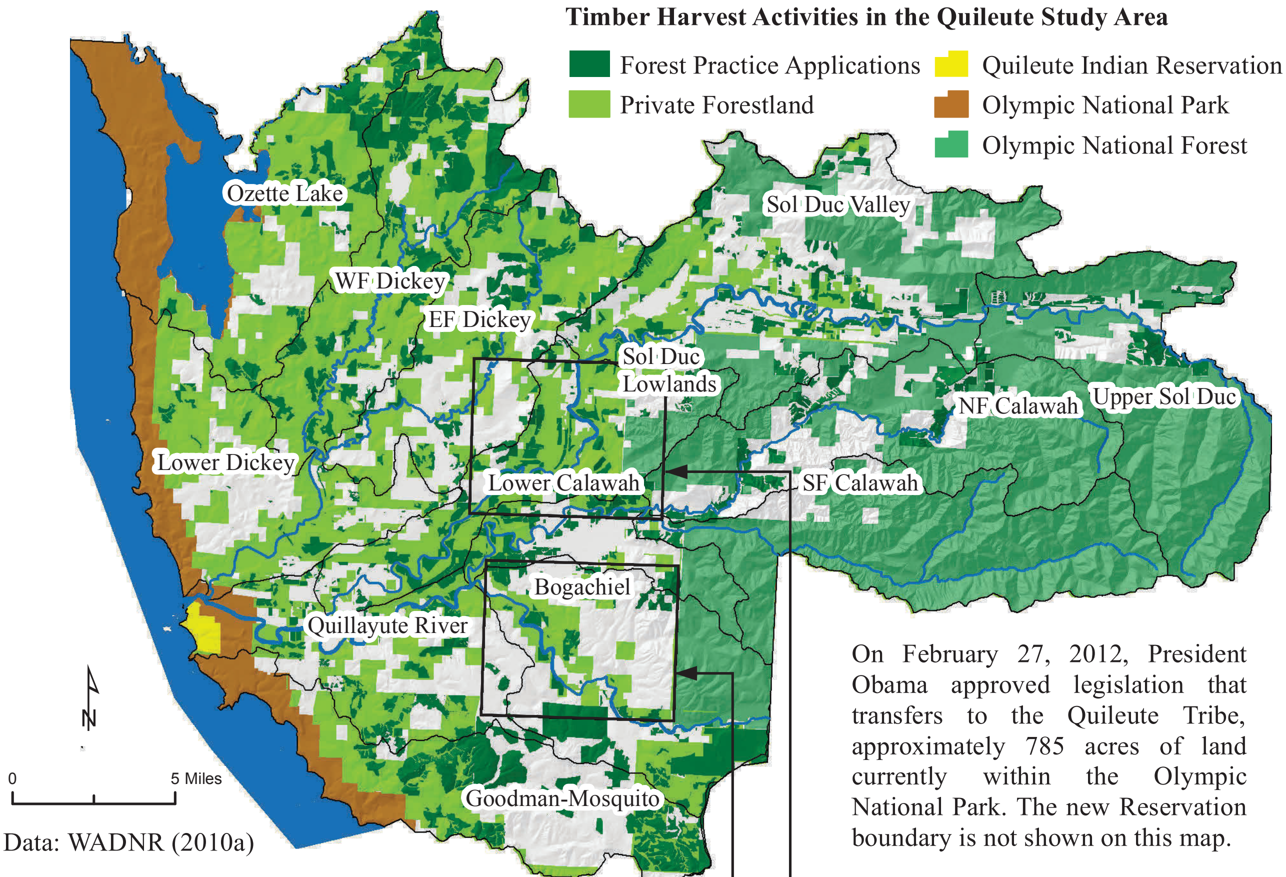


The Quileute Tribe has co-management responsibilities with the Makah Tribe in the Lake Ozette basin. With the Endangered Species Act listing of Lake Ozette sockeye as threatened in 1999, the National Marine Fisheries Service spearheaded a Steering Committee made up of co-managers and other stakeholders to develop a Recovery Plan (NOAA 2009). The plan has extensive discussions of limiting factors, threats, and recovery recommendations. This process was funded by the federal government. Very limited funding is available now for facilitation of an Implementation Steering Committee and for the present, recovery projects will need to be funded on an individual basis, largely by competitive grants.

Forest Practice Activities Impact Forest Cover

Between 1998 and 2010, about 33% of private forestlands in the area were harvested. Also, 15% of Washington state-owned forestlands were harvested during the same period. Vegetation removal is known to result in poor large woody debris and riparian conditions that may alter flow regimes in the basin.

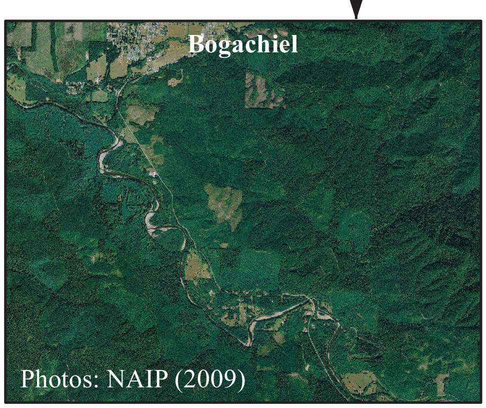
According to the WRIA 20 Watershed Plan and Detailed Implementation Plan (IB, 2010), the restoration of degraded riparian habitat and reintroduction of large woody material in stream channels are crucial to restore properly functioning river processes in the basin. The removal of vegetation from commercial timber harvesting has resulted in poor large woody material and riparian conditions in the Quileute Tribe's Management Area (Smith, 2000). Between 1998 and 2010, about 33% of private forestlands in the area were harvested. An additional 15% of state-owned forestlands were also harvested during the same period.



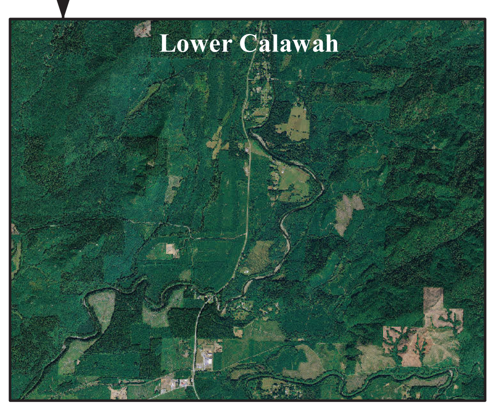
Data: WADNR (2010a)

On February 27, 2012, President Obama approved legislation that transfers to the Quileute Tribe, approximately 785 acres of land currently within the Olympic National Park. The new Reservation boundary is not shown on this map.

In the Bogachiel and Lower Calawah subbasins, about 45% and 41% of the private forestlands were harvested respectively from 1998 to 2010. Removal of vegetation alters the flow regime, a factor limiting salmon production in the basin (Smith, 2000).



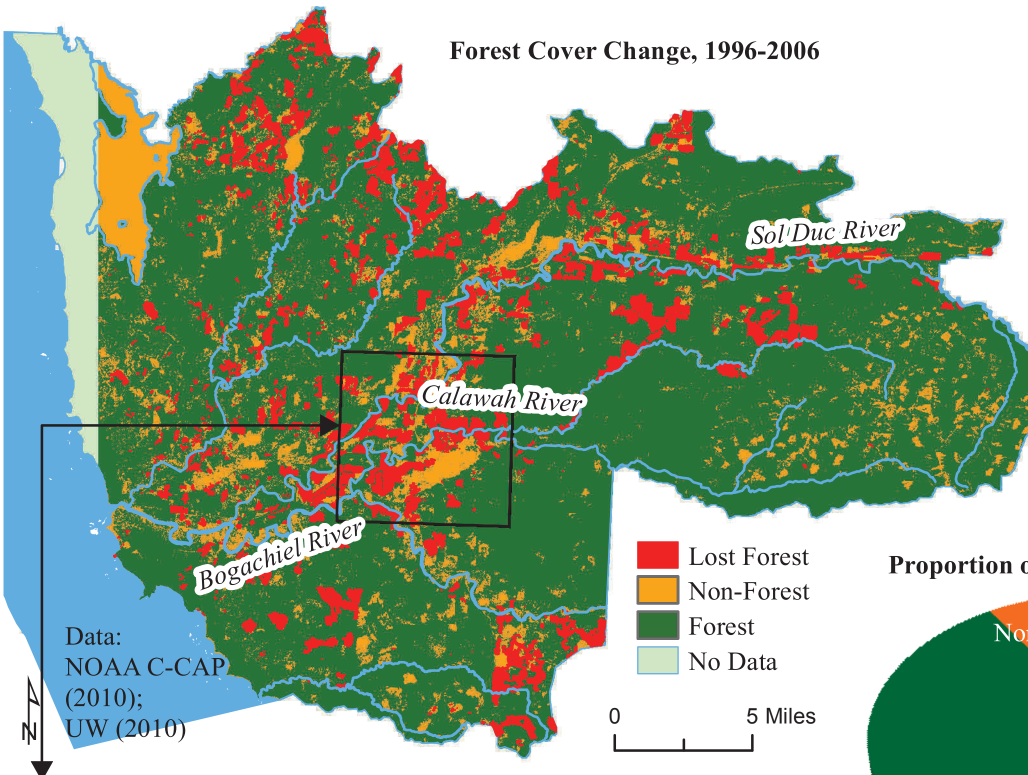
Photos: NAIP (2009)

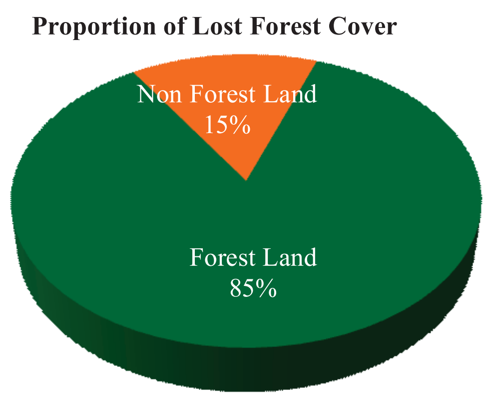


Loss of Forest Cover Impacting Fish Habitat

About 35 square miles of forest cover were lost in the Quillayute watershed in 10 years, from 1996 to 2006. It is estimated that 15% of that cover in designated "non-forest" areas is permanently lost. Some of the losses were in the riparian zones of major rivers and their tributaries, particularly the Calawah, Bogachiel and Sol Duc rivers.

An overarching goal of the WRIA 20 watershed plan "is the maintenance of forest cover to benefit fish habitat, water quantity and water quality and to provide additional ecosystem services such as carbon sequestration" (IB, 2010). Loss of forestland negatively impacts fish habitat and several detailed implementation plan actions aim to reduce the conversion of forestlands to non-forested uses.





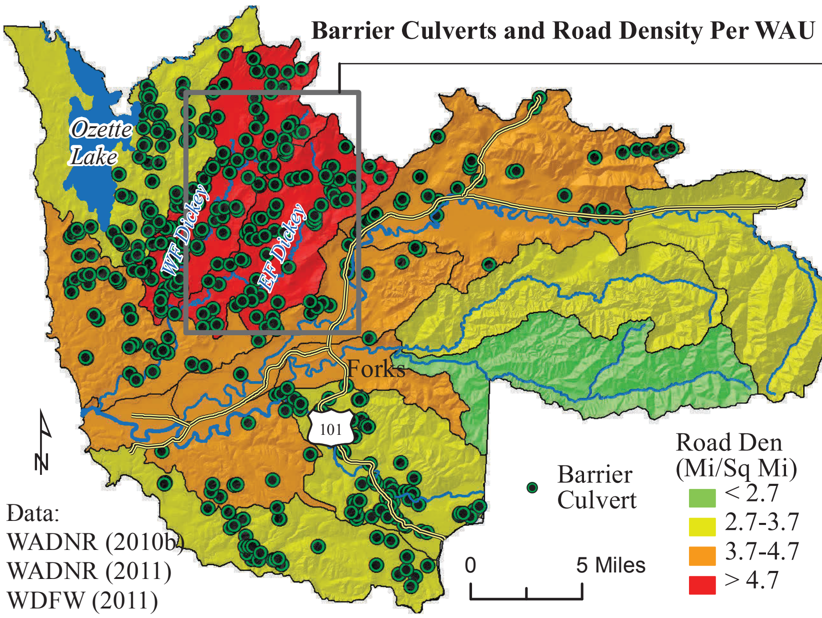
A total of 35 square miles of forest cover were lost in the Quillayute watershed in 10 years, between 1996 and 2006. About 85% of this is zoned as commercial forest. Although it is likely that this category will not be converted to other non-forest uses, it will take a while for any new forest to perform the same ecological functions as the old one. Another 15% lost is zoned for non-forestry uses. This loss of forest cover in the latter category is most probably permanent.

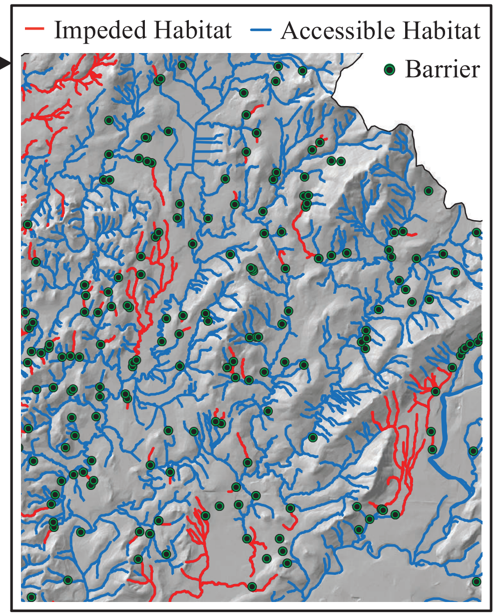
Some of the lost forest covers were in the riparian zones of major rivers and their tributaries, particularly the Calawah, Bogachiel, and Sol Duc rivers. As a result, the many benefits of riparian plants to the entire watershed, including supply of large woody material, loss of bank stability, and stream shading, could be lost. The resulting riparian area degradation may negatively impact fish habitat.

Impact of Roads on Fish Habitat

Barrier culverts, a significant proportion of which are on private forestlands, partially or fully block over 168 miles of stream habitat in the Quileute Management Area. Forest road densities and road crossings at many watersheds were at levels that indicate a significant impact on stream health.

Forest practices result in the construction of roads which can affect fish habitats by increasing erosion and sediment loading, and changing channel morphology. If not properly constructed or maintained, culverts at road crossings may become fish barriers. The WRIA 20 Detailed Implementation Plan recommends restoring fish populations by working to remove fish passage barriers (IB, 2010).

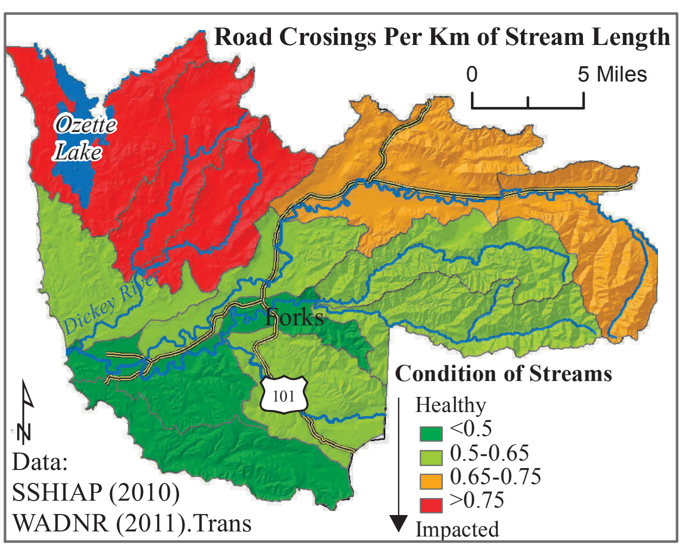




Road densities were also highest in the West Fork and East Fork Dickey watersheds, the result of the high network of roads built for timber harvesting. Stream degradation occurs at a higher probability when forest road densities exceed two miles per square mile of area (NOAA, 1996). All the Watershed Administrative Units in this study area had road densities above that number.

Also, barrier culverts partially or fully block over 168 miles of stream habitat, a significant proportion of which is impeded by culverts on privately owned forestlands.

Barrier Culvert
Photo: Frank Geyer



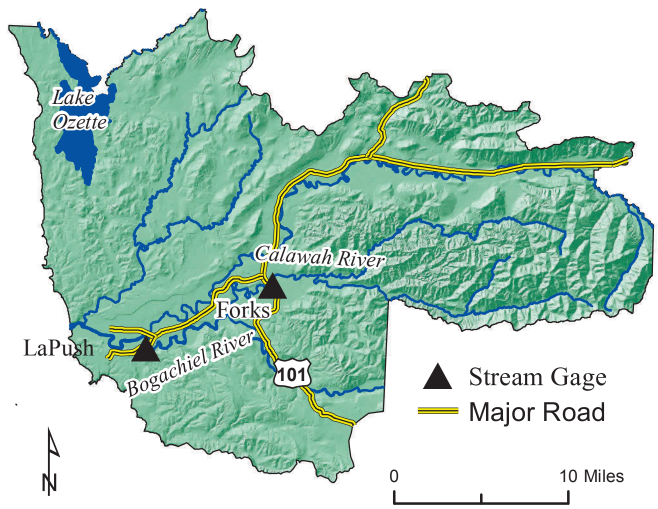
The West Fork and East Fork Dickey watersheds had the greatest number of barrier culverts in the entire basin. Barrier culverts block access to suitable habitat, and less habitat results in less fish production.

The Dickey and Ozette Lake watersheds had the highest road crossings per kilometer of stream length, with values that indicate an impact on stream hydrology and fish habitat. When averages exceed two road crossings per kilometer of stream length, stream health has a significantly higher probability of being degraded (Alberti et al, 2007).

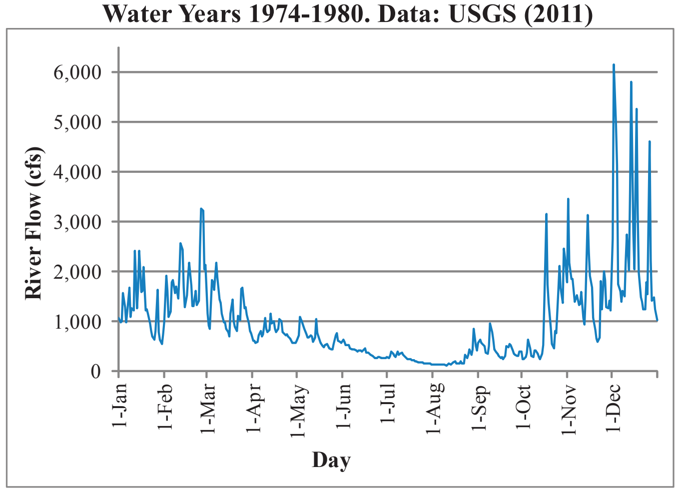
Stream Flow Trends May Cause Loss of Habitat

Between 1975 and 2010, peak flows for the Calawah River showed an increasing trend while the mean low flows showed a decreasing trend. Both trends indicate that salmon habitat and other aquatic ecosystem functions may not be receiving adequate protection. The ability of aquatic systems to provide adequate water for fish is critical for fish survival and productivity.

The variation in stream flow timing and magnitude shown for the Bogachiel River is typical for streams in this basin with peak flows in the winter months and low flows in the summer months. The ability of these systems to provide adequate water for fish is critical for fish survival and productivity. Protection of instream flows is a key goal of the WRIA 20 Watershed Plan (Golder Associates, 2009).

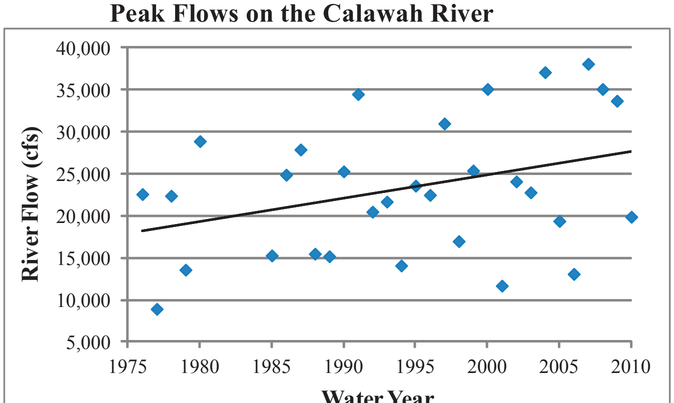


Daily Mean Flows for Bogachiel River Water Years 1974-1980. Data: USGS (2011)



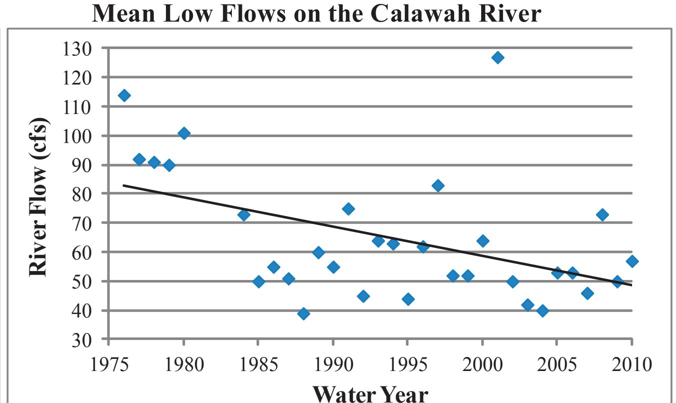
The peak flows for the Calawah River from 1975 to 2010 show an increasing trend while the mean low flows show a decreasing trend, a scenario predicted to occur as a result of climate change (Mantua et al, 2009). Both trends would indicate that salmon habitat and other aquatic ecosystem functions are not being protected. Increased peak flows may be the result of removal of vegetation (Beschta et al, 1995; Hicks et al, 1991). They cause the scoring of streambeds, channel incision (and subsequent disconnection from floodplain), and downstream transport of wood, resulting in simplified stream channels and greater instability. The trend of increasing peak flows has been shown to make streams less productive (Beamer and Pess, 1999). Many studies in the Pacific Northwest (Quinn and Peterson, 1996; Mathews and Olson, 1980; Hartman and Scrivener, 1990) have documented the relationship between low stream flows and poor salmonid survival. Loss of stream flow results in loss of habitat.

Peak Flows on the Calawah River



Data: USGS 2011

Mean Low Flows on the Calawah River

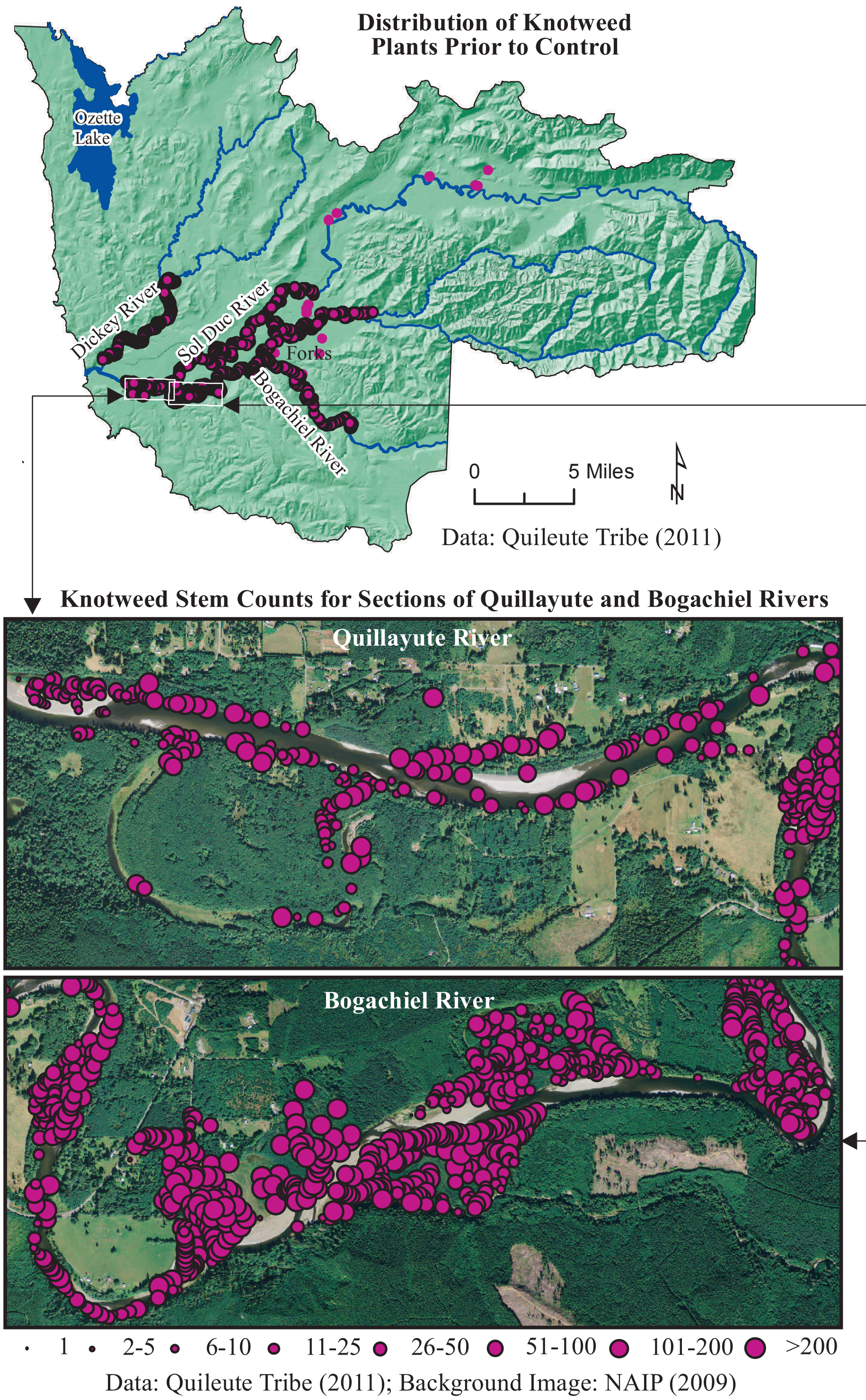


Data: USGS 2011

Invasive Knotweed Control

Invasive knotweed plants have been successfully removed in the riparian zones of the Dickey, Calawah, and Sol Duc drainages. Removal in the Bogachiel drainage is largely complete. Their removal from the Quillayute watershed was listed as a "Top Priority" salmon restoration project by the Quileute Tribe.

Invasive knotweed *(Polygonum spp)* species are non-native plants widely distributed in the riparian zone of the Quillayute watershed (Hunter, 2006).



Quileute staff treating knotweed patch
Photo: Frank Geyer, Quileute Tribe

These plants are known to displace native species and alter riparian vegetative communities (Urgenson et al, 2009). They can cause long-term changes to the structure and functioning of the riparian forests, thus negatively impacting watershed health and adjacent fish habitat.

The Quileute knotweed eradication program has resulted in the successful removal of these plants in the Dickey system (Hunter, 2006). The Calawah and Sol Duc drainage eradication was completed in 2010 (Frank Geyer, Quileute Tribe, personal communication). The Bogachiel drainage eradication, started in 2008, is largely complete. The Quileute Tribe continues to monitor these systems for re-infestation.

Summary

The Quileute Tribe's Management Area is in the northern portion of WRIA 20, from Lake Ozette to the Goodman Creek Watershed, and includes the entire Quillayute River Basin. The area supports Chinook, coho, sockeye, chum, and pink salmon as well as steelhead and cutthroat trout, but chum and pink salmon are infrequent and not managed by the Quileute Tribe (Roger Lien, Quileute Tribe). The Quileute Tribe has co-management responsibilities with the Makah Tribe in the Lake Ozette basin. The Lake Ozette sockeye is listed as "threatened" under the Endangered Species Act. The National Marine Fisheries Service spearheaded a Steering Committee made up of co-managers and other stakeholders to develop a Recovery Plan (NOAA 2009).

The area is heavily forested with relatively low, impervious cover. A part of the basin lies in the Olympic National Park, which has been protected from timber harvest and other major human impacts, but those lands outside the Park, which include the US Forest Service, Washington Department of Natural Resources (WDNR), and private timberland, are subject to timber harvest. About 88% of the basin is managed for forestry. Its economy is a natural resource based one that relies greatly on fisheries, commercial forestry, agriculture, hunting, and tourism. These activities, in turn, can be impacted by the condition of its watersheds and surrounding forestlands.

Commercial timber harvest is a major activity in the Quillayute basin. Between 1998 and 2010, about 33% of private forestlands in the area were harvested. Also, 15% of Washington state-owned forestlands were harvested during the same period. The removal of vegetation through commercial timber harvesting has resulted in poor large woody debris and riparian conditions in this area (Smith 2000).

Forest practices result in the construction of roads, many of which have culverts at river crossings. Barrier culverts, a significant proportion of which are on private forestlands, partially or fully block over 168 miles of stream habitat in the Quileute Management Area. Forest road densities as well as road crossings at many watersheds were at levels that indicate a significant impact on stream health and could degrade fish habitat.

About 35 square miles of forest cover were lost in the Quillayute watershed in 10 years, from 1996 to 2006. It is estimated that 15% of that cover, zoned for non-forestry uses, is permanently lost. Some of the losses were in the riparian zones of major rivers and their tributaries particularly the Calawah, Bogachiel and Sol Duc rivers. An overarching goal of the WRIA 20 watershed plan "is the maintenance of forest cover to benefit fish habitat, water quantity and water quality and to provide additional ecosystem services such as carbon sequestration" (IB 2010). Loss of forestland negatively impacts the ways streams provide habitat for fish.

Between 1975 and 2010, peak flows for the river for which data was available, the Calawah River showed an increasing trend while the mean low flows showed a decreasing trend, a scenario predicted to occur due to climate change (Mantua et al. 2009). Both trends indicate that salmon habitat and other aquatic ecosystem functions may not be receiving adequate protection.

The ability of aquatic systems to provide adequate water for fish is critical for fish survival and productivity. The trend of increasing peak flows has been shown to make steams less productive (Beamer and Pess 1999) while other studies (Quinn and Peterson 1996; Mathews and Olson 1980; Hartman and Scrivener 1990) have documented the relationship between low stream flows and poor salmonid survival.

Invasive knotweed species, non-native plants widely distributed in the riparian zone of the Quillayute watershed, have been successfully removed in the riparian zones of the Dickey, Calawah and Sol Duc drainages. Removal in the Bogachiel drainage is largely complete. Their removal from the Quillayute watershed was listed as a “Top Priority” salmon restoration project by the Quileute Tribe. The Tribe continues to monitor these systems for re-infestation.

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State of Our Watersheds Report
Chehalis River Basin

Habitat – if we can't get the fish back with habitat, we've got a problem. People are going to have to sacrifice to get restoration, and that requires internal cooperation right now. There aren't going to be any quick fixes.

–GUY MCMINDS, QUINAULT INDIAN NATION

Quinault Indian Nation

The Quinault Indian Nation (QIN) consists of the Quinault and Queets tribes and descendants of five other coastal tribes: Quileute, Hoh, Chehalis, Chinook and Cowlitz.

Quinault ancestors lived on a major physical and cultural dividing line. Beaches to the south are wide and sandy, while to the north, they are rugged and cliff-lined. Quinault people shared in the cultures of the people to the south as well as those to the north.

Living in family groups in longhouses up and down the river, they were sustained by the land and by trade with neighboring tribes. Salmon runs, abundant sea mammals, wildlife and forests provided substantial material and spiritual wealth.

A great store of knowledge about plants and their uses helped provide for the people. The western red cedar, the "tree of life," provided logs for canoes, bark for clothing, split boards for houses and more. The Quinault are the Canoe People, the people of the cedar tree.

Tribal headquarters are located in Taholah, Wash.

Second Largest River Basin, Mostly Forested

The Chehalis River basin is one of the largest within the state of Washington. The river originates in the northern portion of the Willapa Hills where it flows in a generally northwesterly direction through a gradually broadening valley with moderate to low gradient into the Pacific Ocean at Grays Harbor.

The land use is divided as follows:

- More than 81% of the basin is forestland primarily owned by private timber companies and small forestland owners;
- Residential housing development (7%);
- Undeveloped land and open areas (7%); and
- Agriculture (5%) makes up the remainder of the land within the basin.

The system supports chinook, chum and coho salmon, steelhead and cutthroat trout, as well as char. Bull trout were listed as "threatened" under the federal Endangered Species Act in 1999. Their foraging presence is known in parts of the basin, but it is unlikely the species spawns within the basin.

Coho salmon especially rely on access to smaller tributary streams that are often blocked by failing or inadequate culverts.

Habitat Restoration Plan Seeks to Undo Damage

The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for Water Resource Inventory Area (WRIA) 22 and 23 follows the statewide vision for salmon recovery: restore salmon, steelhead and trout populations to healthy and harvestable levels, and improve the habitat on which fish rely.

Analysis of limiting factors within the watershed found that human activity has degraded or eliminated aquatic habitat by altering many of the key natural stream processes that support salmonids.

The identified limiting factors include:

- Channel incision;
- Sedimentation;
- Riparian loss or conversion;
- Loss of large woody material;
- Reduced channel complexity;
- Water quality problems; and
- Reductions in stream flow.

The approach adopted for the Chehalis basin is to address the most pressing limiting factors identified within individual subbasins of WRIAs 22 and 23 through the pursuit of seven guiding strategies:

1. Attain a healthy and diverse population of wild salmonids;
2. Restore, enhance and protect the Grays Harbor estuary;
3. Restore and preserve properly functioning riparian areas;
4. Restore habitat access;
5. Restore properly functioning hydrology;
6. Restore floodplain and stream channel function; and
7. Prioritize habitat projects and activities within subbasins that provide the highest benefit to priority stocks.

Forest Roads, Deforestation, Culverts Threaten Fish

Insufficient time has elapsed since the development of the Chehalis Basin Salmon Habitat Restoration Strategy for WRIA 22 and 23 to assess the progress toward the goals and objectives of this habitat recovery strategy. Only general conditions and trends can be highlighted.

However, when we compare the magnitude of salmon habitat loss and degradation in the system with the type and scope of restoration projects being planned and funded, there is little reason for optimism that current trends of habitat loss and degradation can even be curbed, let alone reversed.

Land use in the Chehalis basin is still dominated by forestry, but loss of vegetation cover has been occurring in the basin with continued loss of lowland forest cover. This trend affects the ecological processes that create and maintain fish habitat by increasing peak flow and water yield from a watershed, increasing sediment supply, reducing wood recruitment, decreasing water quality and raising water temperature.

Between 1996 and 2006, more than 113 square miles, or about 6.6%, of forest cover was lost mainly from conversion to agriculture and urbanization use. Many watersheds within the basin are trending toward moderate to worse forest conditions. The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy acknowledged this trend and seeks to focus restoration work to reverse this degradation.

Road densities and crossings are impacting streams within the Chehalis basin by increasing erosion rates and potentially reducing stream productivity. The proper functioning of salmon-bearing streams may be at risk when road densities exceed 2 miles of road per square mile of area. The majority of watersheds within the Chehalis basin have road densities that exceed 3 miles of road per square mile of area, a level where salmon-bearing streams could cease to function.

Some watersheds also have road crossings at or approaching levels at which they negatively impact stream conditions. The 2010 Restoration and Preservation Strategy calls for a reduction of sediment loading by reducing road density.

Analysis has shown that barrier culverts in the Chehalis basin are negatively impacting habitat by blocking or impeding access to more than 1,500 miles of anadromous salmon upstream habitat. Washington state law requires most land owners to have a Road Maintenance and Abandonment Plan (RMAP), a schedule for any repair work needed to address aquatic habitat and fish passage issues. Data from Washington Department of Natural Resources indicate that only 46% of the RMAP projects at forest road river crossings in need of repair or upgrades have been completed according to schedule. This leaves the majority of the identified barrier culverts within the Chehalis basin still awaiting replacement.

Solutions to fish-passage barriers, such as the box culvert pictured, need to be replicated many times over in the Chehalis basin if salmon numbers are to improve.

Increased Number of Exempt Wells Threaten Basin

The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy identified low summer flows in some subbasins as a concern. Several streams in the Chehalis basin, including Scatter Creek as well as Black, Skookumchuck and Newaukum rivers, are closed to further consumptive appropriations.

Still, between 1980 and 2010, there was an increase of more than 460% in the number of permit-exempt wells in the basin. These are largely concentrated in the Black River, Scatter Creek, Lower Skookumchuck and Newaukum subbasins.

Research has found a dynamic interaction between ground and surface water in the basin. The impact of wells is expected to be greater in those areas where stream flow already does not meet regulatory minimums. Summer low flow conditions lead to higher water temperature, which negatively impact salmon stocks.

Quinault tribal member and fisheries technician John Bryson Jr. marks a steelhead redd during salmon spawning surveys. If conditions are to improve for salmon in the Chehalis watershed, land-use regulation reform will be needed along with continued funding for habitat restoration activities.

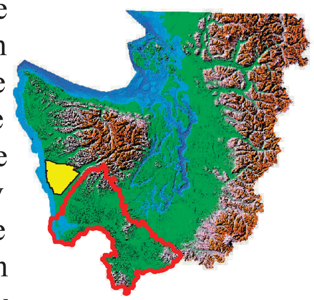
Looking Ahead

Pressure from population growth, agricultural practices and timberland use within the Chehalis River basin will continue to present challenges to salmon conservation and recovery efforts. Land-use management and forest practice regulations continue to allow the further degradation of floodplain and riparian habitat throughout the watershed.

Current trends indicate that land-use regulation reform is required and continued funding of habitat restoration activities is necessary in order to achieve salmon recovery goals. The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23 relies almost exclusively on restoration to address limiting factors within the basin.

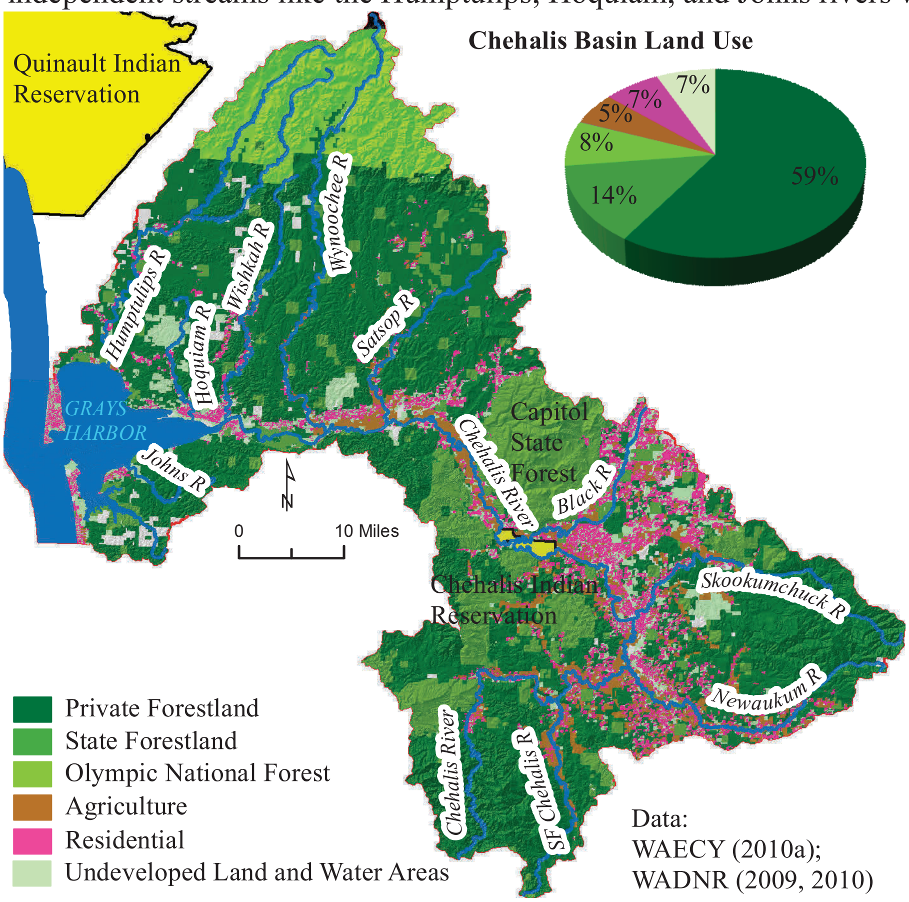
However, we are still witnessing the continued loss and fragmentation of habitat through barrier culverts, high road densities and crossing, forest cover removal and exempt wells. The lack of progress on the protection of existing habitat remains the biggest impediment to salmon recovery.

Quinault Indian Nation - The Chehalis River Basin



The Quinault Indian Nation conducts treaty-reserved fisheries on many of the rivers, streams and beaches of WRIAs 21, 22 and 23. While the watersheds in WRIA 21 have their issues, the focus of this report is WRIAs 22 and 23, the Chehalis River Basin. This basin is the largest in the state of Washington outside the Columbia River Basin. The mainstem Chehalis River is formed by the confluence of the East and West Forks at approximately river mile 118 (Phinney and Bucknell 1975). The river originates in the Willapa Hills region near the town of Pe Ell, from where it flows in a generally northwesterly direction through a gradually broadening valley with moderate to low gradient (Phinney and Bucknell 1975; Weyerhaeuser 1994) into the Pacific Ocean at Grays Harbor.

The Lower Chehalis (WRIA 22) is comprised mainly of the lower portion of the Chehalis River drainage, major tributaries like the Wishkah, Wynoochee and Satsop rivers as well as a number of independent streams like the Humptulips, Hoquiam, and Johns rivers which drain into Grays Harbor.



The Upper Chehalis (WRIA 23) includes the upper reaches of the Chehalis River drainage and a number of major tributaries such as the South Fork Chehalis, Newaukum, Black and Skookumchuck rivers. Although the upper and lower basins are separated for management purposes, the watershed processes in each basin are intimately linked.

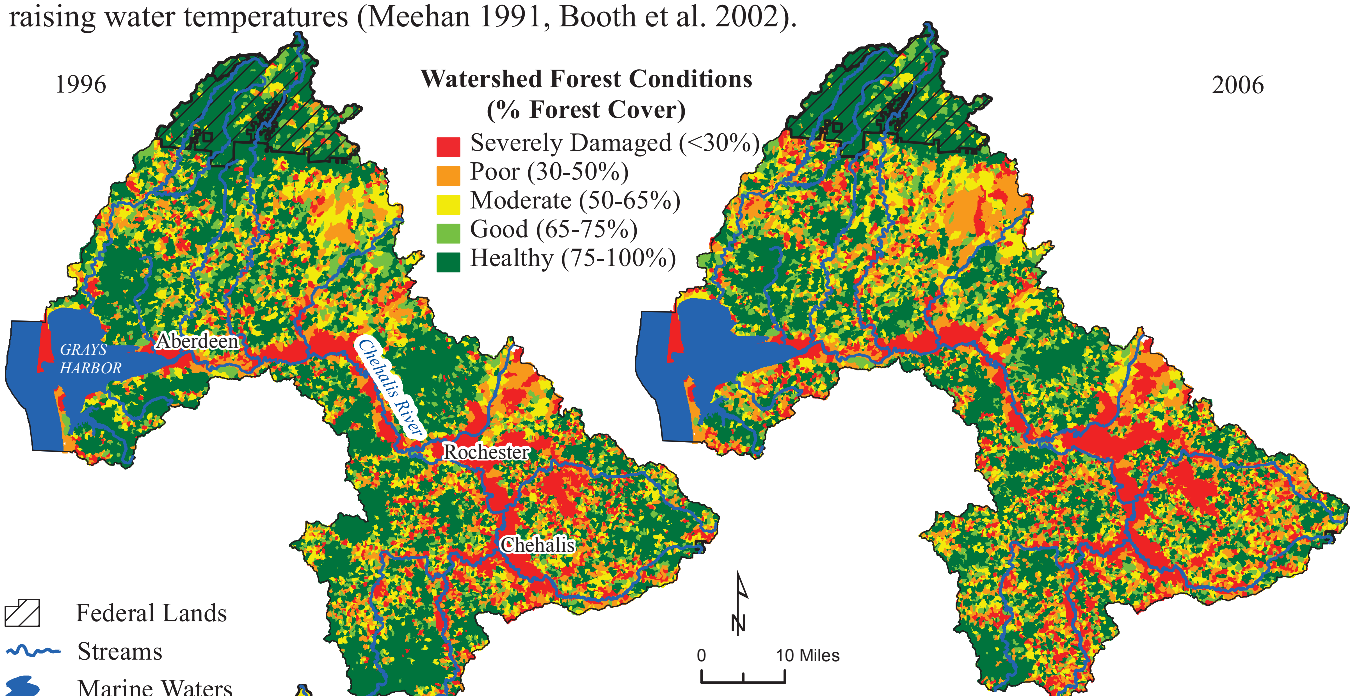
Over 81% of the basin is forestland primarily owned by private timber companies and small forestland owners. The Washington State and US governments also own large pieces of forestland particularly in the Capitol State Forest and Olympic National Forest respectively. Residential housing development (7%), undeveloped land and open areas (7%), and agriculture (5%), make up the reminder of the land within the basin.

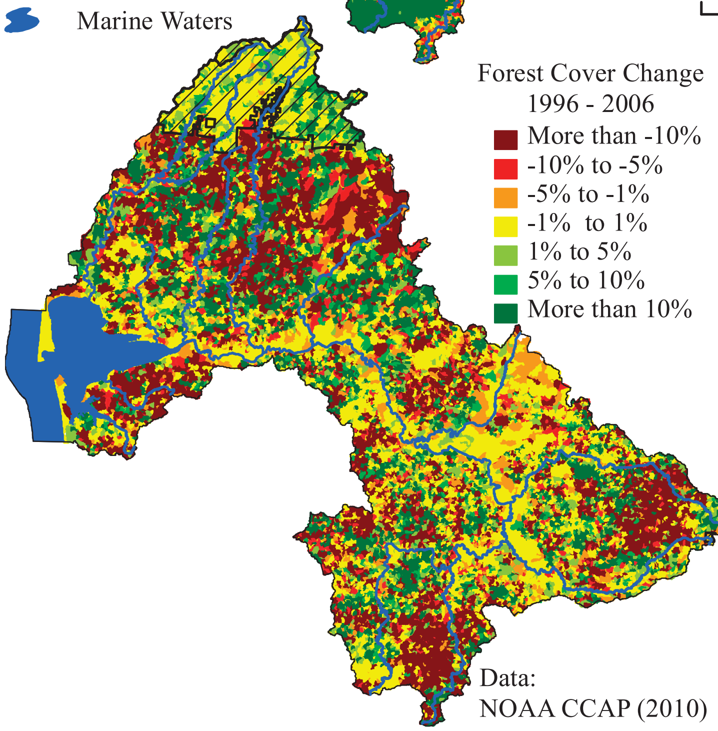
The Chehalis River Basin supports chinook, chum, and coho salmon, as well as steelhead and cutthroat trout (Smith and Wenger 2001). Although salmonids in the basin have fared better than in Puget Sound (CBP 2010), several habitat factors limit salmonid production in the basin. These include channel incision, sedimentation, riparian loss or conversion, loss of large woody material, reduced channel complexity, water quality problems, and reduction in stream flow (Smith and Wenger 2001). Most of these problems are caused and or exacerbated by human activity. The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy (CBP 2010) includes specific action plans for addressing some of these limiting factors.

Lowland Forest Cover Loss Continues

Between 1996 and 2006, over 113 square miles or about 6.6% of its forest cover was lost in the Chehalis basin mainly from conversion to agriculture and urbanization use. And many watersheds are trending towards moderate or worse forest conditions. A plan of the Chehalis Basin Habitat Restoration and Preservation Strategy (2010 Update) is to reverse this trend, and restore and preserve properly functioning riparian areas.

Land use in the Chehalis basin is still dominated by forestry, but loss of vegetation cover, which in turn affects the ecological processes that create and maintain fish habitat, has been occurring in the basin. In the decade from 1996 to 2006, about 6.6% of its forest cover (over 113 square miles) was lost. A decrease in forest cover negatively alters salmon habitat by increasing peak flow and water yield from a watershed, increasing sediment supply, reducing wood recruitment, decreasing water quality, and raising water temperatures (Meehan 1991, Booth et al. 2002).





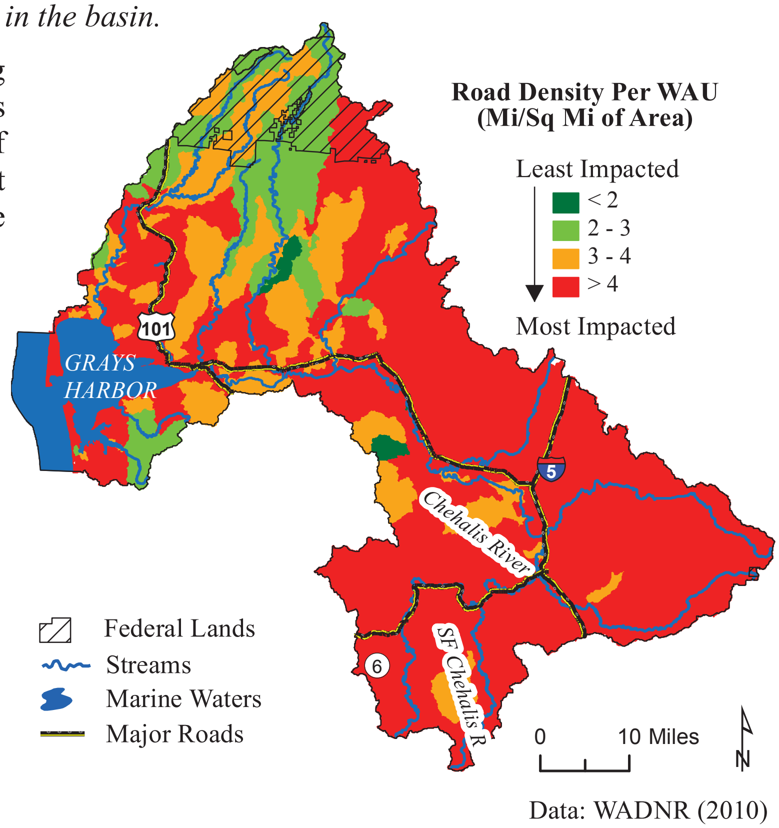
Many Chehalis basin watersheds are trending towards moderate or worse forest conditions. Notable exceptions are those watersheds in the National Forest and National Park. This makes it critical to protect and preserve those watersheds with good or better forest conditions. Smith and Wenger (2001) identified the extensive loss of riparian vegetation (coupled with the conversion of conifer to hardwoods) mainly from agriculture and urbanization as a factor limiting the production of salmonids in the basin. The Chehalis Basin Habitat Restoration and Preservation Strategy (CBP 2010) adopted the restoration and preservation of properly functioning riparian areas as an important strategy for addressing this limiting factor.

Road Densities and Crossings Impact Streams

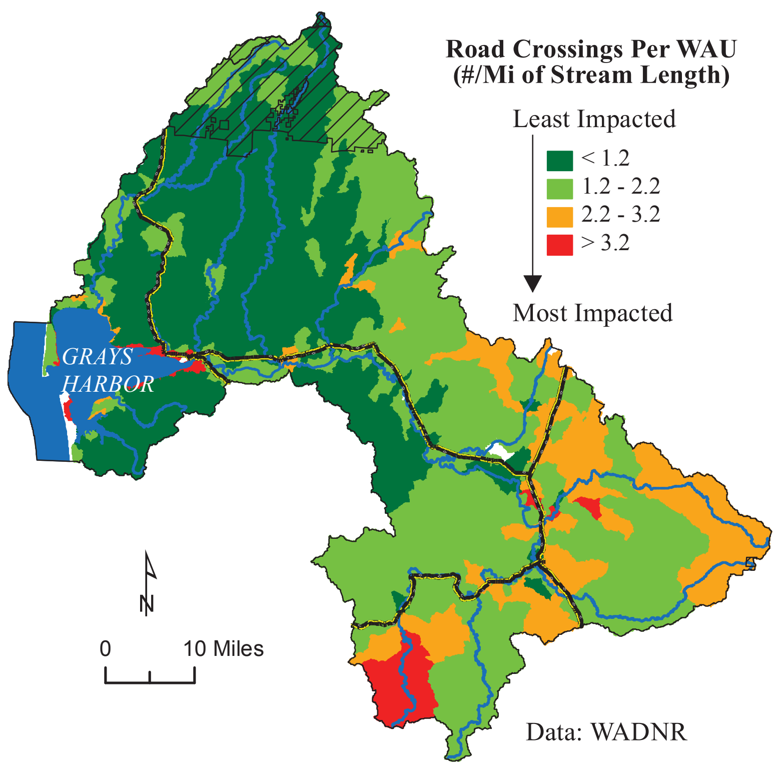
A vast majority of watershed units in the Chehalis basin have road densities that exceed three miles of road per square mile of area, the level at which streams cease to function properly. Some units also have road crossings at or approaching levels at which they negatively impact stream conditions. The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy (2010 Update) calls for a reduction of sediment loading by reducing road densities in the basin.

The proper functioning of salmon-bearing streams may be at risk when road densities exceed two miles of road per square mile of area and cease to function properly at densities over three miles per square mile (NOAA 1996).

South Fork Chehalis Bridge Construction
Photo: Washington State Dept of Transportation



A vast majority of watersheds in the Chehalis basin have road densities that exceed this value. Streams have also been shown to approach poor biological conditions when exceeding two crossings per kilometer (3.2 crossings per mile) of stream length (Alberti et al. 2007). For now, most watersheds in this basin have crossings below this value.



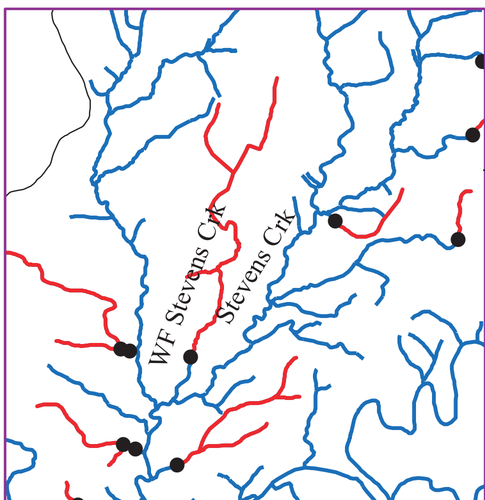
Roads bring about increased erosion rates in watersheds (Beschta 1978), leading to mass wasting and sediment delivery to streams. Elevated fine sediment levels, identified as a limiting factor by the Chehalis Basin Salmon Habitat Restoration and Preservation Strategy (CBP 2010), decrease the quality of spawning gravels. Cederholm et al. (1981) found increased sediments in salmonid spawning gravels when roads exceeded 3% of the total basin area. The Chehalis Basin Plan calls for the reduction of sediment loading by reducing road densities.

Man-made Structures Remain Barriers to Salmon Habitat

Barrier culverts in the Chehalis basin are negatively impacting habitat by blocking or impeding access to over 1,500 miles of anadromous salmon upstream habitat. And only about 46% of structures at forest road crossings in need of repairs or upgrades have been completed according to schedule. The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy (2010 Update) identified the replacing of dysfunctional culverts as a very high priority.

Approximately 1,100 inventoried barrier culverts in the Chehalis basin are blocking or impeding access to over 1,500 miles of anadromous salmon upstream habitat. This is most likely an underestimation since the data does not represent a complete inventory of fish passage barriers. The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy (CBP 2010) identified the replacing of dysfunctional culverts as a very high priority because they eliminate access by wild salmonids to prime and pristine habitat.

In one example, a barrier culvert on West Fork Stevens Creek, which joins Stevens Creek, a tributary to the Humptulips River, blocks access to over 4 miles of stream habitat that could benefit coho stocks.



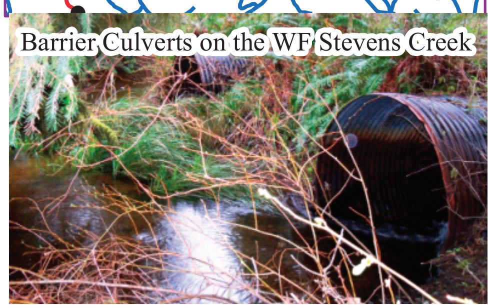
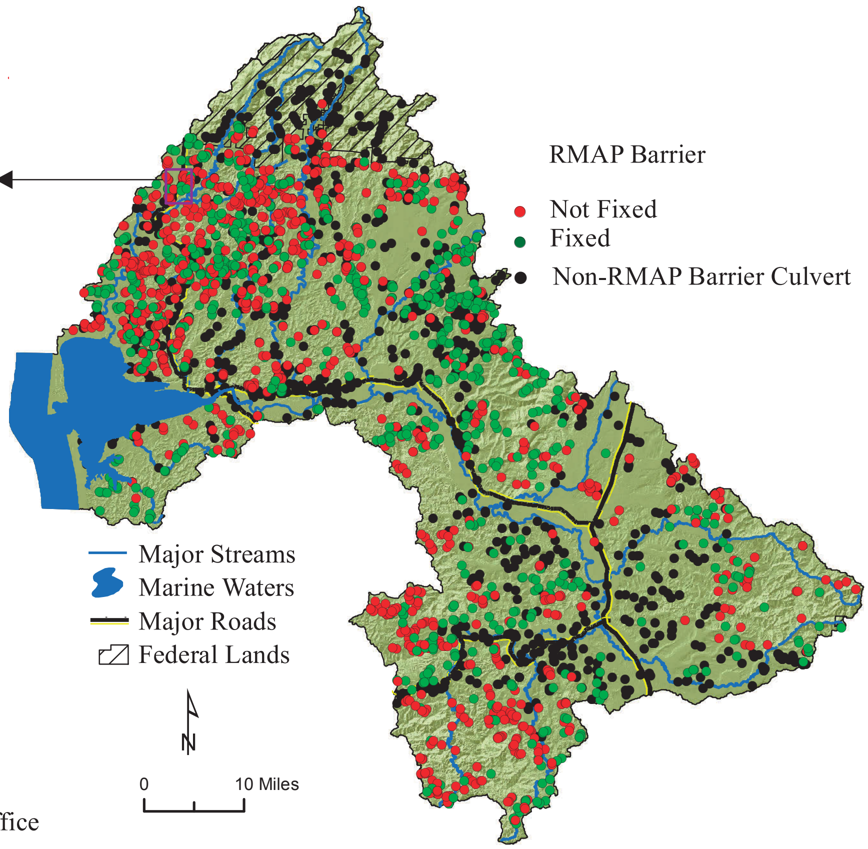
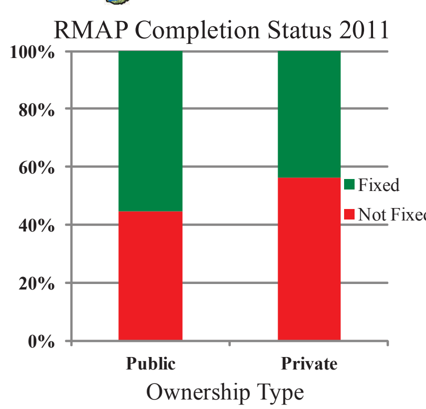


Photo: WA Recreation and Conservation Office



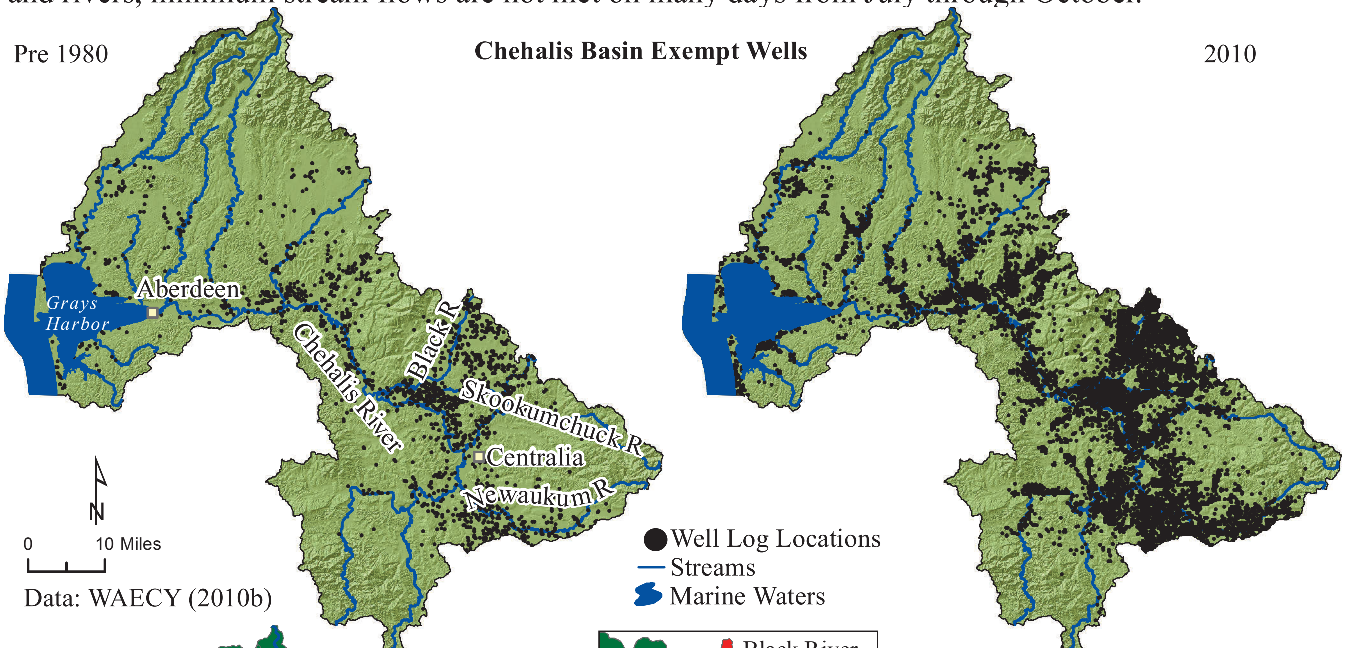
To minimize the effects of forest roads on fish habitat, Washington State law requires most forest landowners to have a Road Maintenance and Abandonment Plan (RMAP), a schedule for any repair work needed to address aquatic habitat and fish passage issues. Data from WADNR shows that 56% of RMAPs on privately owned property within the Chehalis basin are yet to be fixed compared to 45% on publicly owned property. Overall, 46% of RMAP projects within the basin have been completed according to the schedule, while 54% have not been completed.

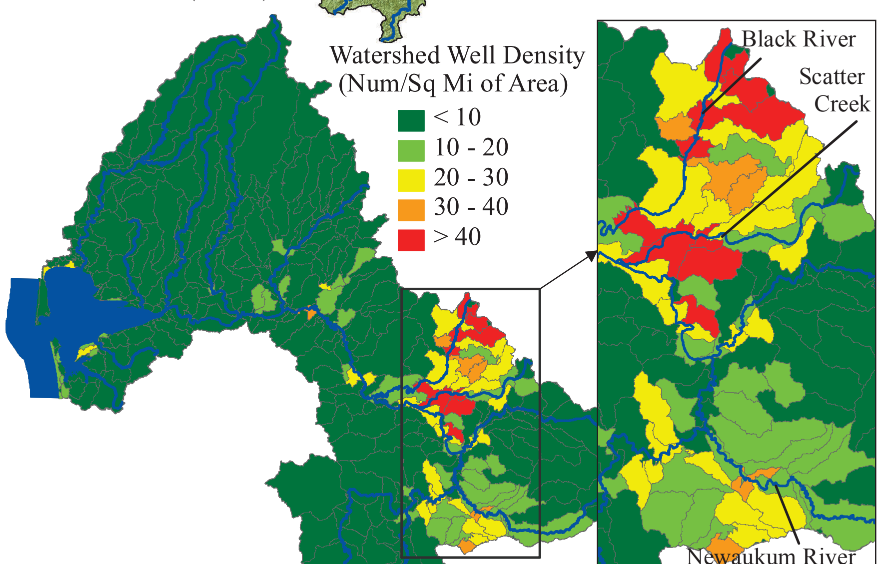


Exempt Wells Potentially Impacting Summer Low Flows

Within the last 30 years, the Chehalis basin has seen an increase of over 460% in the number of permit-exempt wells. According to the Chehalis Basin Salmon Habitat Restoration and Preservation Strategy, increased water use by people within the basin has critically reduced summertime flows in some basins. Low flow conditions lead to higher water temperatures which negatively impact salmon stocks.

Under state law, landowners may access water for domestic purposes without obtaining a water right. These “exempt wells” may cause “small withdrawals” but their cumulative impact can be significant since they affect water quality, salmonid habitat and instream flows in the Chehalis basin. The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy (CBP 2010) identified low summertime flows in some subbasins as a problem. An earlier assessment (CBP 2000) found that in many streams and rivers, minimum stream flows are not met on many days from July through October.





Many streams in the Chehalis Basin including Scatter Creek, as well as Black, Skookumchuck, and Newaukum rivers, are closed to further consumptive appropriations (WAC 173-522-050). Even then, from 1980 to 2010, there was an increase of over 460% in the number of permit-exempt wells in the basin. Exempt well distribution shows higher levels in the Black River, Scatter Creek, and Newaukum subbasins.

Groundwater withdrawals from these wells are suspected to have an impact on stream flows in the Chehalis Basin. In a USGS study, Gendaszek (2011) found a dynamic interaction between ground and surface water in the basin. The impact of wells is expected to be greater in those areas where stream flows already do not meet regulatory minimums. During the summer months, low flow conditions in streams lead to higher water temperatures which stress salmonid stocks.

Summary

The Quinault Indian Nation conducts treaty-reserved fisheries on many of the rivers, streams and beaches of WRIAs 21, 22 and 23. While the watersheds in WRIA 21 have their issues, the focus of this report is WRIAs 22 and 23, the Chehalis River Basin. This basin is the largest in the state of Washington outside the Columbia River Basin. The mainstem Chehalis River is formed by the confluence of the East and West Forks at approximately river mile 118 (Phinney and Bucknell 1975). The river originates in the Willapa Hills region near the town of Pe Ell, from where it flows in a general northwesterly direction through a gradually broadening valley with moderate to low gradient (Phinney and Bucknell 1975; Weyerhaeuser 1994) into the Pacific Ocean at Grays Harbor.

The basin is predominantly forestland with over 81% of the basin owned by private timber companies and small forestland owners. The Washington State and US governments also own large pieces of forestland particularly in the Capitol State Forest and Olympic National Forest respectively. Residential housing development (7%), undeveloped land and open areas (7%), and agriculture (5%), make up the reminder of the land within the basin. The Chehalis River Basin supports chinook, chum, and coho salmon, as well as steelhead and cutthroat trout (Smith and Wenger 2001). Bull trout were listed as "threatened" under the Endangered Species Act in 1999 (USFWS 2004) and foraging presence is known in parts of the basin, but it is unlikely the species spawns within the basin.

Although land use in the basin is still dominated by forestry, loss of vegetation cover has been occurring in the basin. In the decade between 1996 and 2006, about 6.6% of its forest cover (over 113 square miles) was lost. A decrease in forest cover negatively alters salmon habitat. Forest conditions in many watersheds are trending towards moderate or worse forest conditions. The Chehalis Basin Habitat Restoration and Preservation Strategy (CBP 2010) plans to reverse this trend.

A vast majority of watershed units in the Chehalis basin have road densities that exceed three miles of road per square mile of area, the level at which streams are known to cease to function properly (NOAA 1996). Some units also have road crossings at or approaching levels at which they negatively impact stream conditions. Roads bring about increased erosion rates in watersheds, leading to mass wasting and sediment delivery to streams. The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy (CBP 2010) calls for a reduction of sediment loading by reducing road densities in the basin.

The presence of forest roads typically result in the installation of culverts at stream crossings. Barrier culverts in the Chehalis basin are blocking or impeding access to over 1500 miles of anadromous salmon upstream habitat. This is most likely an underestimation since the data does not represent a complete inventory of fish passage barriers. The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy (CBP 2010) identified the replacing of dysfunctional culverts as a very high priority because they eliminate access by wild salmonids to prime and pristine habitat. To ameliorate the problem of barrier culverts, state law requires most forest

landowners to have a Road Maintenance and Abandonment Plan (RMAP). Only about 46% of RMAP projects within the basin have been completed according to the schedule.

Many streams in the Chehalis Basin including Scatter Creek, as well as Black, Skookumchuck, and Newaukum rivers, are closed to further consumptive appropriations (WAC 173-522-050). Even then, from 1980 to 2010, there was an increase of about 460% in the number of permit-exempt wells in the basin. Exempt well distribution shows higher levels in the Black River, Scatter Creek, Lower Skookumchuck, and Newaukum subbasins. According to the Chehalis Basin Salmon Habitat Restoration and Preservation Strategy (CBP 2010), increased water use by people within the basin has critically reduced summertime flows in some basins. Low flow conditions lead to higher water temperatures which negatively impact salmon stocks.

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State of Our Watersheds Report
Sauk, Suiattle and Cascade River Basins

The Sauk-Suiattle Indian Tribe is blessed to live on 20 acres surrounded by beautiful rivers, mountains, an abundance of trees and nature. Our biggest concern is to assure our people's future at least seven generations from now. We need to protect the salmon habitat we have and restore the habitat we have lost. The past five years have shown a slow recovery, but more must be done to restore the salmon runs that are so important to our tribal culture.

**–MICHAEL HOFFMAN,
SAUK-SUIATTLE INDIAN TRIBE**

Sauk-Suiattle Indian Tribe

The Sauk-Suiattle Indian people have lived under the gaze of Whitehorse Mountain for many generations. They lived as hunters, gatherers and fishermen in the region of Sauk Prairie near the present-day town of Darrington, Wash. In the early days, they were known as the Sah-ku-mehu.

Sauk-Suiattle homelands encompassed the entire drainage area of the Skagit, Sauk, Suiattle and Cascade Rivers. The tribe had an important village at Sauk Prairie near the confluence of the Sauk and Suiattle rivers.

Following the U.S. Homestead Act, the tribe became a landless people, but continued to live in scattered groups close to the traditional homelands. Though many tribal members left the area or joined neighboring tribes, Sauk-Suiattle maintained its tribal government, social structure, identity and hope for the future

Tribal membership numbered around 4,000 before the 1855 Point Elliott Treaty. By 1924, numbers had dwindled to 18 members.

Residents of the Sauk-Suiattle Indian Reservation are the surviving descendents of the original peoples who lived in this special valley. Current membership numbers around 200 individuals.

Wild and Scenic Rivers Part of Federal Lands

The Skagit, Sauk, Suiattle and Cascade basins remain among the healthiest within Puget Sound. The Skagit, Sauk, Suiattle and Cascade rivers are designated as "Wild and Scenic," and the Sauk is one of the largest un-dammed river systems remaining in the Pacific Northwest.

The upper portion of these watersheds is primarily under control of the federal government, located within the Mount Baker-Snoqualmie National Forest and North Cascades National Park.

The middle and lower sections of the watershed are largely held as forestland, either in state or private ownership. The delta reaches are predominantly held in agricultural land.

The forestry practices that constitute the primary land use within the basin over the last 150 years have resulted in the degradation of salmon habitat. Spawning and rearing habitat is being degraded by fine sediment from surface erosion and mass wasting due to timber harvest and access roads.

Limiting factors for salmon production important to recovery include those long understood to be at issue:

- Juvenile holding and rearing capacity;
- High water temperature;
- Loss of delta habitat, pocket estuaries and connectivity;
- Degraded riparian areas;
- Illegal habitat degradation;
- Illegal fishing or poaching;
- Sedimentation and mass wasting;
- Flooding;
- Current hydroelectric operations;
- Hydro-modifications;
- Water withdrawals; and
- Seeding levels.

In addition, the impacts of climate warming are now understood to be of fundamental significance to conservation and recovery of native fishes. As average temperatures climb, rates of glacial recession are increasing at the same time winter rains replace snowfall throughout mid-elevation areas. In sum, these phenomena will drive wholesale change in hydrology, sediment transport and water temperature regimes – threatening a number of fish species and life history types.

Restoration Plan Implemented Slower than Hoped

The habitat protection and restoration strategy pursued for the Skagit, Sauk, Suiattle and Cascade basins seeks to protect existing fish habitat and restore damaged habitat and habitat-forming processes. Priorities focus on the largest scale possible.

The protection strategy focuses on:

- Stream flows;
- Basin hydrology;
- Water quality;
- Sediment quality and transport;
- Stream channel complexity;
- Riparian areas and wetlands;
- Tidal delta area and nearshore; and
- Fish passage and access.

The restoration strategy focuses on fish production. Restoration actions have been weighted by the degree to which they restore landscape conditions in the basin and thus contribute to the long-term recovery.

Specifically, restoration and protection efforts have focused on forest road maintenance, floodplain protection and water quality issues.

Implementation of the Water Resource Inventory Area (WRIA) 3&4 Salmonid Recovery Plan is lagging behind the pace originally anticipated during plan development. Restoration work has progressed with numerous capital projects focused on restoring fish habitat and passage. However, WRIA 3&4 have faced significant funding shortages for restoration projects, limiting implementation progress.

Progress also has lagged on implementing the regulatory and incentive programs to protect and restore salmon habitat and habitat-forming processes.

Numerous Shoreline Management Plans are still in the process of being updated and action on regulatory gaps such as agriculture buffers and FEMA's Flood Plain Insurance Program still need to occur. A major element of the habitat protection and restoration strategy for the Skagit, Sauk, Suiattle and Cascade basins relies on revisions to state and national environmental regulatory programs that have proven difficult to adjust to address the needs of the salmon resources in the Northwest.

Forest Roads Add to Salmon Habitat Degradation

A review of key environmental indicators for the Skagit, Sauk, Suiattle and Cascade basin indicates the slow progress that has occurred regarding habitat recovery. The Skagit Chinook Recovery Plan recommends the full and timely implementation of the Forests and Fish Report (FFR) Road Maintenance and Abandonment Plan (RMAP) as the primary vehicle for private and state forest road restoration.

A legacy of poorly designed and maintained forest roads has reduced spawning and rearing habitat quality by increasing sediment to streams through surface erosion and mass wasting. Originally, RMAP was scheduled to be fully implemented in 2016, however, the state has extended the deadline to 2021.

In the Sauk watershed, there are 263 miles of RMAP forest roads. As of 2011 approximately 51%, or 188 miles, of these roads have been repaired. This delay in road restoration directly affects the success of salmon recovery efforts.

Similar delays in road maintenance are occurring with federally managed forest roads. In the Sauk River watershed, there are 518 miles of U.S. Forest Service (USFS) forest roads. As of 2011 only 28%, or 147 miles, of these roads have had the necessary drainage upgrades.

The USFS road maintenance budget prioritizes drivable access; this should be amended to give equal priority to road drainage. A road should not be considered maintained if its drainage system continues to impact water quality adversely.

The Skagit River System Cooperative (SRSC) removed a portion of Similk Bay Road and a non-functioning tide gate that isolated about 8 acres of estuary in Turners Bay. SRSC is the natural resources extension of the Swinomish and Sauk-Suiattle tribes.

The road removal restored natural processes to a nearly 60-acre pocket estuary at the head of Similk Bay, which is part of Skagit Bay. This type of small, sub-estuary is essential habitat for out-migrating chinook fry.

Pocket Estuaries, Riparian Habitat Impaired

At the five-year mark, a review of key environmental indicators reveals mixed results in progress toward the recovery plan's goals and objectives.

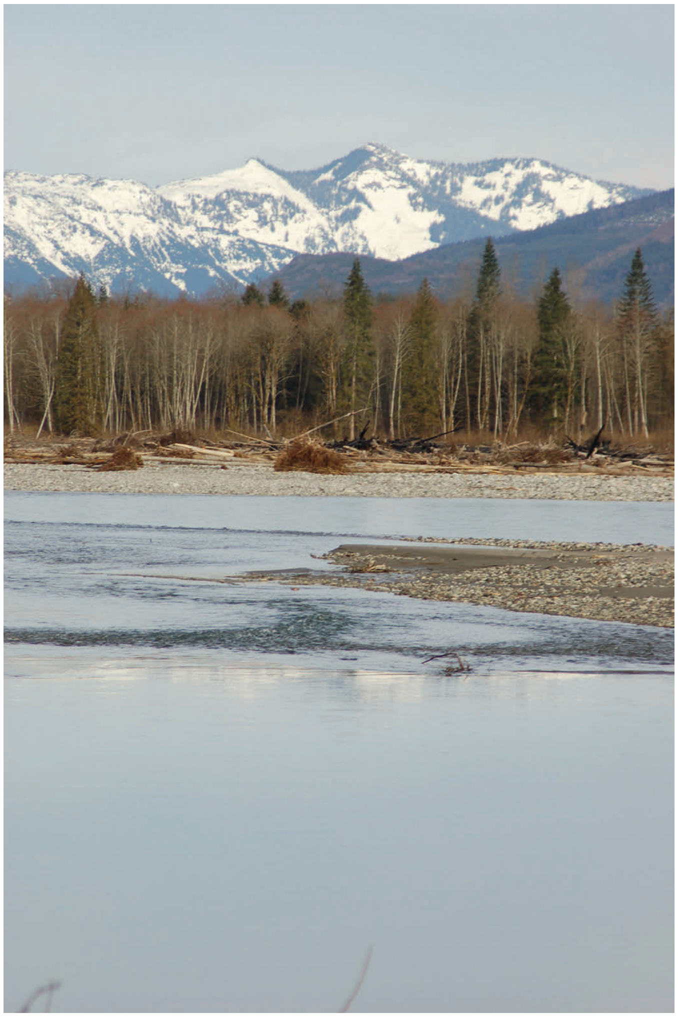
The five-year target for Whidbey basin pocket estuaries restoration has been met with the completion or active work on seven projects. These projects will increase the production capacity of the Whidbey basin by an estimated 47,868 smolts.

Pocket estuaries provide essential low-energy and high-nutrient habitat for juvenile chinook as they migrate through Puget Sound from their natal river and delta. Research suggests that pocket estuaries within a day's swimming time from the Skagit River delta have experienced an 86% net reduction.

The Skagit Chinook Recovery Plan prioritized restoration and protection of riparian areas and wetlands. Since 2005, only 6% of the recovery plan's original restoration goals for tidal wetland habitat have been realized and tidal delta habitat capacity has been increased by an estimated 76,668 smolts.

Tidal wetland habitat remains a limiting factor for Skagit River chinook production. Agriculture lands dominate riparian areas in the delta region. As of 2006, riparian areas within the delta region are 83% impaired. Of the impaired land, 12% is developed and built upon, and 71% is supporting crops and pasture. The lack of riparian forests and canopy cover on agricultural lands is detrimental to salmon habitat within the delta.

Tribe Buys Land for Habitat



The Sauk River flows between the mountains of the Cascades range through a section of the Mount Baker-Snoqualmie National Forest to the town of Darrington, then north to join the Skagit River from the south at Rockport. The Sauk River's confluence with the Suiattle River is about 12 miles south of Rockport.

The Skagit Chinook Recovery Plan recognizes that riparian forests provide shade, nutrients and stream bank stability for salmon spawning and rearing habitat. The recovery plan recommends protecting riparian forests that are healthy and restoring those that are impaired.

In the middle Sauk River floodplain, an estimated 64% of the riparian zone is at least moderately healthy and in need of protection. The remaining 36% is at least moderately impaired and in need of restoration. More than 65% of the riparian forest needing active restoration is on rural residential, agricultural and urban lands. This fact only underscores the need for updating the current environmental regulatory coverage and programs pertaining to these land use types.

The Sauk-Suiattle Indian Tribe has initiated a land conservation program focused on restoring and protecting critical chinook habitat in the Sauk River floodplain. With purchases of more than 250 acres of floodplain habitat in the last three years, the Sauk-Suiattle Indian Tribe is committed fully to habitat protection in the Sauk River floodplain, as recommended in the Skagit Chinook Recovery Plan.

The tribe joins Seattle City Light, the Nature Conservancy and federal, state and local governments in protecting floodplain resources through conservation acquisitions with about 976 acres now acquired along the river.

This joint action reflects one of the bright spots in the progress toward chinook habitat recovery within the Skagit, Sauk, Suiattle and Cascade basins. These conservation benefits could be greatly enhanced by FEMA amending its National Flood Insurance Program to incorporate a "protected zone" where no adverse affects are allowed in the floodplain floodway, channel migration zones and riparian habitat. This would guarantee protection of an estimated additional 875 acres of floodplain area not currently in conservation easement or public land.

The Skagit River System Cooperative removed an 80-foot-long, 8-foot-tall, 12-foot-wide culvert from Tenas Creek, a tributary to the Suiattle River. The culvert had provided vehicle access across the creek on a U.S. Forest Service road, but it was a barrier to resident fish species and was at risk of failing and sending sediment to salmon habitat downstream.

Sauk-Suiattle natural resources technician Kevin Lenon examines a salamander egg nest in a wetland on the tribe's reservation. Amphibians are thin-skinned and sensitive to disturbances in their habitat, so they are good indicators of wetland health. The tribe's amphibian survey could reveal a pattern of mutations or changes in populations that indicate increased pollution or effects of climate change.

Water Quality Degrades

Water quality has been degraded and continues to be impacted by leaching from mine waste rock, tailings, unprocessed ore and sediment from several abandoned mine sites within the Sauk watershed. Of particular concern are the water quality impacts in the South Fork Sauk River to spawning areas for steelhead and bull trout, which are both listed as "threatened" under the Endangered Species Act.

Eight abandoned mining sites are slated for cleanup that would isolate 16,275 cubic yards of waste rock, ore, tailings and contaminated soil in two repositories. This cleanup is to begin in 2012 and is scheduled to conclude in 2013. Given the immediate threat to steelhead and bull trout spawning habitat it is imperative that the U.S. Forest Service implement the cleanup schedule as they have set forth.

Looking Ahead

The regulatory approach within WRIA 3&4 is employing a strategy that seeks to ensure that there will be no loss of productivity and the current habitat conditions for the fish not worsen.

With this strategy, the regulatory framework must protect the existing habitat as improvements in habitat quality and quantity are realized through voluntary effort and directed capital enhancement projects.

However, progress within the Skagit, Sauk, Suiattle and Cascade basins is not keeping pace with the goals of the Recovery Plan. Available funds for enhancement activities are lacking, and projected costs within the three-year work plan are consistently exceeding original projections.

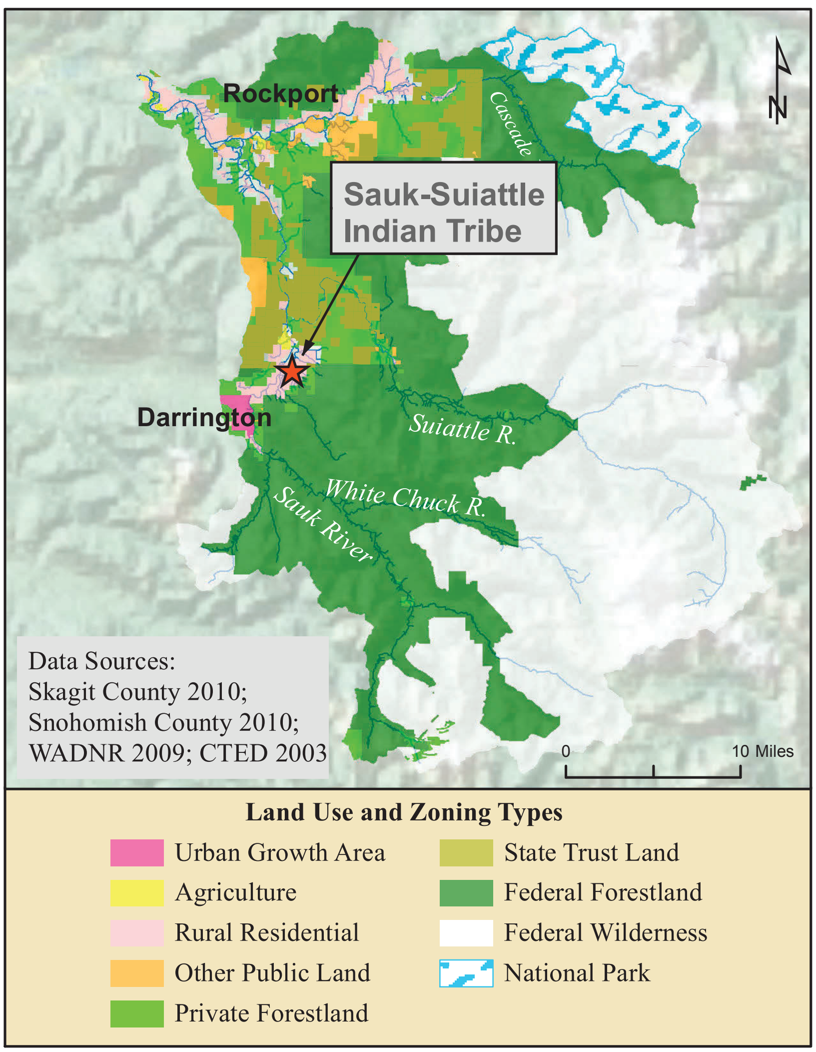
When facing the reality of the recovery process, regulatory reform is required as the current framework clearly has not provided adequate protection of the water quality and riparian habitat within the basin.

The Sauk-Suiattle Indian Tribe (Sauk, Suiattle and Cascade River Basins)

At a combined 732 sq. miles, the Sauk and Suiattle River watersheds provide nearly half of the Skagit River's flow at the Sauk's confluence with the Skagit. The Sauk River originates in the Glacier Peak Wilderness in eastern Snohomish County and flows northward to join the Skagit River at Rockport. The Suiattle River also originates in the Glacier Peak Wilderness and flows into the Sauk from the east, approximately 12 miles south of the town of Rockport.

The Sauk and Suiattle rivers support stocks of anadromous salmonids and trout. These include Chinook, coho, chum, pink salmon, and steelhead, cutthroat and bull trout. Lower Sauk, Upper Sauk, and Suiattle Chinook stocks are all listed as 'stable' based on their 1990 to 2009 escapement trends (NMFS, 2011). However, from 1999 to 2009, the escapement trend and growth rates for Suiattle Spring Chinook have been declining (Judge, 2011) and their continued stability may be in jeopardy.

The Sauk-Suiattle Indian Tribe's homeland includes the Sauk, Suiattle, and Cascade River watersheds. The Tribe fishes, hunts, and gathers food and medicines, throughout this entire area. The Tribe's Reservation is located near the confluence of the Sauk and Suiattle Rivers, just north of Darrington.

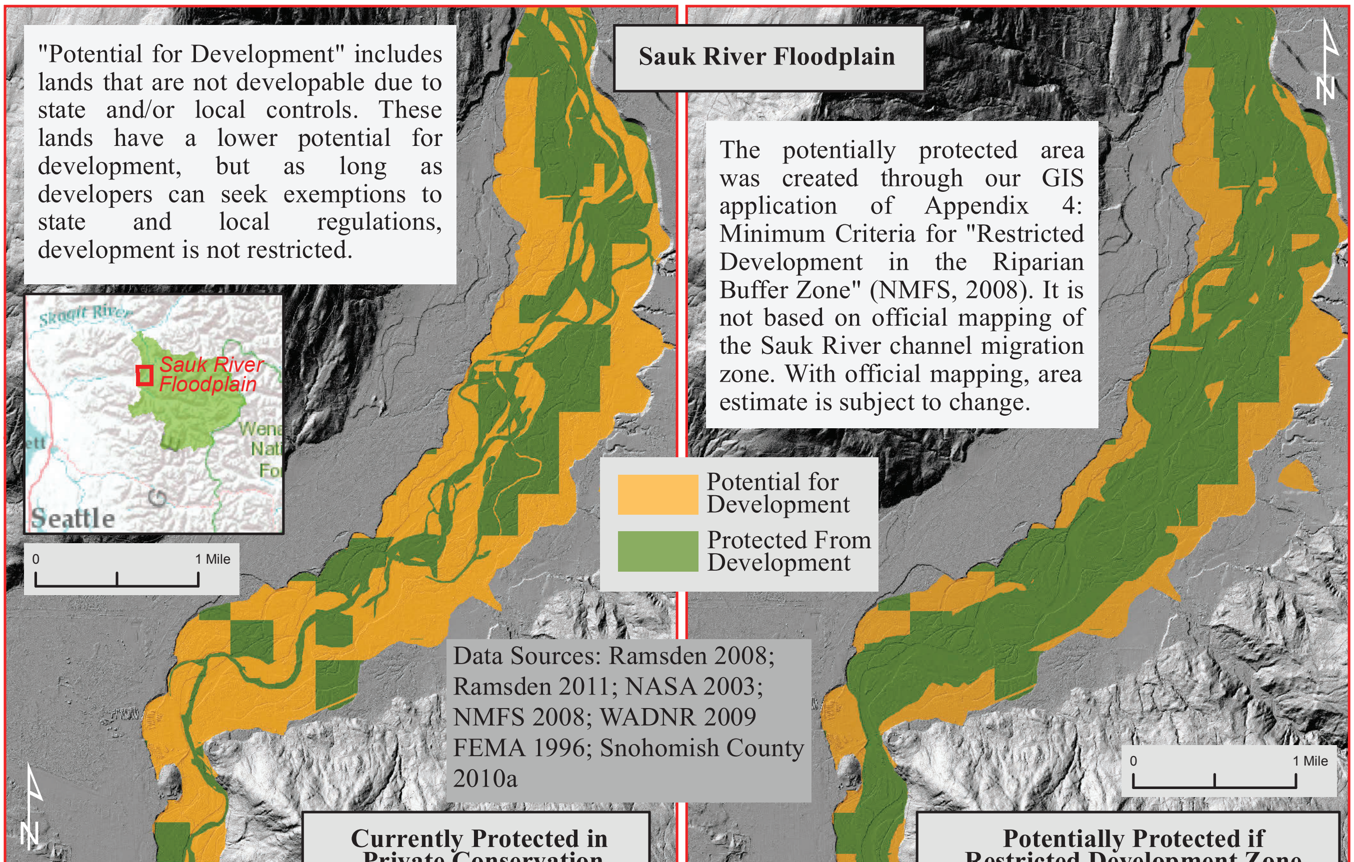


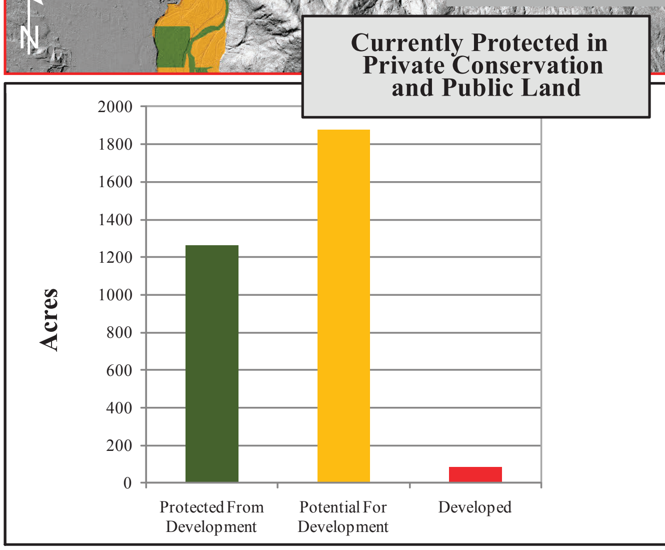
Over half of the Sauk-Suiattle watershed is federal wilderness. This contributes to a relatively healthy environment for wildlife and fish. In the non-wilderness areas of the watershed, the last 150 years of timber harvest, agricultural land clearing, and commercial and residential development have resulted in younger forests, less instream wood, high road densities, and floodplain development. These impacts are concentrated in the Sauk River floodplain and immediate foothills where much of the watershed's

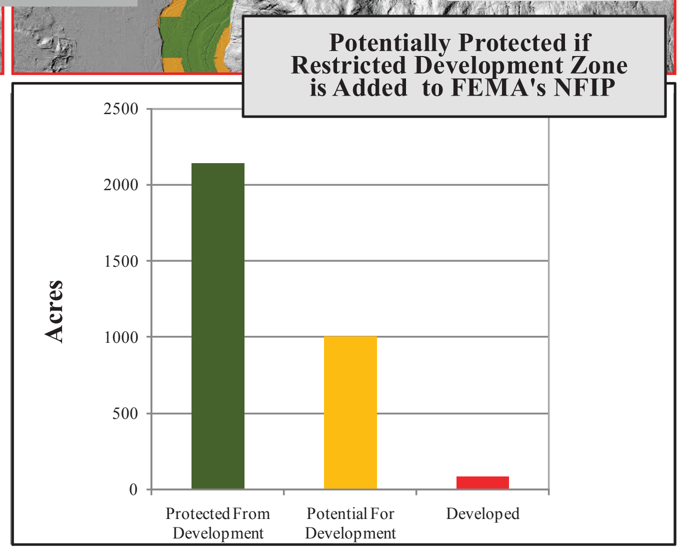
The Sauk, Suiattle, and Cascade Rivers remain some of the healthiest in the Puget Sound region. There is the potential for full restoration of these rivers, which is rare in the Puget Sound. The Skagit Chinook Recovery Plan provides a strategy for both protection and targeted restoration, and is beneficial to other aquatic species and water quality beyond Chinook salmon. To fully implement the Plan, federal, state, and local governments will have to provide a consistent guide for future landuse.

Restricted Development Zone for the FEMA National Flood Insurance Program Further Protects Sauk River Floodplain

In the Skagit Chinook Recovery Plan, protecting stream channel complexity from further degradation is a priority. Specifically, the plan recommends prohibiting any new development within the active floodplain or the channel migration zone. Echoing the Recovery Plan, in 2008 the National Marine Fisheries Service issued a Biological Opinion stating that in the Puget Sound, the FEMA National Flood Insurance Program (NFIP) adversely affects the habitat of certain threatened and endangered species. NMFS asked FEMA to establish a "restricted development zone" where no adverse effects to Puget Sound Chinook are allowed in the floodplain's floodway, channel migration zones, and riparian habitats. In the Sauk River floodplain, implementation could mean guaranteed protection of an additional 875 acres of floodplain area not currently in conservation easement or public land. Implementation of the protected zone aligns with the Chinook Recovery plan and will directly benefit Chinook salmon relying on floodplain habitat in the Sauk River system.

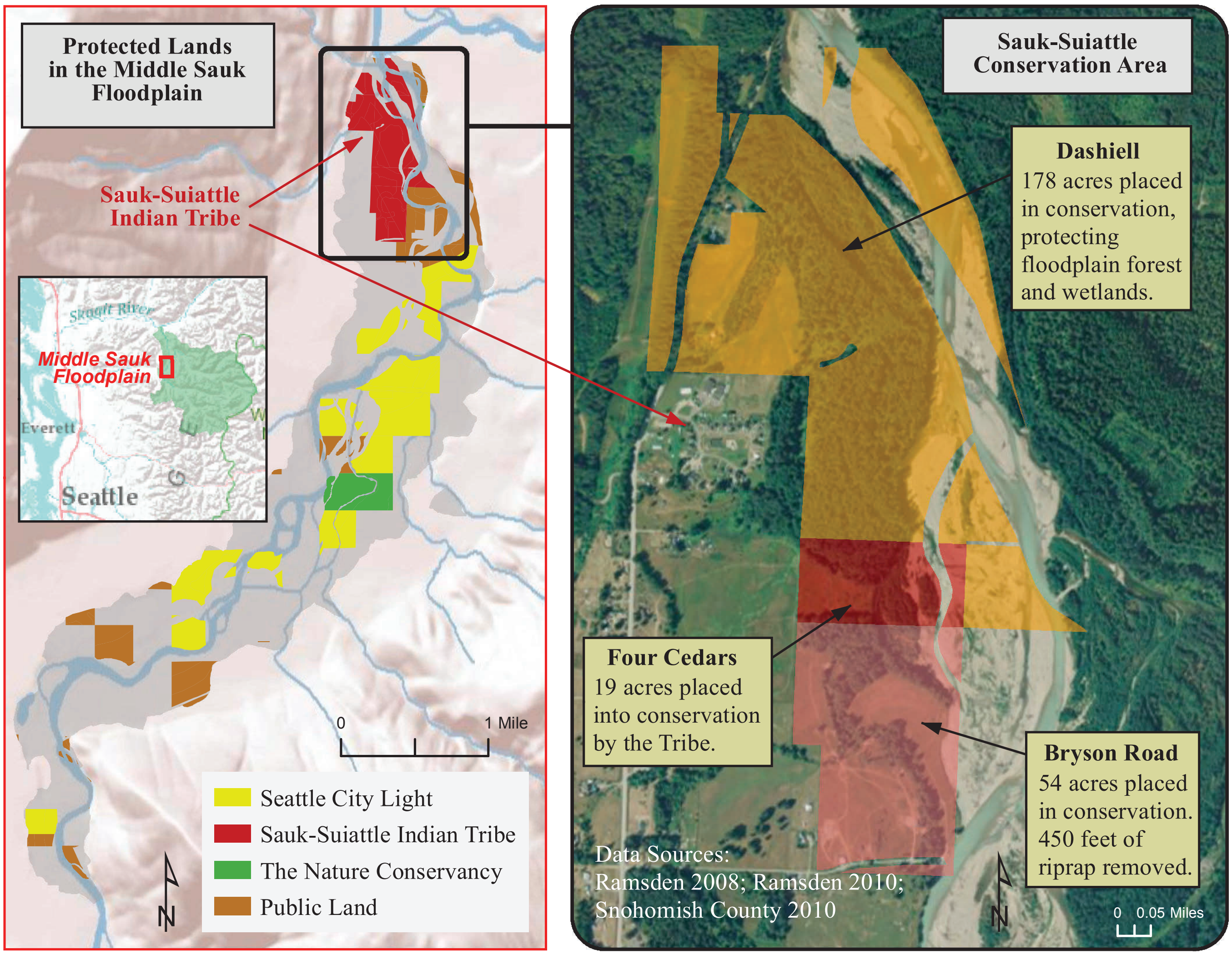






Sauk-Suiattle Indian Tribe Protecting the Sauk River Floodplain through the Sauk-Suiattle Conservation Area

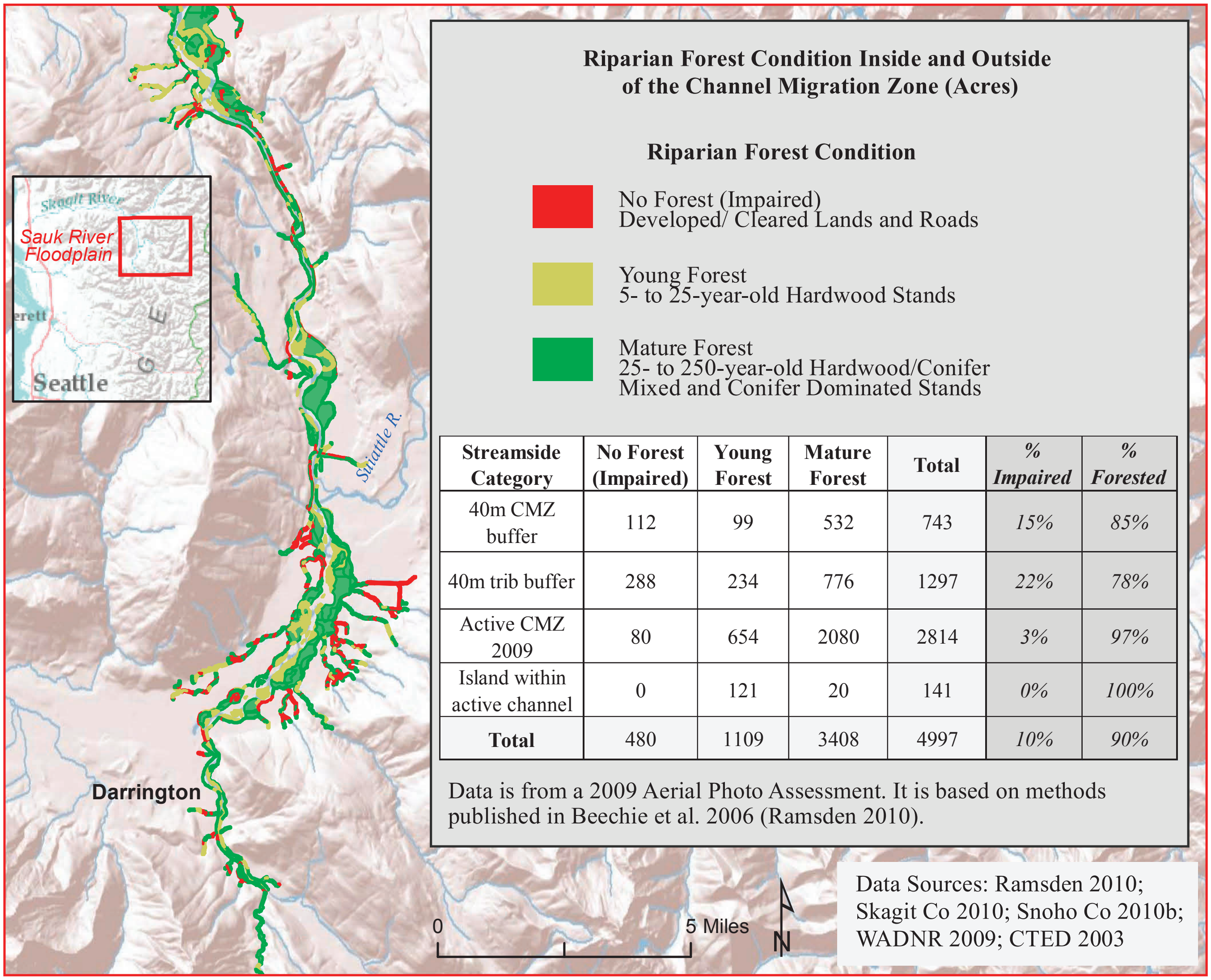
The Skagit Chinook Recovery Plan recommends floodplain habitat protection through acquiring parcels which experience chronic flooding and which require bank hardening for protection of human life and capital. In 2008, using funds from a Salmon Recovery Funding Board (SRFB) grant secured by the Skagit River System Cooperative (SRSC), the Sauk-Suiattle Indian Tribe purchased approximately 54 acres of land in the Bryson Road vicinity and placed them into conservation status. The Tribe, SRSC, and Skagit County have been actively working together to restore the site by demolishing or relocating all structures, removing undersized culverts, planting native riparian vegetation, and removing 450 feet of riprap bank armoring to restore connectivity to a historic side channel. In 2010, the Tribe purchased an additional 178 acres with funds from another SRFB grant managed by the Skagit Land Trust. The Tribe also placed an additional parcel that they previously owned, called Four Cedars, into conservation status, bringing the total area of the Sauk-Suiattle Conservation Area to approximately 250 acres.



With purchases of over 250 acres of floodplain habitat placed in the Sauk-Suiattle Conservation Area in the last three years, the Sauk-Suiattle Indian Tribe is fully committed to habitat protection in the Sauk River floodplain, as recommended in the Skagit Chinook Recovery Plan. They join Seattle City Light, the Nature Conservancy, and federal, state and local governments in protecting floodplain resources through conservation acquisition. An estimated 20-25% of protected land in the Sauk River floodplain is in the Sauk-Suiattle Conservation Area. This is second only to Seattle City Light which has acquired 46% of protected land in the floodplain.

Riparian Forest Condition in the Sauk River Floodplain

The Skagit Chinook Recovery Plan recognizes that riparian forests provide shade, nutrients, large woody debris, and stream bank stability for spawning and rearing Chinook. The plan strongly recommends protecting riparian forests that are healthy and restoring those that are impaired. Riparian areas of the middle Sauk River floodplain are 90% forested and relatively undeveloped. The active (non-regulatory) channel migration zone (CMZ) of the Sauk River dominates the floodplain riparian area and is between 97 and 100% forested. While the area buffering floodplain tributaries and buffering the CMZ only makes up 41% of total riparian area in the floodplain, 83% of impaired riparian area is found in that region.



Riparian Forest Condition Inside and Outside of the Channel Migration Zone (Acres)

Riparian Forest Condition

- No Forest (Impaired) Developed/ Cleared Lands and Roads
- Young Forest 5- to 25-year-old Hardwood Stands
- Mature Forest 25- to 250-year-old Hardwood/Conifer Mixed and Conifer Dominated Stands

Streamside Category	No Forest (Impaired)	Young Forest	Mature Forest	Total	*% Impaired*	*% Forested*
40m CMZ buffer	112	99	532	743	*15%*	*85%*
40m trib buffer	288	234	776	1297	*22%*	*78%*
Active CMZ 2009	80	654	2080	2814	*3%*	*97%*
Island within active channel	0	121	20	141	*0%*	*100%*
Total	480	1109	3408	4997	*10%*	*90%*

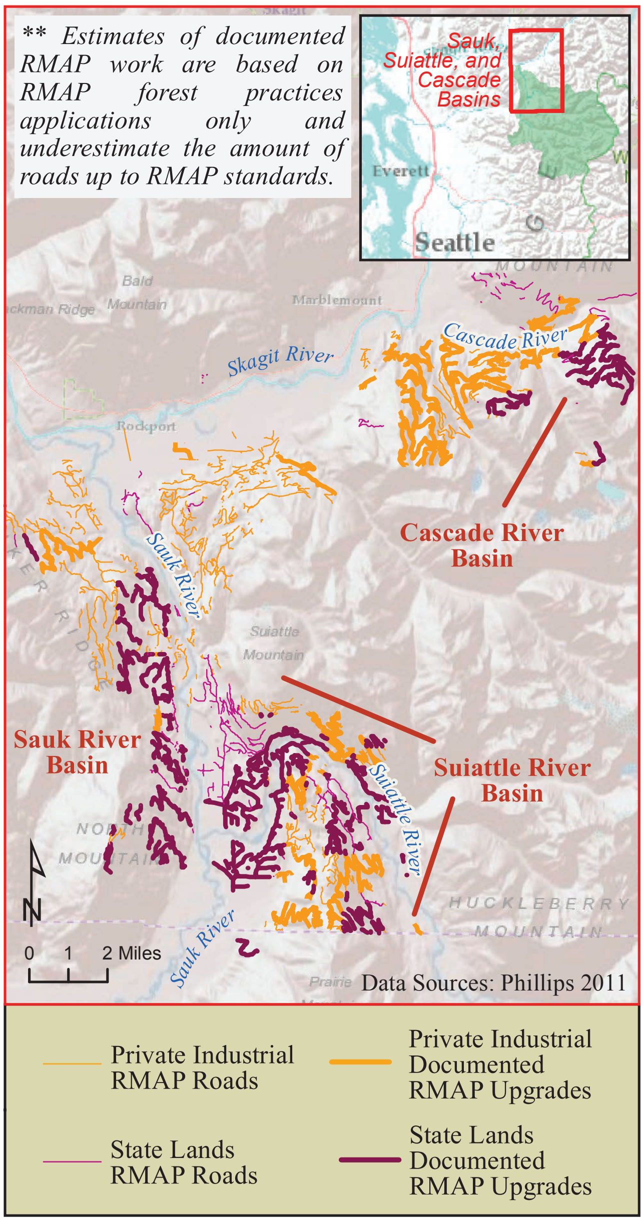
Data is from a 2009 Aerial Photo Assessment. It is based on methods published in Beechie et al. 2006 (Ramsden 2010).

As per Skagit Chinook Recovery Plan recommendations, the Salmon Recovery Funding Board has been funding Sauk River floodplain protection through conservation purchases. The Skagit River System Cooperative developed the data used in this assessment to target riparian restoration opportunities (Ramsden, 2010). Most of the riparian area along floodplain tributaries and bordering the active CMZ is on agriculture and rural residential lands. According to the Chinook Recovery plan, to protect these areas from further impairment, agriculture practices exemptions from the Shoreline Management Act (SMA) need to be eliminated, or agricultural practices need to develop alternative mechanisms that provide protection equivalent to the SMA. Additionally, the small forestland owners exemption from the riparian protections of the Forests and Fish Agreement is not consistent with the original agreement, and should be removed to consistently protect riparian resources across all lands regulated through the Forests and Fish Agreement (SRSC; WDFW, 2005).

Improvement of Forest Roads Reduces Sedimentation in the Sauk, Suiattle and Cascade River Basins

*The Skagit Chinook Recovery Plan recommends full and timely implementation of the Washington Forest Practices Road Maintenance and Abandonment Plans (RMAP) as the primary vehicle for private industrial and DNR State Lands forest road upgrades. Based on state mandate, recovery planners expected RMAP to be fully implemented by 2016. Since completion of the Recovery Plan, the state has agreed to allow private industrial landowners to apply for an extension of the RMAP deadline to 2021. As of December, 2011, approximately 51% of RMAP have documentation that road upgrades have been implemented in the Sauk, Suiattle, and Cascade basins**. In the Sauk, Suiattle, and Cascade basins, the DNR State Lands has 71% of its RMAP obligation documented as complete, and private industrial forestland owners have 39% documented as complete. These represent significant watershed improvements that will benefit fisheries in the Sauk, Suiattle, and Cascade basins. Despite uncertainties, these data also suggest that the RMAP timetable envisioned in the Skagit Recovery Plan will not be met on private industrial forestlands unless progress accelerates. Use of the deadline extension could further add to delays.*

Private Industrial and State Lands RMAP Forest Roads in the Sauk, Suiattle and Cascade Basins



A legacy of forest roads poorly maintained or built under old standards has reduced aquatic habitat quality by increasing sediment to streams through surface erosion and mass wasting (SRSC; WDFW, 2005). In the Sauk, Suiattle, and Cascade basins there are approximately 366 miles of private industrial and State Lands forest roads. As of December, 2011, 51% (188 miles) of these roads had documented upgrades**. An unknown number of miles of road may not require upgrades because they already meet RMAP standards. There is inadequate tracking and road inventory work to accurately determine the status of RMAP progress in the Sauk, Suiattle, and Cascade basins.

RMAP Implementation in the Sauk River Basin (Miles)

	RMAP Roads	Documented RMAP Upgrades	Percent Documented RMAP Upgrades
Private Industrial	227	89	39%
State Lands	139	99	71%

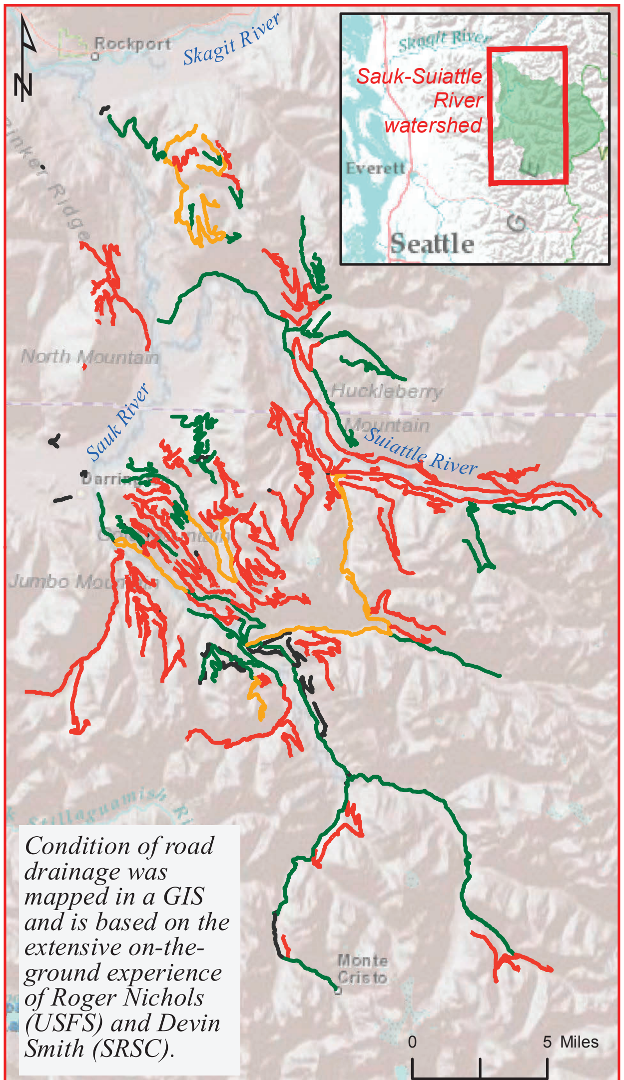
This improved forest road has an efficient drainage system that routes runoff to the forest floor to filter sediments, rather than into streams.

RMAP is seen as a key vehicle in the Skagit Chinook Recovery Plan to upgrade forest road and decrease sediment delivery to aquatic habitat. If RMAP are not implemented in a timely and effective schedule, the restoration of Chinook salmon habitat may suffer, and their recovery delayed.

Salmon Recovery Funds Help Restore USFS Roads in the Sauk and Suiattle River Watersheds

In the Sauk River watershed, there are 518 miles of USFS forest roads; as of 2011 only 28% (147 miles) of these roads have had the necessary drainage upgrades. From1999 to 2008, $976,000 in restoration funds were spent to upgrade 48.5 miles of road drainage in the Sauk-Suiattle watersheds. Prior to the Skagit Chinook Recovery Plan, from 1999 to 2005, 4.5 miles of road drainage were upgraded in the Sauk-Suiattle Watershed. From 2005 to 2008, as a direct result of Skagit Chinook Recovery Plan recommendations, $735,000 were allocated to upgrade 44 miles of road drainage. The Salmon Recovery Funding Board (SRFB) provided funds through the Skagit River System Cooperative and the Skagit Conservation District for 85% of USFS road work completed between 1999 and 2008.

United State Forest Service Roads in the Sauk-Suiattle River Watershed



Condition of Road Drainage System

- Not Upgraded (>50% impaired)
- Insufficient Upgrades (35-50% impaired)
- Upgraded (<35% impaired)
- Status Unknown

Data Sources:
MBSNF 2010;
Nichols, R. and D.Smith 2011, pers. comm., 5 Aug.

Federal lands in the basin contain 518 miles of forest roads, many built in the mid-1900s primarily for timber harvest. In addition to being built under old standards, many are located on steep hillslopes with frequent stream crossings. They have been severely impacted by storm events, resulting in both watershed damage and loss of tribal access. As federal logging has declined in recent decades, the USFS has had very limited revenue for maintenance, repairs, upgrades and/or abandonment of unneeded roads. Thus, the USFS has had to rely on SRFB funds to manage their road system.

Prior to the 1999 ESA listing of Puget Sound Chinook, the USFS used $579,000 in restoration funds to upgrade drainage on 57 miles of road. Between 1999 and 2008, the USFS used $976,000 in restoration funds on 48 miles in the Sauk-Suiattle watersheds (WRCO, 2011; MBSNF, 2009).

Since 2008, the USFS has received additional federal funding to improve selected legacy roads that negatively impact aquatic resources (Wilderness Society, 2011). The lower Suiattle and upper Sauk watersheds are priority basins for road drainage upgrades (MBSNF, 2009). Additional federal funding for restoration is necessary, but restoration funding alone is not enough.

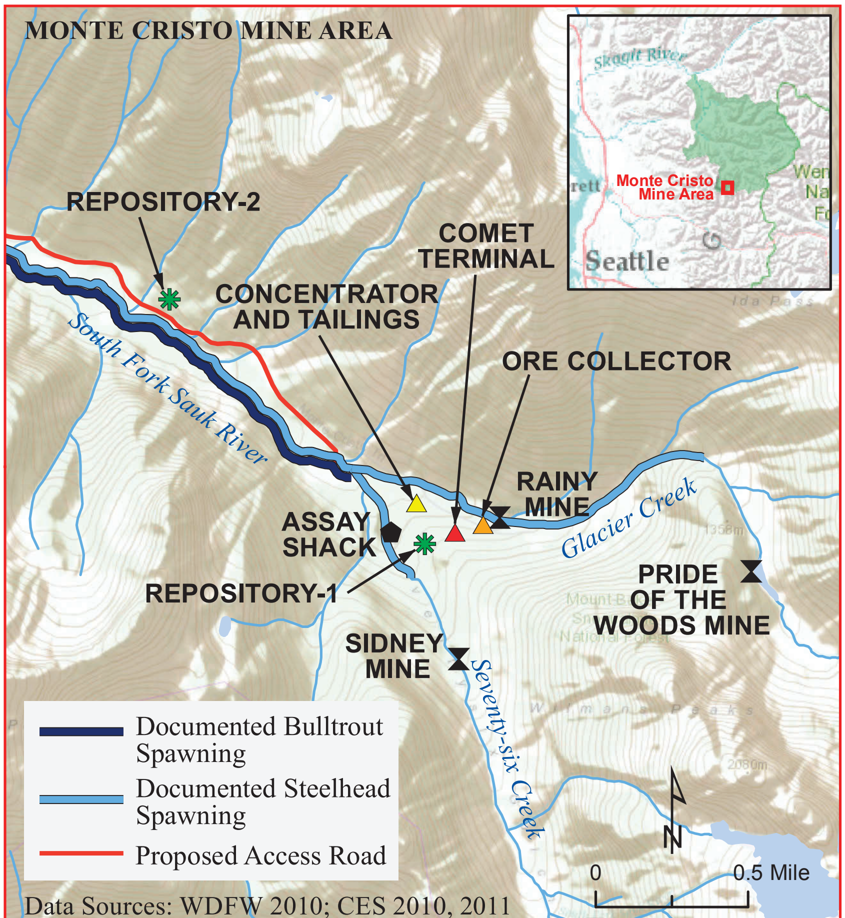
USFS Road Status in the Sauk-Suiattle River Watershed (Miles)

	Treated	Insufficiently Treated	Not Treated	Unknown Status	Percent Treated
Forest Roads	147	48	303	18	28%

General USFS road maintenance budgets, which prioritize drivable access, need to give equal priority to road drainage. A road should not be considered maintained if its drainage system continues to adversely impact water quality.

Cleanup Planned as Abandoned Mines Pollute Bull Trout and Steelhead Trout Habitat in South Fork Sauk River

Toxics from mining enter streams when groundwater and precipitation leach through mine shafts and exposed piles of waste rock. A large quantity of mine waste was piled near streams, and is now being actively eroded. The dissolved toxic metals are carried downstream through the Sauk and lower Skagit channels. Stream sediments with high arsenic content have accumulated in Monte Cristo Lake, downstream of the mining area. Unless cleaned up, these sediments pose a downstream risk when they are eroded by the South Fork Sauk. Risks to human and ecological health are from exposure to high levels of hazardous substances, particularly arsenic, found in the mine waste rock, tailings, unprocessed ore, sediment, and seeping water. Of particular concern in the South Fork Sauk River are the water quality impacts to Bull Trout and Steelhead, as both spawn in the area and both are federally listed as "Threatened" under the Endangered Species Act.



MINE OR FACILITY RECOMMENDED FOR REMOVAL AND DISPOSAL IN MCMA REPOSITORY	VOLUME OF WASTE MATERIAL (bcy)
PRIDE OF THE WOODS MINE	900
RAINY MINE	3,300
SIDNEY MINE	425
COMET TERMINAL	1,000
ORE COLLECTOR	2,500
HAULAGE WAYS	200
CONCENTRATOR AND TAILINGS	8,200
ASSAY SHACK	200
TOTAL VOLUME RECOMMENDED	**16,725**

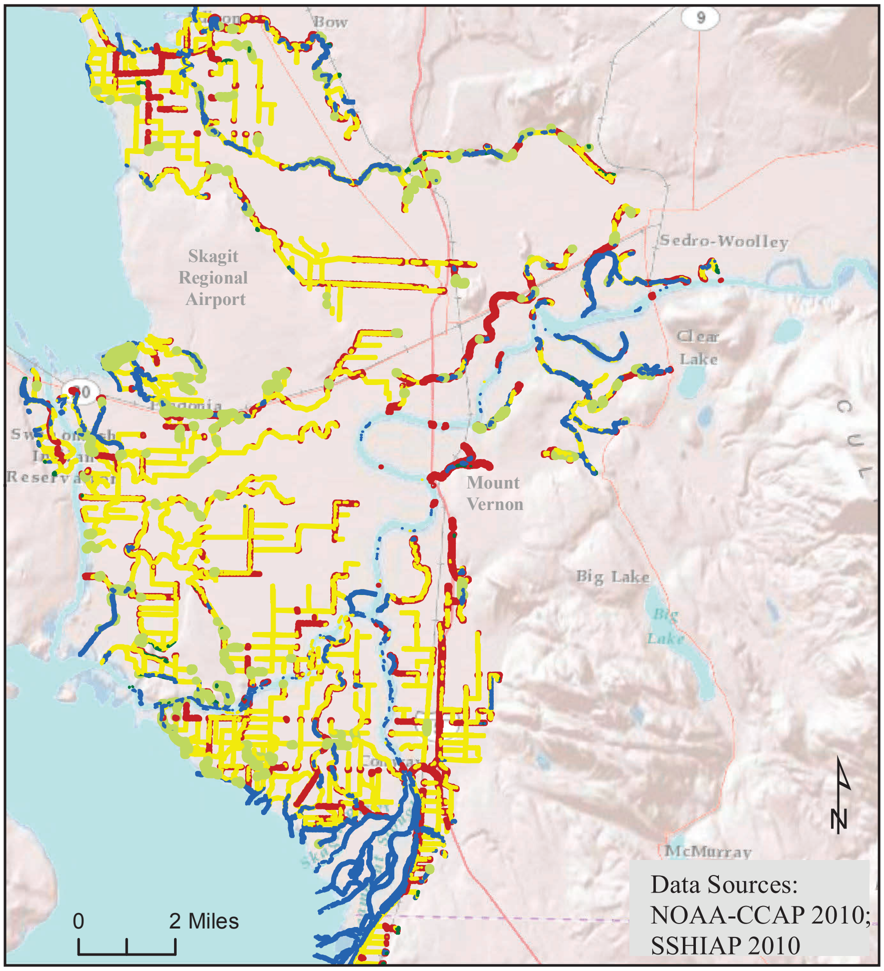
The earliest mining claims for the Monte Cristo area came in 1889. Wagon road and Railway to Monte Cristo were completed in 1893. This led to the boom years for the mine, from 1894 to 1906. ASARCO purchased the Monte Cristo mines and Everett Smelter in 1903. Production at the mine ended in 1907.

The recommended cleanup would isolate a total of 16,275 cubic yards of waste rock, ore, tailings and contaminated soil in two on-site repositories. It would focus on cleaning up areas close to hiking trails and areas actively eroding into surface water bodies. Proposed cleanup will cost an estimated $5.5 million dollars (CES, 2010), and will be funded primarily by ASARCO as part of their 2009 bankruptcy agreement.

Building and repair of the access road is to begin summer of 2011. Phase 1 of cleanup and repository storage is to begin summer 2012, with phase 2 following the summer of 2013. Post clean-up monitoring is to begin the fall of 2013. The immediate threat to Steelhead and Bull Trout spawning makes it imperative that the Forest Service implements the cleanup schedule they have set forth.

Agriculture Lands Provide Impaired Riparian Conditions in the Skagit River Delta Region

The Skagit Chinook Recovery Plan recognized the value of riparian forests and strongly recommends the protection of riparian forests that are healthy and restoring those that are impaired. As of 2006, riparian areas of the Skagit River delta region are 83% impaired. Of the impaired riparian lands, 12% are developed and built upon and 71% are supporting crops and pasture.



Riparian Forest Condition

- Cleared/ Crops and Pasture (Impaired)
- Developed/ Built (Impaired)
- Shrubs/ Grasses
- Forest (Deciduous, Mixed, Evergreen)
- Wetlands (Forested and Emergent)

Riparian Forest Condition by Zoning in the Middle Skagit River Delta Region (Acres)

Land-Use and Zoning	Developed/ Built (Impaired)	Cleared/ Cropland and Pasture (Impaired)	Shrubs/ Grasses	Forest	Wetland	Total	% Impaired
Agriculture	921	7619	183	68	1052	9843	87%
Rural Residential	81	92	19	37	72	301	58%
Urban Growth Area	284	141	13	21	80	540	79%
Public Land	1	15	12	5	350	383	4%
Skagit Delta Riparian Zones	1287	7867	227	132	1554	11067	83%

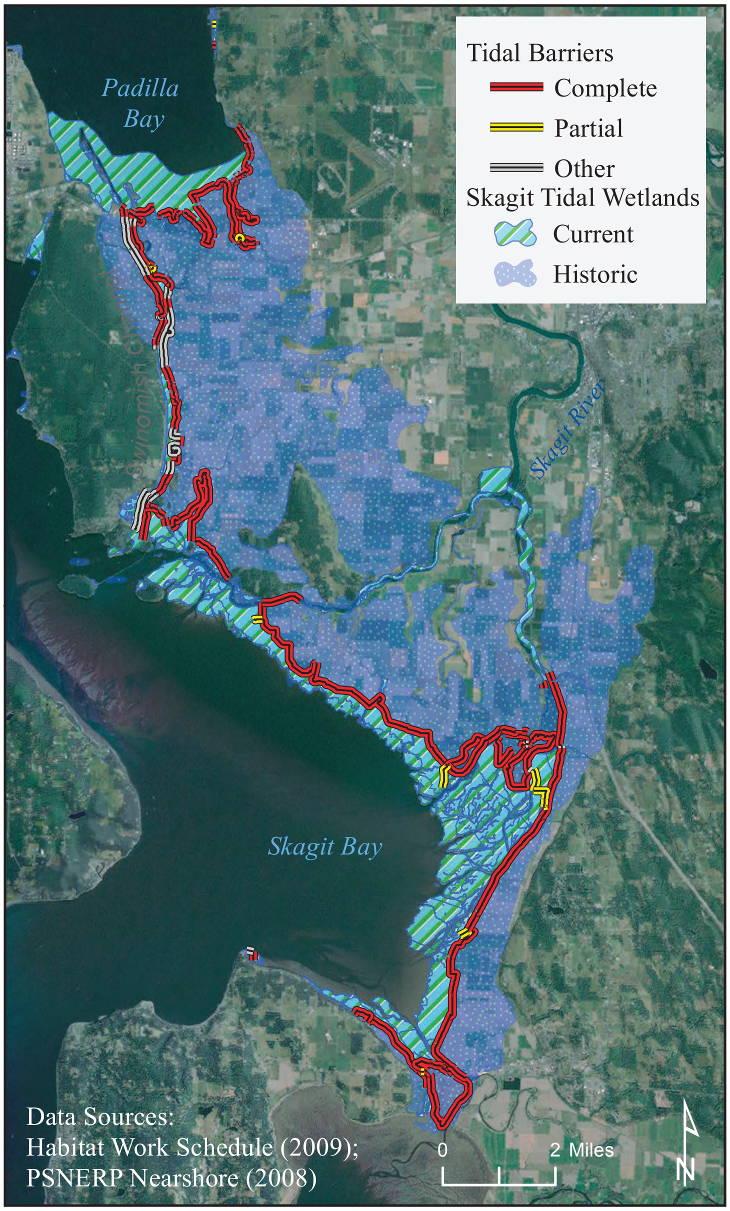
The Skagit Chinook Recovery Plan recognizes the importance of farming on the Skagit delta; it also recognizes that the managed clearing of riparian forests by delta farmers is detrimental to salmon habitat. As of 2006, 77% of total impaired riparian area in the delta region was zoned agriculture.

The Skagit Chinook Recovery Plan recommends developing a water quality based approach to agricultural practice, with a commitment to use of Farm Plans that apply the Best Available Science (BAS).

While more recent data is needed to verify conditions on the ground in 2011, as of 2006, the riparian recommendations of the Skagit Chinook Recovery Plan were not being fully implemented.

Lack of Tidal Wetland Habitat Remains a Limiting Factor to Skagit River Chinook Production

The Skagit River Chinook Recovery Plan habitat restoration goal for the tidal delta is to expand habitat capacity to support 1,350,000 additional Chinook smolts. If current tidal delta restoration planning is fully implemented, the Recovery Plan will exceed its original goal and restore enough area to support 1,456,494 additional smolts. Since 2005, 6% of the Recovery Plan's original restoration goals have been realized and tidal delta habitat capacity has increased by an estimated 76,668 smolts (HWS, 2011).



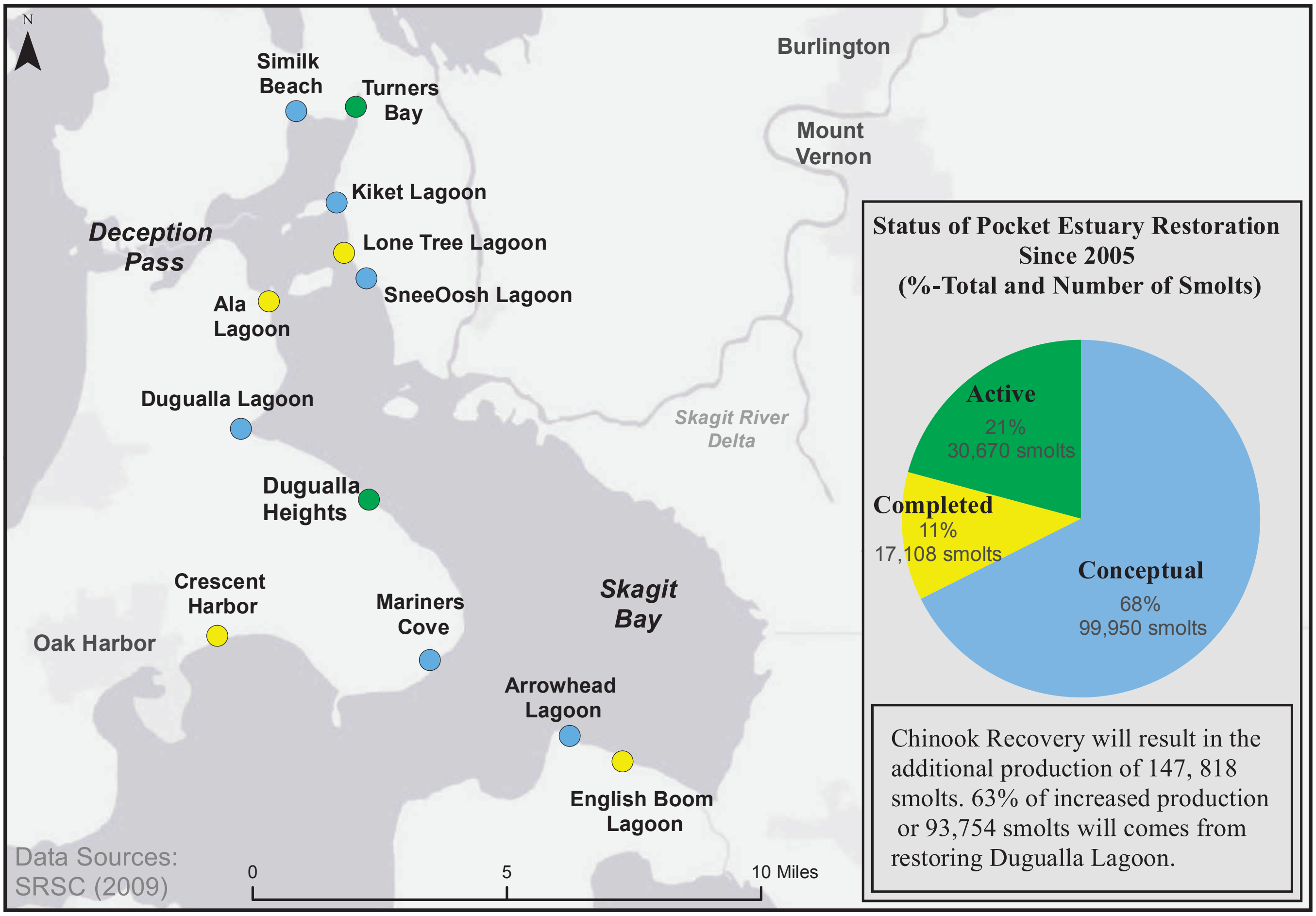
Skagit Delta Tidal Wetland Conditions	Miles of Tidal Barriers	Acres of Preferred Delta Rearing Habitat
Historic (1860s)	0	3,146
Current (2000)	71	381

Diking, dredging, filling, clearing, and developing the Skagit delta over the last 150 years has reduced tidal wetland area from 28,375 acres to 7,705 acres (Beamer et al, 2005) and added 71 miles of tidal barriers along the shoreline (PSNERP, 2009). This has resulted in an estimated 88% loss of juvenile Chinook rearing habitat in the delta, leading to an overpopulation of existing habitat. This has also resulted in stunted growth of Chinook currently in the delta and restriction of the number of Chinook that can be in the delta.

All six wild Skagit Chinook stocks rear in the delta, and there is not enough tidal wetland habitat available for all the juvenile Chinook that want to rear there. At a minimum, Skagit Chinook Recovery planners still need to add habitat capacity for 1,275,000 additional smolts.

Restoration of Whidbey Basin Pocket Estuaries Under way And the 5-Year Recovery Target Has Been Met

The Skagit Chinook Recovery Plan prioritized the restoration of 12 pocket estuaries totaling 76.8 acres of useable habitat area. These 12 sites are all within one day of Chinook fry travel from the Skagit river estuary. If all 12 sites are restored, annual Chinook production will increase from 73,442 smolts to 221,260 smolts (SRSC, WDFW 2005). For the first 5 years, restoration was planned for seven sites, 31.4 acres of useable habitat, and an increase of 27,903 smolts. Through the first 5 years, restoration has been or is being implemented at 6 sites, totaling 33.6 acres for an increase in Chinook production of 47,868 smolts, almost 20,000 more smolts than planned. The additional restoration gains are primarily the result of the active restoration of Dugualla Bay Heights, which was not originally planned for the first 5 years.



Pocket estuaries are small-scale estuaries within the larger Puget Sound estuary that form behind coastal accretion landforms, at embayments created by submerged valleys, or at small creek deltas (Beamer Et al. 2005). They provide low-energy and high-nutrient habitats for juvenile Chinook as they migrate through the Sound from their natal river and delta. The Skagit River Chinook Recovery Plan focuses on restoring and protecting pocket estuaries in the Whidbey Basin that are within a day's swimming distance for Chinook fry.

For the Whidbey Basin, modeling and field survey have led researchers to conclude that over two-thirds of historic pocket estuaries have been completely lost to juvenile salmon use, and the remaining one-third has been reduced in size by aproximately 50%. This suggests an approximate 80% net reduction in pocket estuary area. Pocket estuaries within a day's swimming time of the Skagit River delta have experienced an 86% net reduction (Beamer Et al. 2005).

Summary

The major resource concern for the Sauk-Suiattle Indian Tribe is the state of salmon within the Sauk River watershed. As a result, the Tribe is deeply committed to the Skagit River Chinook Recovery Plan (SRSC; WDFW, 2005). This report has presented a Sauk-Suiattle Tribe selection of indicators to review how the Skagit Chinook Recovery Plan has been progressing in the Sauk, Suiattle, and Cascade River watersheds. The results thus far appear mixed. The Recovery Plan is being implemented, but it is not clear whether it is being implemented quickly enough, or whether there is enough regulatory support to accelerate recovery. To get a better understanding of these factors, more time and data are needed. Below are some selected findings from the report.

Status of Habitat and the Skagit River Chinook Recovery Plan:

Sauk River Floodplain

- Addition of restricted development zone to the FEMA National Flood Insurance Program will potentially add 875 acres of protection to the Sauk River floodplain.
- With 250 acres protected, the Sauk-Suiattle Indian Tribe's Sauk-Suiattle Conservation Area is the second largest conservation holding in the entire Sauk River floodplain.

Riparian Forest Condition

- Between 97 and 100% of riparian forests inside of the active (non-regulatory) CMZ remain healthy.
- 83% of impaired floodplain riparian forest falls along floodplain tributaries.
- Policy changes are needed at the state and local levels to insure that farmers and small forestland owners are managing riparian areas on their land with the full protections afforded riparian areas through state and local regulations (SRSC; WDFW, 2005).

Forest Roads

- In the Sauk and Cascade watersheds, DNR State Lands has documented 71% of its RMAP work is complete, and private industrial forestland owners have documented 39% of their road work is complete. These are good results and fish habitat will benefit from the completed work. The concern for recovery is that extensions for completing RMAP work are further delaying completion at a time when acceleration of the process is needed.
- Salmon Recovery Funding has resulted in key improvements to USFS roads in the Sauk River watershed, while USFS road maintenance budgets have been getting smaller. Since 2008, the federal government has been putting more money towards fixing roads on USFS lands (Wilderness Society, 2011). The majority of USFS roads in the Sauk watershed still need drainage upgrades.

Monte Cristo Mine Cleanup

- The cleanup process will cost an estimated $5.5 million dollars, will result in isolation of 16,275 cubic yards of waste rock, and is scheduled for completion by 2013 (CES, 2010). The immediate threat to steelhead and bull trout spawning makes implementation of the scheduled cleanup imperative.

Citation

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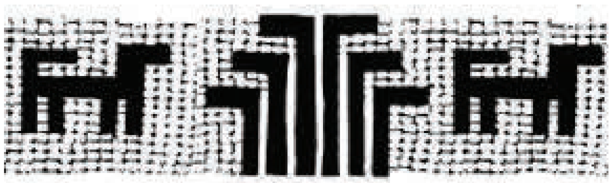
State of Our Watersheds Report
Skokomish-Dosewallips Basin



The Skokomish Tribe is wholly devoted to restoring the Skokomish watershed and its resources – not just for the next five years, not just for another 40 years, but forever. We must continue healing the environment that we depend upon for survival. The health and well-being of the Skokomish watershed is vital to the Skokomish tribal culture, tradition, subsistence and economy.

– JOSEPH PAVEL, SKOKOMISH TRIBE

The Skokomish Tribe

The Twana (ancestors of the Skokomish) were the first human inhabitants of the south Hood Canal region, with villages and fishing camps located near streams where they could take advantage of plentiful fish and shellfish resources.

With the Point No Point Treaty of 1855, the tribes ceded their traditional lands to the U.S. government. At about this time, Euro-Americans began farming the major floodplains and cutting the old-growth timber along the Hood Canal shorelines.

Today, the region is largely rural and forested, with communities relying on logging, fishing, shellfish and recreation. Major land-use impacts on salmon habitat include dam construction, floodplain and shoreline development, roads, and logging, especially in steep-forested terrain.

This report will focus on WRIA 16 Skokomish-Dosewallips basin and surrounding marine waters, which is only a portion of the area that the Skokomish Tribe works in and manages.

History of the Skokomish-Dosewallips Basin

The Skokomish-Dosewallips basin encompasses numerous independent watersheds that drain the steep eastern slopes of the Olympic Mountains before emptying into the southwest shorelines of Hood Canal. A combination of uplift, glaciation and fluvial processes made Hood Canal a natural glacier-carved fjord more than 60 miles long.

The principle watersheds – Skokomish, Hamma Hamma, Duckabush and Dosewallips – support listed Hood Canal summer chum and Puget Sound chinook. At treaty time, the Skokomish River supported large fish runs, including all species of Pacific salmon and steelhead, which returned to the river during almost every month of the year.

The estuarine and nearshore habitats of Hood Canal provide a critical migration corridor for juvenile salmon of all species.

Sizable portions of these major watersheds are contained within Olympic National Park or U.S. Forest Service ownership. The U.S. Forest Service lands were subject to excess resource extraction, causing extreme habitat damage. Since 1994, these lands have been managed under the U.S. Northwest Forest Plan and are protected for the long-term health of forests, wildlife and waterways.

The Skokomish-Dosewallips Basin has remained largely rural and forested with a natural resources-based economy focused on shellfish harvesting, commercial forestry, commercial fisheries, tourism, Christmas tree farming, and agriculture. Unfortunately, habitat quality, which sustains the above economic activities, has diminished due to multiple causes including road and land development, stream modifications, shoreline development, and water pollution from sediment, nutrients and pathogens.

Throughout the west side of Hood Canal, the lower portions of the rivers and estuaries are the most impacted by development and past logging practices.

Historically, the South Fork of the Skokomish River was a significant producer of chinook salmon, including both spring and summer/fall populations.

The tribe has been working with the Department of Fish and Wildlife the past few years to restore some or all of the historic distribution of natural chinook to the South Fork.

In 2008, the tribe and the state hauled fish from the state's George Adams Hatchery and released them in the upper area of the South Fork of the river to try and repopulate the watershed.

Restoration of these fish is an integral part of the recovery of this species in the Skokomish watershed. Work is also moving forward to re-establish spring chinook in the North Fork.

Technical analysis has identified the following significant habitat-limiting factors for decline of the region's salmonid populations:

- **Estuarine habitat loss and degradation;**
- **Loss of channel complexity from large woody debris;**
- **Scouring from high water flows;**
- **Floodplain modifications and loss of wetlands; and**
- **Sediment aggradation**

Implementing a Conservation & Recovery Plan

The habitat protection and restoration strategy pursued for Hood Canal was to work with current landowners on habitat stewardship and restoration projects. Restoration actions were organized by limiting factors within each watershed. The existing regulatory protection tools were viewed as adequate for recovery, "if watershed development occurs as expected and current regulations are maintained or improved and adequately implemented." However, growth has occurred at greater density and with a larger footprint than anticipated.

Still, restoration within the drainages of Hood Canal proceeded under the recovery plans for each watershed. Work has focused on restoring stream connectivity, bed stabilization, riparian replanting, placement of logjams, invasive plant species removal, and road decommissioning. Several projects have been implemented throughout Hood Canal to initiate habitat restoration in estuarine and nearshore areas surrounding the rivers and other major streams.

While steady progress has been made toward restoration goals, progress is not on track to achieve the 10-year goal identified in the recovery plan (2010, Millie M., Judge).

The majority of the land base within the Skokomish-Dosewallips basin is under federal jurisdiction in the Olympic National Park, Olympic National Forest, or wilderness areas. This has led to the concentration of land use and development pressure on a narrow strip of land along the west side of Hood Canal. Ninety-nine percent of this narrow strip of non-federal land is classified as either forest or rural land, meaning it is subject to more development pressure. It is in this narrow strip where the population is located while associated rivers and streams are home to the majority of salmonid spawning and rearing habitat.

At the 5-year mark, a review of key environmental indicators for the Skokomish-Dosewallips Basin Conservation/ Recovery Plan reveals a continued decline in water quality and habitat loss on non-federal lands that are essential to the recovery and survival of salmon in Hood Canal.

The loss of forest cover and diminished riparian buffering has continued within the watershed. Properly functioning riparian buffers provide hydraulic diversity, water quality protection, temperature moderation, and structural complexity, among other ecological services.

According to the Washington Department of Natural Resources, between 1995-2007:

- **32% of the available commercial and private forestland was harvested. Two areas, the South Hood Canal and North Hood Canal-2, saw a harvest rate of more than 40%.**
- **Of the 58,244 acres of forestland in private ownership, only 46,284 acres are enrolled as Designated Forest Land, placing the remaining 6,925 acres (12%) at high risk of converting to non-forest uses.**

The Skokomish Tribe worked with the Olympic National Forest to restore approximately one mile within the upper watershed of South Fork Skokomish River to help improve fish habitat for Puget Sound Chinook, steelhead, and bull trout, which are listed as "threatened" under the federal Endangered Species Act.

Installing wood structures in the river and riparian zone and planting native vegetation in this small stretch will improve spawning and rearing habitat for salmon and other fish. Salmon need deep pools, cover and shade associated with streams reaches that have abundant vegetation and woody debris, channel depth and complexity.

This particular stretch of the South Fork has been heavily impacted by past land management activities including logging and wood debris removal in preparation for a proposed dam project in the 1950s that was abandoned prior to initiation of construction. Past management of the watershed has had a huge effect on habitat.

Runoff, Wells, Development Threaten Water Quality

Water quality within Hood Canal is continuing to decline, with an increasing frequency of low oxygen events and a growing list of impaired and threatened water courses due to temperature, fecal coliform and dissolved oxygen issues.

Agriculture has been identified as a key contributor to the elevated fecal coliform levels in the Skokomish River and Hood Canal. Although agriculture occurs in several locations in the region, most is found in the Skokomish watershed.

Of the 2,210 acres of land zoned for agricultural use within the Skokomish watershed, 84% falls within the 100-year flood zone. As a result, when the Skokomish River floods annually, the fecal coliform from agriculture activities is flushed downstream. The farmlands within the floodplain have been modified over the past century, leaving little riparian buffer to protect the water quality of the Skokomish River.

Only 20% of the riparian area within this agricultural land has a forested riparian zone. In addition to the zoned agricultural lands within the Skokomish watershed, it is estimated that an additional 450 acres are used for agricultural purposes but are zoned rural or non-agricultural, compounding the water quality challenges.

Another water quality concern is the expanding development on non-federal lands. It is estimated that more than 2,400 residents, nearly 1/3 of the region's population, draw their water from exempt wells. During the past 30 years, there has been an increase of 460% in the number of wells. Of the exempt wells, 48% are within 1 mile of the Hood Canal shoreline, and of these, 57% are clustered in the lower portion of the Duckabush and Dosewallips basins. This trend raises concerns regarding surface flow and potential impacts on minimum instream flows, salmon habiat, public health and senior water rights.

Along the Hood Canal shoreline, there are more than 6,360 parcels of land within 2 miles of the Hood Canal shoreline and of these parcels, 2,666 (42%) have an on-site septic system. Such growth and land development can lead to increased nitrogen and fecal coliform-contaminated runoff, which has been the main cause of shellfish closures in Hood Canal since 2003. Also accompanying this development is shoreline modification which degrades nearshore habitat and covers 81% of the Skokomish-Dosewallips basin shoreline. Impervious surface data further illustrates the growing magnitude of the problem with a 20% increase in surface area from 1991-2006. For non-federal lands surrounding the Dosewallips drainage, the impervious surface coverage is now 12%, which is considered "degrading" watershed habitat quality.

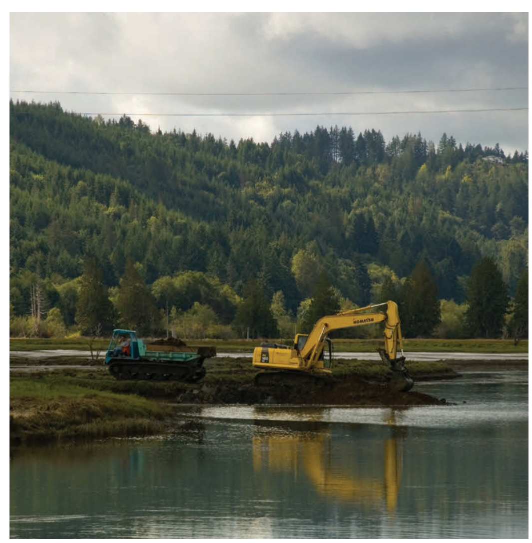
Skokomish Tribe natural resources staff member Jen Green takes a water quality sample from Hood Canal.

Looking Ahead

The combination of land use decisions and resulting habitat conditions make a compelling case that stronger habitat protection, restoration and regulatory oversight is needed if we are going to repair the damages that have been done, and protect the remaining intact habitat and functioning ecological process. Unfortunately, the Skokomish-Dosewallips basin suffers from a lack of data and more information is needed to help support natural resources planning and decision-making processes.

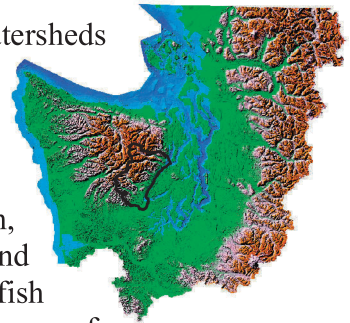
Greater focus and effort is required on conservation measures and restoration activities to offset the negative trends outlined above. The regulatory framework that aims to protect salmon habitat must be upgraded if recovery goals are to be realized and existing habitat is to be protected from loss.

Obviously, we have failed to meet the 1999 recovery goals of keeping impervious cover areas maintained at or within the 10% threshold and rural growth rate of 1.08%. The Jefferson and Mason County's Shoreline Master Programs governing land-use activities and habitat protection in the nearshore, estuarine, and river system had yet to be updated as of March 2011 and should have been calibrated to facilitate the achievement of habitat protection and salmon recovery goals for the Skokomish-Dosewallips basin.



An excavator removes dikes on Nalley Island near the Skokomish Reservation, allowing historic salt marsh habitat and channel networks to re-form and for salmon to use when seeking refuge.

Skokomish Indian Tribe
(WRIA 16: Skokomish-Dosewallips Basin)



The Skokomish-Dosewallips Basin encompasses numerous independent watersheds that drain the steep eastern slopes of the Olympic Mountains and empty into the southwest shorelines of Hood Canal. A combination of uplift, glaciation, and fluvial processes define the current geological landscape, which made Hood Canal a natural, glacier-carved fjord, more than 60 miles long. The principle watersheds – Skokomish, Hamma Hamma, Duckabush, and Dosewallips – currently support listed Hood Canal summer chum and Puget Sound Chinook. At treaty time, the Skokomish River supported large fish runs including all species of Pacific salmon and steelhead. This broad range of species (Chinook, coho, chum, sockeye, pink and steelhead) and fish runs returned to the Skokomish River during almost every month of the year. The estuarine and nearshore habitats of Hood Canal provide a critical migration corridor for juvenile salmon of all species. Sizable portions of these major watersheds are contained within the Olympic National Park or US Forest Service ownership. The US Forest Service lands were subject to excess resource extraction which caused extreme habitat damage and alterations. Since 1994, these lands have been managed under the US Northwest Forest Plan and are now protected for the long-term health of forests, wildlife and waterways.

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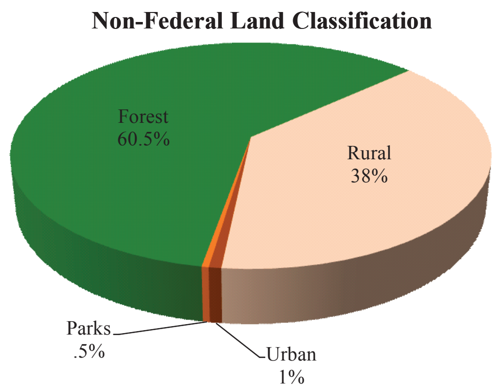
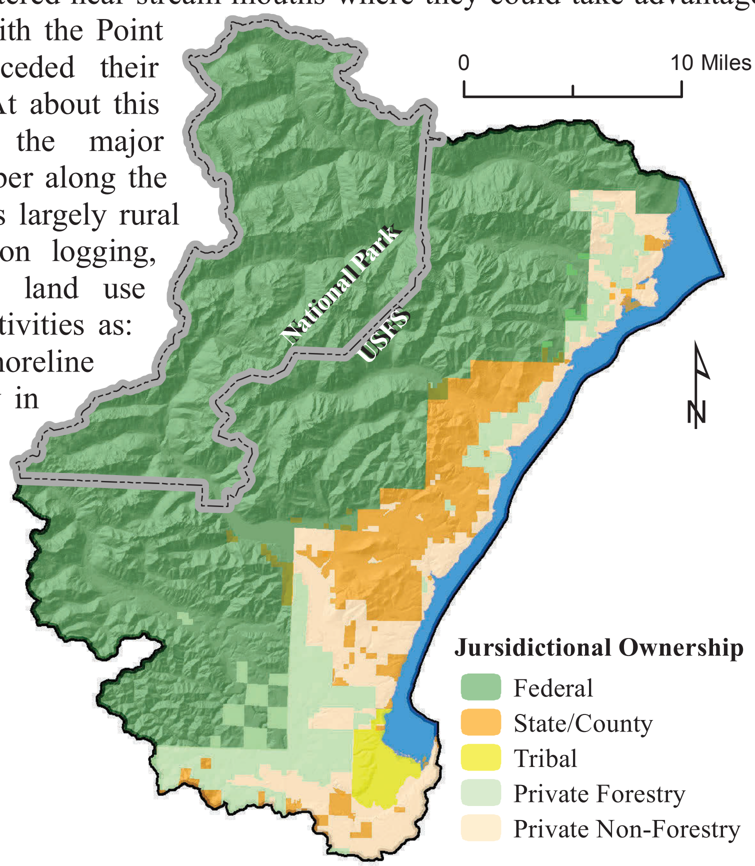




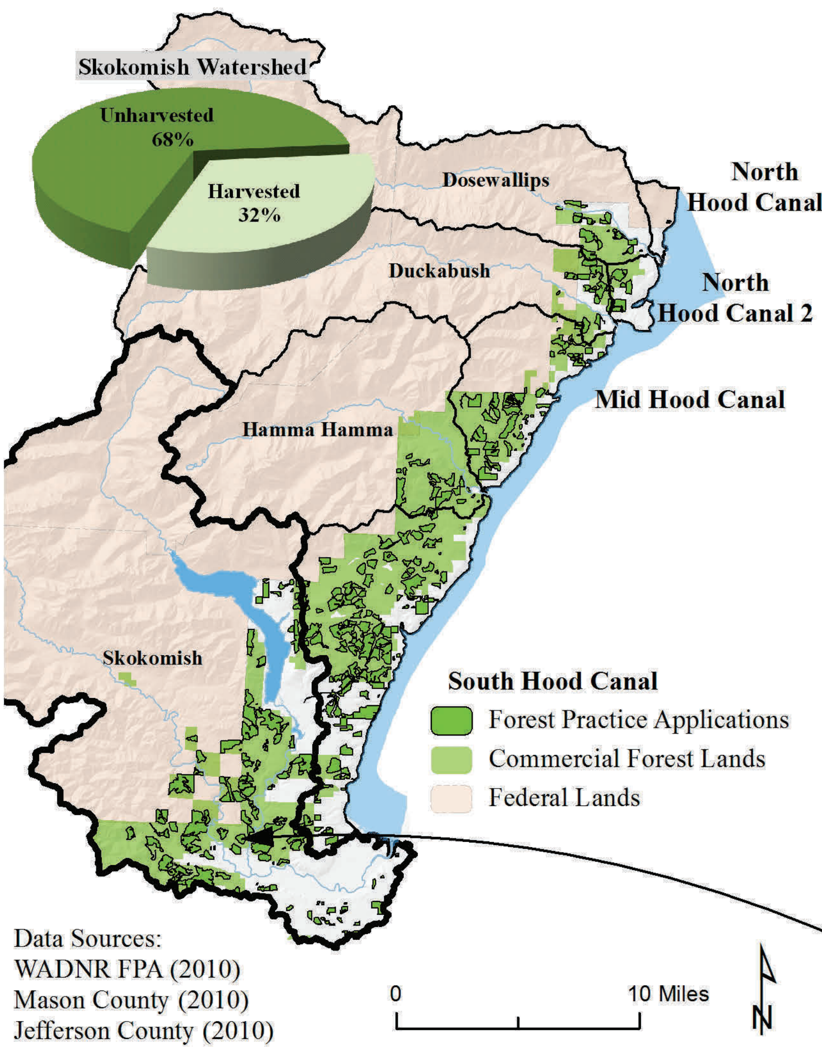
The Skokomish-Dosewallips basin is dominated by federal land ownership, which has the result of concentrating land use and development pressures to the narrow strip of land along the westside of Hood Canal. Ninety-nine percent of this non-federal land ownership is classified as either forest or rural land classifications.

Cumulative Impacts of Timber Harvest Operations

Thirty-two percent of the commercial and private forest lands within WRIA 16 were harvested between 1995 and 2007. South Hood Canal and the North Hood Canal-2 saw the largest impact with over 40% of the commercial and private forest lands being harvested.

Timber harvest on non-federal land is present in all watersheds, with a significant amount occurring in the Skokomish, South Hood Canal, and North Hood Canal-2 subwatersheds. Large clearcuts, inadequate buffers, mass wasting and poorly constructed or maintained forest roads and culverts have all led to the degradation of salmon habitat in WRIA 16. Riparian degradation in the lower Dosewallips, McDonald Creek, lower Lilliwaup River, Skokomish River and lower Duckabush River has been attributed to Forest Practices (WCC, 2003).

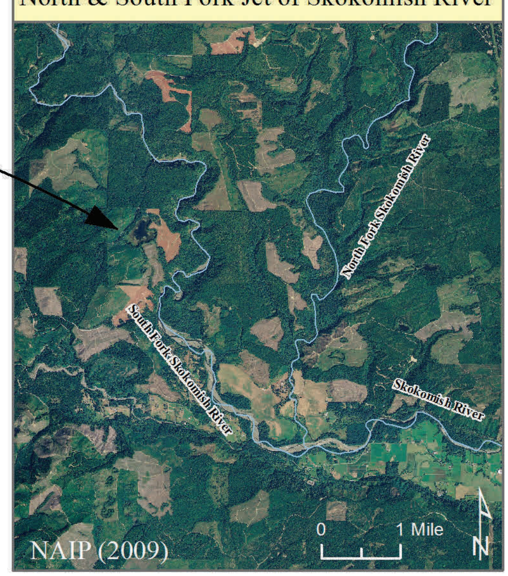
Timber Harvest Activities Impact Lower Watersheds



In the lower watershed, a significant amount of the anadromous fish habitat is on private lands. The lower river and estuaries are the most impacted by development and past logging practices in each of the three watersheds included in the Mid Hood Canal Chinook Recovery Plan (MHCCRPC, 2005).

In the Skokomish watershed, 32% of the non-federal commercial and private forest lands were harvested in a 12 year period (1995-2007). This, in combination with the USFS harvest of about 58,000 acres prior to 1995 in the upper watershed, places this watershed in need of aggressive restoration. These high rates of harvest are one of the main causes of aggradation and flooding seen in the lower river.

North & South Fork Jct of Skokomish River



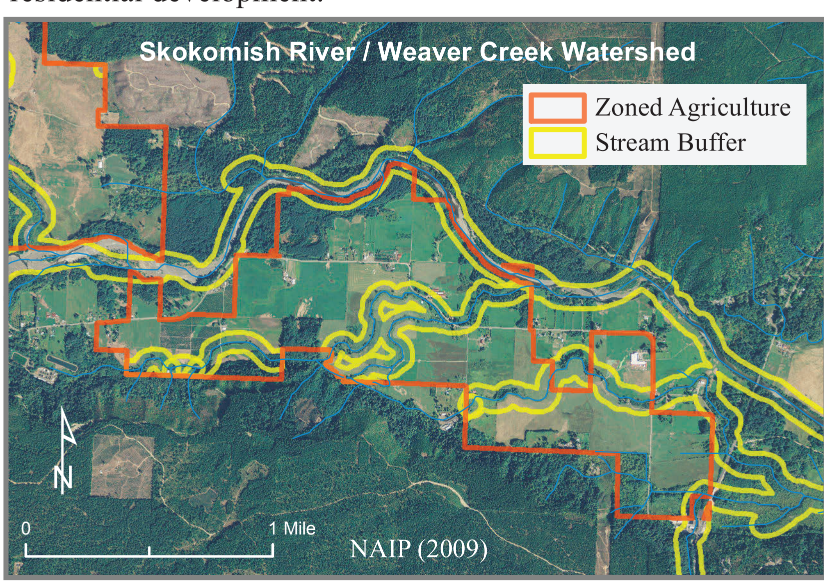
Significant habitat limiting factors which have prevented increased productivity of Chinook include the following: the estuarine habitat loss, channel complexity and overall channel conditions, high water flows in the winter months, floodplain wetlands, and logging roads in the upper watersheds (PSSRP, 2007).

Agricultural Lands

In review of progress made since the listing of the Chinook and chum salmon (2005), no projects have been accomplished within the agriculturally zoned lands to restore the riparian functions. The Skokomish watershed, which represents 95% of the agricultural lands found in WRIA 16, has only 20% of its riparian acres in a forested condition.

Diking began in the 1920s, then expanded between the late 1930s and early 1940s (Amato, 1996; Todd et al, 2006). The lower estuary was diked for the purpose of increasing agriculture lands. Diking became commonplace in the lower valley upstream of the estuary for both flood protection and increasing the amount of agricultural lands. The system of dikes in these areas grew significantly in the 1950s and 1960s, with improvements and dike lengthening continuing to be made after that (Amato, 1996). The restoration of these floodplains is key to the recovery of the Chinook salmon. Dikes need to be removed or repositioned away from the floodplains to allow the return of the natural meandering of the river across the floodplain.

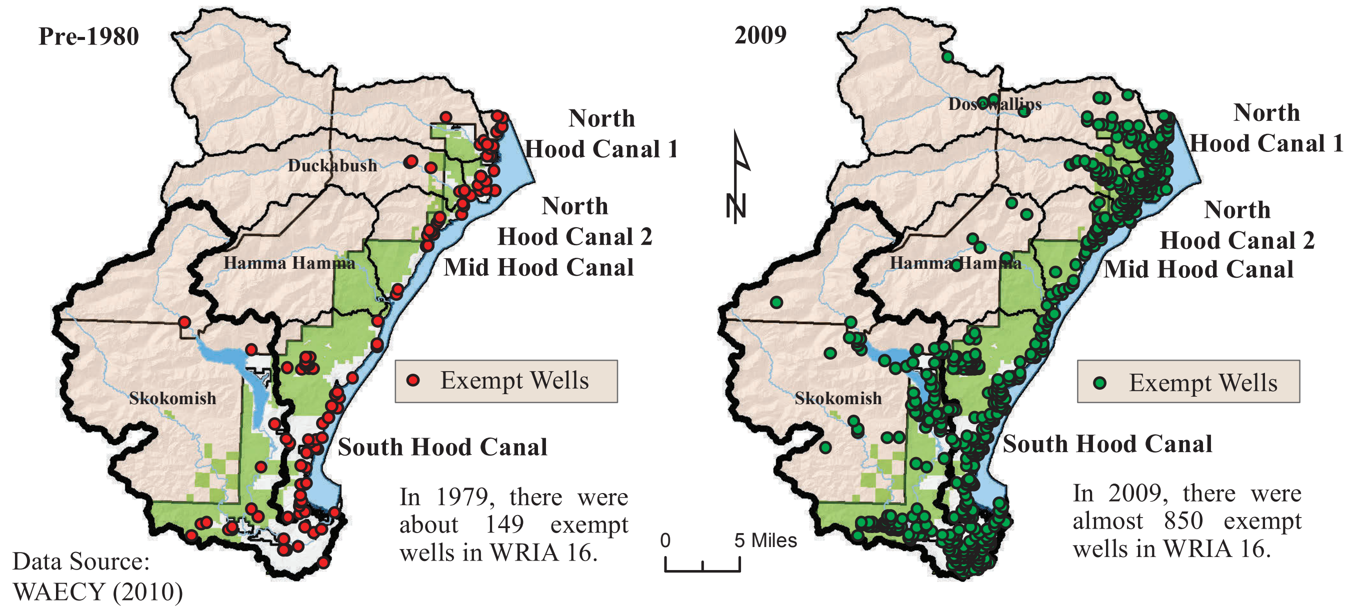
Ninety-five percent of the agricultural lands of WRIA 16 are located in the Skokomish basin. The Skokomish basin has a long history of negative impacts caused by the lack of proper management of these agricultural lands including such impacts as lack of stream buffers, sediment, and cattle being allowed to enter streams. Over 62% of the Skokomish mainstem is sparsely vegetated and has been cleared for agriculture (WCC, 2003). Of the 2,210 agricultural acres in the Skokomish basin, 1,867 (84%) lies within the 100-year flood zone. One of the limiting factors for Chinook recovery is the modifications to the floodplain and loss of freshwater wetlands. These watershed features were largely caused by conversion of the floodplains to pastureland and residential development.



The riparian forest condition was analyzed on all agricultural lands within WRIA 16. Analysis buffers ranged from 150 to 250 feet and were applied to all streams within the agricultural zoned lands. The research found that within the Skokomish Wateshed, only 20% of the riparian acres were actually forested. The Hamma Hamma was 46% forested, Dosewallips was 51% forested, and North Hood Canal was 71% forested.

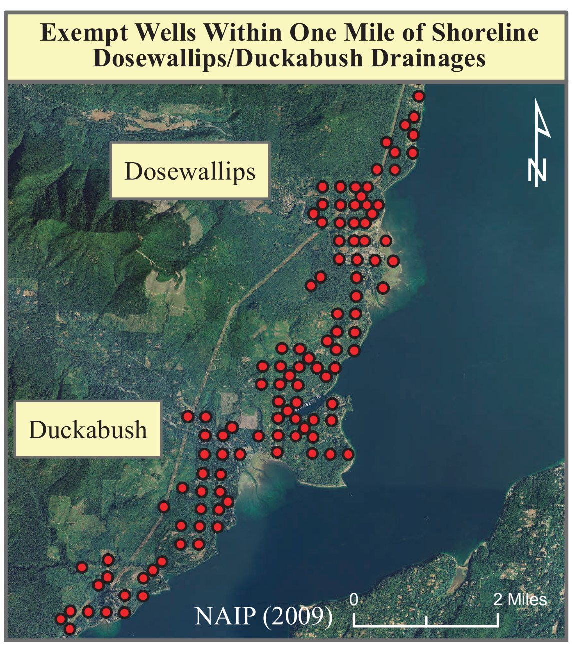
Permit-exempt Wells Potentially Impact Surface Flows

During the past 30 years, WRIA 16 has seen an increase of over 460% in exempt well drilling. 48% of the existing exempt wells are located within one mile of the Hood Canal shoreline.

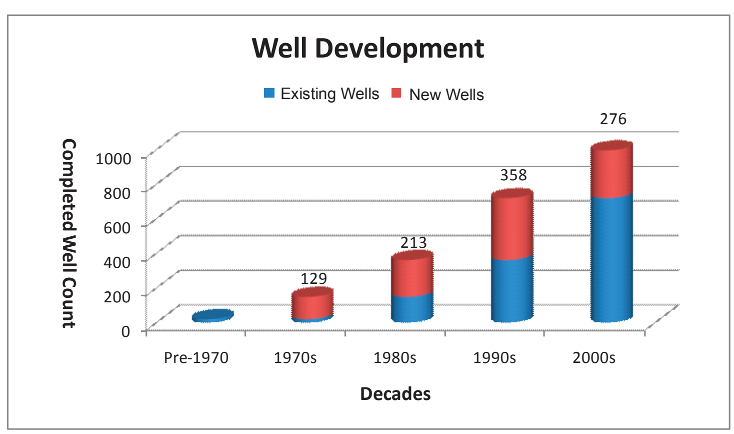


Statute RCW 90.44.050 authorizes the use of exempt wells for single homes or groups of homes (limited to 5,000 gallons per day), livestock, non-commercial lawn or garden 1/2 acre or less, and providing water for industrial purpose, including irrigation (limited to 5,000 gallons per day) without a permit. The cumulative withdrawal of groundwater associated with the recent proliferation of exempt wells has led to concerns of instream flow, salmon habitat, public health and senior water right impact (Ballhorn, 2008).

An estimated 2,460 people residing in WRIA 16 (nearly one-third of the population) draw their water from permit exempt wells; water use from these wells can amount to a significant amount of water (Golder Associates, 2003).



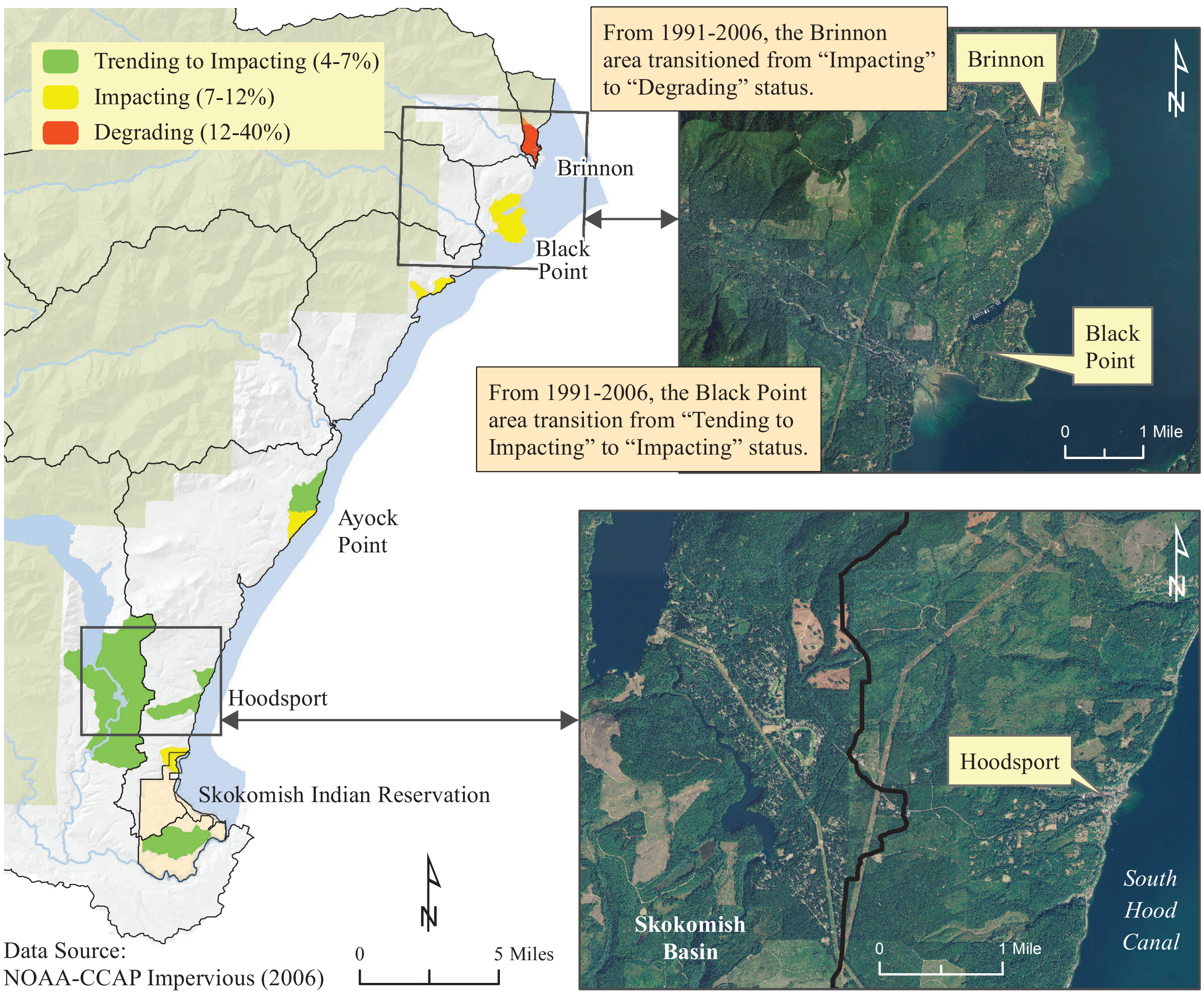
Of the approximately 1,000 exempt wells in WRIA 16, 476 (48%) are found within one mile of the Hood Canal shoreline. A majority (57%) of these exempt wells are clustered in the lower portion of the Duckabush and Dosewallips drainage areas.



Impervious Surface

Impervious surface in WRIA 16 has increased by 20% since 1991. Of this increased amount, 51% was located within the Skokomish basin and about one-third of it was within one mile of the Hood Canal shoreline.

The Chinook Recovery Plans of WRIA 16 clearly state the lower rivers and estuaries were most impacted by historic development patterns and past logging practices. The need for restoration of natural processes to the river and estuarine systems was a continuous theme (MHCCRP, 2005). Development along the shorelines of sensitive areas negatively affects water quality by increasing impervious surfaces and thereby pollutant-containing runoff. The watershed's rivers, streams, and nearshore environment provide important habitat for Chinook, chum, coho, and pink salmon, steelhead and cutthroat trout, and associated aquatic species. Habitat quality has diminished due to multiple causes including roads and land development, stream modifications, shoreline development, and water pollution from sediment, nutrients, and pathogens (Detailed Implementation Plan-WRIA 16 & 14b, 2008).

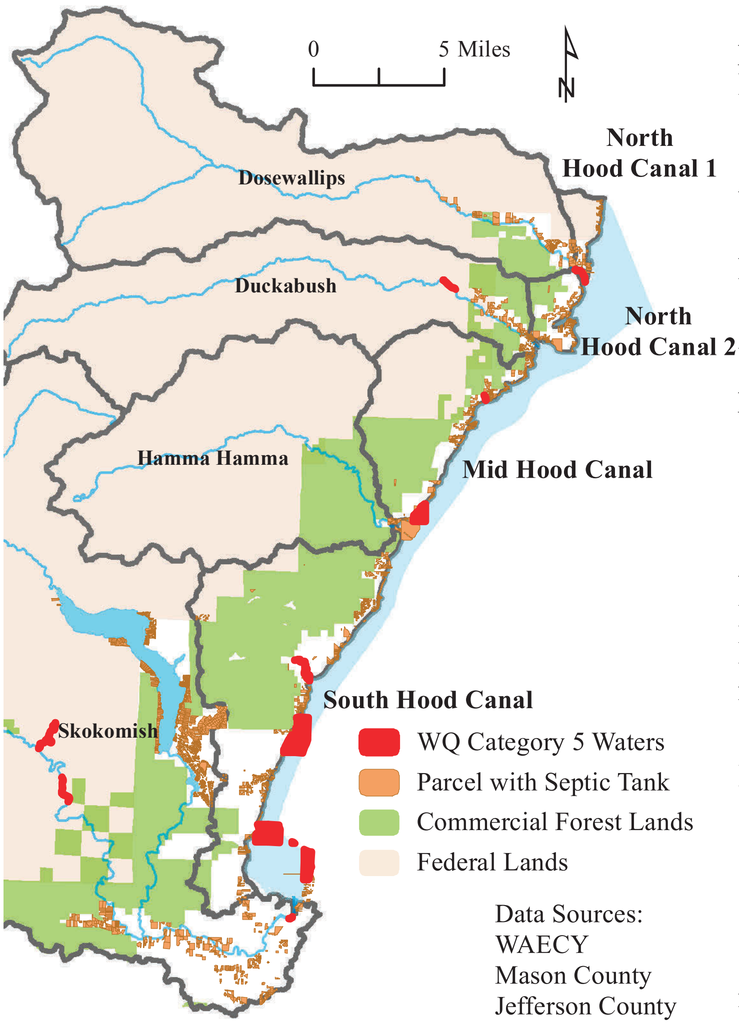


One of the four goals of the Skokomish Chinook Recovery Plan identifies the need to protect the ecological processes, functions, and forms of the Skokomish watershed from ongoing land and water uses, specifically the protection of water quality from further degradation from nonpoint and point pollution sources (RPSRCS, 2010). In review of the NOAA-CCAP Impervious Surface data, the Skokomish Basin had an increase of 51% in the amount of impervious surface from 1991 to 2006.

Human Use of Hood Canal Watershed Impacts Water Quality

Seventeen water courses are currently listed within Hood Canal on the Dept of Ecology's 303d list for having low dissolved oxygen levels and exceeding the fecal coliform and temperature standards. The loss of riparian vegetation, altered stream flows, and pollution from adjacent lands uses have all added to the degraded water quality conditions.

One of the four goals of the Skokomish River Chinook Recovery Plan is the protection of water quality from further degradation from non-point and point pollution sources (RPSRCS, 2010). The Mid Hood Canal Chinook Recovery Plan states the key to recovery of productive, sustainable natural Chinook is the habitat in the watersheds and estuary (MHCCRP, 2005). One of the key factors in the restoration of the habitat is the management of surface flows and stormwater runoff.



WRIA 16 streams and stormwater runoff carry pathogens, nutrients, and chemicals from septic systems, highways, animal manure, and other sources in Hood Canal. Nitrogen in Hood Canal contributes to excessive algae and to the low dissolved oxygen problem. According to the Hood Canal Low Dissolved Oxygen Preliminary Assessment and Corrective Action Plan, the biggest single human source of nitrogen in Hood Canal is sewage leaked from septic systems (PSAT and HCCC, 2004).

It is estimated that there are over 6,000 parcels of land within two miles of the Hood Canal Shoreline. Of these parcels, 2,666 (44%) have an onsite septic system. These parcel range in size from 0.02 to 255 acres and have a mean acreage of about 1.4 acres. The active management of these septic systems is critical to the recovery of water quality in the Hood Canal area.

September 21, 2010: Hood Canal Fish Kill

A fish kill occurred in Hood Canal at the end of September 2010. The low oxygen levels throughout 2010 were a result of poor seasonal flushing of Hood Canal during the fall of 2009, likely linked to and weather conditions. Hood Canal is a system that is very susceptible to periodic fish kills; additional oxygen depressions from human nitrogen loading increase that risk (Newton, 2010).

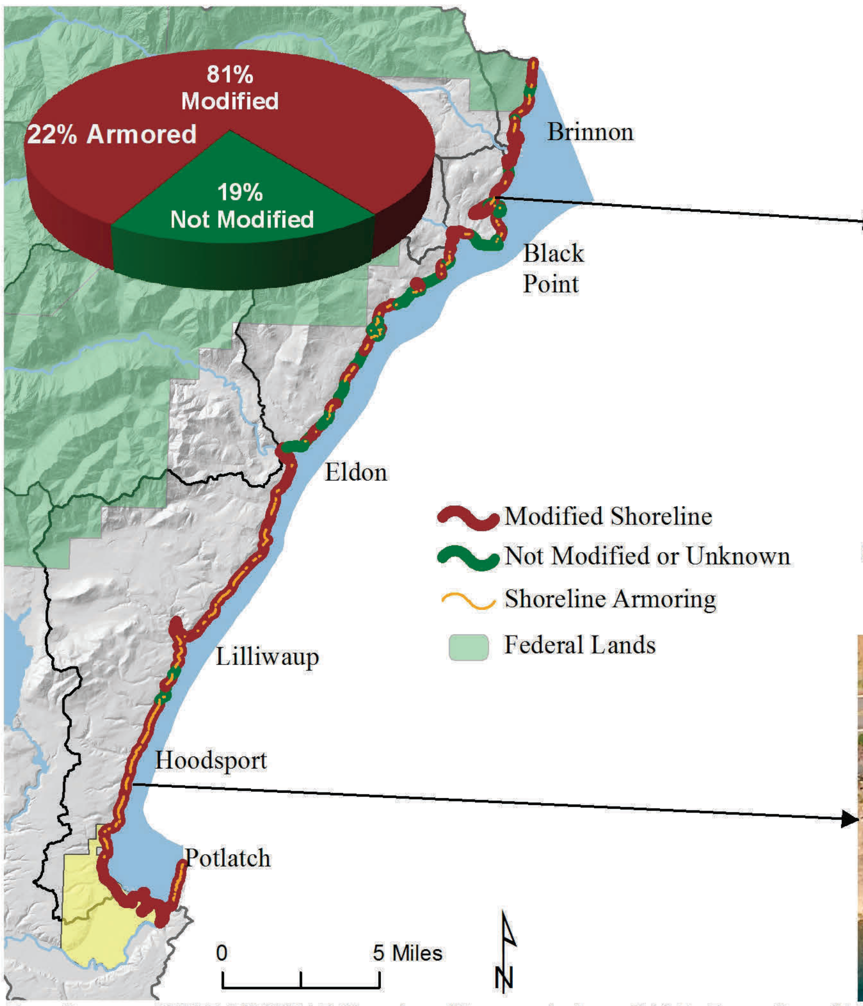
303d List of Impaired and Threatened Water Courses

LISTED STREAMS	WATER QUALITY PROBLEM(S)
Dosewallips River	Temperature
Duckabush River	Temperature
Fulton Creek	Temperature
Great Bend/Lynch Cove	Fecal Coliform
Great Bend/Lynch Cove	Dissolved Oxygen
Hood Canal (south)	Fecal Coliform
Hood Canal (south)	Dissolved Oxygen
Lebar Creek	Temperature
Lilliwaup Creek	Fecal Coliform
Skokomish River	Fecal Coliform
Skokomish River, S.F.	Temperature

Shoreline Modifications Threaten Nearshore Habitat

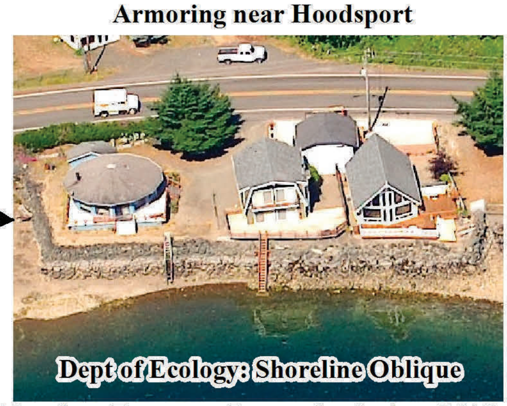
The western shoreline of Hood Canal has been modified over the past several decades from unincorporated and piecemeal development. Over 81% of the marine shoreline segments in the Skokomish Tribe's area of concern have been modified and 22% have actually been armored. The nearshore habitat, which provides critical rearing and foraging for salmonids has been directly and negatively impacted.

The Hood Canal Coordinating Council Salmon Habitat Recovery Strategy (HCCC, 2004) has identified habitat in the nearshore marine waters as a high priority. The intent is to protect and restore what is presently documented as the Chinook and chum habitat, and the watershed processes that support and maintain that habitat. The Mid-Hood Canal Chinook Recovery Planning Chapter (MHCCRPC, 2005) identified the key to recovery of productive, sustainable natural Chinook mid Hood Canal populations is the habitat in the watersheds and estuaries.



Shoreline Modification at Pleasant Harbor

Armoring near Hoodsport



Data Sources: NWIFC/SSHIAP Nearshore/Geomorphology (2008); Puget Sound Nearshore Ecosystem Restoration Project (2008)

One of the objectives of the Skokomish Chinook Recovery Plan is to "protect from further degradation the structural elements that contribute to nearshore habitat forming processes and associated key habitats" (RPSRCS, 2010). A recovery plan framework objective is "to restore nearshore habitat, the estuary, and associated floodplain habitat and function." Needless to say, with 81 percent of the shoreline being in a modified condition, continued, focused efforts will be necessary to reach these objectives.

Shoreline development such as bulkheads, fill, roads, highways, docks, and piers can affect habitat that salmon rely upon for migration, rearing, and refuge. Estuarine, salt marsh, eelgrass and shallow water nearshore habitats are critical to all species of juvenile salmonids as they enter the marine environment.

Summary

The economy in WRIA 16 relies largely on shellfish harvesting, commercial fisheries, commercial forestry, tourism, and agriculture. Unfortunately, habitat quality, which sustains the above economic activities within WRIA 16, has diminished due to multiple causes including, but not limited to: roads and land development, stream modifications, shoreline development, and water pollution from sediment, nutrients, and pathogens.

Roughly 70% of WRIA 16's land area is under federal jurisdiction in Olympic National Park, Olympic National Forest, or wilderness designated areas. This has lead to the concentration of land use, and development pressure on a narrow strip of land along the west side of Hood Canal. Ninety-nine percent of this narrow strip of non-federal land is in either a forest or rural land use classification, which means it is target for future development pressures.

Timber harvest on non-federal lands is present in all watersheds including the Skokomish Watershed. According to the Washington Department of Natural Resources (WDNR) records, during the period of 1995-2007, 32% of the available commercial and private forestlands were harvested. The South Hood Canal and North Hood Canal-2 areas experienced the largest harvest rate of over 40% of available commercial and private forestlands being harvested.

Agriculture has been identified as a key contributor to the elevated fecal coliform levels in the Skokomish River and Hood Canal. Although agriculture occurs in most watersheds, it occupies a relatively large part of the Skokomish watershed. Of the 2,210 acres of agricultural lands zoned for agricultural use within the Skokomish watershed, 84% falls within the 100 year flood zone. As the Skokomish River floods frequently, the pollutants from these agricultural lands are being flushed downstream. The farmlands within the floodplain have been modified during the past century, leaving little riparian buffer to protect the water quality of the Skokomish River. Only 20% of this agricultural riparian zone is in a forest condition, the rest having been cleared for use. In addition to the zoned agricultural lands within the Skokomish watershed, it is estimated that an additional 450 acres are in agricultural use but zoned rural or non-agricultural. These non-agricultural zoned lands combined with the agriculturally zoned lands contribute to the resource managers' challenges to protect and maintain the river's water quality.

WRIA 16 has suffered a significant increase in the number of wells being constructed over the past several decades, prior to 1980 there were approximately 149 exempt wells. By the end of 2009, the number of exempt wells had risen to an estimated 850 wells, representing an increase of 460%. Forty-eight percent of these wells are located within one mile of the Hood Canal shoreline. In addition, it is estimated that 6,000 parcels of land lie within two miles of its shoreline, and of these parcels, 44% have an on-site septic system.

Seventeen water courses within WRIA 16 are currently listed on the Dept. of Ecology 303d list for having low dissolved oxygen levels and exceeding the fecal coliform and temperature standards. The loss of riparian vegetation, altered stream flows, and pollution from adjacent lands uses have all added to the degraded water quality conditions.

During a recent 15-years period, from 1991-2006, there was an increase of 20% in the amount of impervious surface within WRIA 16. This growth of impervious surface has moved some subbasins to an "impacting" and "degrading" impervious surface condition. The areas near the town of Brinnon

(mouth of Dosewallips) and the Black Point area have both moved to the higher status in impervious surface conditions. The area near Brinnon is in the degrading status with > 12% impervious surface condition. During this same time period, the Skokomish basin had an increase in impervious surface area of 51%.

The combination of the land-use decisions and resulting habitat conditions make a compelling case that stronger habitat protection, restoration, and regulatory oversight is needed if we are going to repair the damages which have been done and protect the remaining intact habitat and functioning ecological process. Unfortunately, WRIA 16 suffers from a lack of data and more information is needed to help support natural resource planning and decision-making processes.

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State of Our Watersheds Report
Deep South Puget Sound

The Squaxin Island Tribe is descended from maritime people who have lived and prospered along the shores of the southernmost inlets of Puget Sound for millennia. These waters have always nourished our culture and community. Their protection and restoration is central to providing abundant salmon and shellfish to sustain our way of life.

– ANDY WHITENER, SQUAXIN ISLAND TRIBE

The Squaxin Island Tribe

We are the Noo-Seh-Chatl of Henderson Inlet, Steh Chass of Budd Inlet, Squi-Aitl of Eld Inlet, Sawamish/T'Peeksin of Totten Inlet, Sa-Heh-Wa-Mish of Hammersley Inlet, Squawksin of Case Inlet and S'Hotle-Ma-Mish of Carr Inlet.

The ancestral lands ceded to the federal government in the 1854 Treaty of Medicine Creek included 4,000 square miles. Only one small island, four and a half miles long and a half mile wide was reserved as the main area for all of our people to live.

Our people gradually left the island to take up permanent residence near their original homes. Although there are no year-round residents on Squaxin Island today, it is looked upon as the bond that unites our past, present, and future generations. Squaxin Island is used for fishing, hunting, shellfish gathering, camping, and other activities.

Tribal headquarters are now located in Kamilche, between Little Skookum and Totten inlets, where hundreds of acres of land has been purchased and a thriving community has been established.

The Deep South Puget Sound

The Squaxin Island Tribe's Area of Concern (WRIA 13, and portions of 12, 14, and 15) is second only to the San Juan Islands for total length of marine nearshore. Its shoreline accounts for nearly half of the nearshore habitat in south and central Puget Sound, and provides vital habitat for salmonid reproduction locally and regionally.

The South Sound Salmon Recovery Plan focused on the nearshore environment to recover salmonid populations. The strategy was to ensure that properly functioning nearshore habitats serve rearing, refuge, feeding, physiological transition and migratory needs of local and regional salmonid populations.

Will Henderson with the Squaxin Island Tribe helps measure the width of Goldsborough Creek.

The Squaxin Island Tribe recently took a close look at habitat on Goldsborough Creek for the first time since a dam was removed on there almost 10 years ago.

Since the dam was removed in 2001, the tribe has tracked a steady increase in juvenile coho production. "We've had at least one smolt trap to count salmon during the out-migration season," Haque said. Smolt traps are devices used to safely capture, count and release out-migrating juvenile salmon. "Coho are finding their way to the habitat opened up after the dam came out. What we're doing now is finding out exactly where they're hanging out."

The 34-foot-high Goldsborough Dam prevented salmon from accessing 25 miles of habitat.

Technical analysis has identified significant limiting factors contributing to the decline of the region's salmonid populations and shellfish harvest opportunities (from PSP Action Agenda South Sound Chapter):

- **Habitat conversion from historic conditions, including loss of forest cover; reduced instream large woody debris; elevated summer stream water temperatures, loss of wetlands, degradation of topsoil and duff layer, and marine shoreline armoring.**

- **Disruption of natural hydrologic regimes and loss of natural floodplain functions due to land conversion to impervious surfaces, simplification of stream channels and native vegetation removal.**

- **Extreme sensitivity to toxic, nutrient and pathogen pollution due to poor water circulation in and out of South Sound; contaminants are transported primarily by stormwater runoff and are leading to acidification, hypoxia and shellfish harvest restrictions in South Sound waters.**

Implementing a Salmon Recovery Plan

At the 5-year mark into chinook recovery, a review of key environmental indicators for the Squaxin Island Tribe's Area of Concern indicates a continued decline in forest-land cover, riparian conditions, water quality and quantity, as well as marine shoreline habitat. The majority of these habitat impacts are driven by South Sound experiencing some of the largest population growth in the state. The Area of Concern saw a 7% increase in developed lands and an 8% decrease in forest cover between 1996 and 2006. Industry projections suggest that the region's watersheds will experience an additional 13-14 percent conversion of private forestlands to non-forest uses by 2050 (UW 2009), further challenging biological recovery.

Currently, most watersheds in the region remain below 10 percent impervious surface area and have more than 65 percent forest cover, which is desirable from a restoration standpoint. However, stronger growth management regulations will be required to maintain South Sound watersheds below these thresholds to prevent irreversible decline in habitat conditions.

Stream gage data indicates that all listed streams within the region, for most periods of time since at least the 1980s, fail to meet statutory minimum flows in both the winter and summer months (SIT 2009). This exacerbates problems with elevated water temperature and low dissolved oxygen levels, which are detrimental to salmon migration, spawning and rearing. Additional protection and restoration is required to provide greater riparian shade and groundwater influx to counteract these issues.

Sarah Zaniewski, biologist for the Squaxin Island Tribe, measures a salmon during a beach seine study of deep South Sound nearshore.

The Squaxin Island Tribe studied tiny pocket estuaries in deep South Sound to find out how important they are to endangered juvenile chinook salmon. Anywhere a small stream flows into Puget Sound, juvenile chinook salmon can find refuge. Tribal researchers collected data on juvenile salmon usage in at least 10 pocket estuaries south of the Tacoma Narrow Bridge.

Shoreline Development Threatens Salmon

Shoreline development also has been identified as a key habitat stressor in the South Sound region (PSSRP 2007). About 54 percent of the shoreline in this area has been modified or armored. These alterations interrupt the natural sediment dynamics of the shoreline (e.g. sand and gravel movement) leading to the potential degradation or elimination of spawning habitat of key forage fish. Shoreline modification has negatively affected roughly half the pocket estuaries in the region. Pocket estuaries are critical for foraging and growth for salmonids by providing low wave energy refuge, refuge from predators, and transition zone to saltwater with a rich macroinvertebrate community.

Since population growth and associated habitat impacts within South Sound watersheds and adjacent marine shorelines are the largest threat to maintaining and protecting the area's existing habitat quality and quantity, greater focus and effort is required on protection and restoration actions to offset impacts from this anticipated growth. Emphasis on marine water quality issues has realized isolated benefits with net upgrades in classifications of shellfish growing areas from 2007 through 2010 (WA DOH 2010). However, negative trends continue totally unabated in upland streams and rivers.

Doyle Foster, Squaxin Island Tribe, helps plant willow along Skookum Creek. The Squaxin Island Tribe used willow stakes to restore a streamside forest along Skookum Creek. Branches from most species of willow, such as Sitka willow, easily take root, so a willow grove will soon surround the newly constructed logjams, creating habitat for salmon.

Looking Ahead

The planning area is not on pace to meet its 3-year work plan objectives or 10-year recovery goals mainly due to lack of funding (Judge 2011). Staff capacity is insufficient to engage in comprehensive planning for the region. That requires coordinating the biological recovery efforts of four lead entities, three counties and multiple cities. Many key projects have already been identified, but adequate funding for their implementation is a critical need for this planning area (Judge 2011).

Overall, the goal is to fund and restore abundant finfisheries and enhance shellfisheries in South Sound commensurate with Treaty obligations. These accomplishments will also require attainment of water quality/quantity and sediment management standards, and habitat benchmarks in every water body.

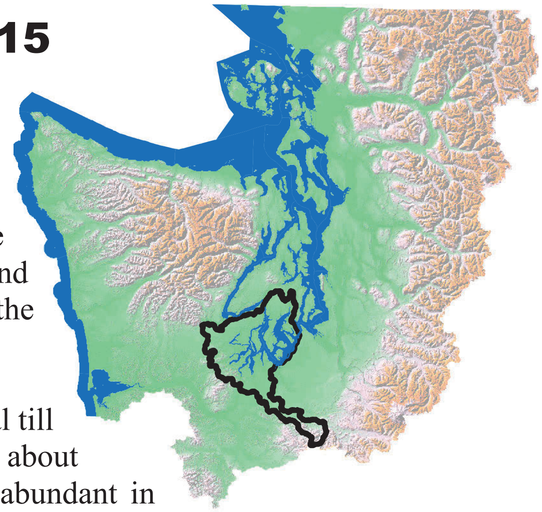
The short term objectives are to:

1) Achieve "approved" harvest status for 1,733 acres of South Sound shellfish growing areas currently classified as conditional by the Department of Health; and,

2) Have sufficient returning adult salmonids to provide for escapement quotas, recreational and non-Indian commercial harvest, and for Squaxin fishers to catch 60,000 chum, 50,000 coho, and 12,000 chinook each year.

Joe Peters and Sarah Zaniewski, biologists for the Squaxin Island Tribe, measure salmon caught in a smolt trap on Goldsborough Creek.

Squaxin Island Tribe - WRIA 13 and portions of WRIA's 12, 14 and 15



The Squaxin Island Tribe's Area of Concern includes WRIA 13 (Deschutes), most of WRIA 14 (Kennedy-Goldsborough), a portion of WRIA 15 (Kitsap), and the marine waters of WRIA 12 (Chambers-Clover). These areas are located at the southernmost end of the Salish Sea in South Puget Sound and are composed of a large, higher elevation watershed, the Deschutes River, and many smaller, independent streams.

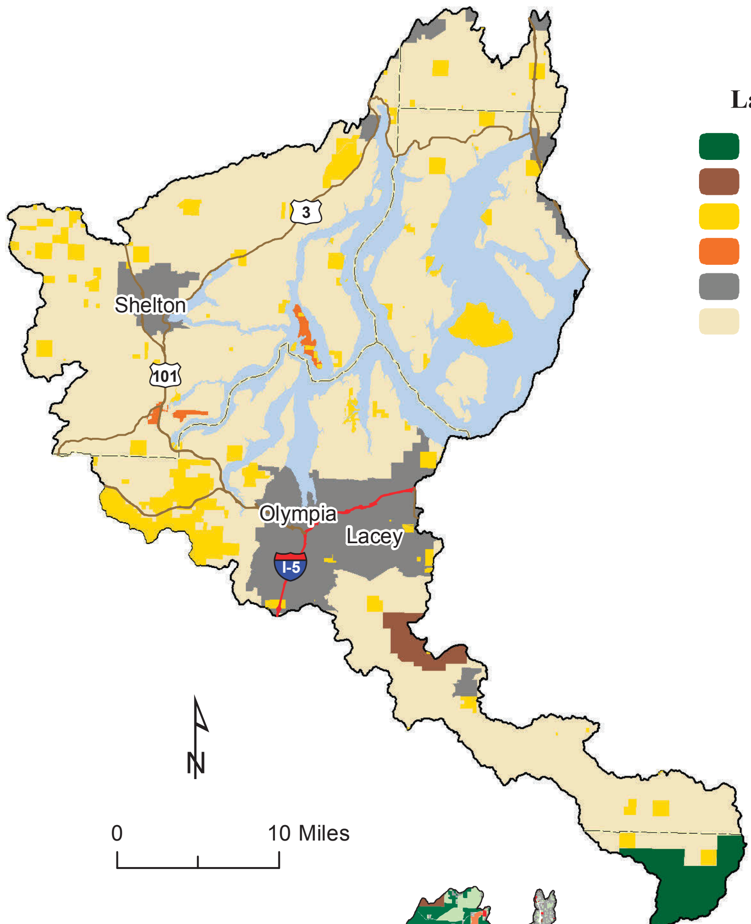
The topography is generally low relief and composed of glacial till and outwash deposits from the Vashon Stade, which ended about 11,000 years ago. This geology has resulted in a landscape abundant in low gradient streams with many lakes and wetlands, especially in the headwaters. Nearer the marine waters, these independent streams typically cut down several aquifers in a "canyon reach" where there is significant influx of groundwater resulting in a substantial downstream cooling of water temperatures, especially notable in the summer.

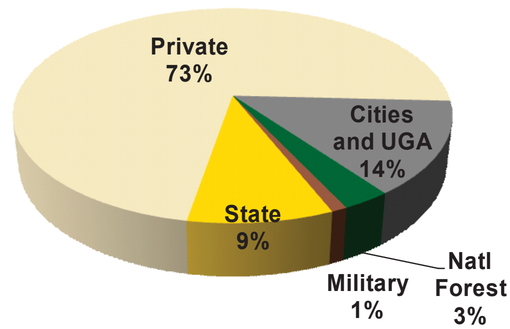
The independent streams are well suited for coho, chum and coastal cutthroat, but in recent memory anadromous salmonids could not pass Tumwater Falls at the lower end of the Deschutes River. In 1952, a fish ladder was installed to allow fish passage and a run of coho has become naturalized although recent numbers are dwindling (Haring and Konovsky, 1999).

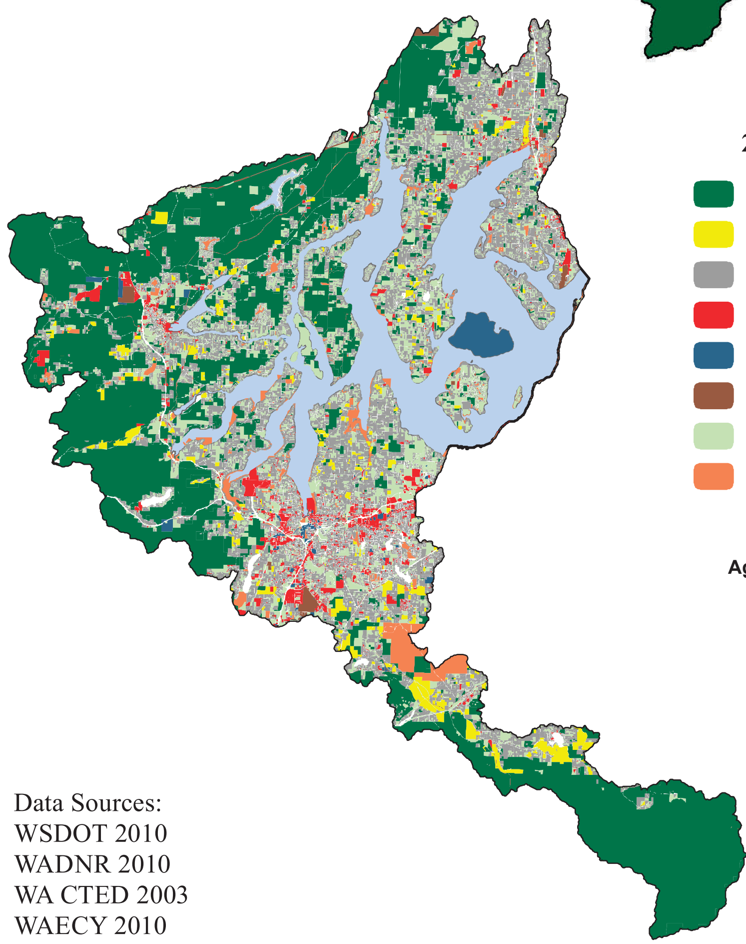
The stream deltas empty into numerous biologically productive inlets that provide a diversity of estuarine and marine habitats for juvenile and migrating salmonids. A tremendous amount of marine shoreline and diversity of habitats support rearing and migrating salmonids in the region. Smolts from elsewhere in Puget Sound, like the Puyallup River, frequently visit South Sound before heading to the open ocean.

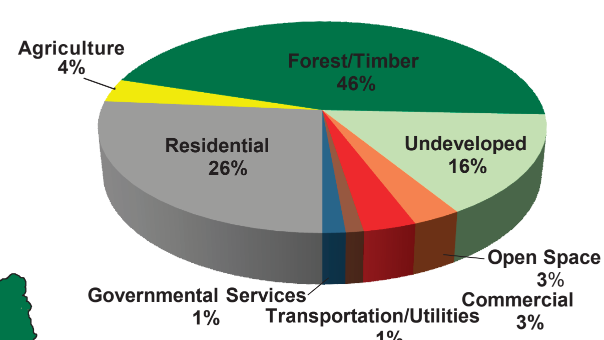
The Squaxin Island Tribe is descended from maritime people who lived and prospered on the finfish and shellfish of South Sound since time immemorial. Their canoe transportation benefited from the extensive waterway connections in each of their seven inlet homes and beyond. In 1854, tribal representatives signed the Medicine Creek Treaty and ceded their lands to the U.S. government. In return, the tribe reserved rights to hunt, gather and fish at all their usual and accustomed places. Tribal members continue to exercise their treaty rights to this day.

Since the arrival of Euro-Americans, the late-serial coniferous forests that once dominated the region have been logged and the landscape is today primarily early and mid-serial forest. Predominant land-use within the basin is gradually shifting from being undeveloped or under commercial timber production to small-scale agricultural, residential and urban uses. The major threats to salmon habitat include land-use impacts on hydrology, instream and riparian habitat, and the marine shoreline.









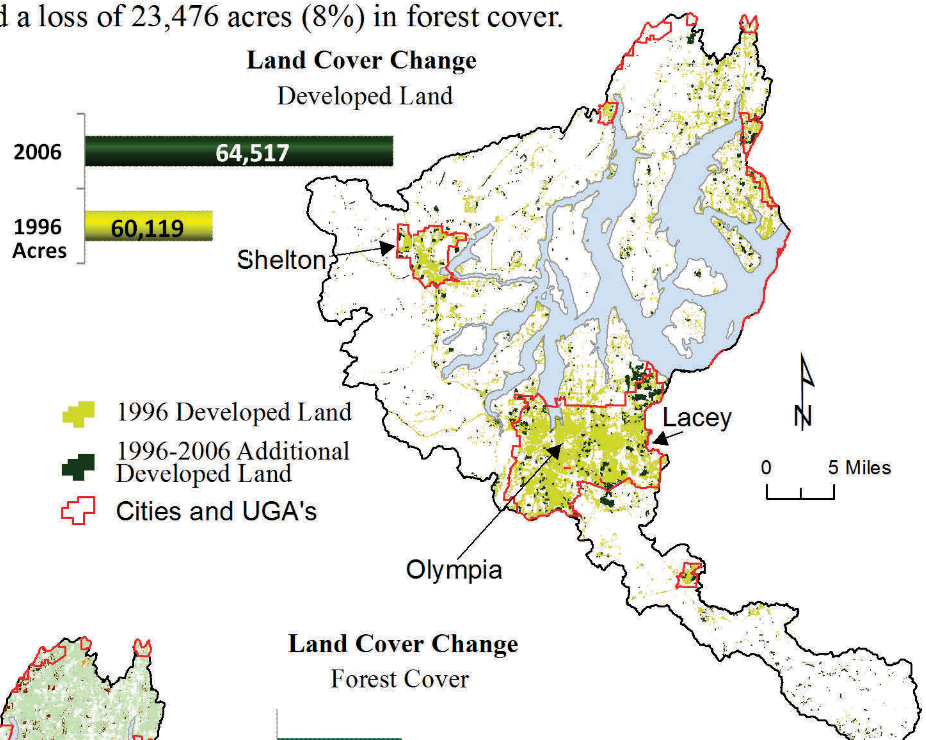
Data Sources:
WSDOT 2010
WADNR 2010
WA CTED 2003
WAECY 2010

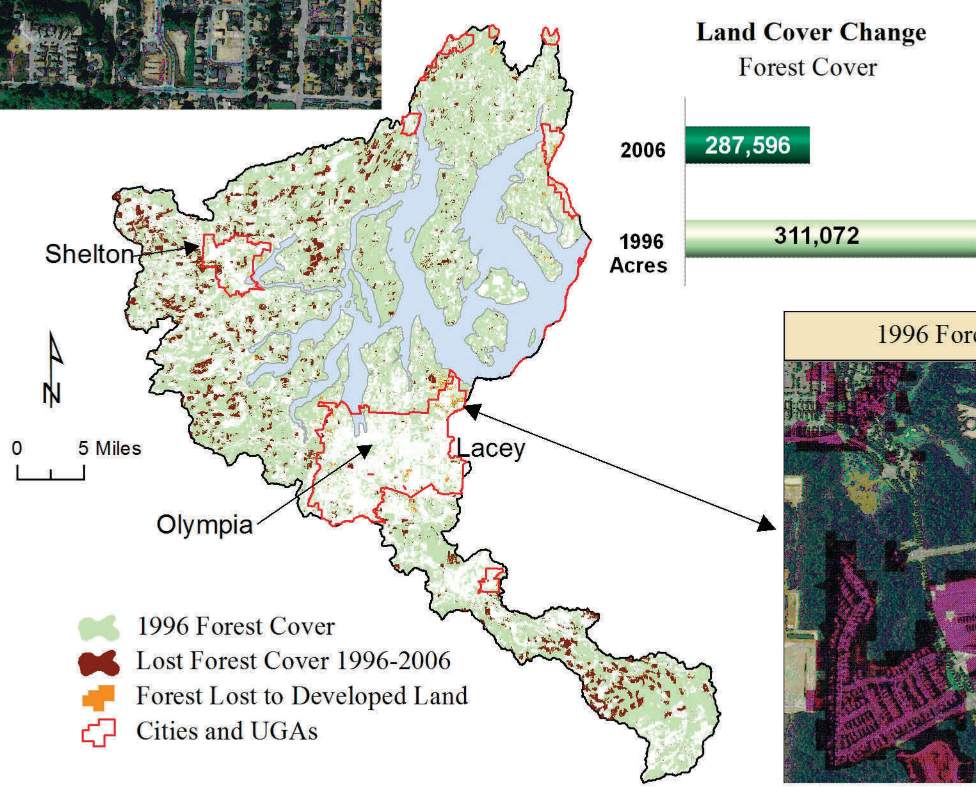
Loss of Forest Cover and Continued Urban Sprawl

From 1996 to 2006, the Squaxin Area of Concern saw a 7% increase in developed lands and an 8% decrease in forest cover. Key indicators addressed by the PSP's 2009 State of the Sound Report tell us that important habitat for coho, chum, and Chinook salmon are still declining, despite the ESA listing for Chinook over 10 years ago.

Timber harvest, agriculture, and residential and commercial development have substantially altered salmonid habitat throughout South Puget Sound. In the Puget Sound region, forestlands are giving way to cities and urbanized areas at a fairly rapid rate. Research shows that as development increases, impacts to streams and stream health tend to progress. Studies have also shown that watersheds with high forest cover are less likely to have degraded stream health (South Puget Sound Forum, July 2006). Data from NOAA-CCAP shows that during the 1996-2006 timeframe there was an increase of 4,398 acres (7%) in developed land and a loss of 23,476 acres (8%) in forest cover.

Forest giving way to urban sprawl in Thurston County





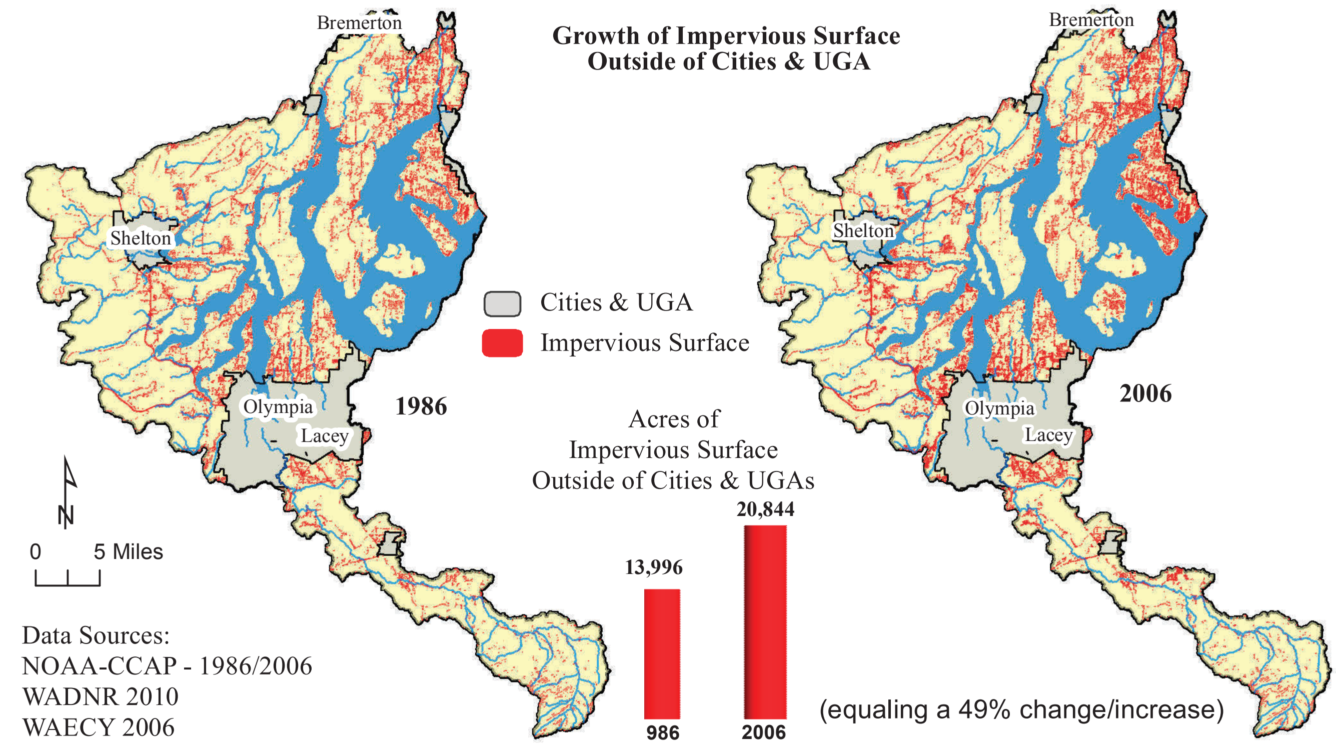
Data Sources:
NOAA-CCAP 2006
WAECY 2010
WA CTED 2003
WSDOT 2009

1996 Forest Cover Lost by 2006

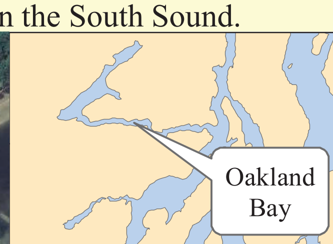
Impervious Surface Continues to Increase Outside UGA

From 1986 to 2006, the Squaxin Island Tribe's Area of Concern saw a 49% increase in impervious surface (Total Impervious Area, TIA) in the total land area outside of cities and Urban Growth Areas, accounting for an additional 11 square miles. The Chinook Recovery Plan for South Sound identified an objective to promote land-use practices that prevent stormwater flows. This objective calls for the preservation of native land cover and natural drainage systems, while limiting the area and connectivity of impervious surfaces (CRPSS, 2005).

South Sound is one of the fastest growing areas in the state, exceeding the State’s growth rate consistently since the 1960s. Much of this growth is clustered around Puget Sound’s Inlets, or near and around streams that feed into Puget Sound. Research shows that as development increases beyond 10% impervious cover and less than 65% forest cover, streams and their fisheries are severely degraded, making them expensive or impossible to recover (Booth, Harley & Jackson, 2002).



The Squaxin area of concern has several basins that have less than 10% impervious surface and generally more than 65% forest cover. The best conditions are found in the Skookum Creek and Coulter Creek basins. Other basins with relatively low impervious surface and high forest cover include Rocky, Sherwood, Deer, Cambell, Uncle Johns, Cranberry, Malaney, Johns, Goldsborough, Mill, Kennedy, Schneider, Perry, McLand and the upper Deschutes. These basins have the best chance for biological recovery and should be prioritized for Puget Sound restoration. Achieving this protection will be key to the survival of salmon and steelhead in the South Sound.



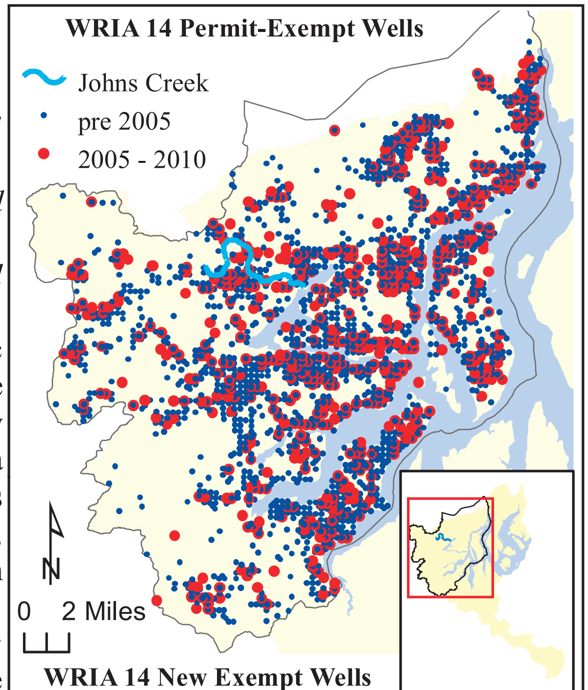
Example of the increase of impervious surface in an area in Oakland bay outside of cities and UGA.

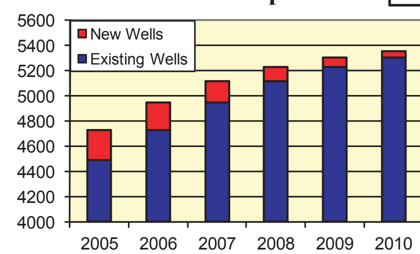
Low Stream Flow and Elevated Water Temperatures

Available stream gage data suggests that all listed streams, for most periods of time since at least the 1980s, fail to meet statutory minimum flows in both winter and summer. Temperature increases, caused by decreased flow and habitat changes, are identified by the South Sound Recovery Plan as a threat to salmon survival.

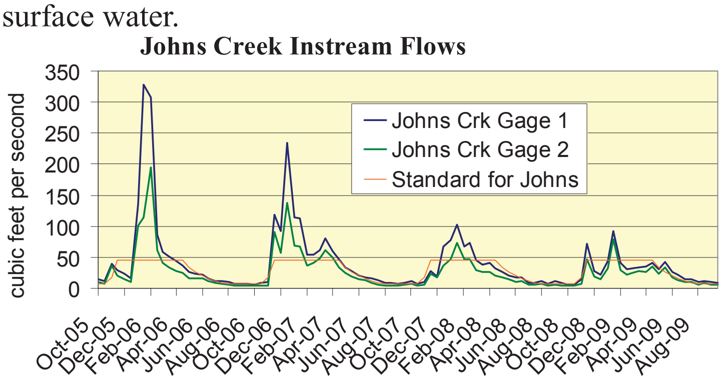
One cause of these insufficient flows is the dramatic increase in the number of exempt wells constructed in the last 30 years. State law allows new wells to withdraw groundwater up to 5,000 gallons/day without obtaining a permit that would require scientific evidence that water is legally available (RCW 90.44.050). Since the 1940s, Thurston County has had the second greatest increase in exempt wells among Washington counties, with Mason and Kitsap not far behind (SIT 2012). Although the water volume a single exempt well uses is small, the cumulative effect of wells in close proximity can be significant.

Temperatures are also affected by increased impervious surface and the removal of forest cover. These poor riparian conditions lead to more stormwater runoff and slower recharge of groundwater that would otherwise cool surface water.





Source: WAECY 2010

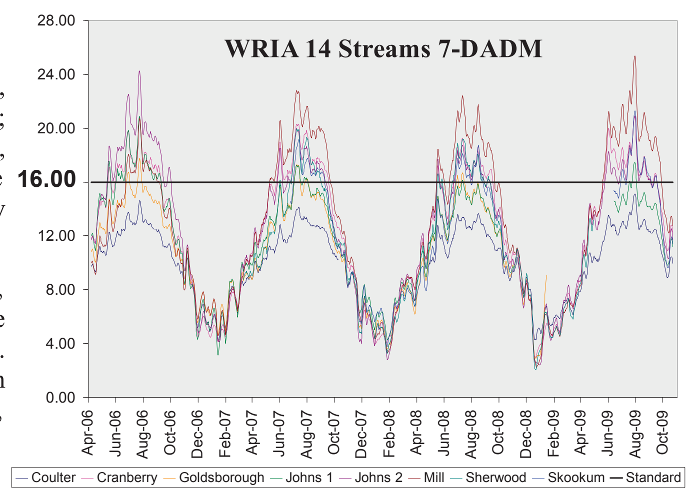


Exempt wells need to be curtailed to protect and eventually restore streamflows. Washington State established minimum instream flows to retain enough water for many uses, including fish habitat. In the Johns Creek watershed, the number of exempt wells has more than doubled since 1980, while streamflows have increasingly failed to meet statutory minimums since at least 2004 (SIT 2009).

Temperature

Increased drilling intercepts groundwater influx, elevating temperatures and limiting dissolved oxygen; both are severely detrimental to salmonid migration, spawning, and rearing. Washington State requires Core Summer Salmonid Habitat to not exceed a 16°C 7-Day Average Daily Max.

Much of Johns Creek exceeds this threshold. To cool it, temperature limits have been developed prescribing more riparian shade and protection of groundwater influx. Other streams in the Squaxin area of concern with temperature limits include the Deschutes, Woodland, Kennedy, Goldsborough, Skookum, Mill, and Cranberry.



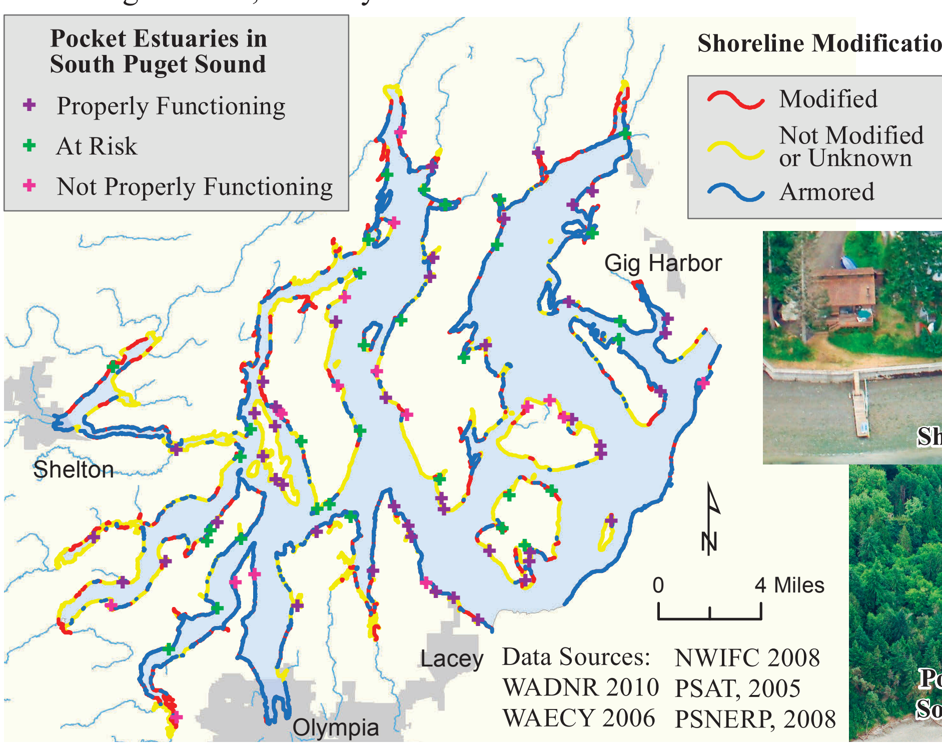
Flow and temperature data source: SIT 2010

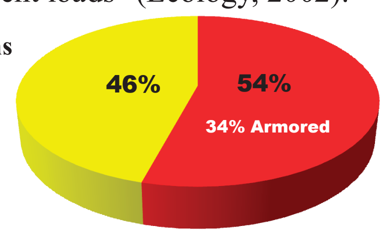
Nearshore Marine Shoreline and Estuary Modifications

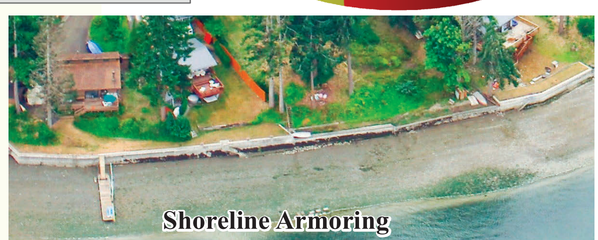
Thurston County's shoreline is among the most extensively armored in Puget Sound. Almost 54% of the marine shoreline segments in the Squaxin Island Tribe's Area of Concern contain some type of modification such as bulkheads, riprap, or other man-made structures. The Chinook & Bull Trout Recovery Approach for the South Puget Sound Nearshore identifies the nearshore as high priority areas for restoration and protection which includes many valuable South Sound pocket estuaries.

About 34% of the shoreline in the Squaxin Area of Concern has been armored. Riprap, wood, and concrete are frequently used to stabilize a failing bank. Shoreline armoring alters natural erosion and deposition patterns, increasing substrate size and altering plant community composition and primary production. Armoring increases erosion rates on beaches, thus converting the beach from a depositional area that accumulates sediment and organic matter to an area that loses these elements on an annual or seasonal basis. Between 1984 and 2002, over 25,000 feet of new bulkheads have been added in Thurston County (SPS indicator report, 2006). Shoreline modifications affect salmon habitat by reducing shallow water areas and nearshore functional benefits. Surf smelt and Pacific sand lance spawn on beaches composed of sand and small gravel, habitat that is lost when wave energy and erosion are increased by shoreline armoring (Shreffler et al, 1995).

South Puget Sound differs from other parts of the Sound with its relatively shallow depth (bathymetry), unique shape (morphology) and relatively long residence time of the marine waters. This makes South Sound highly sensitive to nutrient enrichment leading to reduced oxygen levels in the water. The shallow, dead-end inlets of South Sound are most susceptible to low oxygen levels. Ecology has reported that Case, Carr and Budd Inlets "appear to have the lowest dissolved oxygen levels within South Puget Sound, and may be the most sensitive areas to increased nutrient loads" (Ecology, 2002).







Pocket estuaries are "small scale estuaries located at the mouths of streams and small rivers and other semi-enclosed embayments within Puget Sound that have a tidal channel structure, intertidal marsh and/or mudflats, eelgrass beds and other features typical of larger estuaries" (Averill et al. November 2004). Pocket estuaries provide juvenile salmonids with a refuge from predators and high wave energy, and a transition to salt water. The rich macroinvertebrate community within pocket estuaries is also critical for foraging and growth.

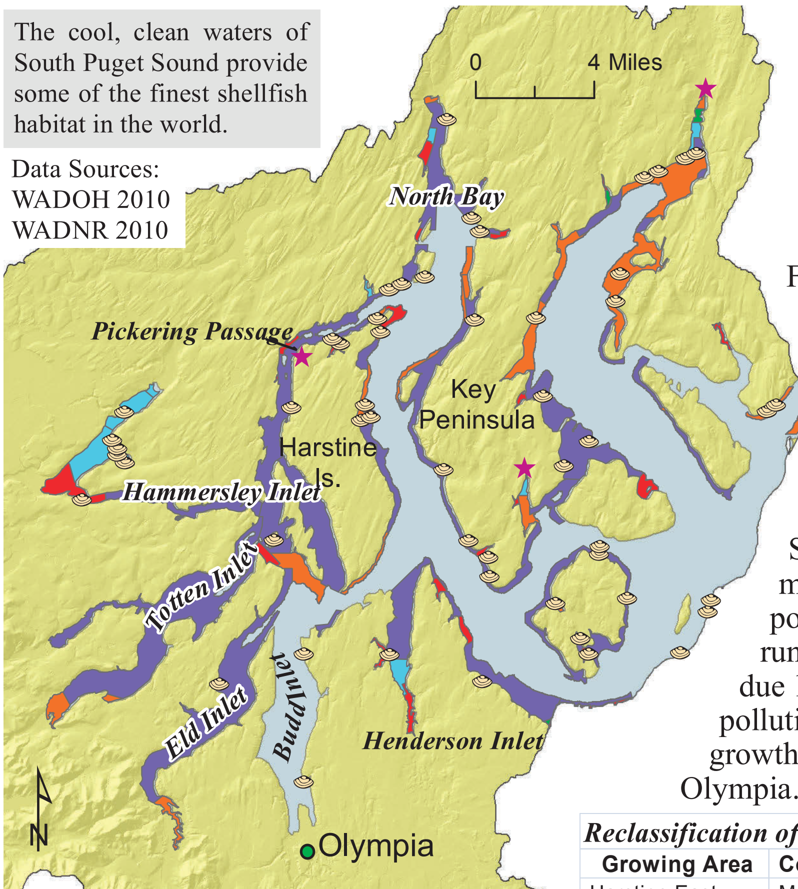
Shellfish Growing Areas Show Some Improvement

Shellfish have been a mainstay for the Squaxin Island people for thousands of years. Their harvest remains vitally important today for subsistence, economic and ceremonial purposes. From 2007 through 2010 improved sanitary conditions resulted in net upgrades in classifications of shellfish growing areas within the Squaxin Island Area of Concern allowing for shellfish harvesting or longer harvest periods on an additional 849 acres (WA DOH, 2010).

As shellfish growing areas are upgraded to an approved status within the Squaxin Area of Concern, the tribe could potentially harvest their treaty share in those expanding areas. In addition to upgraded areas, each year other areas within the Squaxin Area of Concern are being identified and surveyed by the Squaxin Island Shellfish department. The goal of the department is to maintain treaty harvest rights in this area and provide harvest opportunities for Squaxin Island tribal members.

The cool, clean waters of South Puget Sound provide some of the finest shellfish habitat in the world.

Data Sources:
WADOH 2010
WADNR 2010



Commercial Shellfish Growing Areas in the Squaxin Area of Concern

- Recreational Shellfish Beach
- 2011 Threatened Shellfish Growing Areas
- Approved
- Restricted
- Conditional
- Unclassified
- Prohibited
- Puget Sound

Four of the five South Sound inlets are classified for commercial shellfish harvesting. Budd Inlet, the most developed of the five inlets, has been closed to shellfish harvesting for decades along with Shelton Harbor in Hammersley Inlet. In contrast, Totten Inlet, the least developed inlet, along with Squaxin Island beaches, closes only at the most extreme of rain events due to potential pathogen pollution in stormwater runoff. Henderson Inlet is more challenging due largely to the scale and complexity of the pollution problems and continued population growth and urbanization around Lacey and Olympia.

Reclassification of Intertidal Shellfish Growing Areas in 2010

Growing Area	County	Classification Change	Acres
Harstine East	Mason	Prohibited to Approved	187
Henderson Inlet	Thurston	Conditionally Approved to Approved	240
North Bay	Mason	Conditionally Approved to Approved	25
Pickering Passage	Mason	Prohibited to Approved	43

SIT staff spreading oyster shells to find and re-establish a tiny, rare native oyster

Threats to Tribal Treaty Shellfish Harvest include:

- Failing septic systems
- Poor livestock management
- Increased stormwater runoff
- Increased harmful algal blooms
- Contaminated sediment
- Decreased submarine groundwater discharge
- Ocean acidification

Approximately 2,500 acres of shellfish harvesting areas in the Squaxin Island Area of Concern are classified as prohibited due to the proximity of potential pollution sources (WWTP or stormwater outfalls) or otherwise poor water quality caused by nonpoint sources of pollution.

Summary

The Squaxin Island Tribe's Area of Concern includes WRIA 13 (Deschutes), most of WRIA 14 (Kennedy-Goldsborough), a portion of WRIA 15 (Kitsap), and the marine waters of WRIA 12 (Chambers-Clover). These areas are located at the southernmost end of the Salish Sea in South Puget Sound.

The South Sound is one of the fastest growing areas in the state, exceeding the State's growth rate consistently since the 1960s. The landscape and its hydrology, timber harvest, agriculture, and residential and commercial development have substantially altered salmonid habitat, though several basins, including Skookum and Coulter, still have low levels of impervious surface and high levels of forest cover making biological recovery here easier and cheaper. Much of the growth is clustered around Puget Sound's Inlets, or near and around streams that feed into Puget Sound. From 1986 to 2006, the Squaxin Island Tribe's Area of Concern saw a 49% increase in impervious surface outside of cities and Urban Growth Areas. The future management of the area's population growth and associated development will be key to the survival of salmon in the South Sound.

Forestlands are giving way to cities and urbanized areas at a fairly rapid rate. Data from NOAA-CCAP shows that during the 1996-2006 time frames there was an increase of 4,398 acres (7%) in developed land and a loss of 23,476 acres (8%) in forest cover. The PSP examined the rate of land use conversions and increases in impervious surfaces across Puget Sound from 2001-2004. The data shows a disturbing trend of continuing loss of habitat, despite our State's adoption of some of the most aggressive land management tools in the Country. Habitat status and trends monitoring is urgently needed and should be a priority focus for funding.

WRIA 14's population is projected to increase, and the amount of exempt wells will likely correspond. Exempt wells in WRIA 14 are estimated to account for 1,400 acre-feet per year of groundwater use, out of 6,600 total. Several WRIA 14 streams fail to meet minimum instream flow requirements for much of the year, a trend that has been occurring since at least 2004. The impacts of low instream flows affect many measures of water quality, including temperature. As temperature rises, dissolved oxygen increases in shallow water, making it less habitable for salmonids. With increased groundwater withdrawal, stream habitat will suffer.

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State of Our Watersheds Report
Stillaguamish River Basin

We volunteered not to fish for chinook and to focus on the recovery of our salmon. But even with the nets out of the river, our fish numbers are not increasing. We work hard to restore habitat and recover Stillaguamish chinook, but in the meantime, our culture faces extinction. We are a living culture and we must have salmon to harvest.

– **SHAWN YANITY, STILLAGUAMISH TRIBE**

The Stillaguamish Tribe

The Stillaguamish Tribe is composed of descendants of the Stoluck-wa-mish River Tribe. In 1855 the population resided on the main branch of the river, as well as the north and south forks.

The name Stillaguamish, under various spellings, has been used since around 1850 to refer to those Indians who lived along the Stillaguamish River and camped along its tributaries. They were a party to the treaty of Point Elliott of January 22, 1855.

No separate reservation was established for the Stoluck-wa-mish Indians. Some moved to the Tulalip reservation, but the majority remained in the aboriginal area along the Stillaguamish River. Tribal headquarters are located in Arlington, Wash.

Stillaguamish Watershed Salmon Recovery Plan

A young tribal member dances at the Stillaguamish Tribe's First Salmon Ceremony.

The Stillaguamish watershed remains one of the few largely undeveloped rural areas adjacent to major urban centers in Puget Sound. The local economy remains based in natural resources, with forestry the most extensive land use in the watershed.

Streamside land use within the hydrologically connected areas used by anadromous fish comprises 61% forestry, 22% rural, 15% agriculture and 2% urban. Not surprisingly, the leading factors for decline in riparian habitat throughout the watershed have been related to forest practices, and conversion of floodplain habitats to agricultural and urban land uses.

The Stillaguamish Watershed Chinook Salmon Recovery Plan's stated goal is to maintain and restore natural ecosystem conditions that sustain salmon productivity.

A three-tiered approach was outlined for recovery:

- Prevent further fragmentation of aquatic habitat;
- Improve connectivity between isolated habitat patches; and
- Protect and restore areas and necessary functions surrounding critical salmon habitat from further degradation, and allow for the expansion of existing refugia.

While habitat improvement is a major component of the recovery strategy, it is recognized that without protecting existing habitat function, restoration activities cannot reverse the decline of chinook populations within the watershed.

Results Mixed after Recovery Progress Review

The Stillaguamish Implementation Review Committee (SIRC, now known as the Stillaguamish Watershed Council, or SWC) adopted a 10-year watershed goal for habitat enhancement projects. These projects reflected the categories and geographical priorities (riparian, estuary, large woody debris, floodplain, sediment and hydrology) that corresponded with the limiting factors for chinook salmon populations in the Stillaguamish watershed.

The identified project goals are:

- Planting 400 areas of riparian habitat;
- Restoring 195 and creating 120 acres of estuary habitat;
- Installing 51 engineered logjams;
- Restoring 30 acres and removing 4.1 miles of armoring in floodplain habitat;
- Conducting 2 landside treatments and 106 miles of forest road treatments for sediment control; and
- Acquiring 1,445 acres for conservation protection.

Review of habitat recovery progress and trends at the 5-year mark of the Stillaguamish Watershed Chinook Salmon Recovery Plan reveals mixed results:

- 236 of 400 acres of riparian habitat restored;
- 0 of 315 acres of estuary marsh land created or restored;
- 4 of 51 engineered logjams installed;
- 7 of 34 acres of floodplain habitat reconnected or restored;
- 1 of 2 landslides treatments completed;
- 82 of 106 miles of forest land road treatments completed;
- 525 of 1,445 acres of land acquired in priority reaches.

For some categories and geographical priorities the work is on pace for completion in 10 years and others are not.

Greater Population Demands Degrade Habitat

The recovery plan envisioned that a variety of protection tools and incentive-based voluntary actions would be drawn upon to protect chinook salmon habitat. Central to this effort would be development of non-regulatory and programmatic actions to encourage habitat conservation and the integration of salmon recovery goals and objectives with local comprehensive plans and land use policies. Little to no progress has been made on this protection strategy.

Closer assessment of habitat conditions and trends indicate that salmon habitat within the Stillaguamish watershed continues to degrade. The human population of the watershed has increased more than 85% in the last 20 years with more growth occurring outside the urban growth area than within. The associated groundwater demand has placed five groundwater basins within the Stillaguamish watershed in danger of overwithdrawal. Summer low flows are now a concern in the small tributaries within these basins. These conditions have a negative impact on fish habitat and production.

Significant loss of nearshore, estuary and salt marsh habitat has occurred over the decades in the Stillaguamish Watershed and adjacent area. Nearly 40 years since the enactment of the Shoreline Management Act to protect the inherent conditions of state shorelines from uncoordinated and piecemeal development, more than 57% of the shoreline of the Stillaguamish, Port Susan and East Camano shorelines remain armored or modified. The Shoreline Management Act's over-arching policy permits the destruction of habitat through the placement of armoring and other modifications, as long as it's consistent with the policies of the act.

Conversion to agricultural land has led to the loss of 75-85% of the salt marsh in the delta, habitat that is essential to salmon recovery within the watershed. Priorities to protect agricultural land now are hindering salmon habitat restoration work and recovery efforts to address the legacy of habitat loss in the estuary.

Stillaguamish Chairman Shawn Yanity, in red, and assistant fisheries director Jeff Tatro paddle a hand-carved shovel-nosed canoe.

Land Uses Reduces Forest Cover, Slows Salmon Recovery

Land-use management regulations continue to permit the further degradation of flood plain and riparian habitat throughout the watershed.

Currently only 23% of the 1,777 acres of riparian area within the floodplain have any forested cover and the long-term goal is 80% forest coverage. Private and state forest-dominated subbasins within the watershed continue to lose hydrologically mature forest cover.

More disturbingly, between 1996 and 2006, in parcels where forestland conversion is allowed, there was a 41% decrease in forest cover in urban growth areas and a 22% decrease in rural residential. More than 1,500 acres of forestland was converted to residential.

There is high risk that this trend of forestland conversion will continue as 54,464 acres or 36% of the private forestland in the watershed is not enrolled in the designated forestland program. These reductions in forest cover change the watershed's hydrology and riparian stands, negatively, impacting salmon production through changes in temperature, sediment load and stream flow.

Pressure from population growth, agricultural practices and timberland use within the Stillaguamish watershed will continue to pose challenges to salmon conservation and recovery efforts.

Current trends indicate that land-use regulation reform is required and continued funding of habitat restoration activities is necessary in order to achieve the agreed upon recovery goals.

Lack of progress on the protection of existing habitat remains the biggest impediment to recovery. We are still witnessing the continued loss and fragmentation of habitat; the same processes that led to the critical status of Stillaguamish chinook in the first place.

Salmon Runs Continue to Decline under Status Quo

The Stillaguamish Watershed Council has concluded that Stillaguamish chinook cannot be recovered without major changes at the state and federal levels including:

- adequate instream flows;
- improved timber harvest regulations and enforcement to reduce peak flow activity;
- improved water quality enforcement and compliance;
- improved protection and enforcement on agricultural lands; and
- development regulations that protect critical habitat throughout the floodplain and the estuary.

As David Montgomery points out in his 2003 book, *King of Fish: The Thousand-Year Run of Salmon*, "many share the blame for the decline of salmon in the Pacific Northwest. Not surprisingly, there is no shortage of finger-pointing: Land developers blame the fishing industry. Fishermen blame the timber industry. Loggers blame land developers. Some even blame hungry sea lions and fish-eating birds. And there is a long history of blaming declining salmon populations on Indian fishing. Yet even though there is a broad consensus among scientists regarding the primary factors driving salmon declines, actions to stem known causes remain either mired in institutional, corporate, and societal denial, dissipated by spin-doctoring, or thwarted by political agendas and bureaucratic inertia."

The continued decline of salmon populations (and their habitat) in the Stillaguamish is a reflection of a society operating under the status quo policy direction.

"With legions of professionals engaged in salmon recovery, it remains rare to hear policy makers or anyone else acknowledge that how we live on the land leads directly (and sometimes indirectly) to the risk of local or regional salmon extinction," Montgomery writes. "We seldom, if ever, hear a public official admit that the decline of salmon has been an implicit, even if inadvertent, policy for over a century. And yet, unless we address the fundamental underlying issues, we may well spend a lot of money and still end up with no fish to show for it."

Stillaguamish tribal members gather to return the remains of the first salmon to the river during the tribe's First Salmon Ceremony.

Looking Ahead

If the trends continue, the status of Stillaguamish salmon will continue to decline precipitously, directly impacting the Stillaguamish Tribe's treaty rights. It is time for elected officials and scientists to have a frank discussion of the true cost of continuing on the current societal pathway. The data presented in the State of Our Watersheds report indicate that it will lead to the extinction of fisheries (if not populations themselves) as surely as it did for Atlantic salmon in Europe and on the East Coast. Though written in 1861, the words of Charles Dickens in *All the Year Round: A Weekly Journal* should cause us pause in the Stillaguamish today:

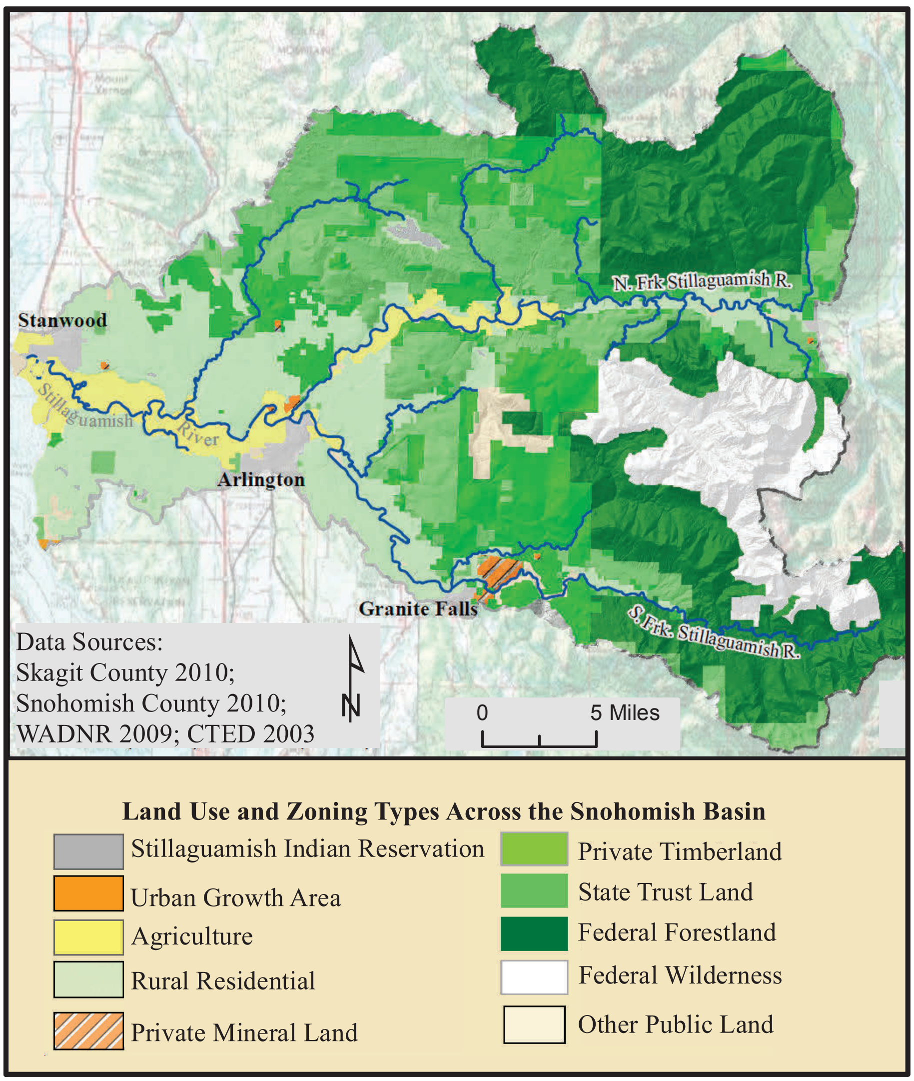
"The cry of 'Salmon in Danger!' is now resounding throughout the length and breadth of the land. A few years, a little more over-population, a few more tons of poison, a few fresh poaching devices ... and the salmon will be gone – he will become extinct."

The Stillaguamish Indian Tribe -- Stillaguamish River

At 694 sq. miles, the Stillaguamish River is the fifth largest drainage basin in the Puget Sound region, and includes portions of both Skagit and Snohomish counties. The basin extends to the headwaters of its two major forks in the North Cascade Mountains. The two major forks of the Stillaguamish are the North Fork, which drains approximately284 sq. miles, and the South Fork, which drains approximately 255 sq. miles. The Stillaguamish supports both wild and hatchery stocks of anadromous salmonids and trout. These include Chinook, coho, pink, chum, and sockeye salmon, and steelhead and cutthroat trout.

The Stillaguamish River basin is within the ancestral home of the Stoluckwamish River Tribe whose descendants are the Stillaguamish Tribe of present. Traditionally, people of the Stillaguamish fished, hunted, and gathered their food, medicines, clothes, and building materials from within and around the watershed's boundary.

Since European settlement, land use in the watershed has continued to be dominated by physical geography. The foothills and mountains are mainly used for wood products and outdoor recreation. The more fertile and developable lowlands are primarily used for agriculture and rural residential development. Most of the basin's human population is centered in and around the towns of Granite Falls Stanwood, Arlington, and Darrington.

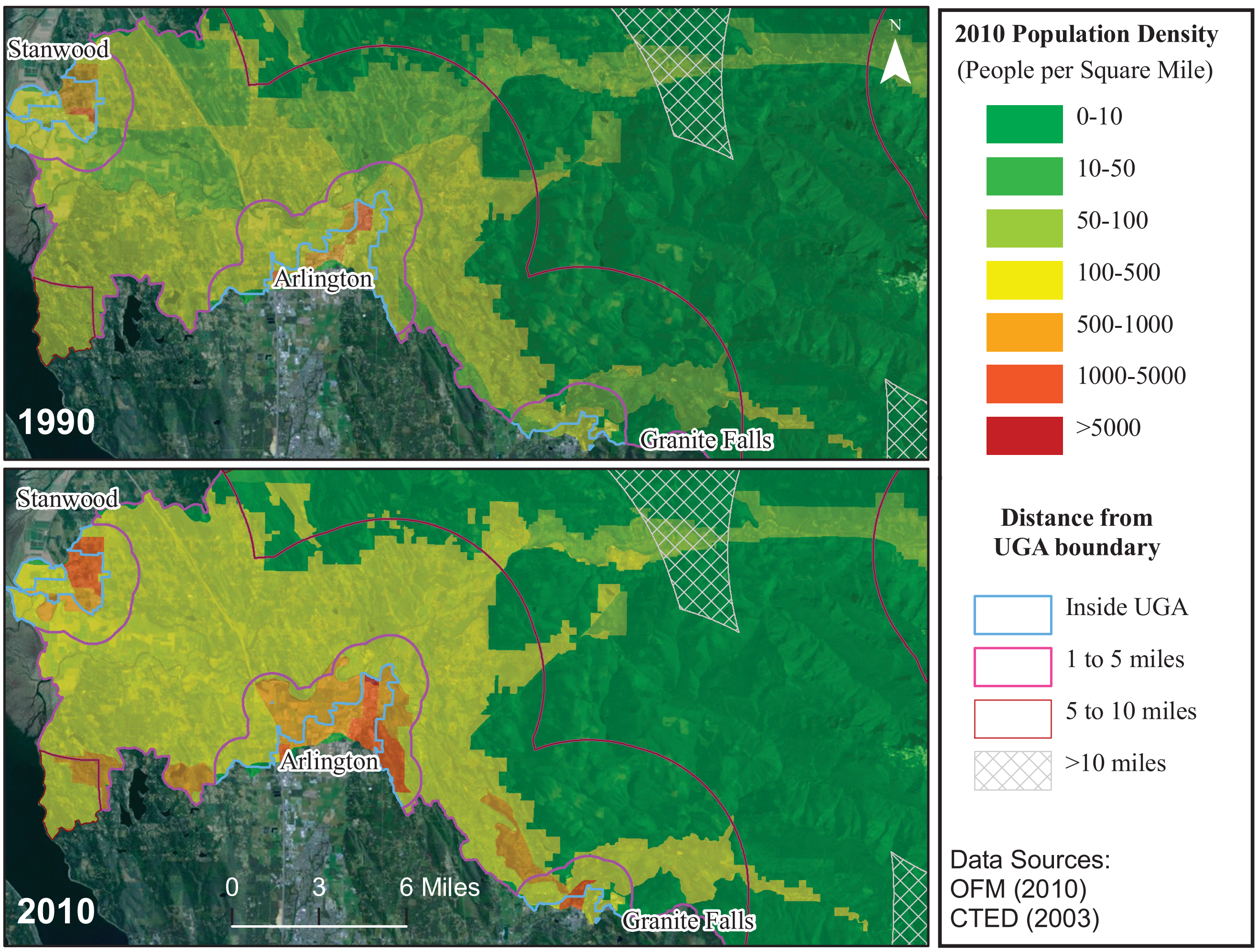


Federal lands comprise 39% of the Stillaguamish watershed, primarily in the headwaters. State and private forestlands are 37% of the watershed, and agriculture and rural residential lands are 21% of watershed. Urban area is a little over 1% of the watershed's land base.

The last 150 years of human land use has left the natural ecology of the Stillaguamish watershed stressed and depleted. The future of the watershed will require a better understanding of the current state of the watershed's natural resources, and a greater commitment to actively restoring, as well as changing, land-use behavior within the landscape.

Rural Population Continues to Sprawl Outside of the Watershed's UGA boundaries

The Stillaguamish watershed has seen an 85% increase in population over the last 20 years (OFM 2010), There are currently an estimated 52,807 people living in the watershed (OFM 2010), almost 79% of all residents live outside of the Urban Growth Area (UGA) boundaries.



Distribution of Population Change in the Stillaguamish Watershed (1990 to 2010)

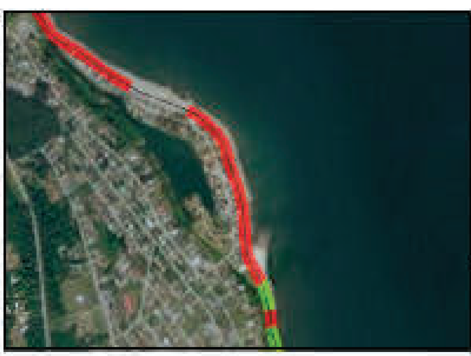
Distance from UGA	Total Population in 1990	Estimated Population in 2010	Percent Change in Population from 1990 to 2010
Inside UGA	5407	10868	101%
0 to 1 mile from UGA	5853	12970	122%
1 to 5 miles from UGA	14622	24042	64%
5 to 10 miles from UGA	2528	4720	87%
>10 miles from UGA	178	205	13%

While population grew over 101% within the UGA, it also continued to sprawl outside of the UGA. Even with higher growth rates in and around the cities, town, and UGAs, it stll remains that 55% of watershed residents live farther than a mile from those areas.

Shoreline Modification and its Impact on Nearshore Ecology

Nearly 40 years since enactment of the Shoreline Management Act to protect the inherent condition of state shorelines from uncoordinated and piecemeal development, over 57% of 66 miles of the Stillaguamish, Port Susan, E. Camano shoreline remain armored or modified. Rearing area and food sources for salmon are both directly and negatively impacted by shoreline modification.

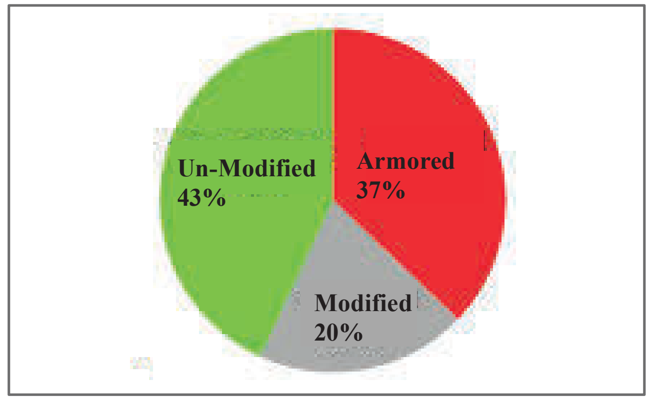
Armoring along the delta shoreline to protect agricultural land has factored in the loss of 75-85% of tidal marsh habitat critical to the survival of Chinook salmon (Collins 1997).

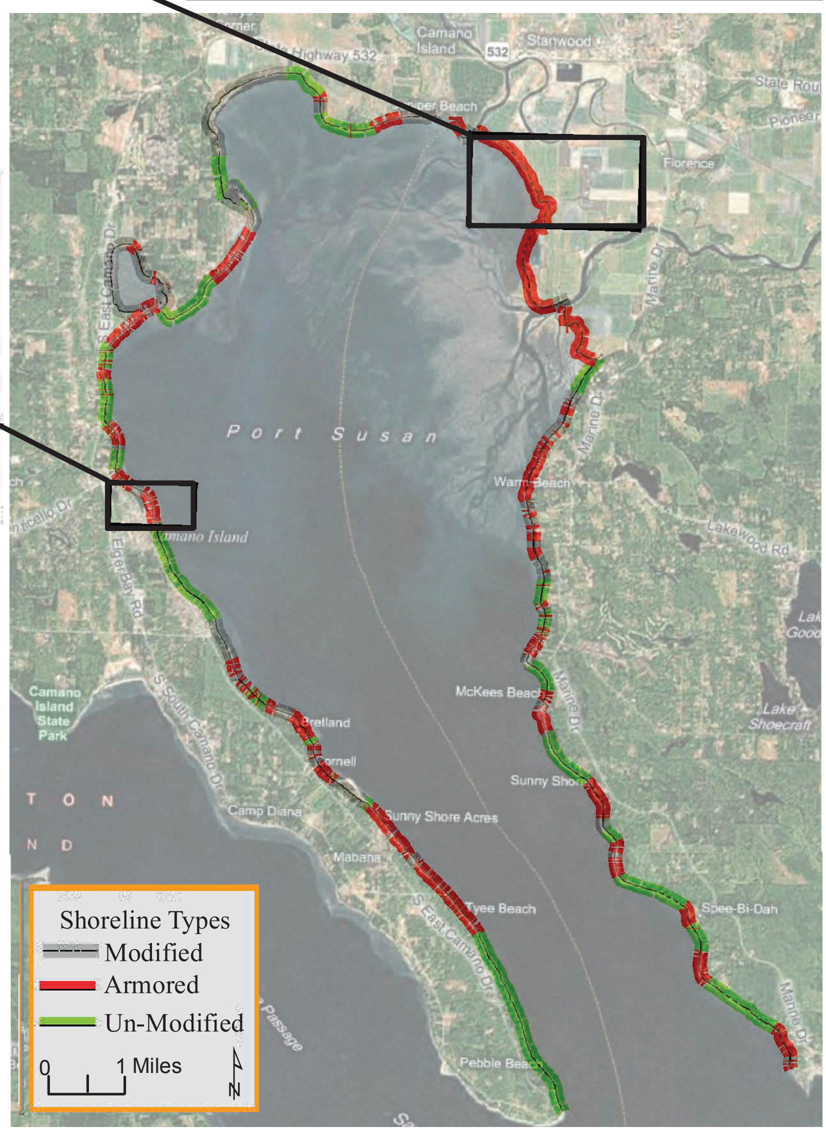


Sand lance and surf smelt, which make up a major portion of the diets of juvenile Chinook salmon, spawn almost exclusively on sand and gravel beaches, making them especially vulnerable to the degrading effects of shoreline modification and armoring in these areas (Duffy et al 2010).

The east shore of Camano Island is dominated by sediment source and barrier beaches, key spawning habitats for forage fish. Residential development along the east shore has meant the armoring of almost 30% of this habitat.

Condition of Port Susan and East Camano Shoreline





The Legacy of Habitat Loss in the Estuary and the Long Road to Restoration

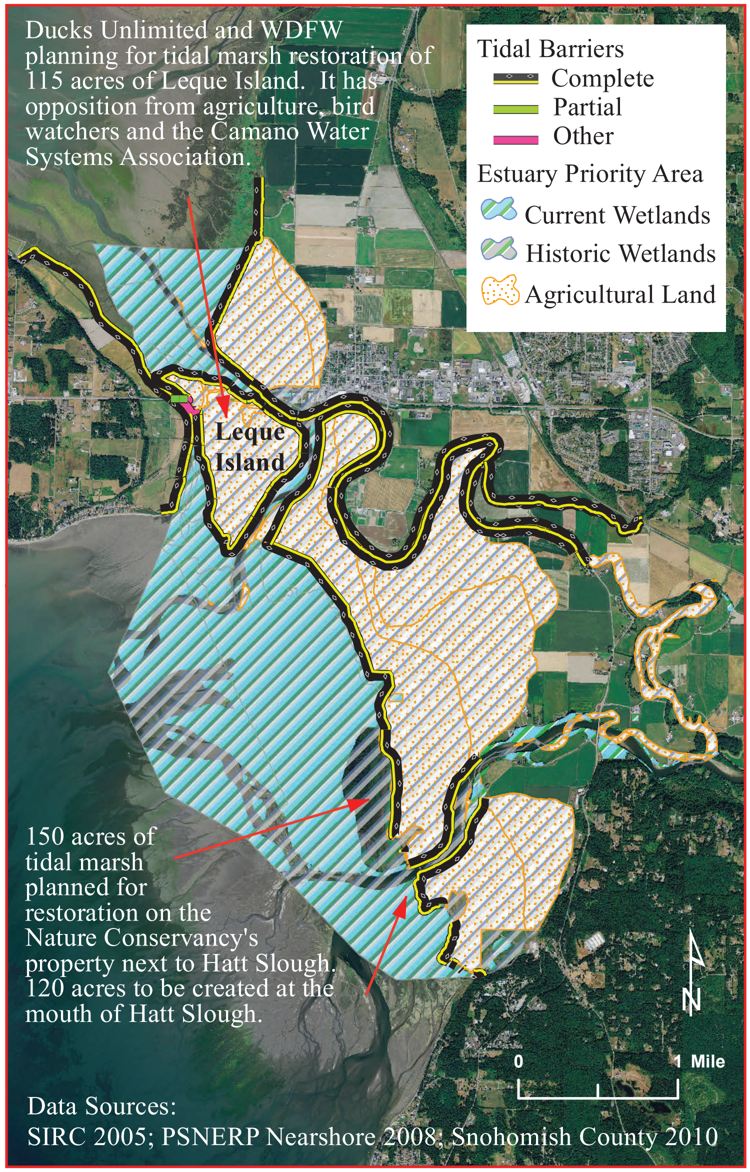
The sustained loss of ~75% of salt marsh habitat is being investigated as a major factor limiting the size of Chinook populations in the Stillaguamish watershed (Stillaguamish Tribe, 2005). The 10-year goal for estuary restoration in the Salmon Recovery Plan is 315 acres. Presently, 385 acres of estuary restoration have been planned, but none of the restoration has been completed.

History of Estuarine Habitat Loss

Estuary salt marshes provide critical feeding and salinity transition habitats for outgoing juvenile Chinook migrants. Between 1870 and 1968 agricultural land development in the estuary resulted in the loss of 85% of original salt marsh habitat. Since 1968, mudflat habitats have expanded in the estuary, but the valuable salt marsh still remains 15-25% of historic conditions (Collins, 1997; WCC, 1999; SIRC, 2005).

Current and Historic Conditions Inside the Estuary Priority Area of the Salmon Recovery Plan

Conditions	Miles of Tidal Barriers	Acres of Estuarine Habitat	Restoration Needed for Properly Functioning Conditions (Acres)	10-Year Restoration Goal from Salmon Recovery Plan (Acres)	Completed Restoration from Salmon Recovery Plan Goal (Acres)
Current	24	2,166	2,020	315	0
Historic (pre-1870)	0	5,291	0	0	0



Opposition to Restoration

The Snohomish Agricultural Advisory Board reviews every acre of restored habitat on agriculture zoned land as a potential loss of productive crop land. The local Farm Bureau has additionally taken a stance of no net loss of Agricultural land. These groups appear especially concerned about potential losses to salmon habitat restoration, as has been evident through their review of restoring tidal marshes to 115 acres of public land on Leque Island. Over 92% of the land in the Chinook Recovery Plan's Estuary Priority Area is zoned Agriculture, which means every future restoration opportunity in the estuary has a good potential of being scrutinized by the Ag. Adivsory Board and the local Farm Bureau. Regional help from the Puget Sound Partnership and NOAA Fisheries will be necessary to reconcile salmon habitat restoration with agricultural land conservation (Stevenson and Griffith, 2010).

Changing Practices in the Stillaguamish Watershed Lead to the Return of Shellfish Harvest in Port Susan

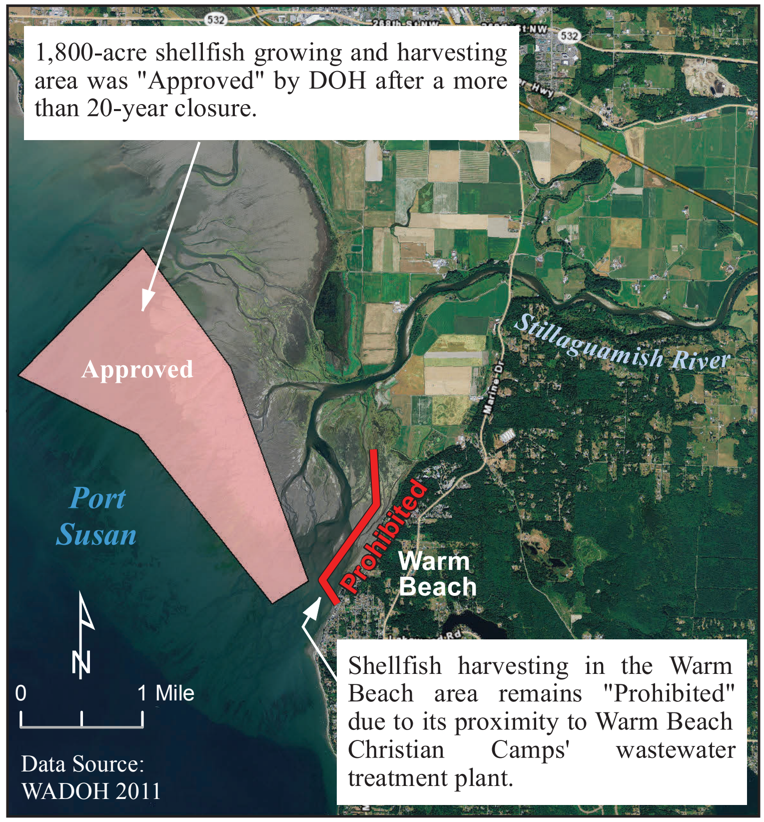
On April 2, 2010, 1,800 acres of Port Susan's shellfish area were upgraded to the State Department of Health's high rating of "Approved" as a result of marine water quality improvements detected through monitoring by the Stillaguamish Tribe. Fecal coliform counts were so high in the late 1980s that access to the entire bay was closed. The improved water quality of Port Susan detected through tribal monitoring coincides with changes in farming practices, city wastewater management, and updates to rural septic systems in the Stillaguamish watershed. Maintaining the "Approved" rating will require continued monitoring, continued maintenance of fecal coliform sources that have been cleaned up, and continued cleanup of excessive sources of fecal coliform pollution.

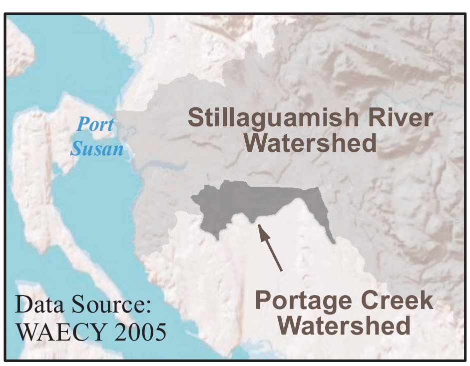
Clean Water District Sees Results

In 1993, the Snohomish County formed a Clean Water District (CWD) to "Restore water quality in saltwater tidelands; bringing about the upgrading of conditionally approved, restricted, and prohibited shellfish beds" (Snohomish County, 2011).

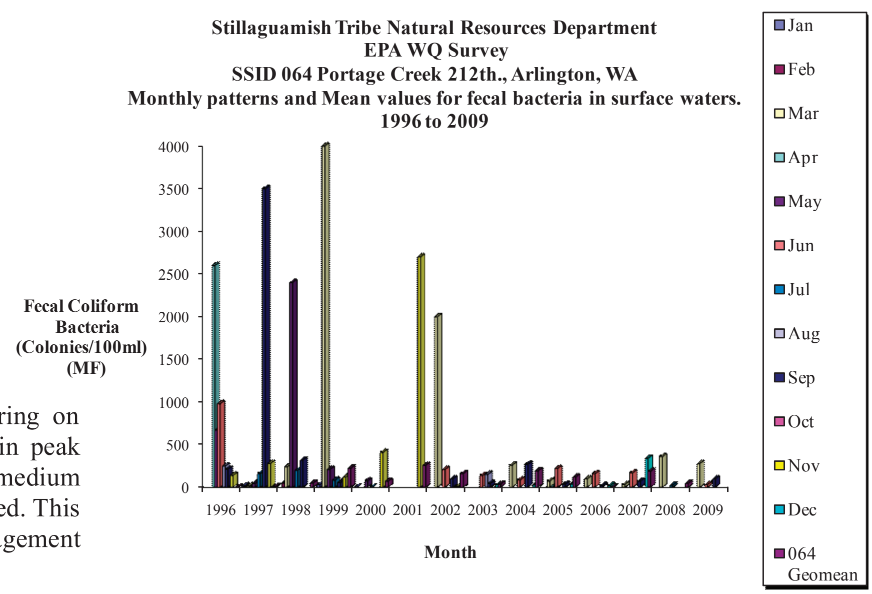
Efforts of the CWD have resulted in improved water quality conditions in Port Susan, and improved freshwater conditions in the Stillaguamish River.

The CWD and county shellfish protection programs remain vigilant, as on-site septic, livestock, and pet pollution remain persistent nonpoint pollution sources (Snohomish County, 2011).

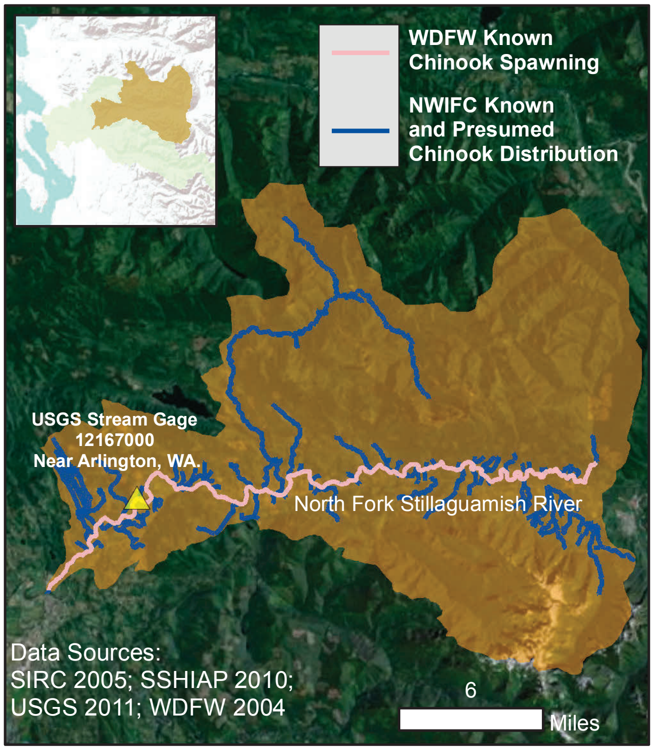




Stillaguamish Tribe water quality monitoring on Portage Creek shows a drastic reduction in peak fecal events after 2002, coinciding with a medium sized dairy farm moving out of the watershed. This suggests a relationship between dairy management and improved water quality.



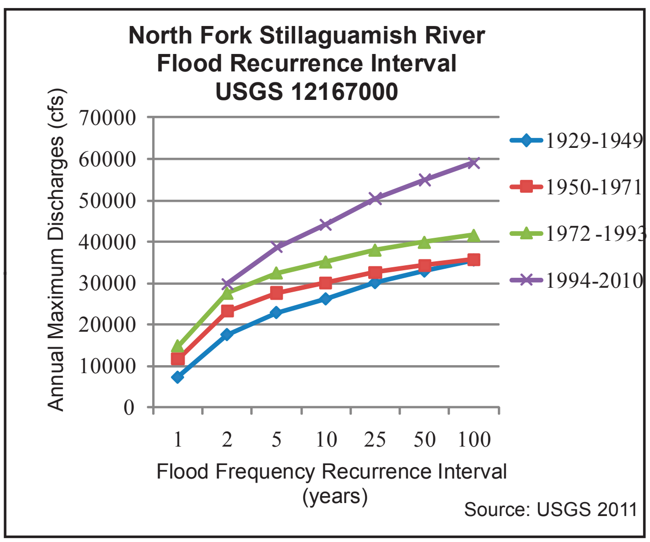
Increasing Peak Flows on the North Fork Stillaguamish River Are Limiting Chinook Salmon Production

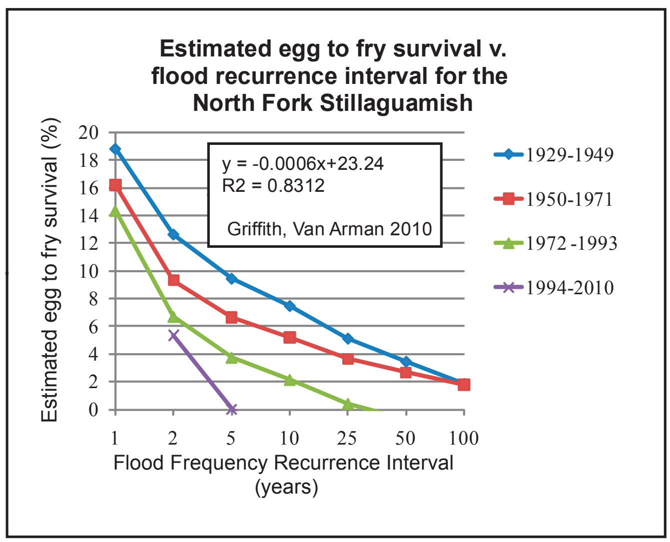


With an egg to fry survival rate of 5% being dictated by peak flow every 2 years, each current brood year of spawning North Fork Stillaguamish Chinook has a 50% chance, rather than a (historic) 10% chance, of being exposed to (peak) flow events that correspond to egg to fry survival rates where the (Chinook) stock does not replace itself (Beamer and Pess 1999; SIRC 2005).

Flood Waters are on the Rise

Based on data from the USGS stream flow gage on the North Fork Stillaguamish near Arlington, a peak flow that would have happend once in 25 years in the 1930s now happens once every 2 years. Six of the largest floods recorded at the North Fork gage have come in the last 10 years, with the largest flood on record coming December 2010.





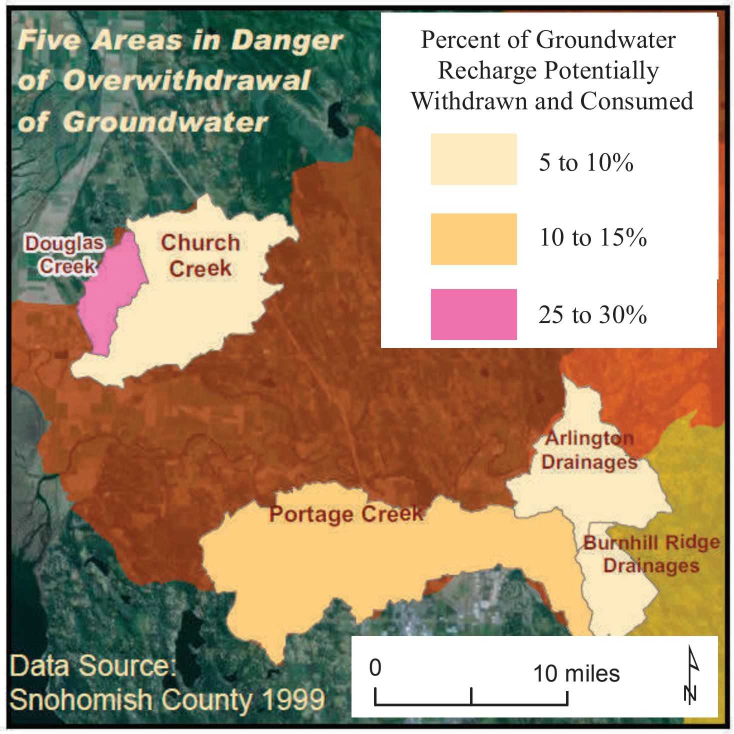
Driving Factors, Research and Restoration

Suspected human factors impacting peak flow hydrology in the North Fork Stillaguamish watershed are the conversion of mature forests to immature forests through industrial forest practices. The associated building of forest road networks throughout the upper North Fork watershed to support industrial forestry. The filling of wetlands and and slough habitats, and the disconnection of those habitats from the mainstem North Fork river. All of which have removed natural water storage from the basin, resulting in more water being more often available for peak flow runoff events. Currently the Stillaguamish Tribe is being funded through an EPA grant to investigate how these as well as climate factors, are driving peak flows in an effort to target landscape restoration and lower impact to spawning Chinook of future peak flow events.

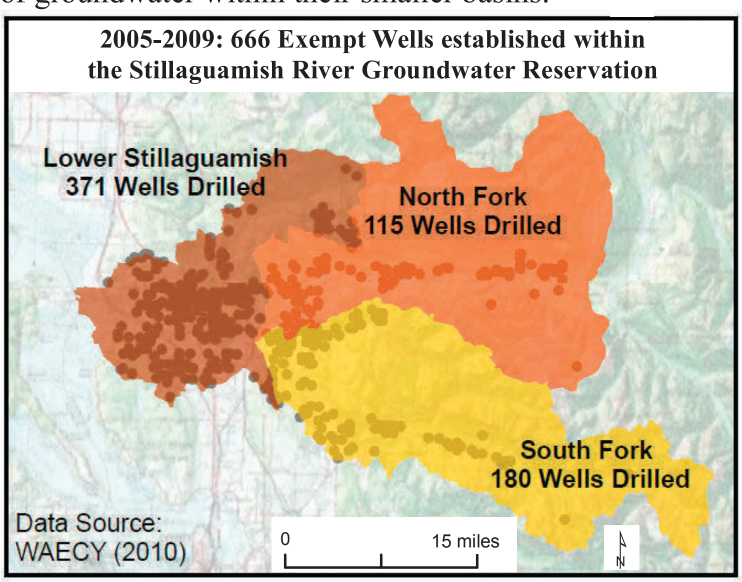
2005 Instream Flow Rule Leaves Tributaries Vulnerable to Baseflow Impacts from Groundwater Withdrawal

In 1999, Church Creek was identified as a basin where groundwater withdrawls are at rates that can limit base streamflow in August and September (Snohomish County 1999). Since the 2005 Instream Flow Rule's closure of the Stillaguamish watershed, Church Creek has continued to see annual groundwater well development and has failed to meet its state-mandated instream baseflow 100% of the time.

In 1999, Snohomish County produced a Groundwater management plan. In it, five different groundwater basins in the Stillaguamish watershed were identified as being in danger of overwithdrawal of groundwater (Snohomish County 1999). In those areas it was forecasted that well development will mean more groundwater will be withdrawn than can be naturally recharged, and tributary baseflows may decrease as a result. It is considered overwithdrawal of groundwater when the amount being taken out of a particular basin exceeds 5% of the amount of groundwater recharging that basin.



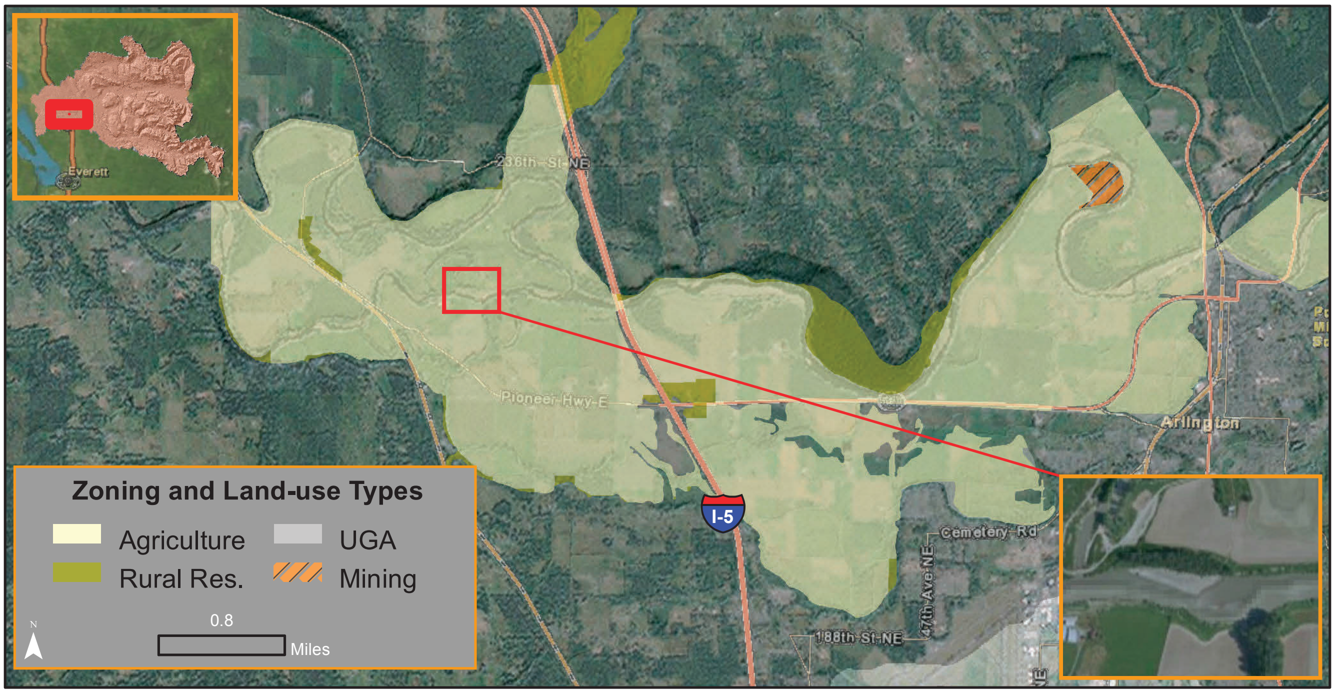
Church Creek is one of the 5 areas identifed in 1999 in danger of overwithdrawal of groundwater, yet Church Creek remains open to exempt well development. Since 2005, Church Creek has failed to meet its State Instream Flow requirement 100% of the time in August and September. Adequate late summer and early fall baseflow in Church Creek are critical for coho, chum and cutthroat habitat. The groundwater reservation setup as part of the Instream Flow Rule does not protect tributaries like Church Creek from the risk of overconsumption of groundwater within their smaller basins.



In the fall of 2005, the State closed the Stillaguamish River to further granting of surface water rights (WAECY 2005). As part of the closure, a reservation of groundwater was created for future permit exempt well drilling in the North Fork, South Fork, and Lower Stillaguamish River subbasins. In 2010, the State published the first report documenting withdrawal from the exempt well reservation since 2005 (WAECY 2010), None of the three watersheds consumed more than 4% of the reserve over this 4-year period. So no limits will be placed on withdrawal from the groundwater reserve.

Riparian Forest Clearing and Bank Armoring Continue to Limit Salmon Habitat Area and Quality in the Floodplain

The Salmon Recovery Plan suggests that over 50 years, 80% of riparian areas should be forested to achieve properly functioning conditions (SIRC 2005). Currently, only 23% of riparian area within the floodplain have any forest cover. Progress is being made, 235.7 acres have been replanted, and that represents 59% of the Recovery Plan's 10-year goal of 400 acres. The progress being made in restoring floodplain forests is being somewhat negated by the lack of progress being made on the removal of bank armoring. There is a 10-year goal of removing 4.1 miles of bank armoring to restore critical habitat forming functions to the floodplain. To date, 0.43 miles of armoring have been added since 2005, and now 4.53 mile of bank armoring need to be removed to meet the 10-year goal of the Salmon Recovery Plan.



The long-term absence of mature riparian vegetation throughout the floodplain coupled with the straightening and armoring of floodplain channels has resulted in huge deficits to habitat area and quality (SIRC 2005).

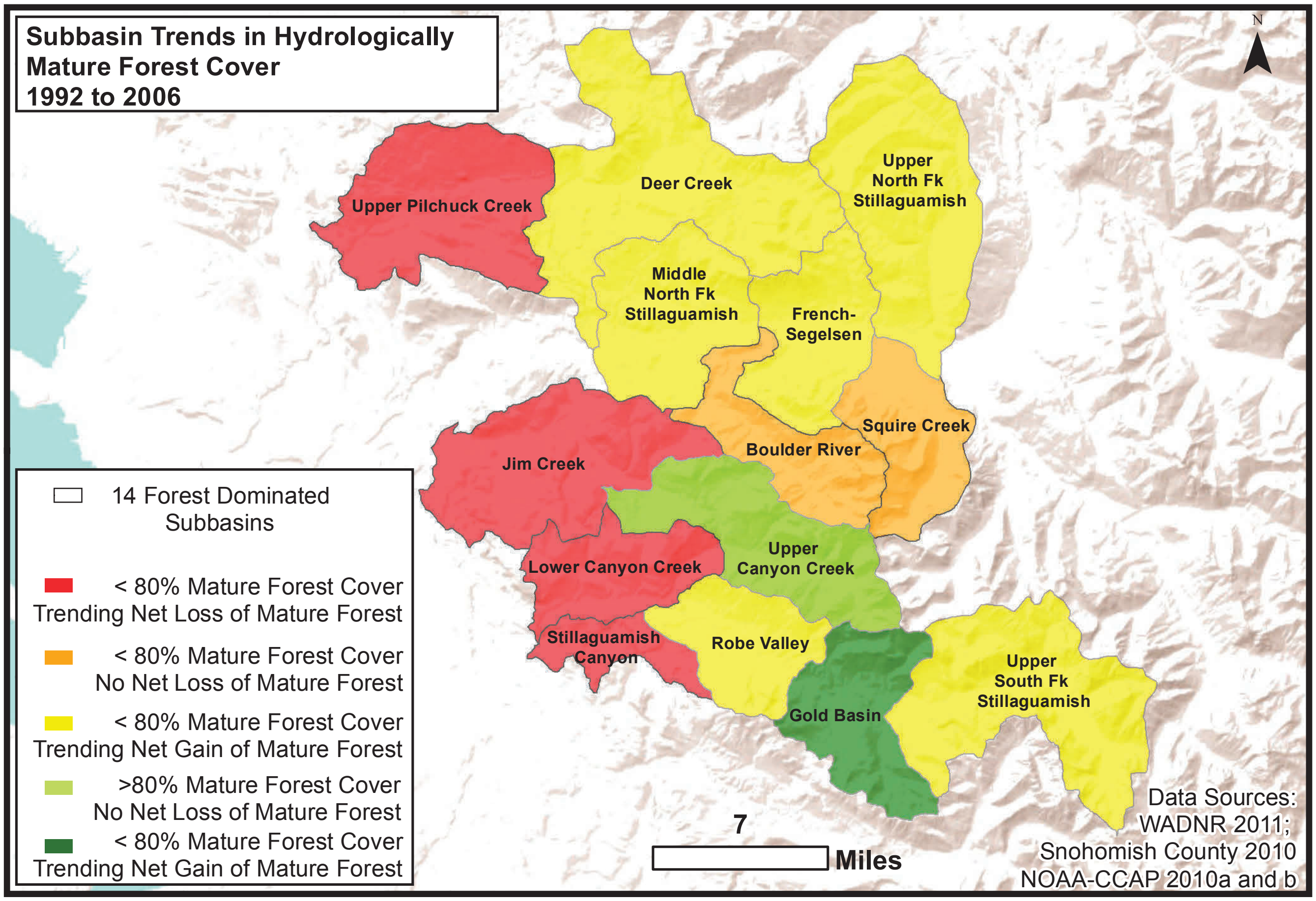
Floodplain and Riparian Forest Cover Change by Zoning and Land-use: 1992-2006

Zoning/ Land-use Categories	Total Floodplain Acres	%- Forest Cover 1992	%-Forest Cover 2006	Total Riparian (within 200-ft of a stream) Acres	%- Forest Cover 1992	%-Forest Cover 2006
Agriculture	8488	14	13	1398	18	18
Rural Residential	1464	43	41	346	41	40
Forestry	83	72	72	19	60	60
Mining	41	0	0	7	0	0
Urban Growth Area	40	24	24	7	0	0

These include lack of habitat forming large woody debris, lack of stream shade, changes in nutrient cycling, and lack of root structure for natural bank stabilization. As well, the river that once meandered through the forests undercutting banks and recruiting shade, wood and nutrients while creating habitat is no longer allowed that interaction from its armored channel. Over 80% of the floodplain is zoned for agricultural use, with only 13% forest cover and when you focus on riparian areas in the agricultural floodplain only 18% has forest cover.

Private and State Forest Dominated Subbasins Continue to Lose Hydrologically Mature Forest Cover

The Salmon Recovery Plan recommends 80% of forest cover be in hydrologically mature forests in 14 forest-dominated subbasins (SIRC 2005). Of the 14 watersheds, only 2 were >80% hydrologically mature forest. From 1992 to 2006, 10 of the watersheds had either no net loss of mature forest, or were on a trend to gain hydrologically mature forest in the future. Each of those watersheds is dominated by Federal Forestland. 4 subbasins in the watershed were <80% hydrologically mature forest and were trending towards younger forest from 1992 to 2006. These are dominated by Private and State owned forests.



From 1992 to 2006, net loss of forest cover is highest in those watersheds that are dominated by private and state ownership: Stillaguamish Canyon, Jim Creek, Lower Canyon Creek, and Upper Pilchuck Creek. In these four watersheds 50% more forest cover was cleared than was regenerated during that period. Of the total acres of forest cleared in federal, private and state forestlands within the 14 subbasins from 1992 to 2006, more than 62% or 12,316 acres was located in these 4 watersheds.

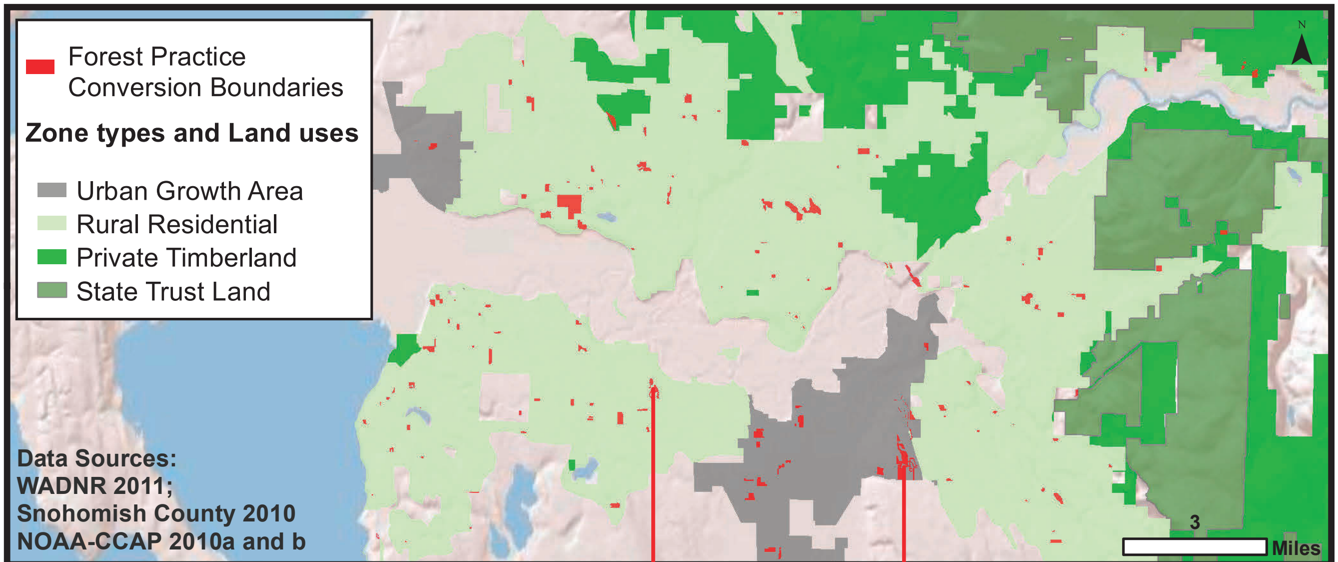
So, while federal forestlands are returning to hydrologic maturity, private and state forestlands appear to be continuing to trend towards hydrologic immaturity.

4 Subbasins Dominated by State and Private Forestland (Turner 2002)

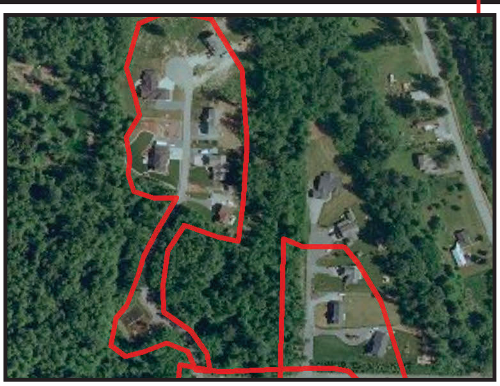
Subbasin	*Acres of Commercial Forestland*	*%-Private Forest*	*%-State Forest*	*%-Federal Forest*
Stillaguamish Canyon	5630	91	3	7
Jim Creek	22985	54	23	23
Lower Canyon Creek	15597	80	9	10
Upper Pilchuck Creek	29408	65	35	0

Lowland Forestland Conversion and Forest Cover Loss from 1996 to 2006.

From 1996 to 2006, there was a 41% decrease of forest cover from 58% to 17% inside the Urban Growth Area conversion application parcels, and there was a 22% decrease of forest cover from 83% to 61% inside the Rural Residential conversion and harvest application parcels.



Rural Residential



Urban Growth Area

As seen in their respective aerial images, the conversion of forests in the UGA results in suburban- to urban-like densities of infrastructure, houses and people. In rural residential areas, forest conversion leads to lower densities of houses and roads, but forests are fragmented resulting in smaller forest patches and more edge forest along a human interface.

Over 1,500 acres of forestland was converted to residential uses between 1996 to 2006, of that 96% is currently zoned rural residential or inside a UGA boundary. The forest cover loss resulting from forest conversion to urban and rural residential land use is considered permanent and the trend is expected to continue. Currently, 36% of private forestland in the Stillaguamish basin is not signed up for the "Designated Forestland Program," and is estimated to be at a 91% risk for conversion (UW 2009).

Changes in Forest Cover on Converted Forestlands from 1996 to 2006

Zone Type	*Acres of Converted Forestland*	*%-Change Forest Cover*
Urban Growth Area	678	-41
Rural Residential	871	-24
Private Forestland	47	-24
State Forestland	22	-4

Summary

The last 150 years of human expansion and development has depleted natural resources and left degraded the natural ecology of the Stillaguamish river basin. One of the major resource concerns for the Stillaguamish Tribe is the state of salmon within the watershed, and the Tribe has been deeply committed to the Stillaguamish Watershed Chinook Salmon Recovery Plan (SIRC 2005). The Salmon Recovery Plan clearly identifies historic habitat loss, and the causes of continued habitat degradation. This report highlights some of the major landscape-level causes for sustained salmon habitat loss throughout the watershed, from the estuary to the headwaters.

By 1968, over 85% of critical Chinook salmon salt marsh habitat in the estuary had been lost. Since then, salt marsh habitat has improved slightly but still remains at 25% of historic amounts. Through the Recovery Plan a 10-year goal of 315 acres restored was set, and of that only 295-acres is planned for restoration. However, over 2,000 acres is needed in the long-term and the local agriculture conservation interests have continued to make it difficult to make future estuary habitat gains.

The Salmon Recovery Plan suggests that, over the long-term (50 years) 80% of riparian areas should be forested to achieve properly functioning conditions (SIRC 2005). Currently, only 23% of the 1,777 acres of riparian area within the floodplain have any forest cover. This means that without losing any of the current riparian forest cover, roughly 1,000 acres of riparian area within the floodplain would need to be reforested. Over 80% of the flood plain is zoned agriculture, which means much of the 1000 acres of needed riparian area in the floodplains will have to be obtained from agricultural lands, and the organized opposition to estuarine restoration may also be present for floodplain riparian restoration.

The watershed is primarily composed of state, private and federal forestland. The majority of these forestlands have been cleared at least once over the last 150 years. As a result, forest cover has been converted from hydrologically mature to hydrologically immature. This has resulted in more flooding during extreme precipitation events. Presently, federal forests are returning to a hydrologically mature condition, but as a result of continued high rates of harvest coupled with conversion of forestland to residential land, forests on state, private and rural residential lands remains hydrologically immature.

While the Salmon Recovery Plan represents a well organized, scientifically based and by its own accounting, a largely successful approach to restoration in the Stillaguamish watershed, overall land-use of the watershed continues to place a countervailing pressure on the natural ecology of the watershed. The sustained drainage and clearing of the estuary and the floodplain for agriculture, the maintained harvesting intensity of state and private industrial forests, and the growing popularity of the watershed with rural residents are all continuing to limit restoration gains. Through both incentive-based programs and regulation enforcement, people within the watershed will have to make some changes in their natural resource use behaviors if the full benefits of the Salmon Recovery Plan are to be met.

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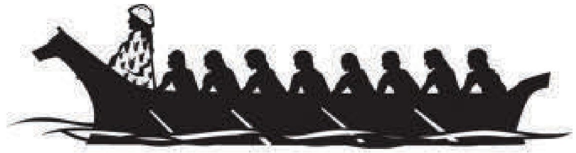
State of Our Watersheds Report
Kitsap Basin



Respect for the land and waters, the abundant natural resources and a deep understanding of the delicate supportive relationships of the natural systems were central themes in all Northwest Indian cultures. It is still true to this day for the Suquamish people. The tribe continues to be a good steward, managing, honoring and enhancing the resources, and guarding habitat and wildlife. Despite encroachments, the Suquamish people are still committed to steadfastly protecting areas of cultural and traditional resource significance.

**– ROB PURSER,
SUQUAMISH TRIBE**

The Suquamish Tribe

The Suquamish Tribe has inhabited the Kitsap Peninsula since time immemorial. They are party to the Point Elliot Treaty of 1855, when tribes ceded their traditional lands to the U. S. government. This report will focus on the east Kitsap Basin ('East Kitsap Focus Area') and surrounding marine waters, one of many areas within the Suquamish Tribe's adjudicated usual and accustomed fishing area. The Kitsap shoreline accounts for nearly half of the nearshore habitat in south and central Puget Sound and provides vital habitat for salmonid production throughout the region. Major land-use impacts on salmon habitat continue to result from floodplain and shoreline development, urban development, road construction and logging practices.

Ecological Degradation of the Kitsap Basin

At the 5-year mark, a review of key environmental indicators for the Kitsap Basin recovery planning area reveals a continued decline in water quality and quantity, forest and riparian land cover, as well as shoreline habitat conditions.

Much of these habitat impacts are attributed to the conversion of forestland uses to rural, urban, and resource land uses. The population of Kitsap County has grown by 8.3% between 2000 and 2010. A significant challenge will be accommodating future growth while maintaining forested landscapes and improving riparian conditions.

With a current population of 251,133, the county is the 3rd most densely populated in the state (OFM 2011). Kitsap County lies on the fringe of the Puget Sound metropolitan area. The fringe areas on the east side of Puget Sound include rural and agricultural land as a buffer to forests.

In Kitsap County, there is no agriculture (i.e., zero zoned – some hobby) and a history of pre-GMA sprawl densities (e.g., less than 4 dwelling units per acre) outside of cities and UGAs. This puts greater pressure on our forested lands that are still in large blocks (20 acres and greater). The value of these lands for commercial forestry is relatively low compared with their potential value from development. Our collective "management" of these lands consists of volatile zoning and regulation shaped by politics and a history of court and hearing board decisions, plus the occasional large open space acquisition. In some cases (e.g., McCormick Woods), we have lost large tracts of forested headwaters (Anderson Creek) to residential development. In other areas (e.g., North Kitsap), forested status remains uncertain, with major action forestalled by "interim forest" litigation.

The population growth has led to about 47% of the land in East Kitsap to now be zoned as urban, while less than 5% is classified as "open/water" areas and "interim-forestry." This resulting land conversion is directly responsible for continued habitat loss and fragmentation. Historical residential, industrial, commercial and transportation development have resulted in substantial loss of intertidal wetland habitat.

Current development pressures are having greater direct impacts on terrestrial wetlands, riparian areas (including marine shorelines), upland forest habitats and on the quality and quantity of intertidal wetland habitat in East Kitsap. Similar trends occur in all categories of shoreforms, with the shoreline gaining about 18 miles of artificial shoreforms, mostly the result of placing fill along the shoreline and in estuaries (PSNERP 2010). Development pressures also result in impervious surface area increases which are positively correlated with decreases in habitat and water quality (Spence et. al. 1996 and Booth et. al. 2002). A recent assessment of impervious surface data reveals an increasing trend toward degrading conditions for most watersheds in the area.

Development Puts Pressure on Water Quality, Quantity

Hydrologically, the East Kitsap Focus Area is more similar to Island and San Juan counties than the other counties surrounding Puget Sound. Local precipitation is the sole source of fresh water for groundwater recharge and streamflow. Increased demands and impacts on freshwater quality and quantity are associated with population growth and residential development in the focus area. Within the past 30 years, the area has seen a greater than 300% increase in the number of exempt wells without consideration for their cumulative effect on wetlands, springs, and low flows in streams and rivers during the summer months. The proliferation of exempt wells continues even though measured low flows fall below critical thresholds in East Kitsap.

For example, Chico Creek, East Kitsap's most intact and naturally productive stream, regulated minimum instream flows were not met during the period of June to September in the 13 water years for which data are available. The result is diminished available fish habitat, increased water temperature, and a negative impact on the ecological functions.

Suquamish Tribe's fisheries biologist Jon Oleyar surveys Dickerson Creek within the Chico watershed for coho carcasses. The watershed is also home to Chico Creek, one of the most sustainable salmon-producing creeks in the region. The tribe has been monitoring spawning salmon in Chico, plus installing gravel and rootwads near the mouth of the creek to help slow the water and create pools that salmon need to rest, hide and feed.

Forest Removal and Roads Threaten Stream Health

Forest and riparian land cover conditions are declining in conjunction with population growth and residential development in the East Kitsap focus area. About 4% of the forestland cover was lost between 1992 and 2006, and the trend in many watersheds is toward "poor" or "severely damaged" conditions. Overall, 53% of the shorelines in the focus area have riparian areas that are heavily influenced or maintained by human development and only 37% have deciduous and conifer dominated forests with closed canopies (Shared Strategy 2007). Riparian forests contribute large woody debris to streams, provide shading, among other functions, and their removal results in a decline of fish habitat quality.

Another byproduct of urbanization is the construction of road networks which can be significant stressors to stream health. The East Kitsap Salmon Recovery Plan includes identifying and removing fish passage restrictions in streams that provide important salmon habitat as a high priority (Shared Strategy 2007). However, this assessment shows that every Watershed Administrative Unit in East Kitsap remains either impacted or degraded from high road densities and high frequencies of stream crossings. Similarly, barrier culverts still partly or fully block more than 158 miles or 43% of potential fish habitat in this area.

A small estuary at the Indianola Waterfront Preserve in Kitsap County, blocked from tidal flow for more than 40 years, was reopened to juvenile fish in fall 2010. A fish-blocking 18-inch pipe under Chief Sealth Drive was replaced with a 16-foot-wide by 8-foot-tall culvert and the estuary was widened from 30 to 150 feet.

Restoring the small or "pocket" estuary at the Indianola Waterfront Preserve provides juvenile Puget Sound chinook, coho and chum salmon a refuge area for resting, eating and hiding from predators.

Impacts to Shorelines Affect Nearshore Habitat

Shoreline development has been identified as a key habitat stressor to Chinook salmon in East Kitsap because it threatens forage fish spawning habitat and predator refuge for juvenile salmon. About 55% of the shoreline in this area has been modified or armored. These alterations disrupt the natural sediment dynamics of the shoreline (e.g., sand and gravel movement) leading to the degradation or elimination of spawning habitat of key forage fish species. Our analysis shows that almost 56% of inventoried sand lance and surf smelt spawning habitat has been modified within the focus area. These species represent key prey items for larger predator fish and wildlife in the Puget Sound marine food web. A healthy and abundant marine food web is essential to recovering and sustaining the area's salmonid populations.

Between 2006 and 2009, the Suquamish Tribe, Kitsap County and Washington Department of Fish and Wildlife, plus citizen volunteers, beach seined 150 miles of the eastern nearshore of Kitsap County. Biologists and volunteers collected information about juvenile salmon and other fish living in the nearshore during the spring and summer. In addition, they studied areas that needed habitat protection or restoration to help boost natural salmon production.

East Kitsap Recovery Strategy

The East Kitsap Recovery Strategy emphasizes a multi-species, ecosystem approach, which prioritizes the restoration and/or protection of naturally productive freshwater and nearshore habitat (PSSRP 2007).

The recovery effort had two areas of focus:

- Prioritization of fish passage restoration actions on streams with high-quality habitat; and
- Restoration of Gorst Creek.

Similarly, the Puget Sound Action Team, the Technical Recovery Teams and Shared Strategy staff recommended that marine and nearshore areas proceed with a protection and restoration strategy designed to protect what is currently functioning while leaving options open for further restoration work (PSSRP 2005). It was anticipated that future restoration efforts would be informed by the work products of the Puget Sound Nearshore Ecosystem Restoration Program.

Coho smolts from Gorst Creek are weighed before being transferred to the Suquamish Tribe's Agate Pass net pen.

Looking Ahead

At the five-year mark, the East Kitsap Focus Area still lacks a unified set of goals, strategies and actions that are prioritized and sequenced across the planning area. Adequate funding and staff capacity have been identified as critical needs for this planning area (Judge 2011). Although a habitat protection strategy was incorporated in the initial recovery plan, the lack of staff capacity has hindered the implementation of this strategy into action.

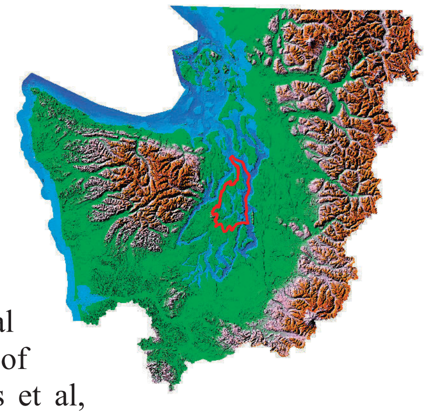
Habitat regulation reform is needed. The current regulatory programs such as Shoreline Master Programs and Critical Areas Ordinances that govern land use activities which affect nearshore, estuarine, and river habitat, are generally constructed with the aim of preventing net loss of ecological functions. These programs require updating if habitat protection and salmon recovery goals are to be realized. In addition, a habitat monitoring program should be established in conjunction with this regulatory reform to determine if observable differences can be detected as a result of implementation of new land-use regulations. The current three-year work plan contains no funding for such regulatory review (East Kitsap 3-year work plan).

In recent years, the Suquamish Tribe has worked successfully with several entities to improve water quality and upgrade the status of a number of shellfish beaches in the East Kitsap focus area from "prohibited" or "unclassified" to "approved". Several challenges remain, however, in making improvements to water quality affecting area beaches that would allow for shellfish harvest.

These challenges also extend to implementing land use policies and codes that better protect and restore watershed, stream, and nearshore functions for salmonids and other finfish, and shellfish resources important to the Suquamish economy and culture. The accomplishments made in water quality and with the re-opening of shellfish beaches are testimony to the value in developing and fostering partnerships with other entities, including local, state, and federal agencies. Suquamish looks to continue working with others and seeks new partnerships that will be necessary to meet the many remaining challenges in salmon recovery, protecting and restoring watersheds, habitat, and water quality, and toward recovery of the Salish Sea.

Suquamish biologists Jay Zischke and Tom Ostrom stand on a box culvert on Kittyhawk Drive, at the mouth of Chico Creek. The tribe is working with Kitsap County to replace the fish-blocking culvert with a natural streambed, which will allow native chum salmon, the creek's predominant salmon species, to take advantage of the widened estuary.

Suqamish Tribe
(Portion of East Kitsap Basin)

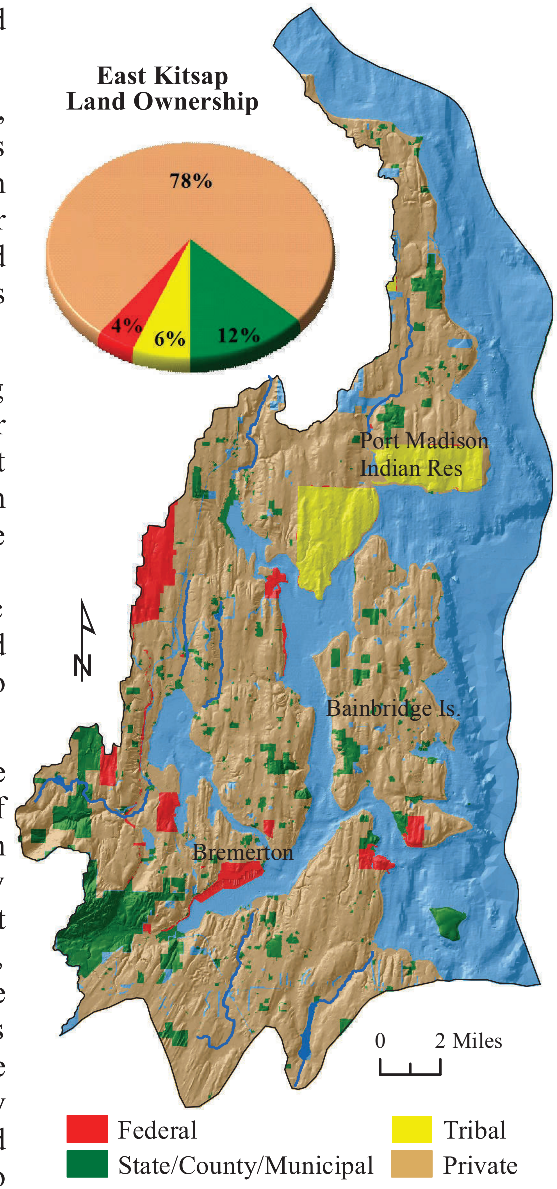


The Suquamish Tribe's focus area for this report is a portion of the East Kitsap basin (herein after "East Kitsap"), although the tribe's usual and accustomed fishing area is much more geographically expansive. The shorelines of East Kitsap form the eastern portion of Kitsap County, including Bainbridge Island, and its streams flow to central or southern Puget Sound. These lowland streams provide ideal spawning and rearing habitat for juvenile and adult salmonids. Many of them originate from lakes, springs, or headwater wetlands (Williams et al, 1975) and stream flows are dependent on precipitation and groundwater contribution.

The entire Kitsap Peninsula is 400 square miles in size, surrounded by 360 miles of saltwater shoreline. This shoreline accounts for nearly half of the nearshore habitat in south and central Puget Sound and provides vital habitat for threatened Chinook, as well as for chum, coho, steelhead and cutthroat trout from watersheds throughout those areas (Shared Strategy, 2007).

Native American people located their villages and fishing camps along the shorelines and near the mouths of major streams in the area. The 1855 treaties led to the establishment of many Indian reservations including the Port Madison Indian Reservation, home of the Suquamish people. The Suquamish Tribe's Usual and Accustomed fishing area includes all of Kitsap County, Hood Canal to the Olympic Mountains, and north to include the San Juan Islands and marine shorelines along the eastern part of Puget Sound to the Canadian border.

The United States Navy owns most of the federal land in the East Kitsap focus area. This creates a unique set of opportunities and challenges. Some of the military lands in East Kitsap contain valuable habitat. However, Navy operations and ongoing construction projects are not designed to protect habitat and water quality. In addition, past operations have left a legacy of contaminated sites in the study area, many in the nearshore. Although the Navy uses internally developed Integrated Natural Resource Management Plans (INRMPs) to carry out its military missions, such plans do not ensure consistency with state and local land use and other environmental laws designed to protect habitat.



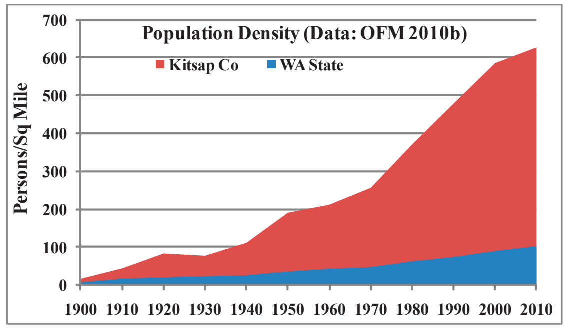
Data: Kitsap County (2010b), WADNR (2009)

East Kitsap salmon recovery has been implemented with the recognition of the critical role played by the nearshore and marine areas in providing support for salmon species originating from all portions of Puget Sound (Shared Strategy, 2007). The overall goal is to protect, restore and enhance the nearshore natural processes and habitat in order to contribute to Puget Sound-wide salmon recovery.

Population Growth and Its Impact on Habitat

The population of Kitsap County has more than doubled since 1970 with a significant impact on land use, water resources and fish habitat. The Urban Growth Area (UGA) of the East Kitsap focus area has increased by 26% since 1998 but in the Silverdale and Port Orchard areas, the UGAs have expanded by 64% and 53% respectively.

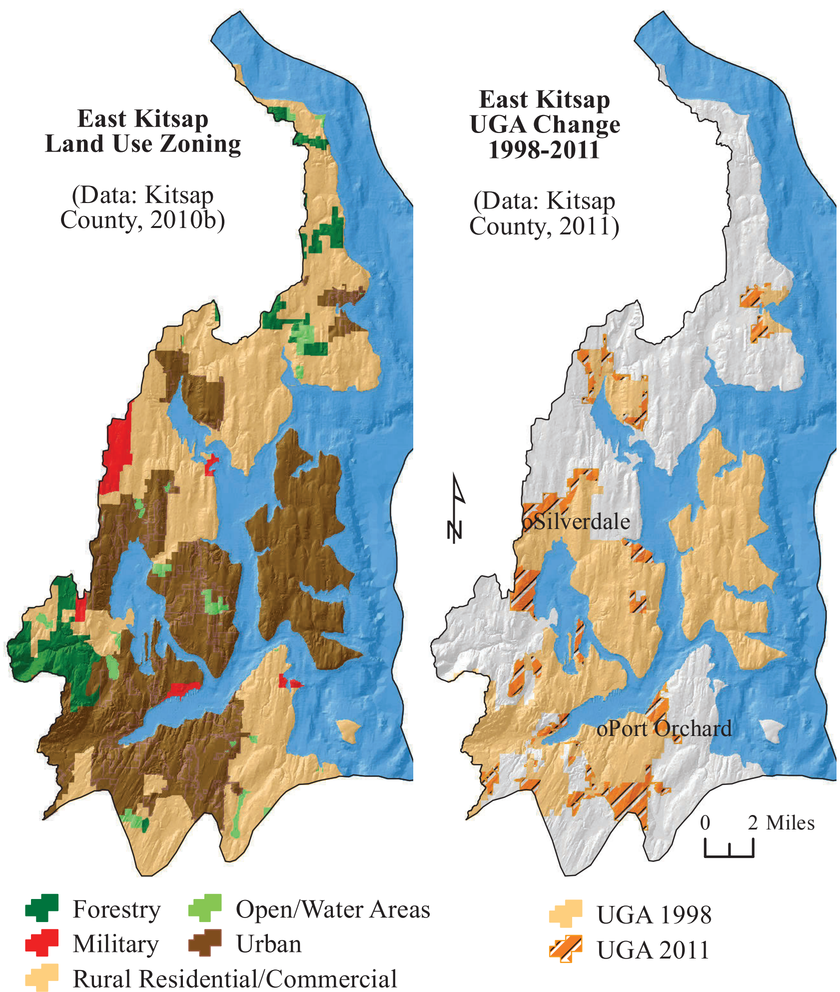
Kitsap County is the seventh most populous county in Washington State but represents the third most densely populated county due to its small geographic size and proximity to the state's largest employment centers. The county experienced an 87% increase in population between 1970 and 1990- far outpacing the state's rate of 55%. It also grew by 22% between 1990 and 2000 and 8.3% between 2000 and 2010 to its current population of 251,133 (OFM 2010a, 2011).



This rapid population growth has a significant impact on land use, water resources and fish habitat as a result of alteration of vegetation, urban development, and the development of coastal zones. This is particularly important in East Kitsap because most of the population centers are in this part of the county.

To accommodate the current and projected population increase, there has been a 26% increase in the county's Urban Growth Area (UGA) since the first Kitsap Comprehensive Plan was adopted in 1998. The UGA expansion is particularly prominent in the Silverdale and Port Orchard areas with a 64% and 53% increase respectively since 1998. Kitsap County's expansion of UGAs in 2006 was found to be contrary to the GMA. These UGA boundaries are currently undergoing revision/retraction, an outcome of litigation.

The Puget Sound Salmon Recovery Plan (Shared Strategy, 2007) identified growth and the resultant urbanization in East Kitsap as one of the key factors contributing to the current declining status of Puget Sound Chinook and other salmon populations in the basin. Development pressures continue to increase along the waterfront and into rural areas. The cumulative impacts resulting from activities such as exempt wells, residential shoreline development, vegetation removal, floodplain development, and stormwater runoff remain largely unchecked and unaccountable.



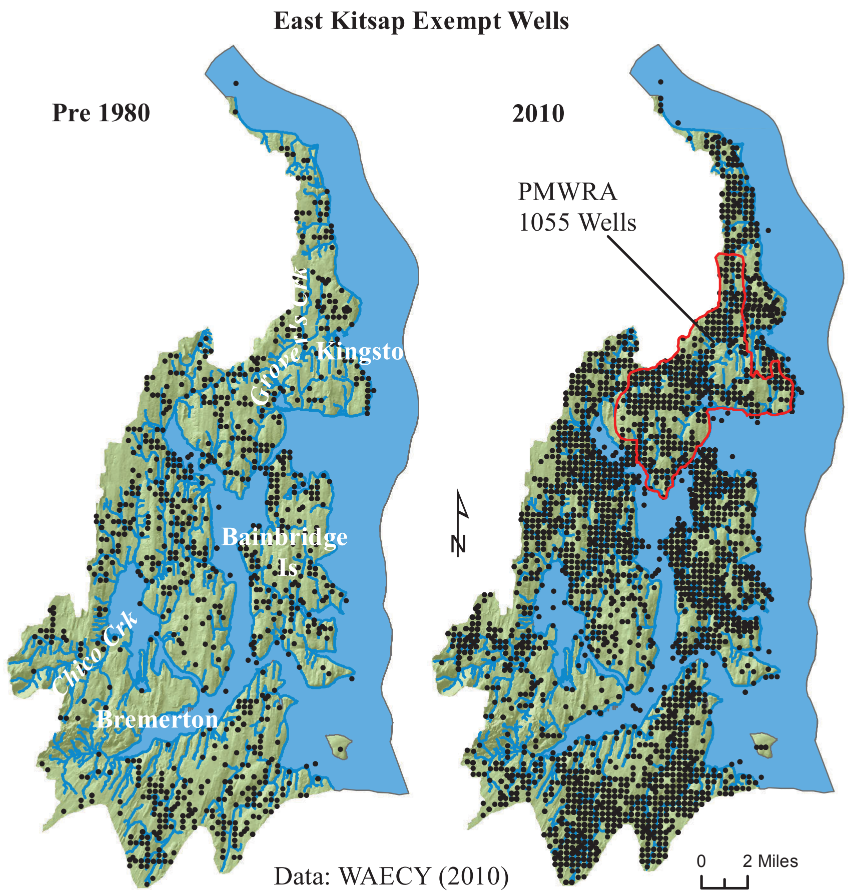
Permit-Exempt Wells Potentially Impacting Low Flows

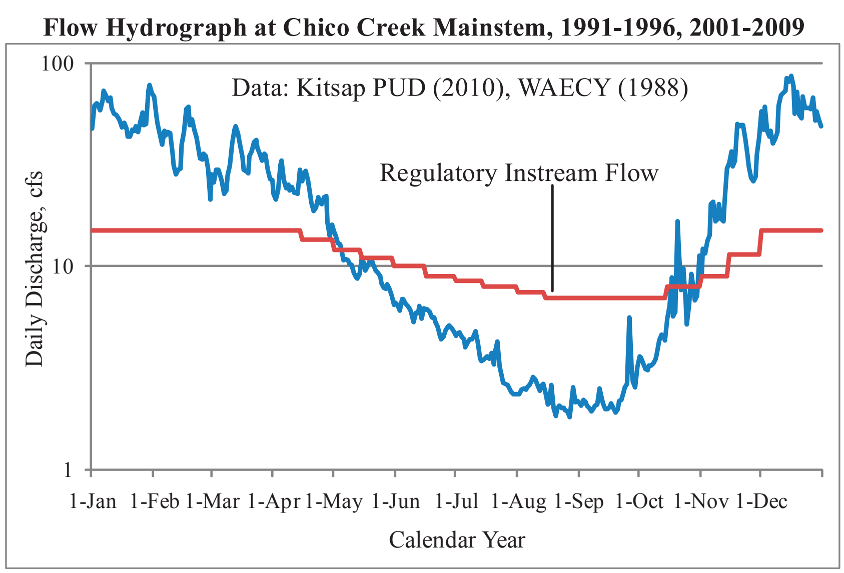
Within the past 30 years, the East Kitsap focus area has seen an increase of over 300% in the number of exempt wells. Maintenance of stream flows necessary to preserve instream resources is a major concern in the basin during the dry months. In Chico Creek for example, minimum instream flows were not met during the period of June to September in the 13 water years for which data is available.

The East Kitsap Salmon Recovery Plan (Shared Strategy, 2007) identified the alteration of natural stream hydrology as perhaps one of the largest impacts/threats to salmon habitat in the basin. There are many small streams in the basin which are highly influenced by groundwater and support many fish populations (Kitsap PUD, 1997).

Between 1980 and 2010, there was an increase of about 300% in the number of permit-exempt wells in East Kitsap focus area. In the Port Madison Water Resource Area (PMWRA), the increase was over 337%. Exempt wells are not subject to the same restrictions and regulations as other water diversions in Washington State. They contribute to the over-appropriation of groundwater and to the decline of aquifers. The cumulative effect of exempt wells reduces water levels in wetlands, springs, streams and rivers. Local zoning and development ordinances rarely provide sufficient protection for groundwater and its critical contribution to summer base flows.

In Chico Creek, minimum instream flows were not met from June to September in the 13 years for which data was available. Grover's Creek in the PMWRA appears to be similarly impacted (Suquamish Tribe's John O'Leary, personal communication). Many studies in the Pacific Northwest have documented the relationship between low stream flow and poor salmonid survival (Quinn and Peterson, 1996; Mathews and Olson, 1980; Hartman and Scrivener, 1990).





Land Conversion and the Loss of Habitat

There has been a 39% (or 0.5 sq mile) loss of vegetated estuarine wetland area and a 23% (or 47 miles) loss of natural shoreform types, particularly sheltered embayments, from historic levels in East Kitsap. Conversely, there are now 18 miles of "Artificial" shoreforms, the result of anthropogenic shoreline development such as armoring, fill, and overwater structures along the shoreline. Impervious surface data shows an increasing trend towards degrading conditions for most watersheds in the area.

Growth and development pressures have an adverse effect on the quality and quantity of intertidal wetland habitats in East Kitsap. There was a decline in the total area of vegetated estuarine wetlands from 1.3 to 0.8 sq miles (or -39%) from historic levels. Intertidal wetlands are one of the habitat types most threatened by human activities and their loss contributes to the decline in Chinook salmon in Puget Sound (PSNERP, 2010).

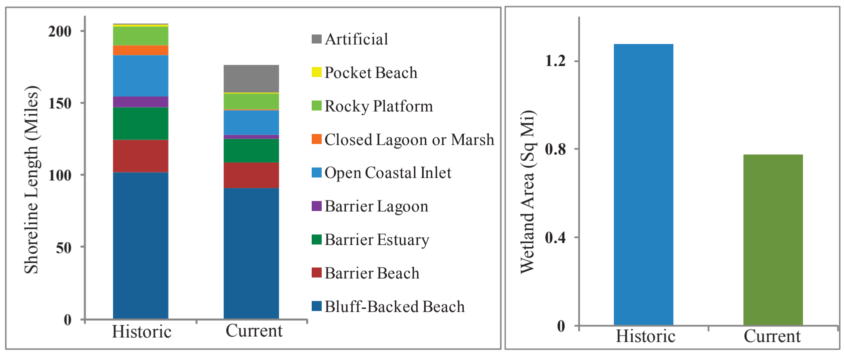
Photo: WA Ecology (2006) Coastal Atlas

Data from PSNERP (2010) shows a loss of 47 miles (or 23%) of natural shoreform types, particularly sheltered embayments, from historic levels. Juvenile chum salmon often use small coastal embayments as refuge from predators (Fresh, 2006). Conversely, there was a gain of 18 miles of "Artificial" shoreforms, the result of anthropogenic activities such as armoring, fill, and placement of overwater structures along the shoreline.

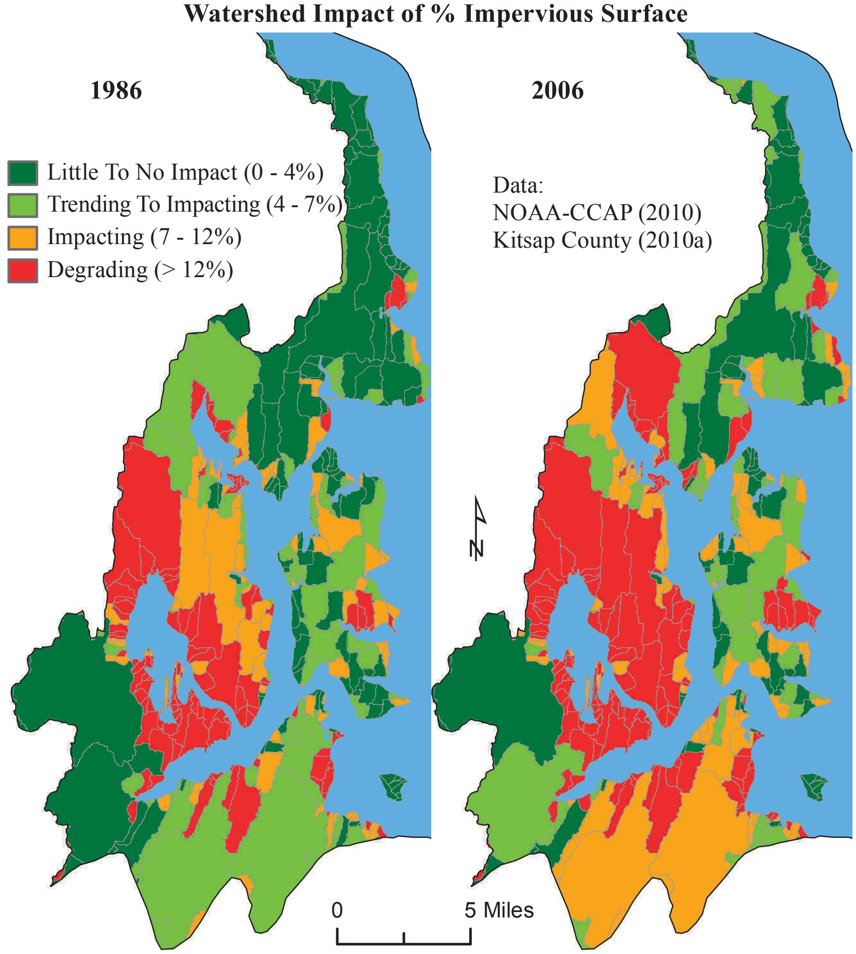
Increases in impervious surfaces associated with development decrease habitat and water quality (Spence et al, 1996; Booth et al, 2002) and adversely affect salmon production in East Kitsap (Shared Strategy, 2007). Impervious surface data for the East Kitsap study area shows an increasing trend towards degrading watershed conditions particularly around Poulsbo, Silverdale and Gorst. A notable exception is the Upper Chico watershed which has remained relatively undeveloped and thus has little impervious surface impact.

Change in Shoreform Composition and Wetland Area from Historic

Data: PSNERP (2010)



Watershed Impact of % Impervious Surface



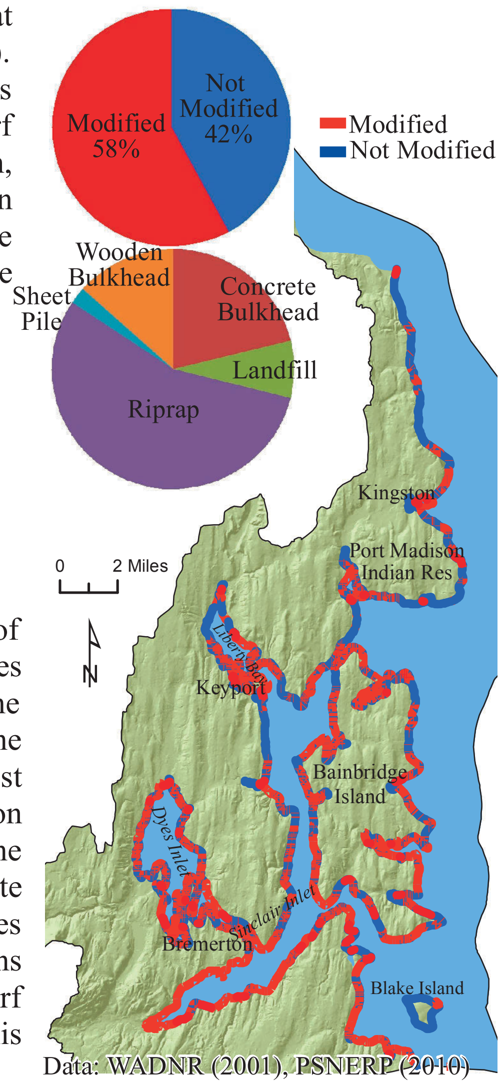
Shoreline Modifications Threaten Salmon Rearing and Forage Fish Spawning Habitat

Shoreline alterations are pervasive in the East Kitsap study area. About 58% of the entire shoreline has been modified by the presence of fill, armoring, roads or similar structures, changing how the ecosystem functions and negatively impacting salmon rearing and forage fish spawning habitat. About 56% of surf smelt and Pacific sand lance spawning habitat has been modified. Over 80% of these modifications are due to riprap and bulkheads.

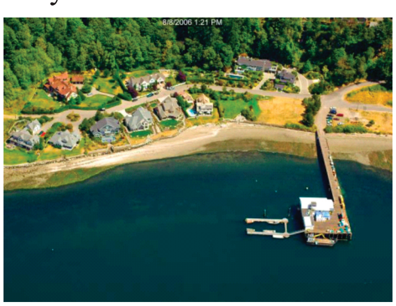
Shoreline development has been identified as a key habitat stressor to Chinook in East Kitsap (Shared Strategy, 2007). Armoring or hardening the shoreline significantly affects sediment supply and distribution. Throughout Puget Sound, surf smelt and sand lance are important forage fish for Pacific salmon, marine mammals and seabirds. Since they spawn exclusively on sand and gravel beaches, they are particularly vulnerable to the cumulative negative impacts of a wide variety of shoreline development activities (Penttila, 2007; Duffy et al, 2010).

Shoreline residential development in East Kitsap
Photo: Steve Todd, Suquamish Tribe

E Kitsap Shoreline Modifications

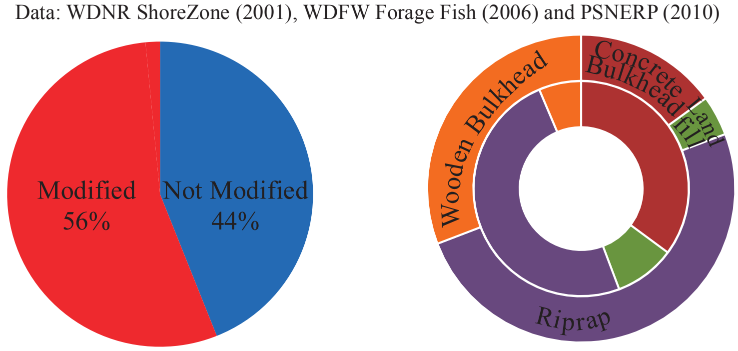


Shoreline alterations are pervasive in East Kitsap. A majority of the shorelines, particularly around Bremerton, Sinclair Inlet, Dyes Inlet, Liberty Bay, and Bainbridge Island, are modified by the presence of fill, roads, or similar structures in the nearshore. The few exceptions to this ubiquitous shoreline development are most of Blake Island and stretches of shoreline in the Port Madison Indian Reservation, south of Keyport, and north of Kingston. The most common type of modification is riprap followed by concrete and wooden bulkheads. These are typically built to protect homes and other structures but they change how the ecosystem functions and have a detrimental impact on fish habitat. Their impact on surf smelt and sand lance spawning habitat is illustrated in this analysis.



Residential and private fish farm development on south shore of Bainbridge Island
Photo: WA Dept of Ecology

Shoreline Armoring and Modification Types on Spawning Habitat for Smelt (Inner Circle) and Sand Lance (Outer Circle)
Data: WDNR ShoreZone (2001), WDFW Forage Fish (2006) and PSNERP (2010)

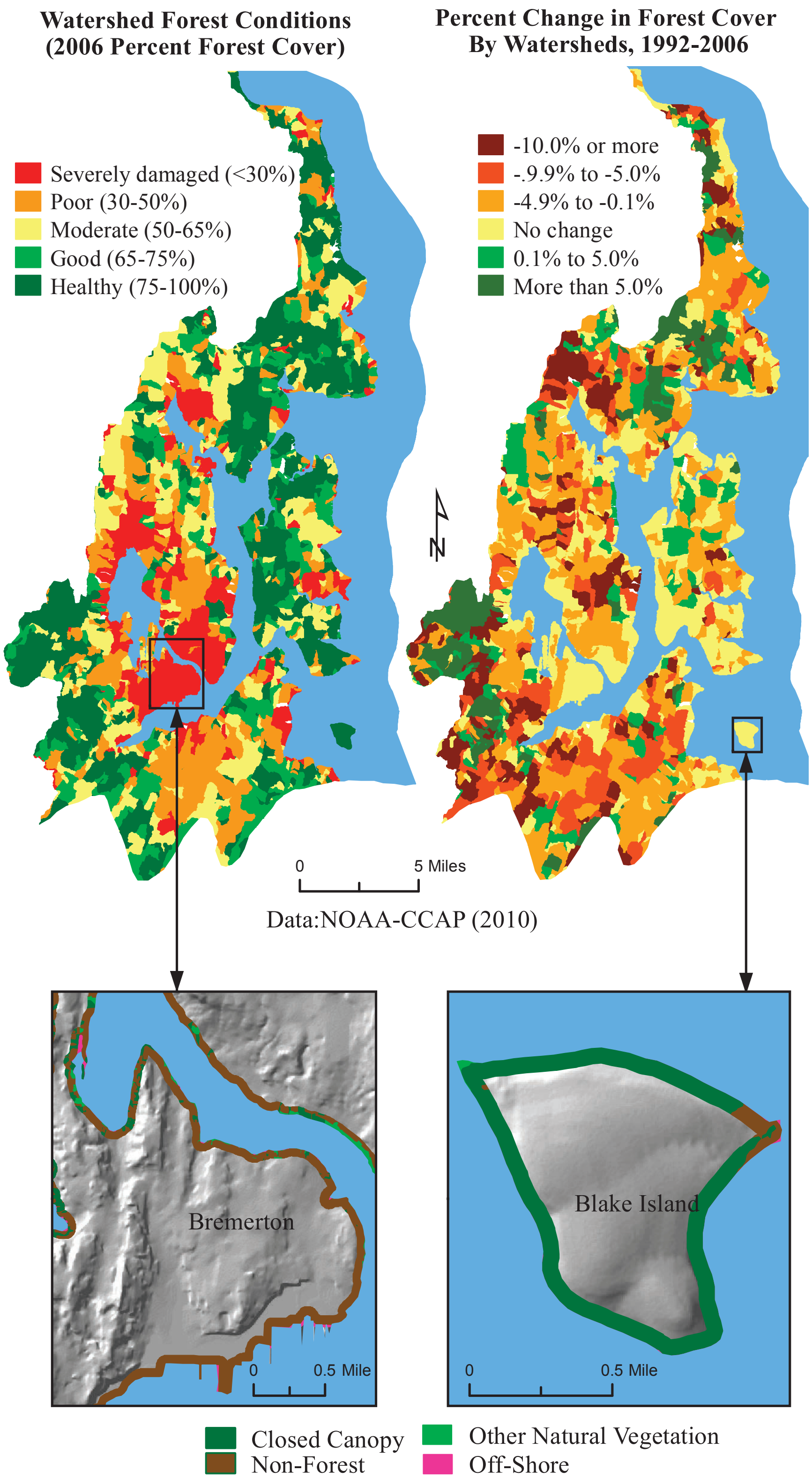


Forest and Riparian Land Cover Conditions

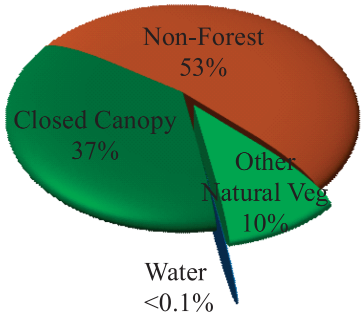
About 4% of the forestland cover was lost in East Kitsap between 1992 and 2006, and the trend in many watersheds continues toward "poor" or "severely damaged" conditions. Also, 53% of the marine and freshwater shorelines have riparian areas that are heavily modified by humans, a factor identified by the East Kitsap Recovery Plan (Shared Strategy, 2007) as limiting salmon production in the basin.

Based on NOAA-CCAP (2010) data, 4% of the forestland cover was lost in East Kitsap between 1992 and 2006. Many watersheds have "moderate" or worse forest conditions. Loss of forest cover typically results in less water retention, increased peak flow, and increased water yield from a watershed (Booth el al, 2002).

East Kitsap shorelines provide vital habitat for threatened Chinook as well as other salmonids (Shared Strategy, 2007), but the shorelines are in decline. Data from PNPTC (2011) shows that 53% of riparian zones in the marine and freshwater shorelines are "non-forest," largely the result of forest clearing and other shoreline modifications. Only 37% have deciduous and conifer dominated forests with closed canopies. Riparian forests along streams provide large woody debris, shade, bank stability, wildlife habitat, and other ecological functions for salmonids and other biota. Their removal and fragmentation degrades habitat quality.



2009 Riparian Land Cover Classification
Data: PNPTC (201
Data excludes Bainbridge Is



Impact of Culverts, Road Density and Stream Crossings

Barrier culverts partially or fully block over 158 miles (or 43%) of stream length in the East Kitsap study area. Almost every watershed is impacted by high road densities and a significant number are equally negatively impacted by stream crossings.

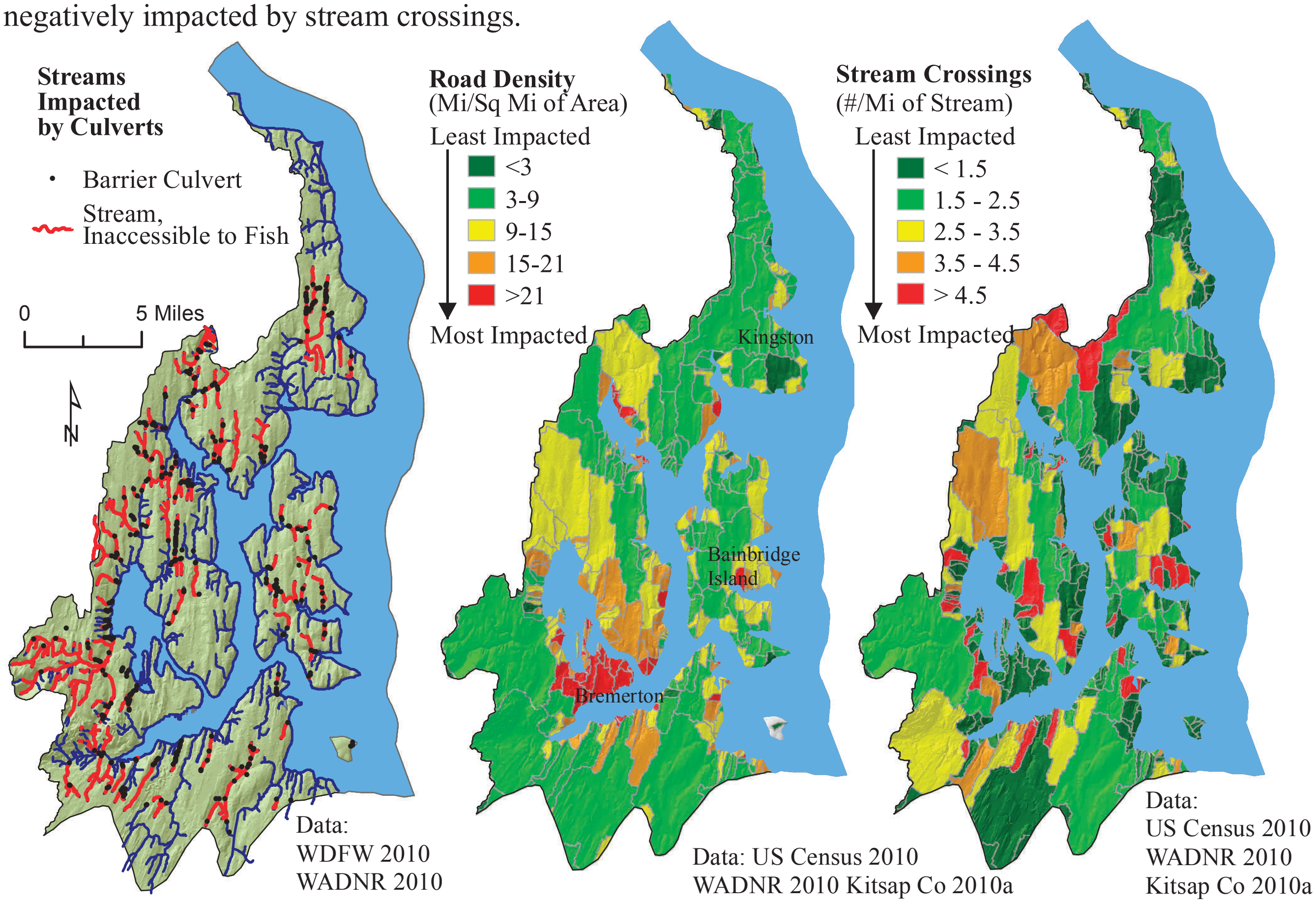
Urbanization typically results in the construction of road networks which can be significant stressors to stream health. High road densities require stream crossings, culverts and other structures that constrain stream channels (Spence et al, 1996). The removal of fish passage restrictions in streams that provide important salmon habitat was identified as high priority in the East Kitsap Salmon Recovery Plan (Shared Strategy, 2007) since they create physical obstructions that impede access to spawning and rearing habitats. Barrier culverts partially or fully block over 158 miles (or 43%) of potential fish habitat in streams of East Kitsap. Recent stream mapping work in East Kitsap (WFC, 2011) suggests that culverts and other man-made obstructions block considerably more habitat than this estimate indicates.

The proper functioning of salmon-bearing streams may be at risk when road densities exceed two miles of road per square mile of area and cease to function properly at densities over three miles/square mile (NOAA, 1996). Streams have also been shown to approach poor biological conditions when exceeding two crossings per kilometer (3.2 crossings per mile) of stream length (Alberti et al, 2007).

This analysis shows that almost every watershed in the East Kitsap study area is impacted by high road densities and a significant number are equally negatively impacted by stream crossings.

Fish-Blocking Culvert Replaced at Indianola Estuary

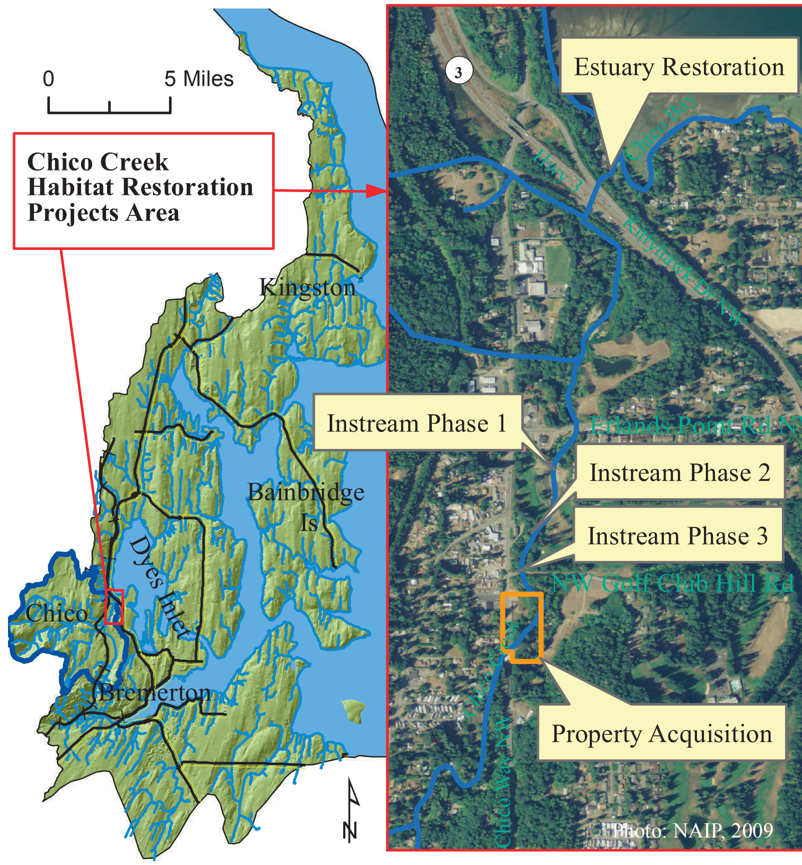
Photos: Tiffany Royal, NWIFC



Habitat Restoration Efforts - The Chico Creek Example

The restoration of Chico Creek, considered the most productive salmon stream on the Kitsap Peninsula, was listed as the highest priority in the East Kitsap Salmon Recovery Plan (Shared Strategy 2007). Between 2005 and 2010, at least four restoration projects as well as property acquisition designed to improve fish habitat conditions have either been completed or are ongoing in the watershed.

The Chico watershed covers about 16 square miles and drains to Dyes Inlet. It is the most productive wild salmon stream on the Kitsap Peninsula, supporting spawning and rearing populations of four anadromous salmonid species: chum, coho, steelhead, and coastal cutthroat trout. In addition, Chinook salmon are occasionally observed spawning in its mainstem. Chico Creek produces between 30,000 and 80,000 chum spawners per year, making it the largest population in the South Sound chum stock (Suquamish Tribe, 2011).



Clam Dig at Dyes Inlet
Photo: Suquamish Tribe

Over the past hundred years, timber has been harvested and property in the Chico watershed has been developed, especially around Kitsap and Wildcat lakes and the creek's lower two miles. Currently, the watershed is about 70% forested. The extensive salt marsh estuary provides nearshore habitat for Puget Sound salmon populations that utilize Dyes Inlet for foraging, cover, marine environment acclimation and out-migration to ocean environments. The estuary also hosts commercial quantities of shellfish.

One success story in Puget Sound salmon recovery efforts has been the strength and resilience of the South Puget Sound chum salmon stock. This stock continues to support significant tribal and non-tribal commercial, recreational, and subsistence fishing. It is also an important food source to a countless variety of aquatic and terrestrial creatures. Recognized for its function and value as salmonid refugia, Chico Creek is a biological hot spot where fish populations have fared well in spite of natural and human caused disturbances. Refugia watersheds like Chico are critically important to salmon recovery because they are potential genetic source areas from which our recovering and more impacted watersheds are repopulated. The restoration of Chico Creek was listed as the highest priority in the East Kitsap Salmon Recovery Plan (Shared Strategy, 2007).

Instream Habitat Restoration

Much of the lower two river miles of Chico Creek is channelized and contained within armored banks. This has generally resulted in straightening of the channel, channel incision, and isolation of the channel from its historic floodplain and channel migration zone. Consequently, instream habitat has been simplified and riparian conditions compromised.

Instream Restoration Phase 1
Photo: Habitat Work Schedule

Instream Restoration Phase 2
Photo: Habitat Work Schedule

In 2007, the County, Tribe and WDFW began a phased restoration program that is reconnecting the channel to its floodplain, increasing geomorphic and hydraulic complexity, restoring instream and riparian habitat conditions, and removing or replacing undersized or problematic culverts.

Instream Restoration Phase3
Photo: Habitat Work Schedule

Estuary Restoration
Photo: Tiffany Royal, NWIFC

Estuary Restoration

The large, tidally influenced Chico estuary is a diverse mix of habitats including stream and nearshore riparian, salt marsh, tidal distributary channels, and intertidal gravel beach. The Suquamish Tribe has documented juveniles of five species of anadromous salmonids (including listed Chinook salmon and steelhead) rearing within the Chico estuary (Suquamish Tribe, 2003). The Tribe utilizes the greater than 100 acres of tidelands for commercial and subsistence shellfish harvest.

The Tribe is currently leading a multiagency effort to implement the first phase of an effort to restore the Chico estuary by removing the fill and culverts created when State Highway 3 and Kitty Hawk Drive (a county-owned road) were constructed nearly 50 years ago. The goal is to restore stream and estuarine structure and function, and to improve fish passage.

Summary

The Suquamish Tribe's focus area for this report is East Kitsap, which comprises part of Water Resource Inventory Area (WRIA) 15, and whose streams flow to central or south Puget Sound.

To summarize, the following are among the biggest challenges in the East Kitsap focus area:

- The majority of the land in the East Kitsap focus area is privately owned and therefore few areas are protected from land use development pressures. An important implication of this ownership status is that land use mechanisms such as the Growth Management Act (GMA) and Shoreline Management Act (SMA) must provide more protective policies and regulations for streams, wetlands, shorelines, floodplains and other resources critical for salmon and Puget Sound recovery. In addition, the US Navy is one of the most important government-owned entities in East Kitsap. Although some military lands in East Kitsap contain valuable habitat, the Navy has left a legacy of contaminated sites, many in the nearshore, and its ongoing operations and construction projects continue to present threats to habitat and water quality. The Navy uses Integrated Natural Resource Management Plans (INRMPs) to carry out its military missions, although such plans do not ensure consistency with state and local land-use laws such as GMA and SMA that are designed to protect habitat.
- With nearly half the land now zoned as urban, East Kitsap is growing rapidly with significant impacts on land use, water resources and fish habitat. To accommodate the current and projected population increase, there has been a 26% increase in the county's Urban Growth Area (UGA) since the first Kitsap Comprehensive Plan was implemented in 1998. The UGA expansion is particularly prominent in the Silverdale and Port Orchard areas, with a 64% and 53% increase respectively.
- Development pressures have reduced forest cover, and increased impervious surfaces, road densities, and the numbers of stream crossings in East Kitsap, with negative consequences to aquatic resources, including salmon. Between 1986 and 2006, almost every watershed area in East Kitsap showed increases in impervious surfaces while ecological conditions are projected to further degrade by 2026. Development pressures continue to increase along the shorelines and into rural areas. The cumulative impacts resulting from activities such as exempt wells, residential shoreline development, vegetation removal, floodplain development, and stormwater remain largely unchecked and unaccountable.
- With over half of the entire East Kitsap shoreline armored, shoreline development is a key habitat stressor. Shorelines, particularly around Dyes Inlet, Sinclair Inlet, Liberty Bay, and Bainbridge Island, have been heavily modified and these changes have direct negative impacts on forage fish habitat and other biota, including shellfish and salmonids.
- About 4% of the forestland cover was lost in East Kitsap between 1992 and 2006, and the trend in many watersheds is towards "poor" (30 – 50% forest cover) or "severely damaged" (less than 30% forest cover) conditions. There is observed damage to a "typical" western Washington watershed with a loss of about 30% forest cover while high-quality watersheds need to maintain forest cover above 65% (Booth et al, 2002). In addition, 53% of the shorelines have riparian areas that are "non-forest," and only 37% have deciduous and conifer dominated forests with closed canopy. The East Kitsap Recovery Plan cites the lack of riparian vegetation as a factor limiting salmon production in the basin.
- The removal of fish passage restrictions in streams that provide important salmon habitat was identified as high priority in the East Kitsap Salmon Recovery Plan. Barrier culverts currently partially or fully block over 158 miles (or 43%) of fish habitat in East Kitsap streams. Recent

surveys in East Kitsap indicate that existing stream maps are significantly underestimating the amount of stream habitat, and they often mischaracterize streams as not fish-bearing (Type N), when they are actually fish-bearing streams (Type F). This new information has important implications for the protections given to streams and wetlands through local land-use regulations.

- East Kitsap has seen an over 300% increase in the number of exempt wells during the past 30 years. The maintenance of stream flows necessary to preserve instream resources is thus a major concern. In Chico Creek, for example, minimum instream flows were not met during the period of June to September in the 13 water years for which data is available. Grover's Creek appears to be impacted similarly.
- As the most productive salmon stream on the Kitsap Peninsula, the East Kitsap Salmon Recovery Plan lists the restoration of Chico Creek as its highest priority. Between 2005 and 2010, at least four restoration projects, as well as property acquisition, have either been completed or are ongoing in the watershed. These improvements are expected to increase fish production in the watershed and contribute to overall Puget Sound recovery.

In recent years, the Suquamish Tribe has worked successfully with several entities to improve water quality and upgrade the status of a number of shellfish beaches in the East Kitsap focus area from "prohibited" or "unclassified" to "approved." Several challenges remain, however, in making improvements to water quality affecting area beaches that would allow for shellfish harvest. These challenges also extend to implementing land-use policies and codes that better protect and restore watershed, stream, and nearshore functions for salmonids and other finfish, and shellfish resources important to the Suquamish economy and culture. The accomplishments made in water quality and the re-opening of shellfish beaches are testimony to the value in developing and fostering partnerships with other entities, including local, state, and federal agencies. Suquamish looks to continue working with others and seeks new partnerships that will be necessary to meet the many remaining challenges in salmon recovery, protecting and restoring watersheds, habitat, and water quality, and toward recovery of the Salish Sea.

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State of Our Watersheds
Skagit River Basin

Swinomish Tribal Community

It's hard to tell our fishermen that they can't fish. If we didn't truly believe we could rebuild these salmon runs, we wouldn't be working as hard as we do. It's difficult to recover weak stocks without recovering their habitat at the same time. We are doing a lot of habitat work, as much as we can. We are also monitoring these projects for their benefits to salmon.

– LORRAINE LOOMIS,
FISHERIES MANAGER,
SWINOMISH TRIBE

Swinomish Indian Tribal Community

The Swinomish Indian Tribal Community is made up of Coast Salish people descended from groups and bands originating from the Skagit and Samish river valleys, coastal areas surrounding nearby bays and waters, and numerous islands including Fidalgo, Camano, Whidbey and the San Juans.

The Swinomish reservation on the southeastern end of Fidalgo Island is surrounded by 27 miles of saltwater shoreline. It is bounded on the west by Skagit Bay, the east by Swinomish Channel and the north by Padilla Bay.

The reservation is about 15 square miles in size and includes 7,450 acres of upland and approximately 2,900 acres of tidelands.

Recovery Plan Seeks to Restore and Protect

The Skagit River remains one of the more pristine watersheds within Puget Sound.

The upper portion of the watershed is primarily under control of the federal government, located within the Mount Baker-Snoqualmie National Forest. Portions of the watershed are in federal wilderness and national parks. The middle section of the watershed is largely held as forestland, either in state or private ownership. The delta reaches are predominantly held in agricultural land.

Human land use over the last 150 years has resulted in the degradation of salmon habitat due to forestry and agricultural practices that constitute the primary land uses within the watershed.

Current limiting factors identified by the Skagit Recovery Plan include:

- Seeding levels,
- Degraded riparian zones,
- Poaching,
- Current hydroelectric operations,
- Sedimentation and mass wasting,
- Flooding,
- High water temperature,
- Hydromodification,
- Water withdrawals,
- Loss of delta habitat and connectivity,
- Loss of pocket estuaries and connectivity, and
- Illegal habitat degradation.

The habitat recovery strategy pursued for the Skagit River sought to protect and restore the system from a process-based and landscape scale. It was recognized that successful recovery depends on the ability to produce an overall gain in the factors that support viable populations. Key strategies and actions focused on habitat protection and restoration.

The protection strategy focused on:

- Stream flows,
- Basin hydrology,
- Water and sediment quality and sediment transport,
- Stream channel complexity,
- Riparian areas and wetlands,
- Tidal delta area and nearshore, and
- Fish passage and access.

The restoration strategy focuses on fish production and weighs restoration actions by the degree to which they restore landscape conditions in the basin and thus contribute to long-term recovery.

Restoration efforts are focused on spawning areas and rearing in freshwater, tidal delta and nearshore habitat.

A child cools off near the new canoe landing site on the Swinomish reservation during the 2011 Tribal Canoe Journey. The beach is part of a marsh restoration project where dredge spoils were removed to return tidal flow and allow unrestricted movement of sediment, nutrients and fish to an estuarine corridor connecting Padilla Bay to Skagit Bay.

Tidal and Nearshore Habitat Restoration Prioritized

In 2010, the Skagit Watershed Council adopted an update to the restoration actions for its strategy. The update is intended to provide a more strategic focus to restoration and recovery efforts.

Three guiding principles were adopted:

1. Restore processes that form and sustain salmon habitats.
2. Protect functioning processes and habitats from degradation.
3. Focus protection and restoration on the most biologically important areas.

Adoption of these principles also prioritized restoration to three areas:

1. Estuary and riverine tidal habitat;
2. Shallow nearshore habitat, including pocket estuaries; and
3. Sediment and hydrology impaired watersheds.

Implementing the Water Resource Inventory Area (WRIA) 3&4 Salmonid Recovery Plan is lagging behind the pace originally anticipated during plan development in 2006. Restoration work has progressed with numerous capital projects focused on restoring fish habitat and passage.

However, WRIA 3&4 has faced significant funding shortages for restoration projects, limiting implementation progress. Progress also has lagged on implementing the regulatory and incentive programs to protect and restore salmonid habitat and habitat forming processes.

Numerous shoreline management plans within WRIA 3&4 are still in the process of being updated and action on regulatory gaps such as agriculture buffers and FEMA's Flood Plain Insurance Program still need to occur. A major element of the 2006 Skagit Recovery Plan relies on revisions to state and national environmental regulatory programs which have proven difficult to adjust to address the needs of the salmon resources in the Northwest.

Tidal flow returns to a high-priority pocket estuary near the Swinomish reservation.

The Skagit River System Cooperative (SRSC) removed a portion of Similk Bay Road and a non-functioning tide gate that isolated about 8 acres of estuary in Turners Bay. SRSC is the natural resources extension of the Swinomish and Sauk-Suiattle tribes.

The road removal restored natural processes to a nearly 60-acre pocket estuary at the head of Similk Bay, which is part of Skagit Bay. This type of small, sub-estuary is essential habitat for out-migrating chinook fry.

Pocket Estuaries, Riparian Habitat Impaired

At the five-year mark, a review of key environmental indicators reveals mixed results in progress toward the recovery plan's goals and objectives.

The five-year target for Whidbey basin pocket estuary restoration has been met with the completion or active work on seven projects. These projects will increase the production capacity of Whidbey basin by an estimated 47,868 smolts.

Pocket estuaries provide essential low-energy and high-nutrient habitat for juvenile chinook as they migrate through Puget Sound from their natal river and delta. Research suggests that pocket estuaries within a day's swimming time from the Skagit River delta have experienced an 86% net reduction.

The Skagit Chinook Recovery Plan prioritized restoration and protection of riparian areas and wetlands. Since 2005, only 6% of the recovery plan's original restoration goals for tidal wetland habitat have been realized and tidal delta habitat capacity has been increased by an estimated 76,668 smolts.

Tidal wetland habitat remains a limiting factor for Skagit River chinook production. Agriculture lands dominate riparian areas in the delta region. As of 2006, riparian areas within the delta region are 83% impaired. Of the impaired land, 12% is developed and built upon, and 71% is supporting crops and pasture. The lack of riparian forests and canopy cover on agricultural lands is detrimental to salmon habitat within the delta.

Forest Rules Exemption Leaves Habitat at Risk

The Skagit Chinook Recovery Plan contained recommendations to eliminate the legislative allowances for narrower riparian buffers on forestland ownership of less than 20 acres.

This exemption means that the forest buffers that are scientifically designed to protect fish are potentially not required for the majority of anadromous fish-bearing streams within the Skagit and Samish river watersheds. Presently, 70% of the lands subject to Washington State Forest Practice Rules in WRIA 3 are under or potentially fall under this Small Forestland Ownership exception.

This land classification allows for narrower buffers than the standard riparian buffer rule requires; 140 feet or greater for most fish-bearing streams. Critical salmon habitat remains at risk.

Tribal crews regularly sample the Skagit and Whidbey basin to keep track of how fish use habitat. The Skagit River System Cooperative has more than 15 years of data from these surveys. Long-term monitoring on a larger scale is essential to understanding and maintaining salmon recovery.

Exempt Wells, Culverts Inhibit Salmon Recovery

Tributary stream flows are still of concern within the Skagit watershed. The recovery plan recommends simply enforcing the provision of the Skagit Instream Flow Rule that stipulates there will be no use of exempt wells in cases where instream flows will be impaired.

Since 1980, exempt wells have increased in the Skagit and Samish watersheds by 611% from an estimated 1,080 exempt wells to an estimated 7,232 exempt wells. During that same time period, exempt wells in the Skagit River tributaries Carpenter and Nookachamps creeks have increased by 764%. The water reservation for Carpenter Creek is over-allocated and the upper Nookachamps Creek is approaching over-allocation.

Regulatory action is required to deal with this crisis for chinook salmon in those tributary watersheds. Low flow can adversely affect chinook by dewatering off-channel habitat, increasing stream temperature, increasing predation and reducing available mainstem habitat.

A fundamental element of the protection strategy for the Puget Sound Recovery Plan focused on addressing fish passage barriers. This recommendation was included within the Skagit River Recovery Plan. Data from 2006 indicates that there were 470 culverts potentially blocking anadromous habitat in the Skagit watershed.

According to 2010 data, 450 of 470 culverts remain barriers to anadromous passage and 82 additional culverts were identified through surveys as barriers. Sadly, since the recovery plans have been implemented, the total amount of identified culverts blocking fish passage within the Skagit River system has increased from 470 to 532.

Swinomish tribal fishermen drift net for Baker River sockeye salmon.

Looking Ahead

Population growth and associated development within Skagit County will continue to pose challenges to salmon conservation and recovery efforts. Current trends indicate that land use regulation reform is required and continued funding of habitat restoration activities is necessary in order to achieve the agreed upon recovery goals.

Restoration and protection work within the Skagit River watershed has not kept pace with the goals of the Recovery Plan. Upgrading the regulatory framework that serves to protect salmon habitat must occur if the underlying assumption to all the recovery goals is to be realized: that existing habitat will be protected from loss.

The current state and federal regulatory framework clearly has not provided adequate protection of the instream flow, water quality and riparian habitat within the basin and nearshore areas.

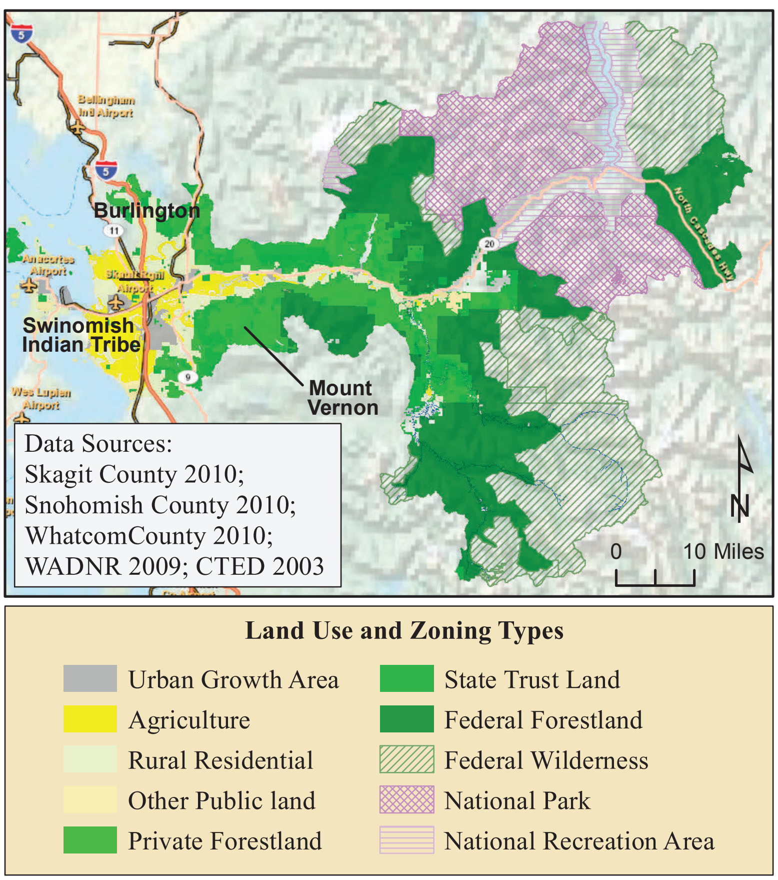
The Swinomish Indian Tribe -- Skagit River and Nearshore

With a 3,100 sq. mile watershed, the Skagit River is the largest in the Puget Sound and the third largest on the West Coast of the continental United States. It provides 30% of the Puget Sound's freshwater input. The Skagit River originates in British Columbia, and flows south into Washington state before continuing westward through Skagit County and into the Sound. The upper half of the watershed is primarily within the National Forest and the North Cascades National Park, and the lower half mainly comprises private forest, agriculture, rural residential, and urban residential lands. The Baker River, Sauk River, and the Cascade River all flow within the Skagit River watershed.

The North Cascade region's only major complex of dams is on the Upper Skagit River. The Diablo, Ross, and Gorge dams provide about 25% of Seattle's energy. There are also two dams on the Baker River.

The Skagit River is home to all six species of Pacific salmon, including steelhead. It has the healthiest and largest runs of wild Chinook and pink salmon in the Puget Sound (SSPS, 2007), yet has serious habitat restoration and protection needs.

The Swinomish Indian Tribe lived in the Skagit and Samish River valleys and in the coastal areas surrounding Skagit, Padilla, and Fidalgo bays since time immemorial. They are Coast Salish people, and their culture has centered around abundant saltwater resources like salmon, shellfish and marine mammals, as well as upland resources, like cedar, berries, and wild game. Their homeland remains on Fidalgo Island, where they are surrounded by 27 miles of saltwater shoreline.

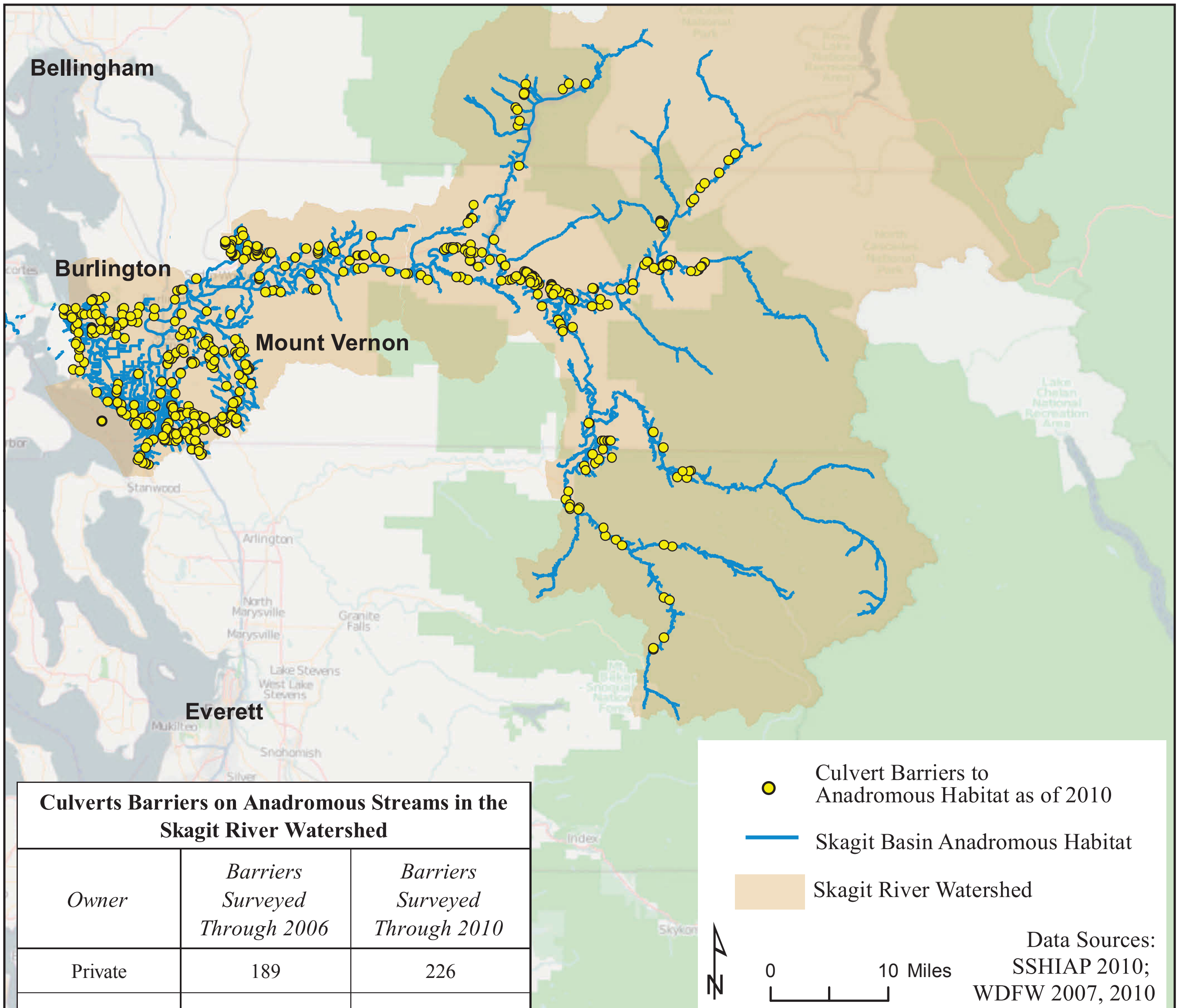


Since European settlement, land use in the watershed has been dominated by natural resources. The foothills and mountains have been mainly used for wood products, mining, and outdoor recreation. The river valleys, the delta, and the coastal areas have been used for agriculture, industry, commerce, and residential development. There are over 104,000 residents in the Skagit watershed, and the greater majority live along the lower river, in the delta and along the coastline.

The last 150 years of human land use has resulted in declines in Chinook productivity, yet the Skagit still remains one of the healthiest in the Puget Sound. The Skagit Chinook Recovery Plan (SRSC; WDFW, 2005) provides a strategy for both protection and targeted restoration. It will take federal, tribal, state and local leadership to provide a consistent yet adaptive plan to control the future impacts of land use in the watershed.

Fish Passage Barrier Culvert Recommendations Not Being Met in the Skagit River Watershed

The Skagit River Chinook Recovery Plan recommends enforcing the current State statute requiring fish-blocking culverts be repaired to allow fish passage. 2006 data show 464 culverts potentially blocking anadromous habitat in the Skagit River system. According to 2010 data, 450 of 464 culverts remain barriers to anadromous passage and 82 additional culverts were identified as barriers through survey. This results in 526 culverts potentially blocking anadromous passage in the Skagit River system and is evidence that recommendations of the Chinook Recovery Plan are not being followed.

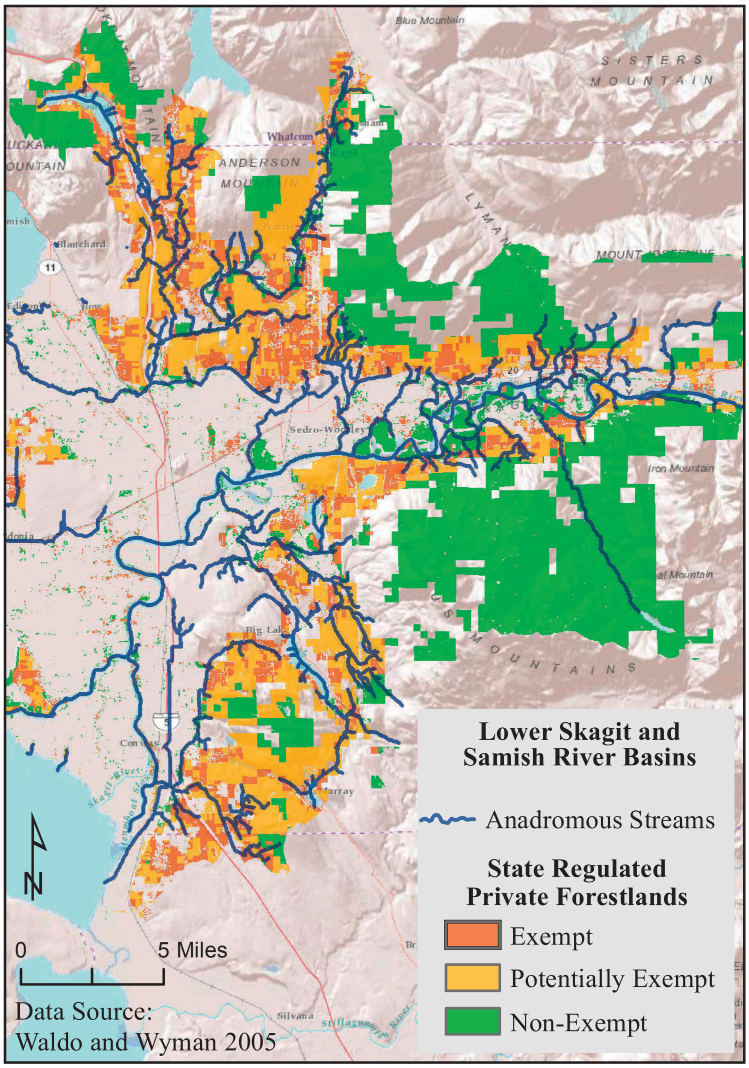


Culverts Barriers on Anadromous Streams in the Skagit River Watershed		
Owner	*Barriers Surveyed Through 2006*	*Barriers Surveyed Through 2010*
Private	189	226
County	157	170
State	66	80
Federal	25	25
City	7	7
Tribal	0	0
Unknown	19	17
Total	*463*	*525*

The Recovery Plan recommends governments be held accountable for repairing culverts under their jurisdiction. In the Skagit watershed 52-55% of all barrier culverts are under government jurisdiction. From 2006 to 2010, documentation of additional blocking culverts outpaced culvert repair. For culvert repair to be meaningful to the recovery of Chinook salmon, governments need to commit to an accelerated schedule of culvert repair.

Small Forestland Owner Exemption Potentially Leaves Majority of Anadromous Streams Underprotected

The Skagit Chinook Recovery Plan recommends eliminating the legislative allowances for narrower riparian buffers on forestland ownerships of less than 20 acres. In WRIA 03, 32% of anadromous streams on lands subject to Washington State Forest Practice Rules fall under the exemption, and 38% of anadromous streams on forest practice lands run through parcels that could fall under the exemption if subdivided. Only 30% of anadromous streams are on large forestland ownerships which will continue to require the scientifically based regulatory riparian buffers. During the initial seven years of this allowance, 2.2% of the anadromous stream lengths on 20-acre parcels was harvested (SRSC data). It is projected that over 20% of eligible anadromous stream length would be harvested over a 70-year timber rotation.



The Washington Forest Practice Rules recognize how important riparian buffers are to maintaining cool, clean water and fish habitat. As a result, they require buffer widths equivalent to a tree height (140 ft or greater for most fish streams). The problem with the State Forest Practice riparian buffer rules are that under the so-called "20-acre Exempt Rule" (WAC 222-30-023), forestland owners with parcels less than 20 acres and a total ownership of less than 80 acres are allowed to leave 29-, 58-, or 86-foot-wide buffers on fish streams, which provide significantly less habitat protection.

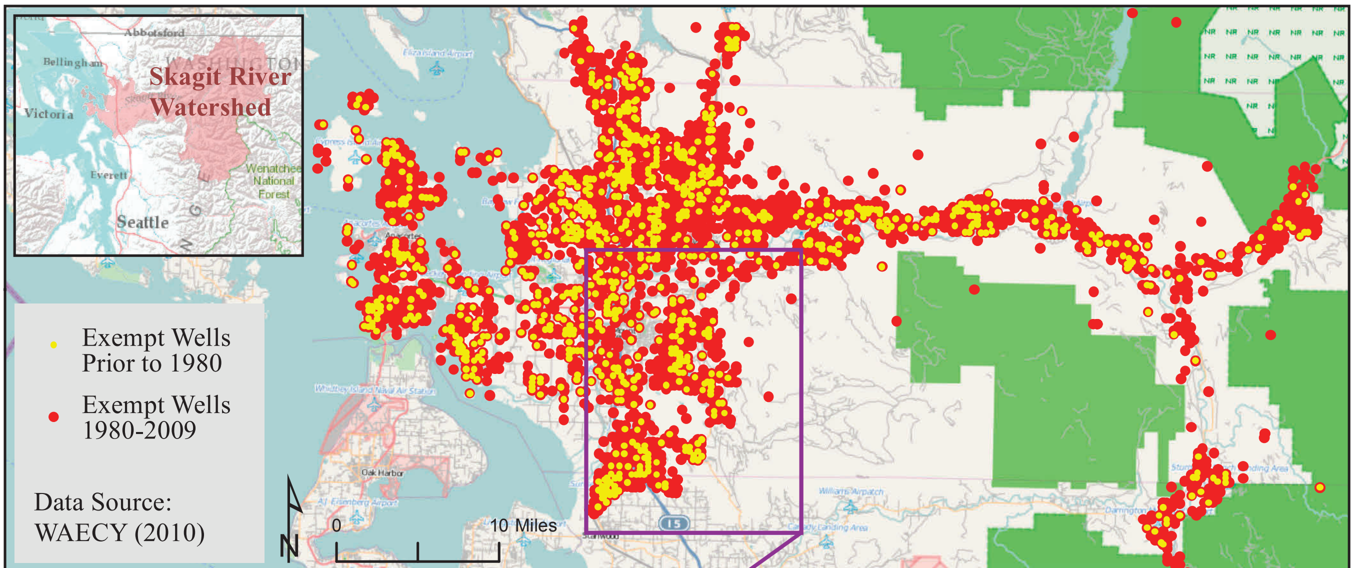
Most of the anadromous stream length in the Samish and lower Skagit basin is vulnerable as long as the small forestland owner exemption remains in place. Presently 32% of anadromous streams on forest practice lands would not get sound riparian protection, and an additional 38% of anadromous streams potentially would not be getting sound riparian protection if legally subdivided in the future (Waldo and Wyman, 2005). Thus, Forest Practice Rules designed to protect fish are potentially not required for the majority of anadromous fish-bearing streams in this critical portion of the Puget Sound.

WRIA 03: Lower Skagit and Samish Basin Anadromous Streams

Lands Subject to Washington State Forest Practice Rules	*Length of Anadromous Stream on Forest Practice Lands (mi)*	*% Length of Anadromous Stream on Forest Practice Lands*
Small Forestland Owner-Exempt	60	32%
Potential Small Forestland Owner-Exempt	70	38%
Large Forestland Owner Non-Exempt	56	30%
Total Anadromous Length	186	100%

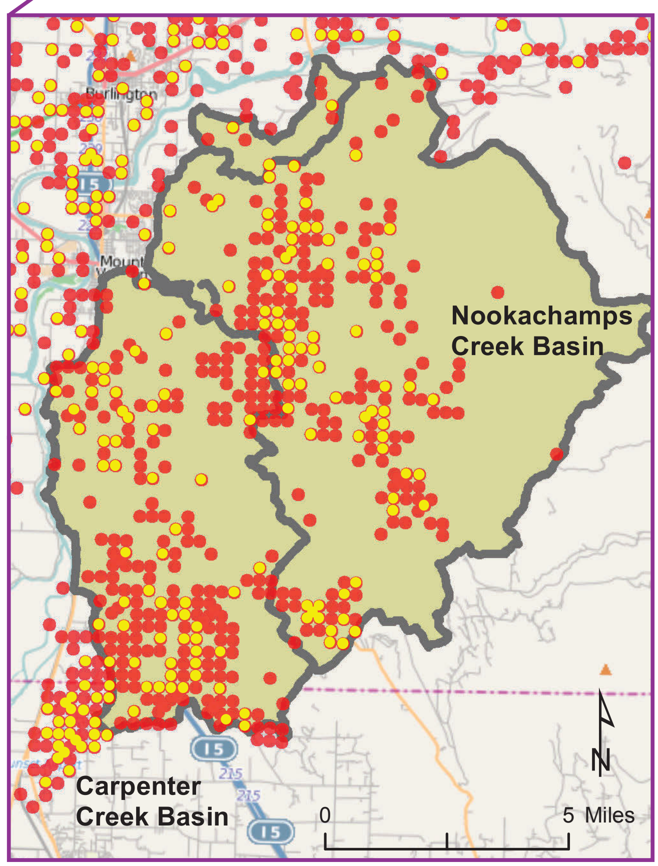
Exempt Wells and Tributary Streamflow Reductions Threatening Skagit River Chinook

Since 1980, exempt wells have increased in the Skagit and Samish watersheds by 611%, from an estimated 1,080 exempt wells to an estimated 7,232 exempt wells. Over that same time period, exempt wells in the Skagit River tributary watersheds, Carpenter and Nookachamps Creeks, have increased at an even faster rate, 764%, from an estimated 120 exempt wells to an estimated 1,035 exempt wells. Close to 30% of that increase has come since the year 2000. By 2011, Carpenter Creek had over-allocated its water reservation by 4,000 gallons per day, and the upper Nookachamps was quickly reaching the limits of its reservation.



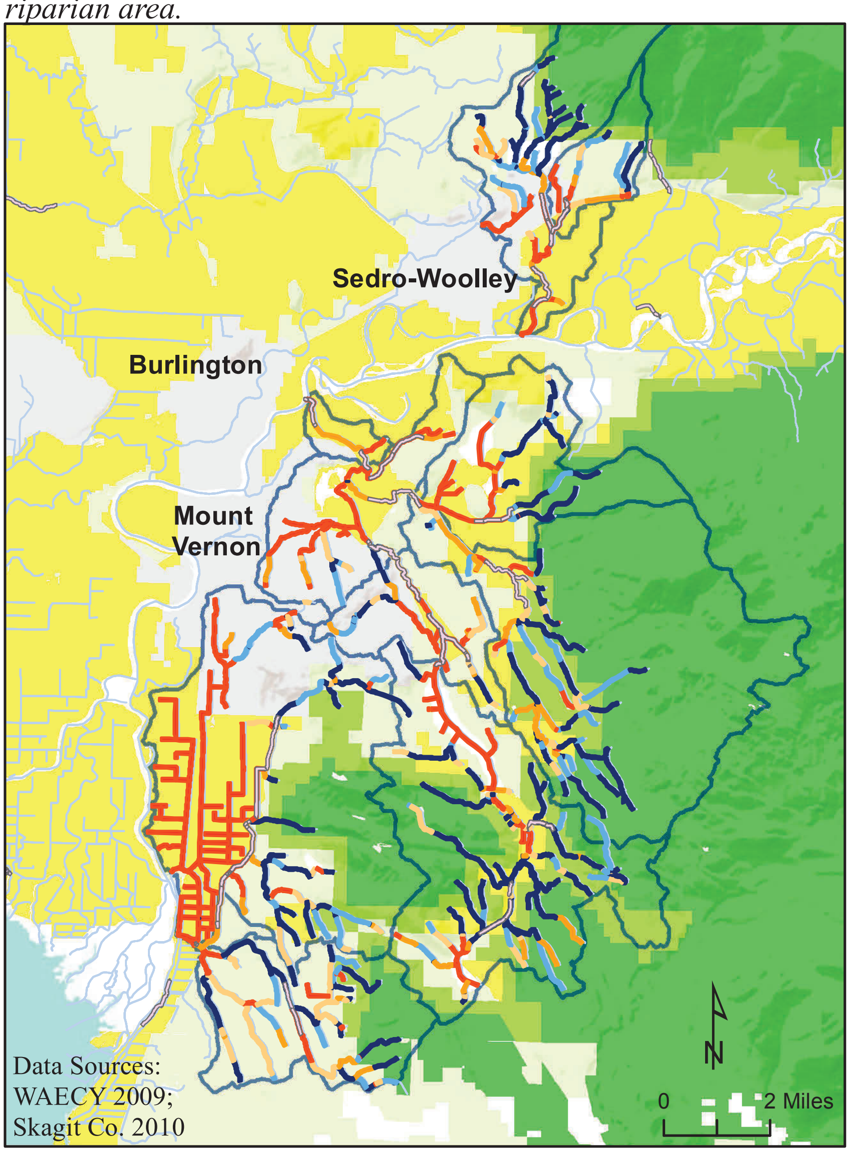
For more than 60 years, the Washington Department of Fish and Wildlife and its predecessors have repeated to Washington Department of Ecology that the continued reductions in the streamflow of Carpenter and Nookachamps Creeks are harming salmon in those basins (Swinomish, 2011). In 2005, the Skagit Chinook Recovery Plan warned that continued exempt well development in the Carpenter and Nookcachamps Creek basins will result in further reductions of streamflow, which will adversely impact the Chinook salmon residing in those watersheds.

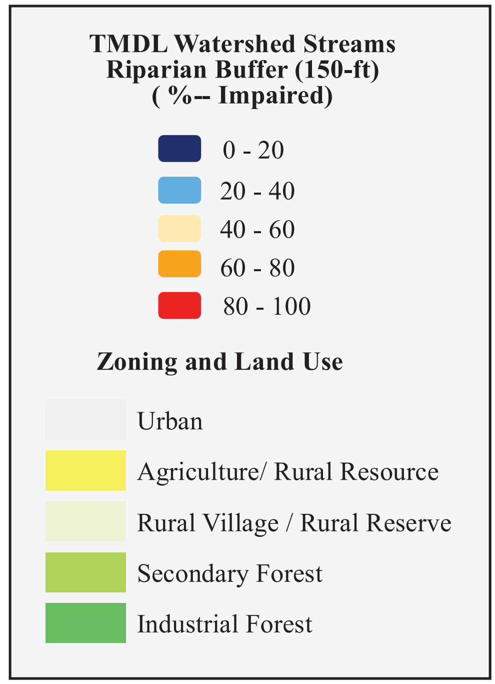
To protect salmon from further reductions in streamflow in Carpenter and Nookachamps Creek, the Recovery Plan recommends simply enforcing the provision of the Skagit Instream Flow rule that says there will be no use of exempt wells in cases where instream flows will be impaired. Neither Skagit County, nor Washington State have completely followed this recommendation, and now Carpenter Creek is over allocated, and the upper Nookachamps is approaching over allocation. This is a crisis for Chinook salmon in those watersheds.



State Plans to Reduce High Stream Temperatures in the Lower Skagit River Basin through Voluntary Measures

In 2008, Washington State Department of Ecology required TMDL plans for eight tributaries in the lower Skagit River watershed to lower stream temperatures that are currently exceeding the State's water quality standard. The State issued TMDLs recommending restoration of riparian tree shading of streams as the primary mechanism for lowering stream temperatures into compliance. Based on 2006 NOAA-CCAP land cover data and Skagit County zoning data, agricultural (Ag-NRL) and rural resource (RR-NRL) lands along fish-bearing streams provide the least amount of riparian shading in the TMDL watersheds. Agriculture and rural resource riparian areas along fish-bearing streams in the TMDL watersheds are over 75% cleared of shade-providing trees and amount to over 48% of total impaired riparian area.



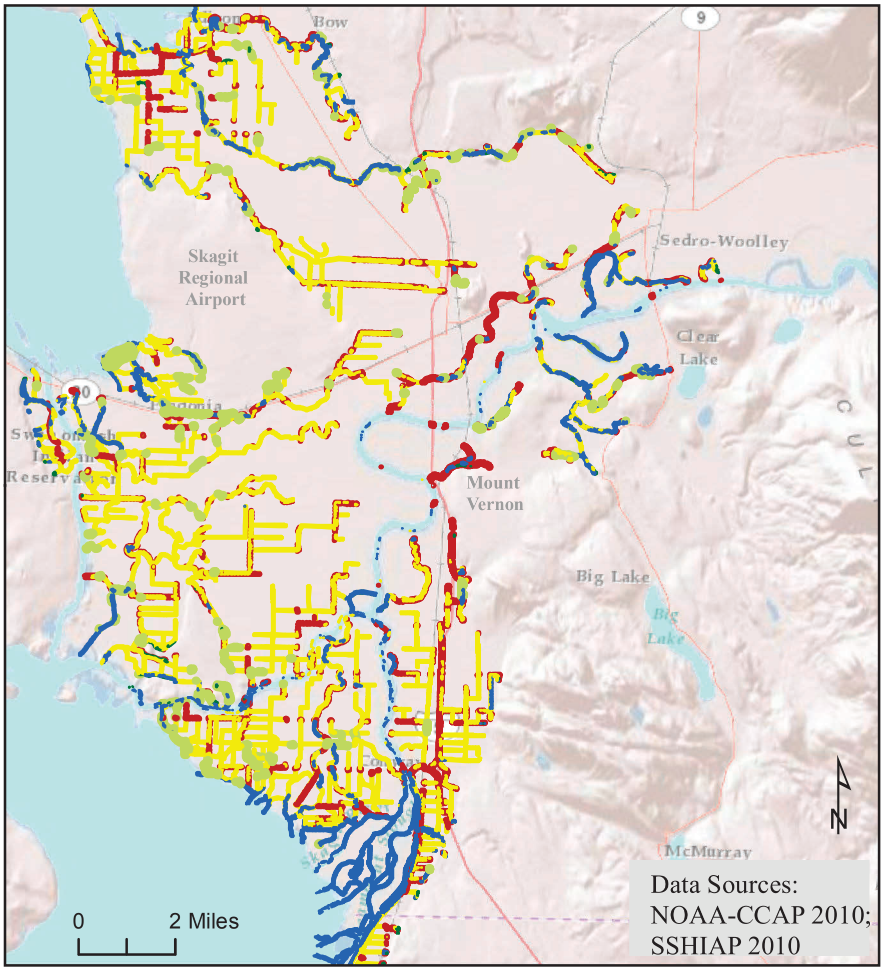


The State's TMDL plan for reducing stream temperature is voluntary and includes a combination of financial incentives, outreach and technical training, and communication (Lawrence, 2008). It is expected that with these measures in place, streams will be in temperature compliance by 2080 (Lawrence, 2008). High stream temperatures impact Chinook salmon at all life stages, and especially during juvenile rearing (SRSC; WDFW, 2005).

Zoning Category	Riparian Acres (150ft- buffer)	Impaired Riparian Acres (Non-forested in 150-ft buffer)	Riparian Buffer Percent Impaired (Non-forested)
Urban	854	561	64%
Agriculture\ Rural Resource	2558	1907	75%
Rural Reserve\ Rural Village	1933	815	42%
Secondary Forest	1024	179	17%
Industrial Forest	877	125	15%

Agriculture Lands Provide Impaired Riparian Conditions in the Skagit River Delta Region

The Skagit Chinook Recovery Plan recognized the value of riparian forests and strongly recommends the protection of riparian forests that are healthy and restoring those that are impaired. As of 2006, riparian areas of the Skagit River delta region are 83% impaired. Of the impaired riparian lands, 12% are developed and built upon and 71% are supporting crops and pasture.



Riparian Forest Condition

- Cleared/ Crops and Pasture (Impaired)
- Developed/ Built (Impaired)
- Shrubs/ Grasses
- Forest (Deciduous, Mixed, Evergreen)
- Wetlands (Forested and Emergent)

Riparian Forest Condition by Zoning in the Middle Skagit River Delta Region (Acres)

Land-Use and Zoning	Developed/ Built (Impaired)	Cleared/ Cropland and Pasture (Impaired)	Shrubs/ Grasses	Forest	Wetland	Total	% Impaired
Agriculture	921	7619	183	68	1052	9843	87%
Rural Residential	81	92	19	37	72	301	58%
Urban Growth Area	284	141	13	21	80	540	79%
Public Land	1	15	12	5	350	383	4%
Skagit Delta Riparian Zones	1287	7867	227	132	1554	11067	83%

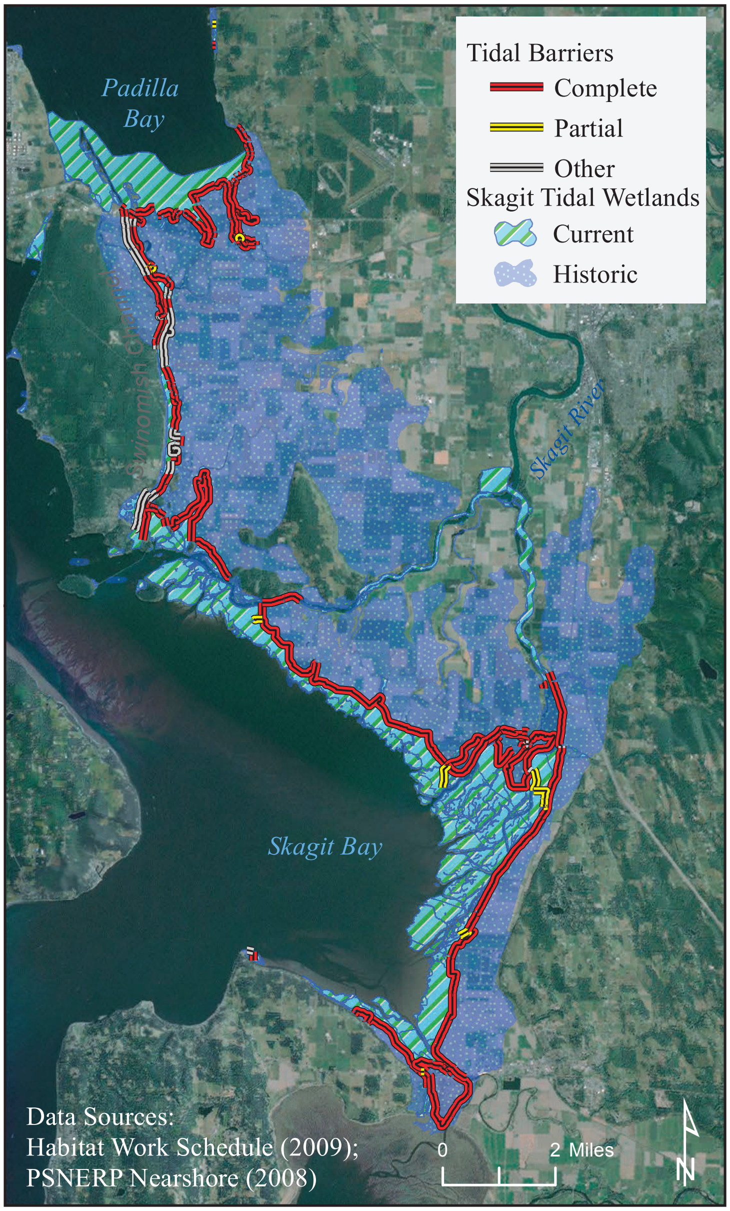
The Skagit Chinook Recovery Plan recognizes the importance of farming on the Skagit delta; it also recognizes that the managed clearing of riparian forests by delta farmers is detrimental to salmon habitat. As of 2006, 77% of total impaired riparian area in the delta region was zoned agriculture.

The Skagit Chinook Recovery Plan recommends developing a water quality based approach to agricultural practice, with a commitment to use of Farm Plans that apply the Best Available Science (BAS).

While more recent data is needed to verify conditions on the ground in 2011, as of 2006, the riparian recommendations of the Skagit Chinook Recovery Plan were not being fully implemented.

Lack of Tidal Wetland Habitat Remains a Limiting Factor to Skagit River Chinook Production

The Skagit River Chinook Recovery Plan habitat restoration goal for the tidal delta is to expand habitat capacity to support 1,350,000 additional Chinook smolts. If current tidal delta restoration planning is fully implemented, the Recovery Plan will exceed its original goal and restore enough area to support 1,456,494 additional smolts. Since 2005, 6% of the Recovery Plan's original restoration goals have been realized and tidal delta habitat capacity has increased by an estimated 76,668 smolts (HWS, 2011).



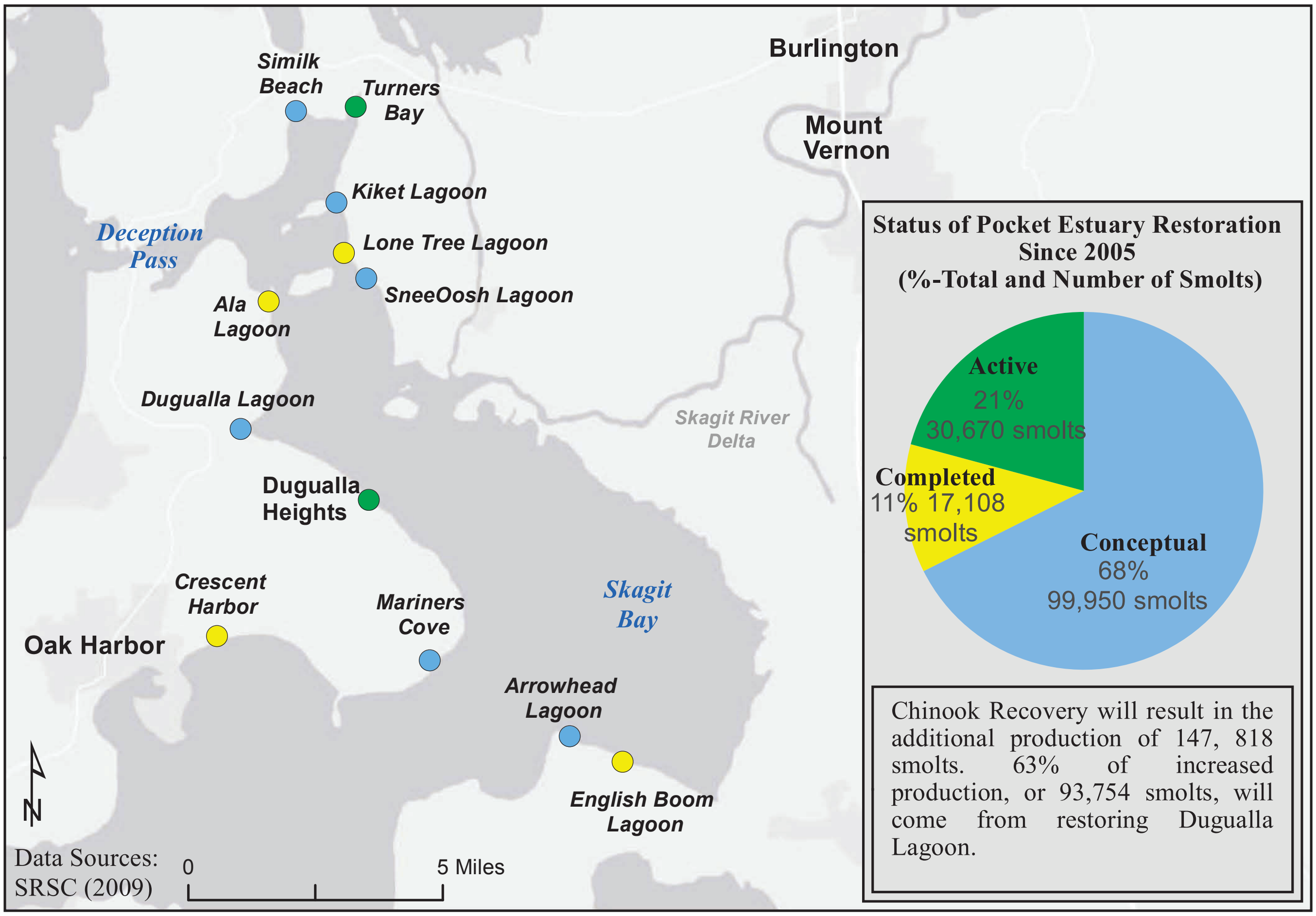
Skagit Delta Tidal Wetland Conditions	Miles of Tidal Barriers	Acres of Preferred Delta Rearing Habitat
Historic (1860s)	0	3,146
Current (2000)	71	381

Diking, dredging, filling, clearing, and developing the Skagit delta over the last 150 years has reduced tidal wetland area from 28,375 acres to 7,705 acres (Beamer et al, 2005) and added 71 miles of tidal barriers along the shoreline (PSNERP, 2009). This has resulted in an estimated 88% loss of juvenile Chinook rearing habitat in the delta, leading to an overpopulation of existing habitat. This has also resulted in stunted growth of Chinook currently in the delta and restriction of the number of Chinook that can be in the delta.

All six wild Skagit Chinook stocks rear in the delta, and there is not enough tidal wetland habitat available for all the juvenile Chinook that want to rear there. At a minimum, Skagit Chinook Recovery planners still need to add habitat capacity for 1,275,000 additional smolts.

Restoration of Whidbey Basin Pocket Estuaries Under Way And the 5-Year Recovery Target Has Been Met

The Skagit Chinook Recovery Plan prioritized the restoration of 12 pocket estuaries totaling 76.8 acres of useable habitat area. These 12 sites are all within one day of Chinook fry travel from the Skagit river estuary. If all 12 sites are restored, annual Chinook production will increase from 73,442 smolts to 221,260 smolts (SRSC; WDFW, 2005). For the first five years, restoration was planned for seven sites, 31.4 acres of useable habitat, and an increase of 27,903 smolts. Through the first five years, restoration has been or is being implemented at six sites, totaling 33.6 acres for an increase in Chinook production of 47,868 smolts, almost 20,000 more smolts than planned. The additional restoration gains are primarily the result of the active restoration of Dugualla Bay Heights, which was not originally planned for the first five years.



Pocket estuaries are small-scale estuaries within the larger Puget Sound estuary that form behind coastal accretion landforms at embayments created by submerged valleys, or at small creek deltas (Beamer et al, 2005). They provide low-energy and high-nutrient habitats for juvenile Chinook as they migrate through the Sound from their natal river and delta. The Skagit River Chinook Recovery Plan focuses on restoring and protecting pocket estuaries in the Whidbey Basin that are within a day's swimming distance for Chinook fry.

For the Whidbey Basin, modeling and field surveys have led researchers to conclude that over two-thirds of historic pocket estuaries have been completely lost to juvenile salmon use, and the remaining one-third has been reduced in size by approximately 50%. This suggests an approximately 80% net reduction in pocket estuary area. Pocket estuaries within a day's swimming time of the Skagit River delta have experienced an 86% net reduction (Beamer et al, 2005).

Summary

There is not one particular habitat problem that caused Chinook salmon decline or that is challenging Chinook salmon recovery. It is a combination of problems and the accumulation of habitat impacts throughout the Skagit River system that are prolonging the decline of Chinook salmon. The Skagit Chinook Recovery Plan recognizes the multitude of habitat problems and has targeted recommendations to fix them.

Based on the sample of problems we looked at in this chapter, implementation of the Skagit Chinook Recovery Plan is having mixed results. In the both the tidal wetlands of the Skagit delta and the pocket estuaries of the Whidbey basin, habitat is being strategically restored and Chinook productivity is expected to increase. The key in those areas is to continue moving forward, as neither area has reached the ultimate restoration goals of the Recovery Plan. On the other hand, the Recovery Plan recommended government entities repair habitat blocking culverts under their jurisdictions, and based on culvert data for 2010, blocking culverts have either increased or stayed the same in number across all jurisdictions. The Recovery Plan also recommended better riparian forest management practices on agricultural lands, yet in the Skagit River delta, 87% of agricultural lands remain cleared of riparian forest. The Recovery Plan warned against continued exempt well development in Carpenter Creek as it was potentially causing streamflow reductions that were having detrimental effects on Chinook salmon in that basin. Exempt well development continued in that basin, and now the Carpenter Creek watershed is over-allocated. The Recovery Plan also warned of the potential for small forestland owner riparian exemptions to negatively impact riparian zones along anadromous streams. Although use of this exemption to date has been modest (projected 20% of stream length affected over a 70-year timber rotation), impacts will increase with accelerated timber harvest. In the mean time, use of the exemption has, and will continue to degrade many productive salmon streams.

Where restoration is recommended in the Skagit Recovery Plan, restoration is occurring largely due to tribal efforts. It needs to continue until the ultimate restoration goals of the plan are met, but the fact it is occurring is encouraging. Where local and state government support for Chinook recovery is needed, it has been lacking. Blocking culverts remain under government roads, agriculture continues to maintain cleared riparian areas, and exempt well development occurs until there is literally no more water to allocate. If the Recovery Plan is going to succeed, a much deeper commitment to its overall recommendations, including government action and restoration will have to be implemented. This is going to require renewed commitment from State and local government to hold both themselves, and the rest of us, accountable to Chinook salmon recovery.

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State of Our Watersheds Report
Snohomish River Basin

Salmon was always the only livelihood of our people. That's all the tribes ever lived on. Tribes have been protecting the salmon and shellfish for thousands of years. That's all we want to do – continue to protect and enhance our natural resources. That's how all of the tribes feel, and we're doing our share to bring these resources back. We just have to keep working at it and get everybody to protect the salmon.

– STAN JONES, TULALIP TRIBES

The Tulalip Tribes

The Tulalip Tribes are successors in interest to the Snohomish, Snoqualmie, Skykomish and other bands of Indians. The Tulalip reservation is at the mouth of the Snohomish River north of Everett, but historically, these tribes inhabited the drainages of the rivers that now bear their names, as well as parts of Whidbey and Camano Islands and the mainland shore from north of Seattle to the mouth of the Stillaguamish River.

At the time of European settlement, members of these tribes traveled throughout Puget Sound and north to the Fraser River and beyond to pursue fishing and trading opportunities.

The 1855 Treaty of Point Elliott preserved tribes' right to fish, hunt and gather in their traditional areas.

The federal government is obligated to protect those treaty-reserved resources. Today the adjudicated usual and accustomed fishing area of the Tulalip Tribes extends 120 miles from the Canadian border south to the north end of Vashon Island.

This report will focus on the Snohomish River basin and surrounding marine waters, which is only a portion of the area the Tulalip Tribes work in and manage.

Degradation of the Snohomish River Basin

The last 150 years of human expansion and development has depleted natural resources and degraded the natural ecology of the Snohomish River basin. Nearly half of the documented Whidbey basin nearshore forage fish habitat has been impacted by human modification of the shoreline.

Almost the entire saltwater shoreline (about 95%) from the Snohomish River delta south to Mukilteo is either armored natural shoreline or artificial shoreline created from fill.

The estuary has had 80-85% of its historic wetland habitat cleared and drained, resulting in chinook losses of potentially between 1 and 1.6 million per year. Dikes, flow control devices, and agricultural development have decreased by 55% the number of side channel sloughs accessible to juvenile salmonids since 1884.

About 40% of surveyed culverts are combining to block approximately 242 miles of anadromous stream habitat in the basin. Impervious surface area in the basin increased 255% between 1972 and 2006. Riparian forest cover, essential to fish habitat for shade, nutrients and structure, remains 20% below desired conditions within the anadromous zone. Exempt wells, which may be a driving factor of critically low flows in 31 of 44 subbasins of the Snohomish basin, have proliferated from about 2,300 to more than 13,000 since 1980. Still, their impacts remain unmonitored by Washington Department of Ecology.

Roads are impacting streams and watersheds from the delta to the headwaters. While paved road crossings are degrading the biological health of lowland streams, forest roads are negatively impacting hydrology in the upland watersheds.

Coho salmon spawn in restored habitat on the Tulalip reservation. In November 2010, 50 coho and 1,000 chum were seen using the newly created Coho Creek.

Since 2000, the tribes created 2,500 feet of stream channel and added thousands of feet of spawning gravel. Eighteen culverts were removed or replaced, a half-acre forested pond was constructed, several log weirs were built and 4 acres of stream bank were planted. In the future, the tribe plans to create additional stream channel and wetlands to offset the impact of further development of the tribes' nearby Quil Ceda business park.

Snohomish Basin Salmon Recovery Plan

The Snohomish Basin Salmon Conservation Plan adopted five principles to guide recovery planning efforts:

- Emphasize protection and reconnection of habitat;
- Use historical information to guide today's decisions;
- Preserve and restore the natural ecosystem processes;
- Use monitoring and assessment to guide adaptive management; and
- Preserve options for the future.

During the development of this plan, the Snohomish Basin Salmon Recovery Forum used computer modeling of habitat-fish relationships to identify a suite of habitat improvement projects for the Snohomish watershed to be implemented within 10 years. Increased rearing habitat quality and quantity in estuary and mainstem areas was the highest priority for salmon recovery projects, as this was where the modeling showed the greatest opportunity for improvement.

One key assumption of this recovery plan was that restoration of lost habitat in the nearshore, estuary and mainstem areas will not, by itself, produce viable anadromous populations in the long term. The recovery strategy depends critically on regulatory action – through the Growth Management, Shoreline Management and Forest Practices acts, for example – that minimizes habitat loss while making an overall net gain in habitat through protection and restoration.

Another key assumption was that land-use regulations would be updated to follow the guidance of the salmon recovery plan. As of December 2010, Island and Snohomish counties' Shoreline Master Programs governing land-use activities and habitat protection in the nearshore, estuary, and river system had yet to be updated.

The state's "no net loss" goal does not result in habitat conditions that lead to recovery, because the benchmark is being established in a watershed that already is in a degraded state, not capable of producing properly functioning conditions from an ecological standpoint.

Restoration Makes Progress, But Not Enough

Habitat recovery milestones were identified for the estuary, nearshore, mainstems and lowland tributaries:

- 1 mile of restored shoreline;
- 1,237 acres of tidal marsh habitat;
- 10.4 miles of restored river edge habitat;
- 256 acres of riparian habitat;
- 41 logjams; and
- 167 acres of off-channel habitat.

Since the recovery plan was adopted in 2005, habitat restoration work has made progress, but the work is not being implemented fast enough to meet the 10-year benchmarks.

The Snohomish basin 3-year workplan for 2010 reports that restoration and mitigation projects have completed:

- 0.2 mile of restored shoreline;
- 375 acres of tidal marsh;
- 1.5 miles of restored river edge habitat;
- 178 acres of riparian habitat;
- 0 logjams installed; and
- 32 acres of off-channel habitat.

These numbers reflect only what has been reported in the habitat work schedule and likely does not capture all activities to date. Implementation monitoring also does not account for the effectiveness of restoration, and the quality of the restored habitat has not been evaluated.

Coordinating Harvest, Hatcheries and Habitat

The 10-year restoration plan was just a start. All parties recognized that this work would be effective only in combination with recovery action across all H's – Harvest, Hatcheries, Habitat restoration and Habitat protection.

The habitat activities specified in the plan complement harvest and hatchery management. Over the past two decades, harvest exploitation rates on Snohomish basin chinook salmon have been greatly reduced from more than 60% to approximately 20%.

Achieving this has required managers to reduce and restrict fisheries from southeast Alaska to the Washington coast. The Tulalip Tribes have closed nearly all of their large usual and accustomed fishing areas to chinook salmon, opening only a small area in Tulalip Bay to target fish produced at the Bernie Kai-Kai Gobin Hatchery.

Working with their state co-managers, Tulalip also has implemented a number of innovative recommendations for changing hatchery practices to greatly reduce the potential harmful effects of hatchery fish on the productivity of naturally produced chinook salmon.

Harvest and hatcheries are being managed in ways that will allow Snohomish chinook salmon to recover, assuming appropriate habitat restoration and protection measures are taken.

Review of habitat recovery progress and trends at the 5-year mark of the Snohomish River Basin Conservation/ Recovery Plan is difficult to evaluate given available information. However, preliminary results from a Washington Department of Fish and Wildlife riparian change analysis indicate that roughly 500 acres of forest cover have been permanently lost within 100 feet of a water body. This compares with the 178 acres of riparian habitat that have been restored, resulting in a net loss of more than 300 acres of riparian habitat, despite major efforts in habitat restoration, and harvest and hatchery management.

The Tulalip Tribes expect that this pattern is widespread and we are continuing to lose many types of habitat throughout the basin, despite our recovery efforts.

A crew excavates a channel in the Qwuloolt estuary. The 350-acre project is one of the largest restorations in Puget Sound and the largest so far in the Snohomish River delta. Tulalip is leading the effort in partnership with the city of Marysville and several local, state and federal agencies. Historic natural conditions will be restored to two streams and fish-blocking tide gates will be removed to open fish access to 16 miles of spawning and rearing habitat.

Barriers to Habitat Restoration and Protection

Restoration

- Funding: For the 2009-11 work plan goal, only $14.5 million has been secured for capital projects of the identified total project cost of $172.6 million. This funding includes a patchwork of sources pooled together. For example, the Qwuloolt estuary project has 12 different sources of funding that each have different reporting requirements.
- Permitting: Local governments do not distinguish between restoration and development actions, resulting in high costs of permitting for restoration actions. Large projects take multiple years to be approved. While there are good examples of programmatic restoration action permits (NOAA), local and state governments are not implementing similar programmatic approvals. In some cases, permitting issues have caused sponsors to lose funding that has a 3-year window.
- Institutional/political roadblocks: Conflict between agriculture and fish interests, zoning issues, and rural development can lead to a lack of community support for salmon recovery actions. For example, in the Snohomish basin, there are several large restoration projects in county ownership that have secured funding. However, the areas are zoned agriculture, and the county is having problems moving forward with restoration because of strong resistance from the agricultural community.

Protection

- Population pressure: The Growth Management Act may not be able to protect habitat as well as expected, in part because exemptions allow large developments outside of the urban growth area. GMA was developed to focus development, not specifically to protect salmon habitat and watershed health.
- Failure of federal, state and local jurisdictions to meet their obligations: When jurisdictions agreed to salmon recovery plans, they were given an umbrella of protection under the Endangered Species Act. They are required to fulfill their commitments in order to be compliant with ESA. The federal government also must uphold its obligations to protect treaty-reserved resources and recover essential habitat to properly functioning conditions.
- Failure of NOAA/NMFS to hold state and local governments accountable for protecting habitats that support endangered species: When NMFS approved the salmon recovery plan, it assumed the responsibility of ensuring there was no loss of existing habitat. They are not holding local governments accountable.

Looking Ahead

The Tulalip Tribes have a reputation in the Snohomish basin as a leading force, committed to full ecosystem recovery through collaboration with watershed partners.

The tribes will continue to push for solutions as we are a permanent fixture in the basin. We believe that the Snohomish system is imminently recoverable. Though there has been significant alteration, much of the change is reversible.

An excellent example is the ongoing Qwuloolt restoration project. We are revitalizing 350 acres of estuary that was diked and thought to be lost. We believe strongly in the resilience of the system. If areas are reopened and the largely intact watershed processes are able to do their work, the basin will be even more productive for salmon.

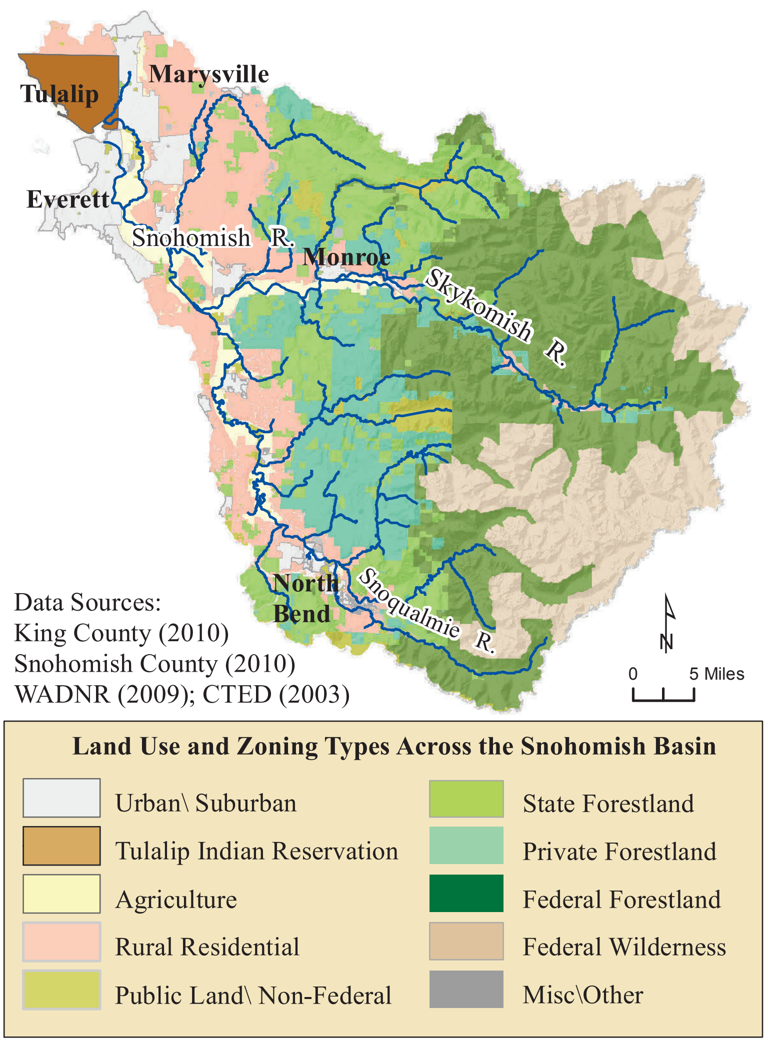
This restoration, along with the increased protection of at-risk areas, will ensure that Tulalip Tribes will be able to continue the practices that we as a people have been dependent on since salmon arrived in the Puget Sound.

Tulalip tribal fishermen harvest Fraser River sockeye off the San Juan Islands.

Tulalip Tribes (Snohomish River Basin)

At 1,856 sq. miles, the Snohomish River has the second largest drainage basin in the Puget Sound. It is the convergence of two major rivers: the Skykomish River and the Snoqualmie River. These rivers flow steeply from their headwaters in the North Cascades before descending on to the flat low-elevation Puget Sound trough (Haring 2002).

The Snohomish River basin is within the ancestral home of a number of tribes and bands that later formed the Tulalip Tribes. The present day reservation lands of the Tulalip Tribes are located along the nearshore of the basin just north of Everett,WA. Historically and today, land use has been dominated by physical geography. The foothills and mountains are mainly used for wood products and outdoor recreation. The lowlands are primarily used for agriculture and rural residential development. As seen in the map below, most of the urban and industrial land use is concentrated around the delta of the Snohomish River in the cities of Everett and Marysville. The Snohomish River system supports anadromous stocks of coho, Chinook, chum, and pink salmon, and steelhead trout (WDFW 2002). The basin is also a major source of municipal water for the cities of Everett, and Seattle, WA and surrounding areas (Haring 2002).



Federal lands comprise 40% of the Snohomish watershed, primarily in the headwaters. Urban, agriculture and rural residential areas combined are 20% of the watershed, primarily in the lowlands.

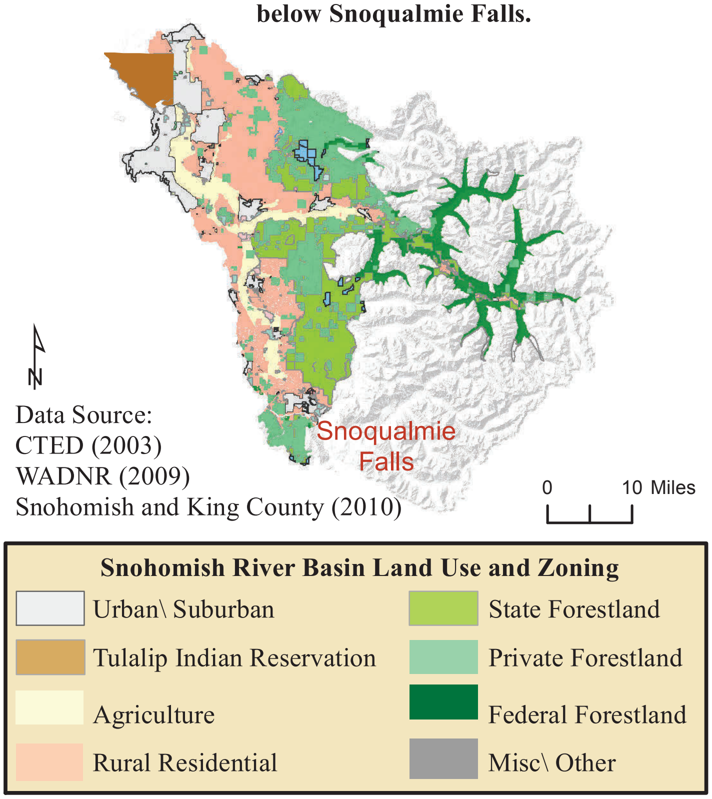
Since 1990 human population is estimated to have grown 65% from~230,000 to over 380,000 (OFM 2010). Over 85% of the current population lives on 20% of the land in urban, ag., and rural residential areas. Population is expected to grow at a 59% rate over the next 30 years (Snohomish County 2005).

The last 150 years of human expansion has left natural ecology of the Snohomish watershed in a stressed and depleted state. The future protection, conservation and restoration of the watershed will require a better understanding of the current state of the watershed's natural resources, and a greater commitment to actively restoring, as well as conserving and protecting resources into the future.

Lowland Landuse and Riparian Forest Cover

The Snohomish River Basin Salmon Conservation Plan ecommends at least 65% forested 150-ft riparian buffer on either side of all fish habitat streams. Along anadromous fish habitat streams flowing through urban, agriculture and rural residential zone lands, riparian forest cover was only 41% in 2006, no gain has occured since 1992.

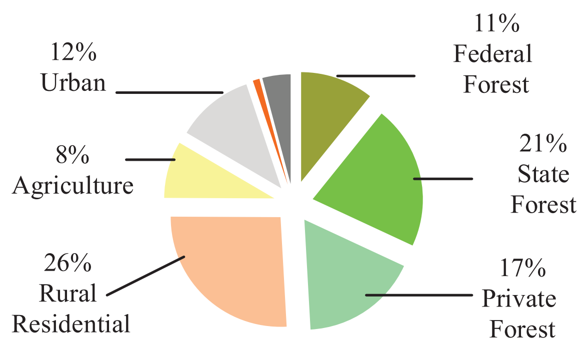
Land use under 700m elevation and below Snoqualmie Falls.



Land Use

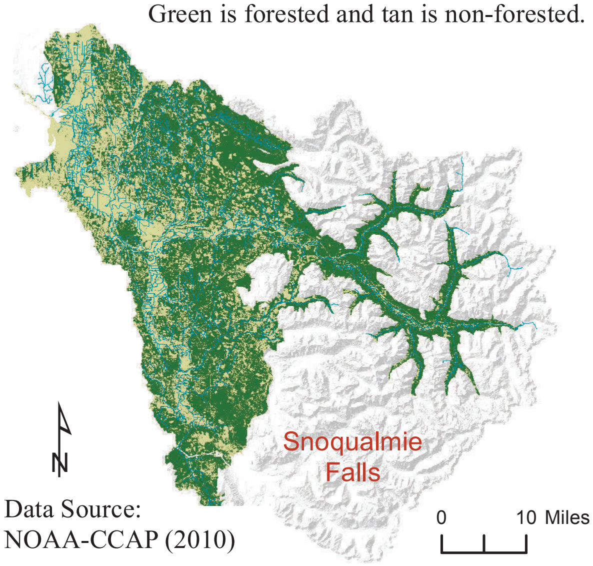
Salmon face near constant environmental stress from the urban, agriculture, rural residential and commercial forestland uses. Most Snohomish river anadromous salmon spawning and rearing occurs below 700m elevation in the foothills, floodplains, estuary and nearshore (Pess et al. 2002). Almost all human economic land use in occurs in the same area. As a result, anadromous salmon are heavily impacted by human land use.

Land use in the anadromous zone under 700-meters of elevation



Forest Cover Along Anadromous Streams Under 700m Elevation

Blue lines are anadromous streams.
Green is forested and tan is non-forested.



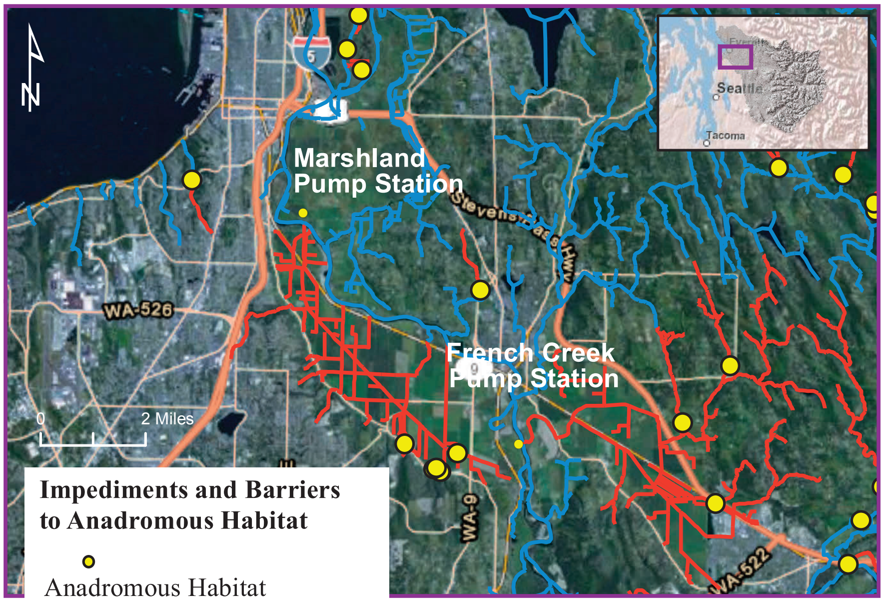
Riparian Forest Cover

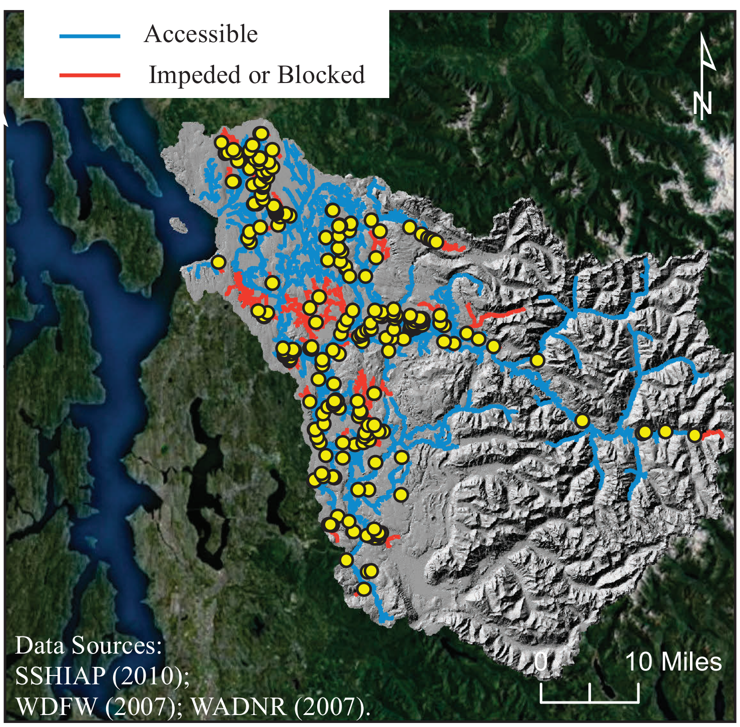
The Snohomish River Basin Salmon Conservation Plan recommends riparian forest buffering of a 150-ft either side of fish habitat streams, with a range of 65% to 80% of stream length per selected subbasins. In the 150-ft zone along anadromous fish habitat streams flowing through urban, agriculture and rural residential zone lands, there was no change in the percent of riparian forest cover, which remained 41% from 1992 to 2006. Forest cover along anadromous streams is particularly lacking in urban and agricultural lands which were only 27% and 18% forest respectively in 2006.

Land-use Zone	%-Forest Cover 1992	%-Forest Cover 2006
Urban	29	27
Agriculture	17	18
Rural Residential	63	62

Man-made Structures Remain Barriers to Anadromous Salmon Habitat

Dikes, levees, and flow devices have resulted in the loss of 55% of critical mainstem salmon habitat (Haas and Collins 2001). 40% of 1,500 inventoried culverts are blocking or impeding access to as much as 240 miles of upstream habitat. Data on the status of barrier removal and on additional barriers found is difficult to come by. One continues to assume a trend of continued barrier impact to salmon and steelhead passage, but lack of data makes the degree of impact hard to determine.





Note:
This is a conservative GIS assessment of culvert-blocked anadromous fish habitat. Fish distribution was provided by SSHIAP and based on the Washington conservation Commission LFA mapping effort (Haring 2002). Culverts are from 2007 WDFW and WADNR culvert datasets.

Barriers to Mainstem Habitat

The French Creek and Marshland pump stations are the largest blockages of lower mainstem side channel habitat, and remain barriers to more than 75 miles of floodplain and hillside tributary channel habitat (Hass and Collins 2001).

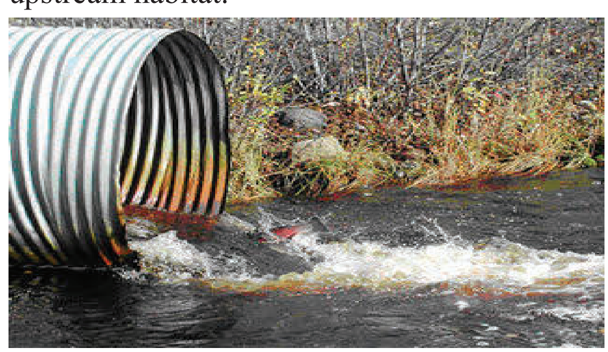
Pump Station	Blocked Habitat (Miles)
Marshland	47
French Creek	28

Barriers to Upland Tributary Habitat

Culverts are all potential impediments to the flow of water, wood, sediment and fish.

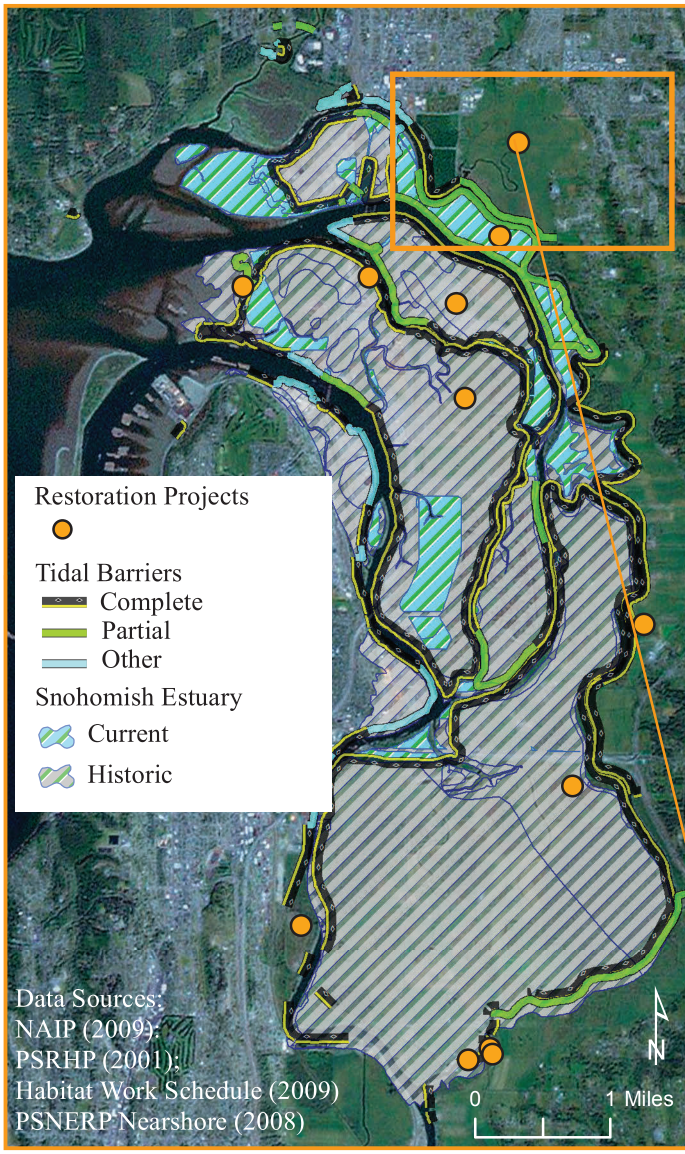
In the Snohomish Salmon Recovery Plan, it is estimated that there are 7,000 culverts in the Snohomish watershed (Snohomish County 2005). Based on survey records, ~1,500 culverts are known to exist in the basin (WDFW 2007; WDNR 2007).

Approximately 600 inventoried culverts are at least partial barriers to anadromous salmon, blocking or impeding access to ~240 miles of upstream habitat.



Tidal Barriers, Land Conversion and the Loss of Chinook Habitat in the Estuary

The Snohomish River Basin Salmon Conservation Plan has a goal to restore 1,237 acres of tidal marsh and blind channel habitat by 2015. The Tulalip's goal is to restore 80% of the historic habitat and they are planning to restore 350 acres of tidal marsh on their Qwuloolt property as part of the current 3-year workplan. The current 3-year workplan has identified the restoration opportunity of 926 acres of tidal marsh in addtion to the 350-acre Qwuloolt project This brings the current total of planned tidal marsh restoration to 1,276 acres. While the 1,276 acres will increase current estuary habitat to 30% of historic totals, it is still far from the 80% habitat restoration desired by the Tulalip Tribes. As well, until the planned restoration is actually happening on the ground, the trend for estuary restoration remains continued loss of functional habitat.



Snohomish Estuary Conditions	Miles of Tidal Barriers	# of Blind Channel Networks	Acres of Tidal Marsh
Historic	0	94	9,760
Current	58	31	1,428

(Haas and Collins 2001)

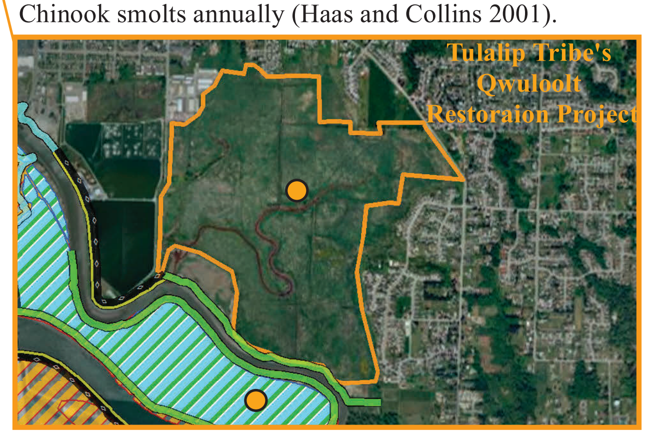
Land Conversion and Habitat Loss

From 1860 to 1950, the clearing and draining of the Snohomish estuary resulted in between 80-85% loss of historic estuarine wetland habitat (Haas and Collins 2001).

The Snohomish estuary is currently a matrix of transportation networks, farms, industry and

Estuary Critical to Chinook Production

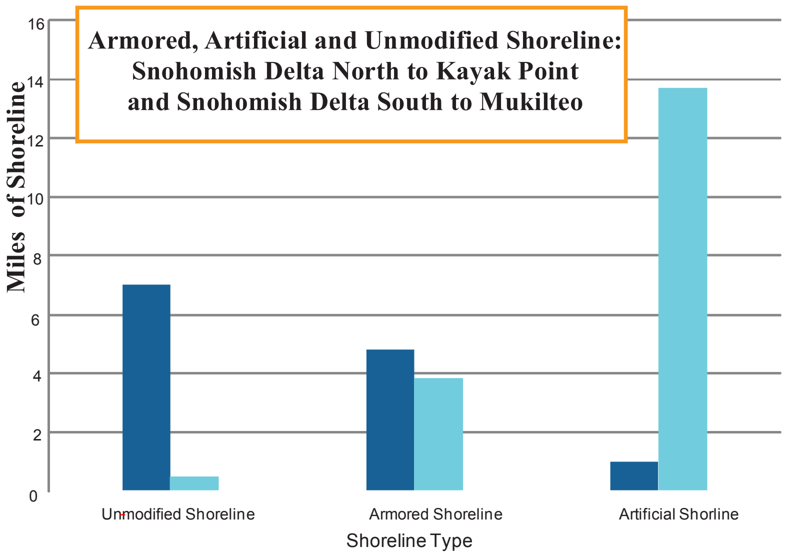
The estuary is believed to be a frequent bottleneck to Chinook production. The loss in habitat area has resulted in a potential loss of 1 million to 1.6 million Chinook smolts annually (Haas and Collins 2001).



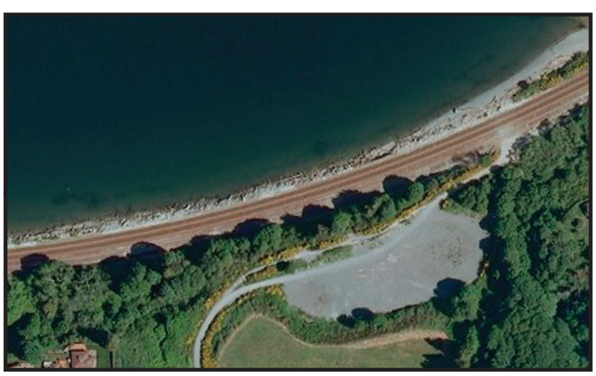
The Tulalip Tribes are sponsoring a 350-acre estuarine restoration project on their land NE of Ebey Slough.

Armoring Concentrated Along Everett City Shoreline

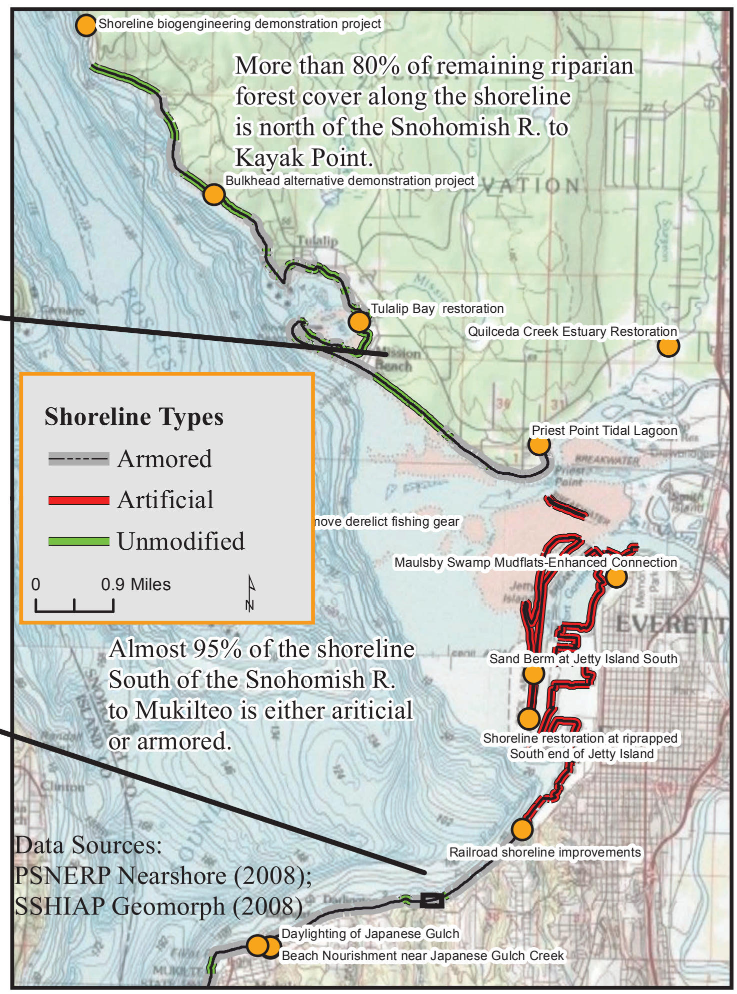
Of the 32 miles of Snohomish shoreline, 70% has been modified. Seventy-five percent of this modified shoreline is located south of the Snohomish River, along the Everett waterfront to Mukilteo. In 2005, the Snohomish River Basin Salmon Conservation Plan identified a 10-year habitat goal to restore at least 1 mile of nearshore beaches and shoreline. To date, only 0.2 miles of that habitat goal has been met, and the result is a continued trend of habitat degradation.



Almost all nearshore riparian forests are north of the Snohomish River along theTulalip Reservation.

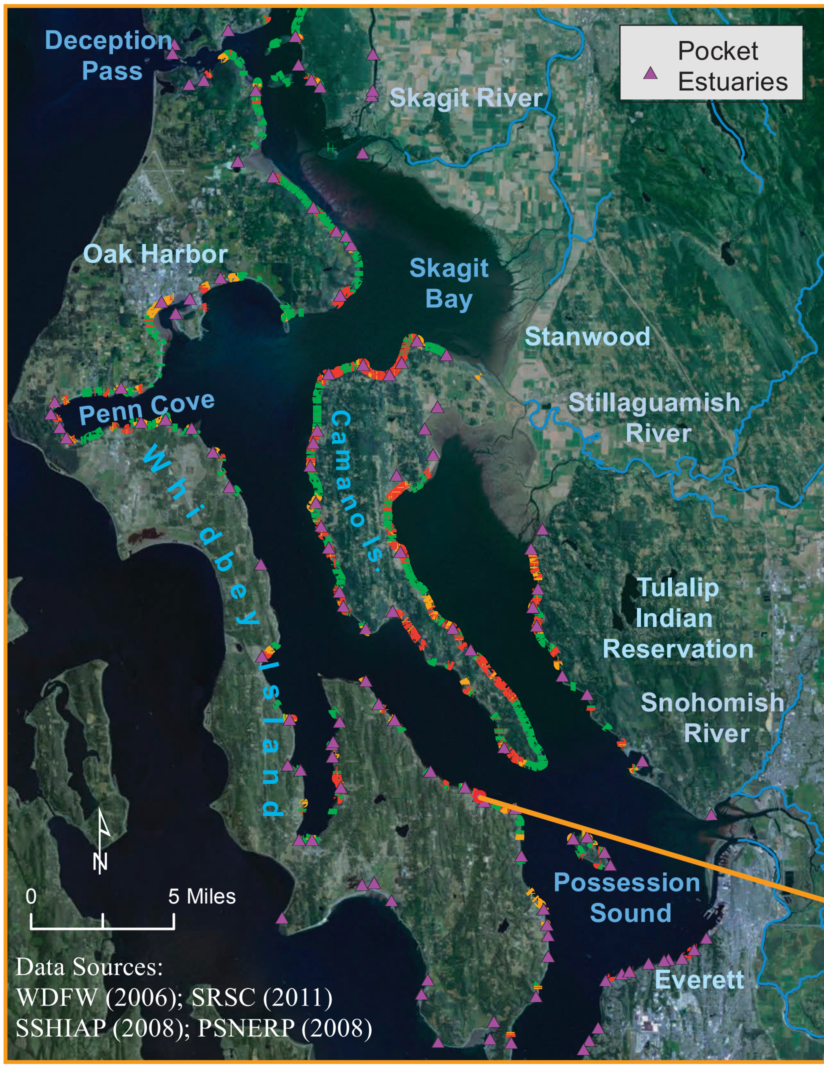


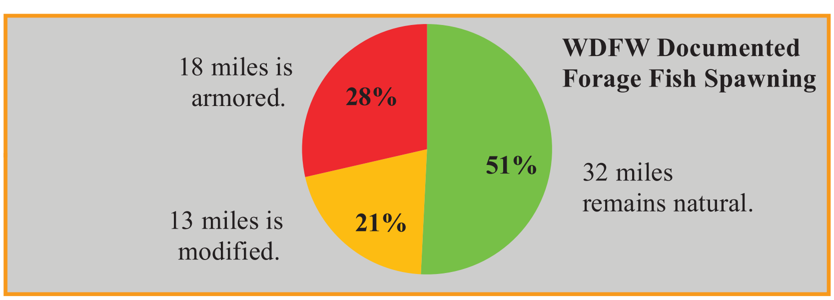
Built in the 1890s, the Burlington Northern Railroad is the largest single impacting feature in the Snohomish nearshore.



Shoreline Modifications Threaten Forage Fish Spawning Habitat in the Whidbey Basin

Almost 50% of inventoried sand lance and surf smelt spawning habitat in the Whidbey basin has been modified and of that 29% has been armored. Armoring and modification interrupt the movement of gravel and sand on these beaches and negatively impact spawning habitat as a consequence. It is assumed that without restoration of these armored and modified beaches, their capacity to support sand lance and surf smelt spawning will continue to decrease over time.





Foraging in the Puget Sound

In Puget Sound ecology, sand lance and surf smelt are an important food for larger fish, marine mammals and seabirds (WAECY 2010). Sand lance is recognized as being one of the most important components of a juvenile Chinook's nearshore diet (Duffy Et al. 2010).

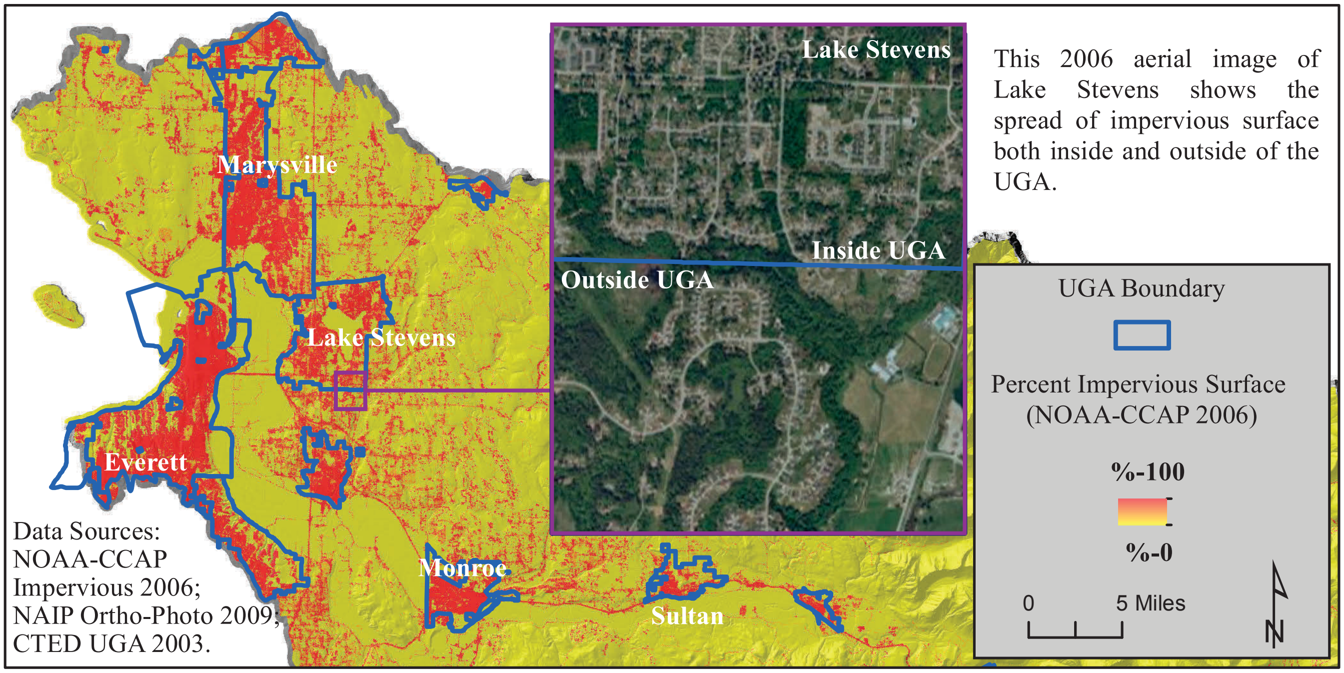
Sand lance (SeaDoc Society)

Sand lance and surf smelt spawn exclusively on sand and gravel beaches, making them especially vulnerable to the degrading effects of shoreline modification and armoring in these areas (WAECY 2010).

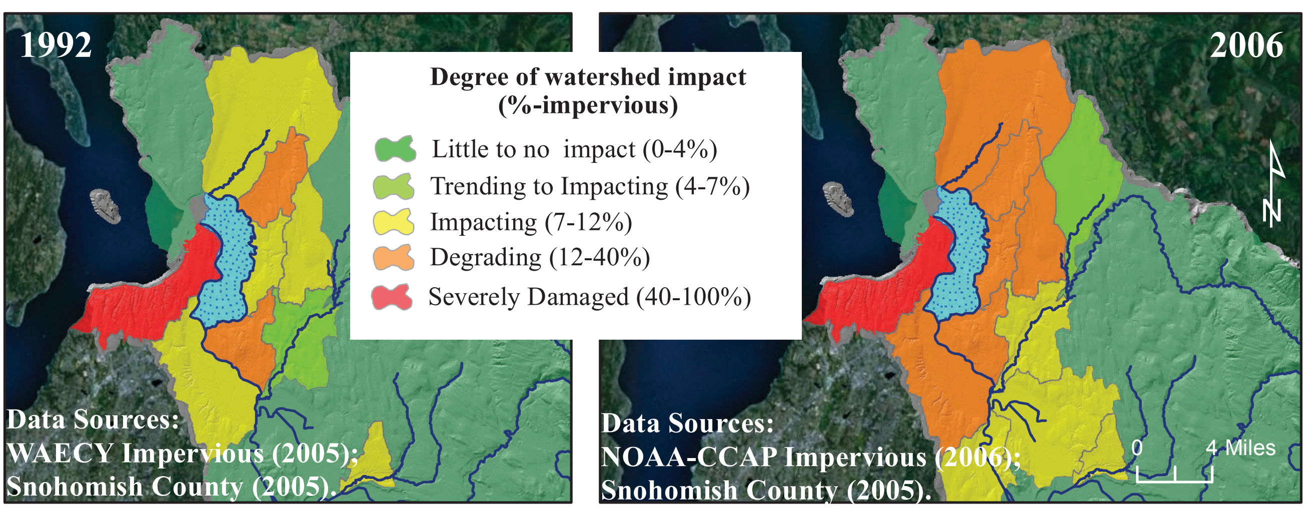
Shoreline modifications have contributed to the loss of beach berm, shallow beach, and pocket estuary habitats that provide refuge and foraging locations for juvenile salmon, and has contributed to the reduction in forage fish spawning habitat.

Impervious Surfaces Continuing to Expand Outside of Urban Growth Area Boundaries

Impervious surface in the Snohomish River basin increased by 255% since 1972. Over 75% of the increase in impervious surface is associated with low density development outside of Urban Growth Areas (UGA) (Powell et al. 2008). In 1992, 20% of the watershed area adjacent to the estuary was biologically degraded (12-40% impervious), by 2006, every watershed adjacent to the estuary is biologically degraded.



Impervious surface is well documented as a coarse measure of human impact on watershed scale hydrology and biology (Alberti Et al. 2007; Booth Et al. 2002; Booth and Jackson 1997). The Snohomish River Basin Salmon Conservation plan targets recovery at under 7% impervious, and warns of degradation over 12% (Snohomish County 2005; Spence 1996).

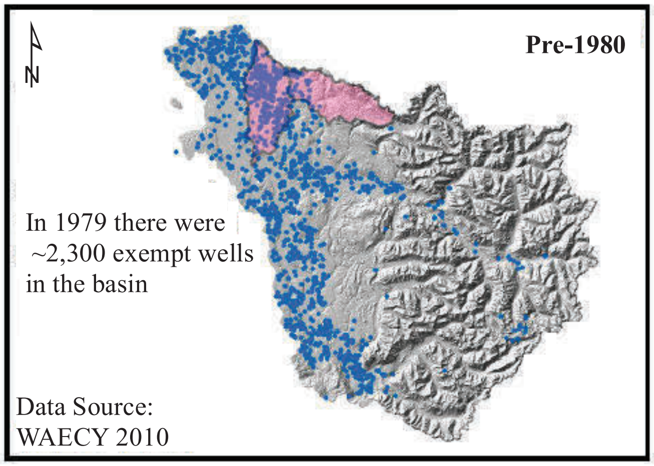


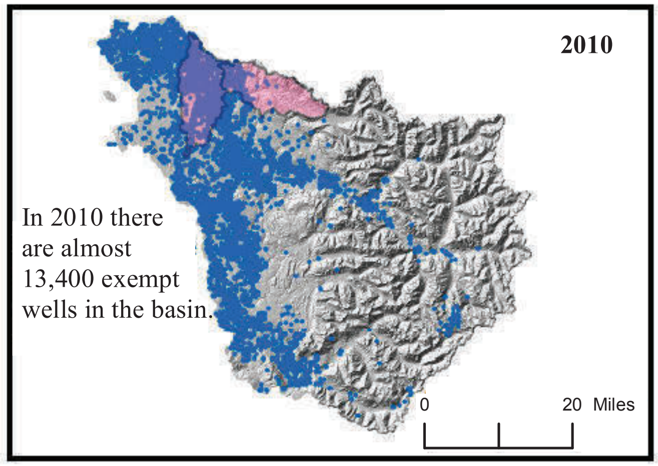
By 1992, impervious surfaces were already impacting the health of lowland watersheds.

By 2006, after15 years of the Growth Management Act, more lowland watersheds are impacted by impervious surfaces, and previously impacted watersheds have become degraded.

Permit-Exempt Wells Potentially Impacting Low Flows

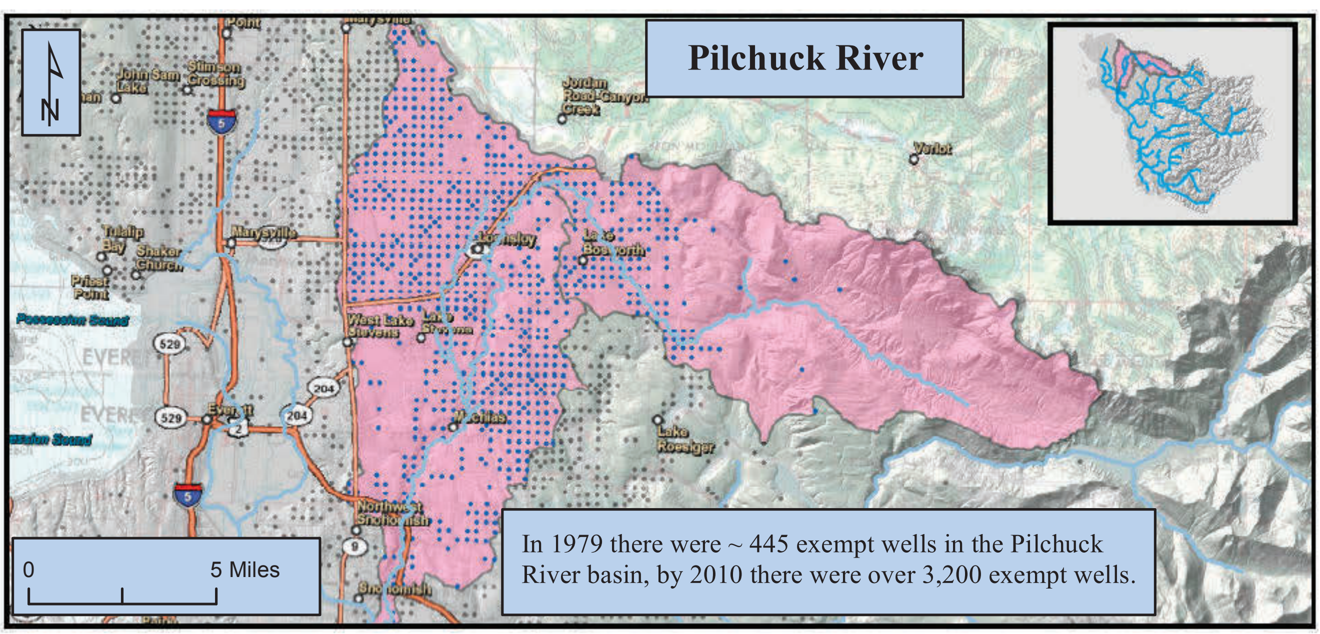
During the past 30 years, the Snohomish basin has seen an increase of over 500% in exempt well drilling. In 31 of 44 tributaries in the Snohomish Basin experiencing problem low flows, exempt wells are suspected as a potential cause for the low flow problems (Lombard and Sommers 2004). It is estimated that 95% of exempt wells drilled are for home construction (Ballhorn 2008). The majority of which has been associated with rural residential development outside of the Urban Growth Area boundary.





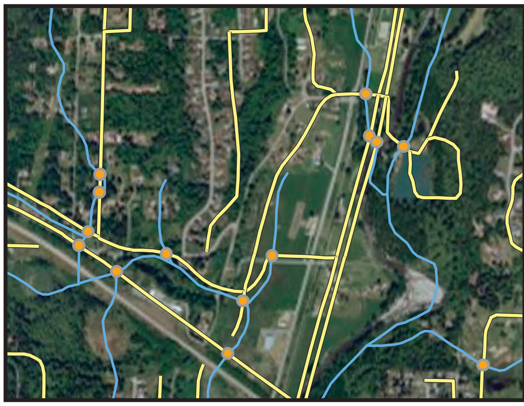
Since 1945, Washington state water law has allowed up to 5,000 gallons/ per day to be drawn from "exempt" wells without a permit. The cumulative withdrawal of groundwater associated with the recent proliferation of exempt wells has lead to concerns of instream flow, salmon habitat, public health and senior water right impacts (Ballhorn 2008).

The Pilchuck River was identified as one of the tributaries where exempt wells are a suspected cause for low flow impacts to fish habitat (Ballhorn 2008; Lombard and Sommers 2004). There has been a ~750% increase in exempt wells in the Pilchuck basin over the last 30 years, and still the cumulative impact of exempt wells on the Pilchuck River's flow is not being measured. Considering that low flows are a problem on the Pilchuck River combined with the extreme proliferation of exempt wells over the last 30 years, quantifying the impacts of exempt wells is necessary to planning for the future health of the Pilchuck River.

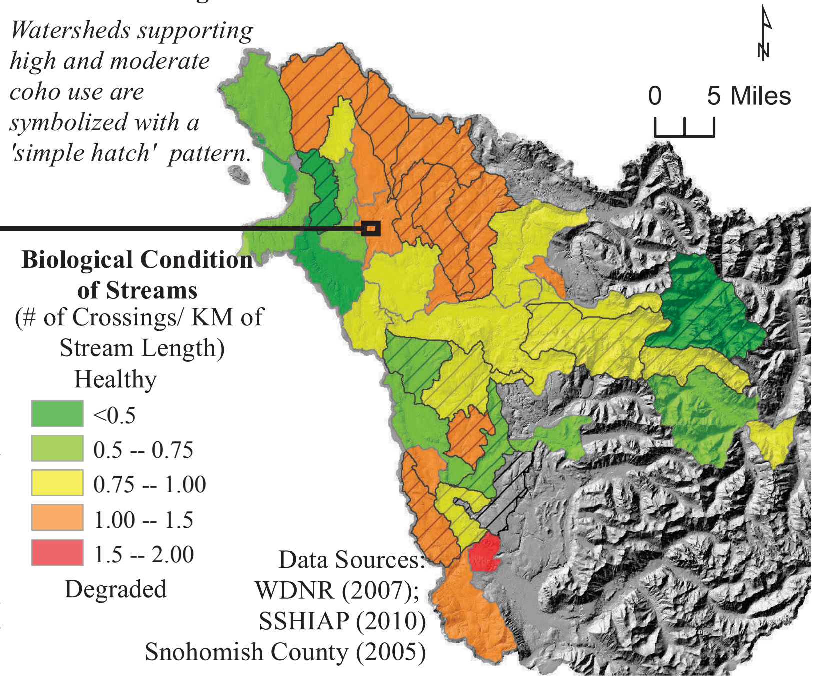


Paved Road Crossings and Forest Road Densities Impact Streams from the Delta to the Headwaters

Road crossings are trending to negatively impact the health of aquatic life in more than 48% of lowland watersheds that, according to the Snohomish River Basin Salmon Conservation Plan, support high to moderate levels of coho salmon use. In addition, according to the Conservation Plan, 49% of headwater watersheds have road densities that potentially threaten the hydrologic condition of streams.



Road Crossings and Stream Health in Lowland Sub-Watersheds



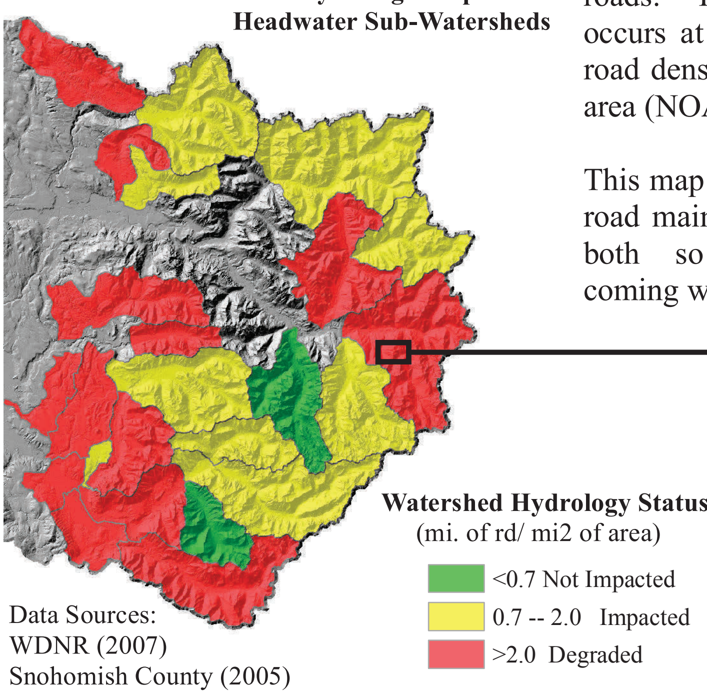
Road networks pose the greatest stress to stream health in developed environments (Avolio 2003).

When averages exceed 2 road crossings per kilometer of stream length, stream health has a significantly higher probability of being degraded (Alberti 2007).

Road networks in the headwaters are primarily forest roads. Hydrologic alteration and stream degradation occurs at a significantly higher probability when forest road densities exceed 2 miles of road per square mile of area (NOAA 1996).

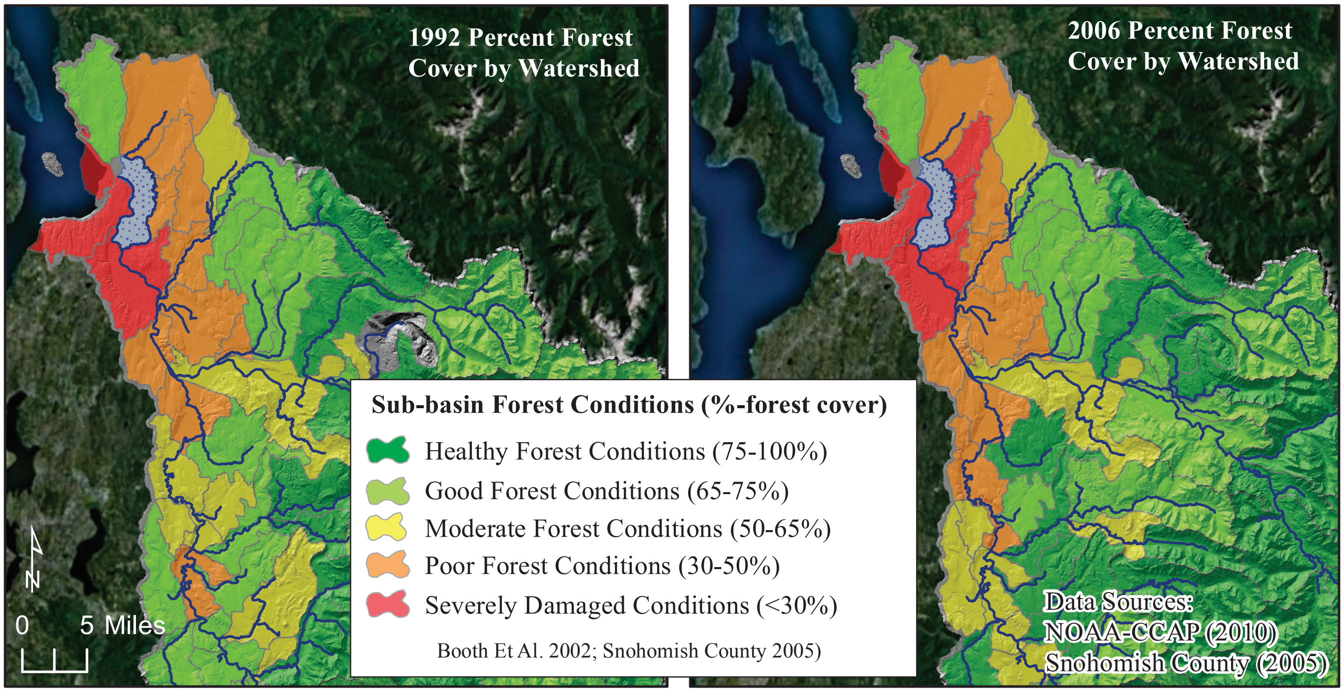
This map does not reflect abandoned roads or changes in road maintenance plans. We need to better monitor for both so that we can see the improvements that are coming with better forest road management.

Road Densities and Hydrologic Impacts in Headwater Sub-Watersheds

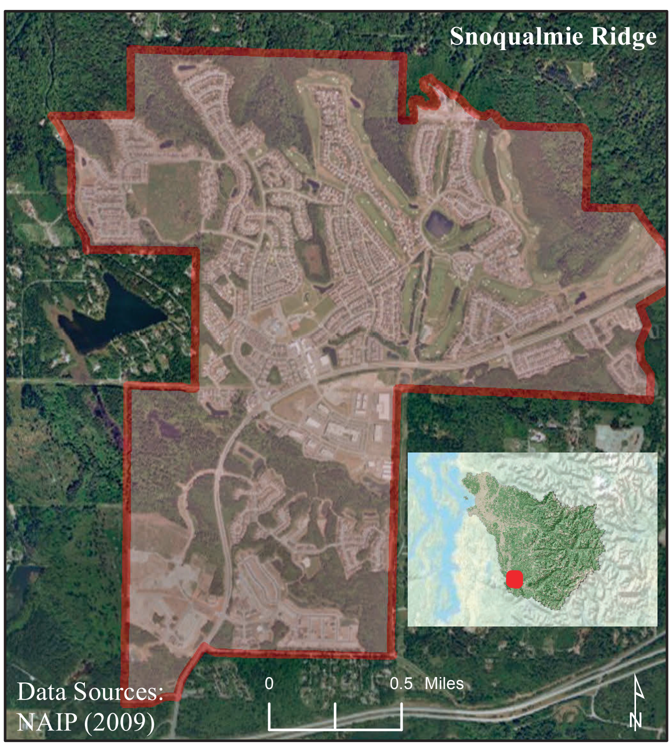


Lowland Forest Cover Loss Continues

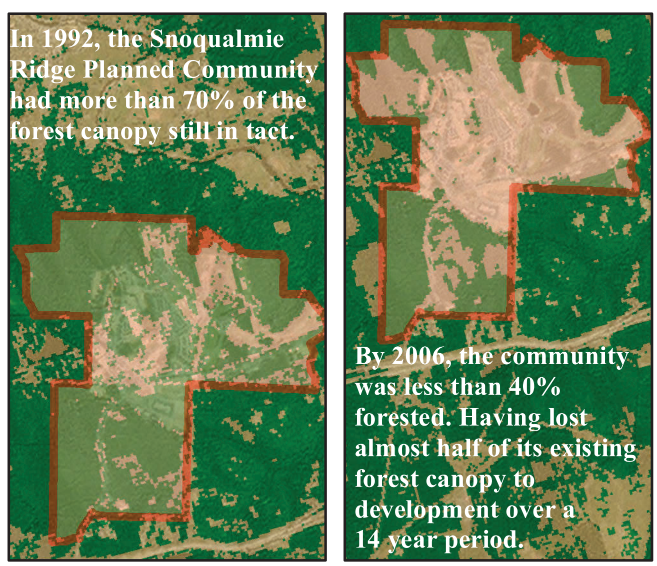
The forest conditions in lowland watershed areas adjacent to the lower Snohomish mainstem and estuary continues to degrade from a "poor" to a "severely damaged condition". For the overall health of critical salmon habitat in the Snohomish River basin, attention needs to be focused on stopping further degradation and on restoring some portion of the forest cover that has been lost.



In 1992, areas of poor and severely damaged forest cover were already centered around the critical habitat areas of the estuary. By 2006, moderate forest conditions centered around the estuary declined to poor conditions, and poor forest conditions continued to spread up the lower mainstems.



As seen here at Snoqualmie Ridge, loss of forest cover to residential land results in more impervious surfaces. This means less water retention, higher peak flows, and less biologic productivity in the streams (Booth Et.al 2002).



Summary

The last 150 years of human expansion and development has depleted natural resources and left degraded the natural ecology of the Snohomish river basin. Forty-nine percent of documented Whidbey basin nearshore forage fish habitat is impacted by human modification of the shoreline. Almost the entire saltwater shoreline (about 95%) from the Snohomish River delta south to Mukilteo is either armored natural shoreline or artificial shoreline created from fill. The estuary has had 80-85% of its historic wetland habitat cleared and drained, resulting in the potential Chinook losses of between 1 and 1.6 million per year (Haas and Collins 2001). Dikes, flow control devices, and agriculture development have decreased the area of side-channel sloughs accessible to juvenile salmonids by 55% since 1884 (Haas and Collins 2001). Around 40% of surveyed culverts are combining to block approximately 242 miles of anadromous stream habitat in the basin.

Impervious surface area in the basin increased 255% between 1972 and 2006 (Powell Et. Al., 2008) degrading stream health during that period. Riparian forest cover, essential to fish habitat for shade, nutrients and structure, remains 20% below desired conditions within the anadromous zone. Exempt wells, which may be a driving factor of critically low flows in 31 of 44 subbasins of the Snohomish basin have proliferated from ~2,300 to over 13,000 since 1980, and yet their impacts remain unmonitored by Washington Department of Ecology. Roads are impacting streams and watersheds from the delta to the headwaters. While paved road crossings are having a degrading effect on the biological health of lowland streams, forest roads are negatively impacting hydrology in the upland watersheds.

For over a decade since Chinook salmon were listed in Puget Sound, harvest and hatchery impacts on Snohomish River Chinook salmon have been greatly reduced, at great cost to the Tulalip Tribes. Meanwhile, significant public funds and volunteer hours have been spent restoring lost habitat according to a comprehensive recovery plan developed cooperatively by many watershed partners throughout the basin. Yet this analysis of habitat trends shows that net loss and degradation of key habitats continues. Unless appropriate habitat protection measures are taken immediately such that we start to see a net gain in habitat, our salmon recovery goals will never be reached, and all other recovery actions will have been in vain. Despite the degradation it has suffered, the Snohomish watershed retains the potential to once again be a strong salmon producer that will provide our people with the benefits they retained when they gave up so much else in the Treaty of Point Eliot. The Tulalip Tribes remain ready and willing to work with all watershed partners to turn us towards the goal of recovered salmon once again being the icon of the Pacific Northwest. But this will not happen without a meaningful commitment to protection of the habitats necessary to sustain them.

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State of Our Watersheds Report
Skagit River Basin

Salmon have been a huge part of our culture for thousands of years. Tribes historically implemented sustainable harvest management practices and our continued careful stewardship allowed us to feed our families for generations. Beginning in the late nineteenth century, adverse environmental changes brought on by man started to dramatically affect the sustainability of the salmon runs. Even today, years after the Endangered Species Act listing of Puget Sound chinook and steelhead, more still needs to be done to improve the habitat and to address ocean conditions as our precious salmon runs continue to struggle to return home.

- SCOTT SCHUYLER, UPPER SKAGIT TRIBE

Upper Skagit Indian Tribe

An original signatory to the Treaty of Point Elliott, the Upper Skagit Indian Tribe comprises descendants from 11 ancestral villages in the Upper Skagit and Samish watersheds.

An Upper Skagit reservation was not established at treaty time and many tribal members refused to relocate to the other reservations. This act of defiance forever preserved the Upper Skagit identity.

Today, Upper Skagit people continue to reside and fish on or near historical villages including Mount Vernon, Sedro-Woolley, Concrete and Newhalem.

Recovery Plan Seeks to Restore and Protect

The Skagit River remains one of the more pristine watersheds within Puget Sound.

The upper portion of the watershed is primarily under control of the federal government, located within the Mount Baker-Snoqualmie National Forest, federal wilderness and national park. The middle section of the watershed is largely held as forestland, either in state or private ownership, and the delta reaches predominantly held in agricultural land.

Human land use over the last 150 years has resulted in the degradation of salmon habitat due to forestry and agricultural practices that constitute the primary land uses within the watershed.

The Skagit Chinook Recovery Plan was developed by the Skagit River System Cooperative and Washington Department of Fish and Wildlife in 2005 to identify limiting factors to the recovery of the Skagit watershed. These factors include:

- Seeding levels;
- Degraded riparian zones;
- Poaching;
- Current hydroelectric operations;
- Sedimentation and mass wasting;
- Flooding;
- High water temperature;
- Hydromodification;
- Water withdrawals;
- Loss of delta habitat and connectivity;
- Loss of pocket estuaries and connectivity; and
- Illegal habitat degradation.

The habitat recovery strategy pursued for the Skagit River sought to protect and restore the system from a process-based and landscape scale. It was recognized that successful recovery depends on the ability to produce an overall gain in the factors that support viable populations. Key strategies and actions focused on habitat protection and restoration.

The protection strategy focused on:

- Stream flows;
- Basin hydrology;
- Water and sediment quality;
- Sediment transport;
- Stream channel complexity;
- Riparian areas and wetlands;
- Tidal delta area and nearshore; and
- Fish passage and access.

The restoration strategy focused on fish production and weighted restoration actions by the degree to which they restored landscape conditions in the basin and contributed to long-term recovery.

Restoration efforts were focused on spawning areas, freshwater rearing, tidal delta rearing and nearshore rearing.

The Hansen Creek project restored 140 acres of freshwater floodplain habitat around a tributary to the Skagit River near the Upper Skagit Tribe's reservation.

Project Restores Habitat, Function to Floodplain

Hansen Creek, a tributary to the Skagit River near the Upper Skagit reservation, is the site of a freshwater floodplain reconnection project, restoring 53 acres of alluvial fan and 87 acres of riparian wetland. Project construction began in 2009 within Skagit County's Northern State Recreation Area Park (726 acres).

Historically, the project site was agricultural land associated with the Northern State Hospital. This project helped address the 53% of Skagit River agricultural floodplain that has been impaired according to the Skagit Chinook Recovery Plan. Project objectives were fulfilled by restoring floodplain connectivity and natural geomorphic processes, enhancing fish habitat, and eliminating downstream dredging and flooding.

The historically dredged and diked creek channel was reconnected to its floodplain via a series of notches and constructed channels. More than 1,300 pieces of large woody debris were installed and 105,000 native riparian and wetland plants were planted.

Since project completion, there have been dramatic improvements in the habitat. Stream length and complexity have increased several-fold and the creek now meanders around large log structures instead of being constrained to the dike channel. Planted vegetation, complemented by naturally recruited vegetation, is flourishing. Sediment loads are trapped within the project rather than deposited in the diked channel. Reduced sediment and flood flows have engaged downstream agricultural interests to further advance farm/fish improvements.

Lack of Funding Limits Recovery Progress

Implementation of the Water Resource Inventory Area (WRIA) 3&4 Salmonid Recovery Plan is lagging behind the pace originally anticipated during plan development in 2006.

Restoration work has progressed with numerous capital projects focused on restoring fish habitat and passage. However, WRIA 3&4 has faced significant funding shortages for restoration projects, limiting implementation. Progress also has lagged on implementing the regulatory and incentive programs to protect and restore salmon habitat and habitat forming processes.

Numerous shoreline management plans within WRIA 3&4 are still in the process of being updated and action still needs to occur on regulatory gaps such as agriculture buffers and FEMA's Flood Plain Insurance Program.

A major element of the 2006 Skagit Recovery Plan relies on revisions to state and national environmental regulatory programs that have proven difficult to adjust to address the needs of the salmon resources in the Northwest.

A young tribal member harvests clams. Nearshore water quality is threatened by increased pollution, leading to frequent closures of shellfish beds in traditional tribal gathering areas.

Pollution, Impervious Surfaces Degrade Habitat

At the 5-year mark, a review of key environmental indicators reveals a continued decline in habitat quality and quantity.

Shallow nearshore habitat is still subject to degradation. The Whidbey basin remains unprotected from further nearshore development. Shoreline modifications have contributed to the loss of beach berm, shallow beach and pocket estuary habitat that provides salmon rearing and foraging.

The modifications also contribute to the reduction of forage fish spawning habitat. Only 44% of documented sand lance and surf smelt spawning habitat in the Whidbey basin has not been modified.

In addition, nearshore water quality also remains an issue. In 2010, elevated fecal coliform bacteria levels in Samish Bay resulted in the emergency closure of the "approved" shellfish growing area 14 times. The following year more than 90%, or approximately 4,000 acres, of "approved" shellfish growing was downgraded from "approved" to "conditionally approved." This occurred in spite of an intense effort to solicit voluntary actions to address water quality issues within the adjacent drainages.

The Skagit Chinook Recovery Plan recommended that impervious surface area be kept below a threshold of 7% in any tributary watershed. Increases in impervious surface area as result of development disrupt both ground and surface water ecology with negative consequences to stream health and productivity. Impervious surface has increased 25% between 1986 and 2006, with 79% of the increases occurring within the floodplain or in the catchments immediately draining into the floodplain.

The Skagit Watershed Council has identified this habitat as of critical importance and essential to the maintenance and recovery of salmon within the river system. Long-term trend forecasts indicate that without modifications of land-use regulations, these impacts will further spread and intensify within the delta and lower reaches of the Skagit watershed.

The middle section of the Skagit River also is facing further development pressure and habitat loss. The Skagit Chinook Recovery Plan contained recommendations to protect floodplain forests and restore those that are impaired. Within the middle reaches of the Skagit River, 48% of the floodplain forest is impaired and 52% is forested.

Agricultural land comprises 73% of the middle Skagit River floodplain, and 53% of agricultural floodplain is cleared, developed, has roads, or is otherwise impaired.

Associated with this impairment is the continued riprap armoring of the river bank to control channel migration and erosion. Riprap has negatively impacted riverine ecology and salmon productivity. There is an estimated 15 miles of riprapped shoreline along the middle Skagit River, a mile of which has been added since 1998.

Additionally, there are at least 88 non-linear hydromodifications along this stretch of river, everything from boat docks to old cars.

Salmon Vulnerable to Temperature, Flow Changes

Historically, the Skagit River relied upon glaciers for 8-12% of its summer stream flow. Since 1993, the Skagit River has experienced a net loss of 400 billion gallons of ice, or one month of continuous flow, for the entire basin.

Low summer flow can adversely affect chinook by dewatering off-channel habitat, increasing stream temperature, increasing predation, and reducing available habitat.

Conversely, flooding has been identified as having the greatest impact on egg-to-migrant fry survival. While shrinking glaciers are associated with lower summer flows, they also appear associated with higher fall flows, because less storage of precipitation as snow and ice means more immediate runoff as water.

Evidence from Bacon Creek in the Skagit watershed suggests that the spawning window for chinook is later, when summer low flows trend lower. As a result, eggs are more vulnerable to the increased fall flows during the incubation period. Potential threats to both salmon spawning and incubation posed by shrinking glaciers put even more pressure on watershed planners to manage for instream flows based on the life history-based biological needs of anadromous salmon.

Protecting and increasing canopy cover within the watershed also will become increasingly important as weather patterns in the northwest continue to change.

Above: The Skagit River was established as a Wild and Scenic River System by the U.S. Congress in 1978. The system includes 158.5 miles of the Skagit and its tributaries, the Sauk, Suiattle and Cascade rivers. Below: Pink salmon spawn in habitat that was created as a result of the Upper Skagit Tribe's Hansen Creek restoration project.

Looking Ahead

Population growth and associated development within Skagit County will continue to pose challenges to salmon conservation and recovery efforts. Current trends indicate that land-use regulation reform is required and continued funding of habitat restoration activities is necessary in order to achieve the agreed-upon recovery goals.

Restoration work within the Skagit River Watershed has not kept pace with the goals of the Recovery Plan. Upgrading the regulatory framework that serves to protect salmon habitat must occur if the underlying assumption to all the recovery goals is to be realized: that existing habitat will be protected from loss. The current regulatory framework clearly has not provided adequate protection of the water quality and riparian habitat within the basin and nearshore areas.

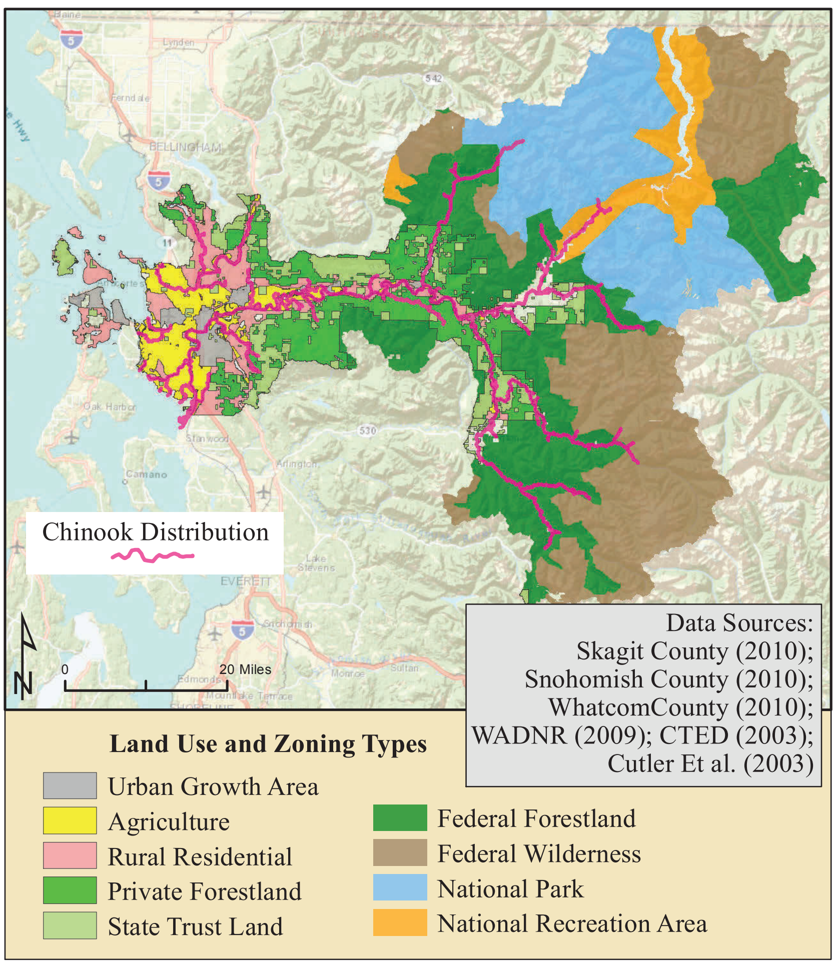
The Upper Skagit Indian Tribe -- Skagit River Watershed

With a 3,100 square-mile watershed, the Skagit River is the largest in the Puget Sound and the third largest on the West Coast of the continental United States. It provides 30% of the Puget Sound's freshwater input. The Skagit River originates in British Columbia, and flows south into Washington State before continuing westward through Skagit County and into the Sound. The upper half of the watershed is primarily within the National Forest and the North Cascades National Park, and the lower half mainly comprises of private forest, agriculture, rural residential, and urban residential lands. The Baker River, Sauk River, and the Cascade River all flow within the Skagit River watershed.

The region's only major complex of dams is on the Upper Skagit River. The Diablo, Ross, and Gorge dams provide about 25% of Seattle's energy. There are also two dams on the Baker River.

The Skagit River is home to all six species of Pacific salmon, including steelhead. It has the healthiest and largest runs of wild Chinook and pink salmon in the Puget Sound (SSPS, 2007).

The Upper Skagit Tribe has occupied lands along the Skagit River and throughout the watershed since time immemorial. The watershed provides them with an abundance of fishing, hunting, and gathering opportunities. The Tribe's administrative offices remain in the Skagit watershed east of Sedro-Woolley.

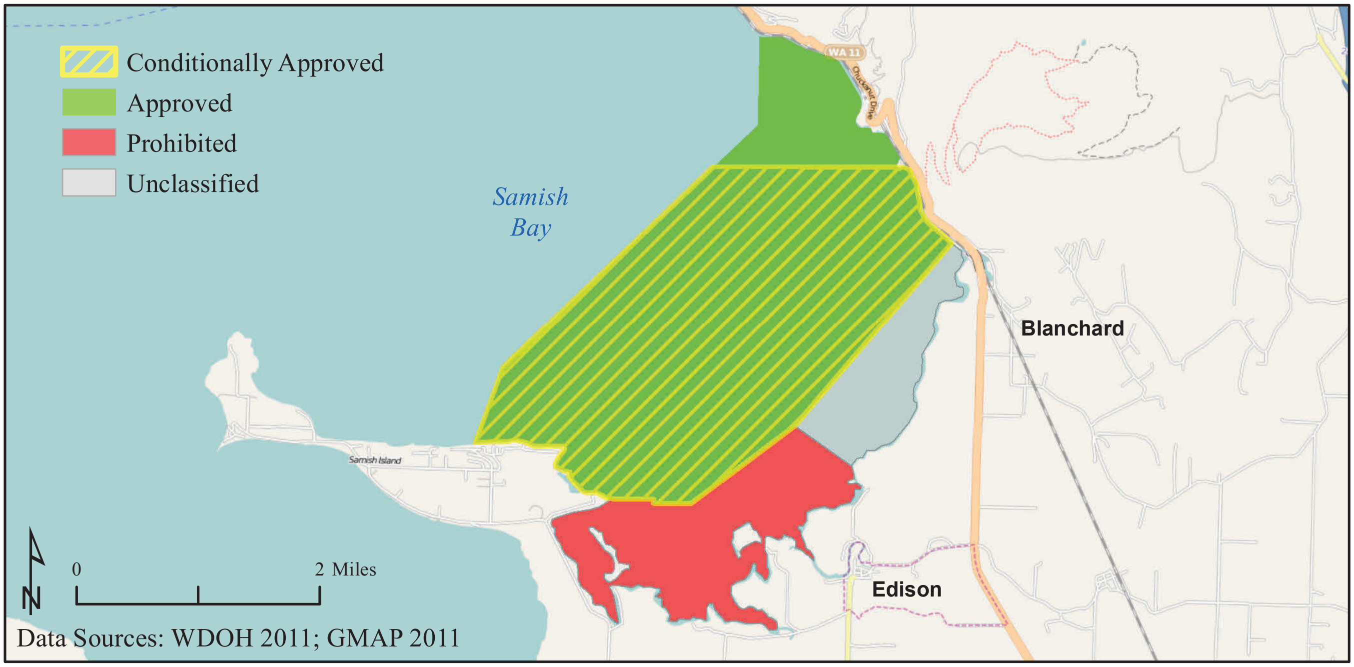


Since European settlement, land use in the watershed has been dominated by natural resources. The foothills and mountains have been mainly used for wood products, mining, and outdoor recreation. The river valleys, the delta, and the coastal areas have been used for agriculture, industry, commerce, and residential development. There are over 104,000 residents in the Skagit watershed. Population growth in the watershed is forecasted to be 46% between 2000 and 2020 (SSPS, 2007).

The last 150 years of human land use has resulted in declines in Chinook productivity, yet the Skagit River watershed remains one of the healthiest in the Puget Sound. The Skagit Chinook Recovery Plan provides a strategy for both protection and targeted restoration. It will take federal, tribal, state, and local leadership to provide a consistent yet adaptive plan to control the future impacts of land use in the watershed.

Samish Basin Fecal Coliform Pollution Threatening Tribal Shellfish Harvest in Samish Bay

Samish Bay is an important bay for shellfish resources, both economically and ecologically. User groups include shellfish growers, recreationists, and members of five different Tribes who have reserved rights to collect fish and shellfish from the bay. The ability to exercise this right has been put into jeopardy by fecal pollution runoff through the entire Samish watershed.



Bivalve shellfish growing areas are managed according to the requirements of the National Shellfish Sanitation Protocol, which is administered by the Food and Drug Administration. Since 1982, water quality has been monitored to ensure compliance, and numerous efforts to control fecal coliform pollution into the bay have been implemented. The city of Edison has installed a wastewater treatment plant, hundreds of On-Site-Septic systems have been inspected and repaired, and many farm plans have been developed for livestock owners.

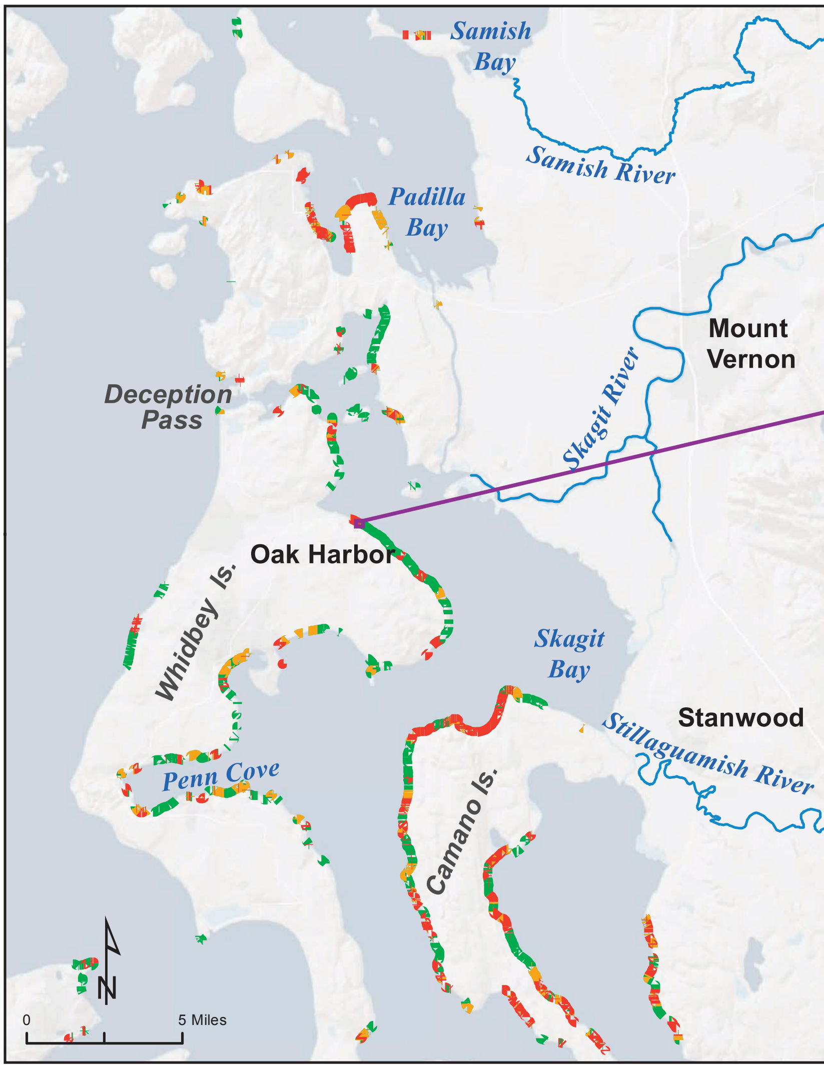

Shellfish harvest for the Upper Skagit Tribe's Blessing of the Fleet (NWIFC 2011)

In spite of these efforts, April 2010 found a downgrade in status of the bay from “Approved” to “Conditionally Approved.” The Clean Samish Initiative, a joint partnership led by Skagit County, state resource agencies, shellfish farmers, local business and conservation groups, and area Tribes have created a plan to focus cleanup efforts in the watershed to address the problem of fecal pollution. With a collective pool of funds totaling over $1,000,000 and commitments from agencies and individuals to clean up land use activities, there is hope that Samish Bay can be upgraded back to “Approved” status.

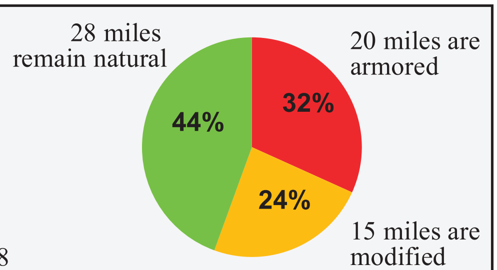
The Upper Skagit Indian Tribe has recently acquired 80 acres of shellfish beds in Samish Bay, with the goal of providing ceremonial, cultural, and subsistence shellfish resources to its members. The Samish Bay shellfish closures are impeding the Tribe's ability to exercise Treaty Rights of providing resources to Tribal members. Future economic development plans of establishing a shellfish farm are also currently suspended due to the uncertainty of a viable protected resource.

Surf Smelt and Pacific Sand Lance Habitats Need Local Protection from Future Nearshore Development

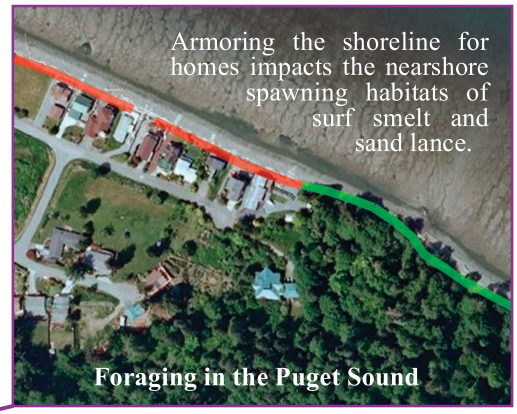
Pacific sand lance and surf smelt spawning beaches are protected through the State's Hydraulic Code Rules, the State's Growth Management Act (GMA), and State's Priority Habitats and Species (PHS) Program, yet these habitats remain vulnerable to shoreline armoring and modification (Penttila, 2007). An estimated 32% of documented Pacific sand lance and surf smelt spawning habitat in the north Whidbey basin, Padilla bay, and Samish bay is currently armored, and an additional 24% is modified from its natural state to some degree. Armoring and modification interrupt the movement of gravel and sand on these beaches and negatively impact spawning habitat as a consequence. With only 44% of documented spawning habitat remaining unmodified, it is critical that State of Washington and Island and Skagit Counties make full use of the laws and programs in place to keep any further modification or armoring of Pacific sand lance and surf smelt habitat from occurring.



Current Conditions of Documented Pacific Sand Lance and Surf Smelt Spawning Beach Habitat



Data Sources: WDFW 2006; SSHIAP 2008; PSNERP 2008



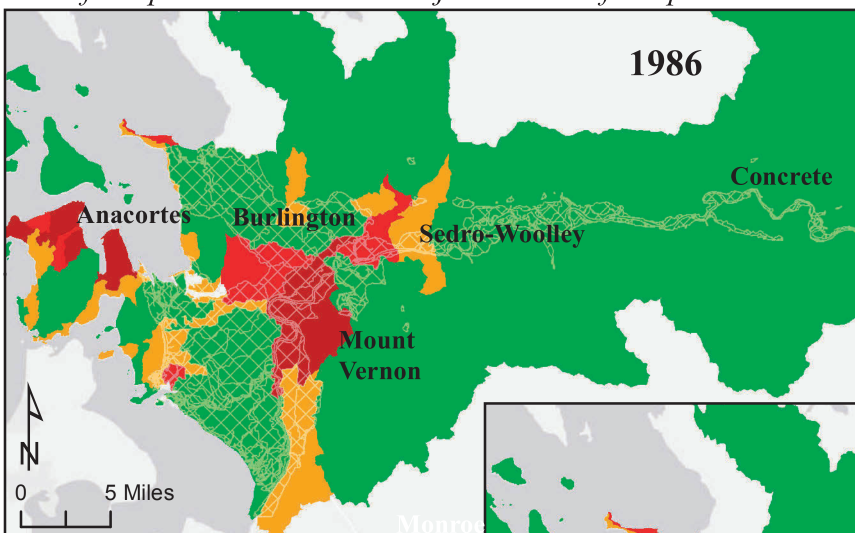
Foraging in the Puget Sound

In Puget Sound ecology, sand lance and surf smelt are an important food for larger fish, marine mammals, and seabirds (WAECY, 2010). Sand lance is recognized as being one of the most important components of a juvenile Chinook's nearshore diet (Duffy Et al., 2010).

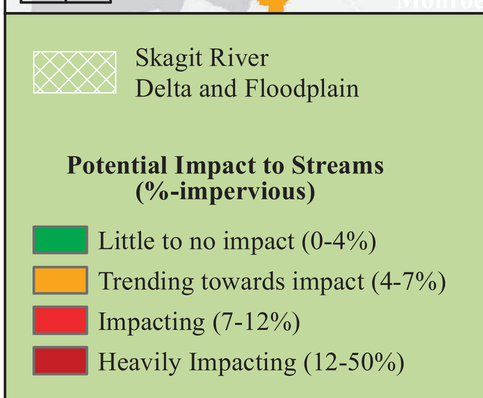
Sand lance and surf smelt spawn exclusively on sand and gravel beaches, making them especially vulnerable to the degrading effects of shoreline modification and armoring in these areas (WAECY, 2010).

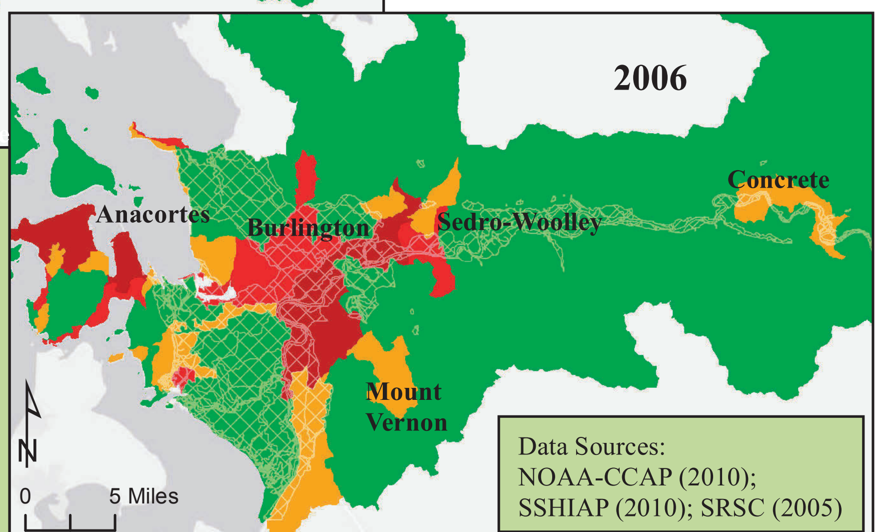
Impervious Surface Increases in the Skagit Basin Threaten Streams If Development Continues As Planned

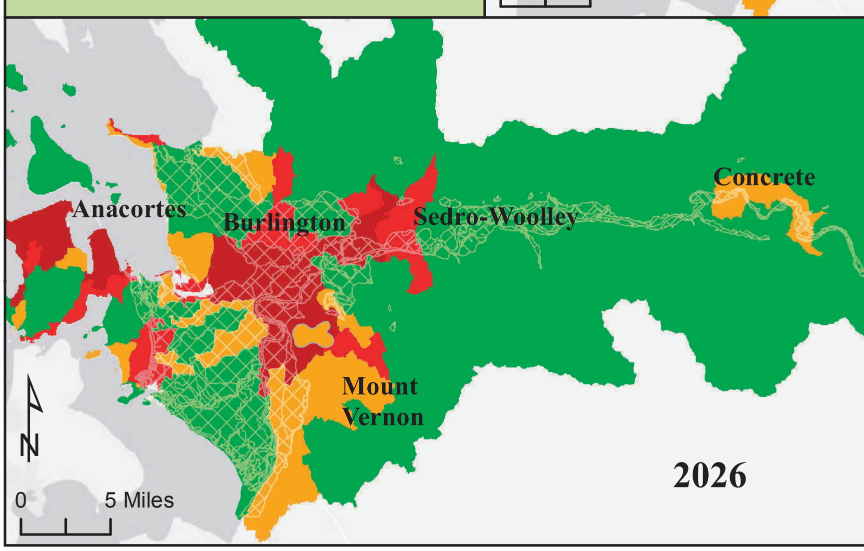
Impervious surface is well documented as a coarse measure of human impact on watershed scale hydrology and biology (Alberti Et al., 2007; Booth Et al., 2002; Booth and Jackson, 1997). The Skagit Chinook Recovery Plan warns that over 7% impervious surface in a watershed can result in down cutting of the stream channel and degradation of instream habitats. They warn that some Skagit basin watersheds may exceed 7% impervious surface at full build-out of the current comprehensive plan. A 25% increase in impervious surfaces from 1986 to 2006 in the Skagit River basin offers some evidence for the concerns of the Recovery Plan. Compounding those concerns, 79% of the increases were either in the floodplain or in the area adjacent to the floodplain.



In 1986, potentially "impacting" impervious surfaces (>7%) were primarily associated with Mount Vernon, Burlington, and Anacortes. By 2006, the potential impact of impervious surfaces had spread south of Anacortes, north of Burlington, and east into Sedro-Woolley. Also by 2006, the area around Concrete had begun to "trend" towards impacting impervious surfaces (4-7%).



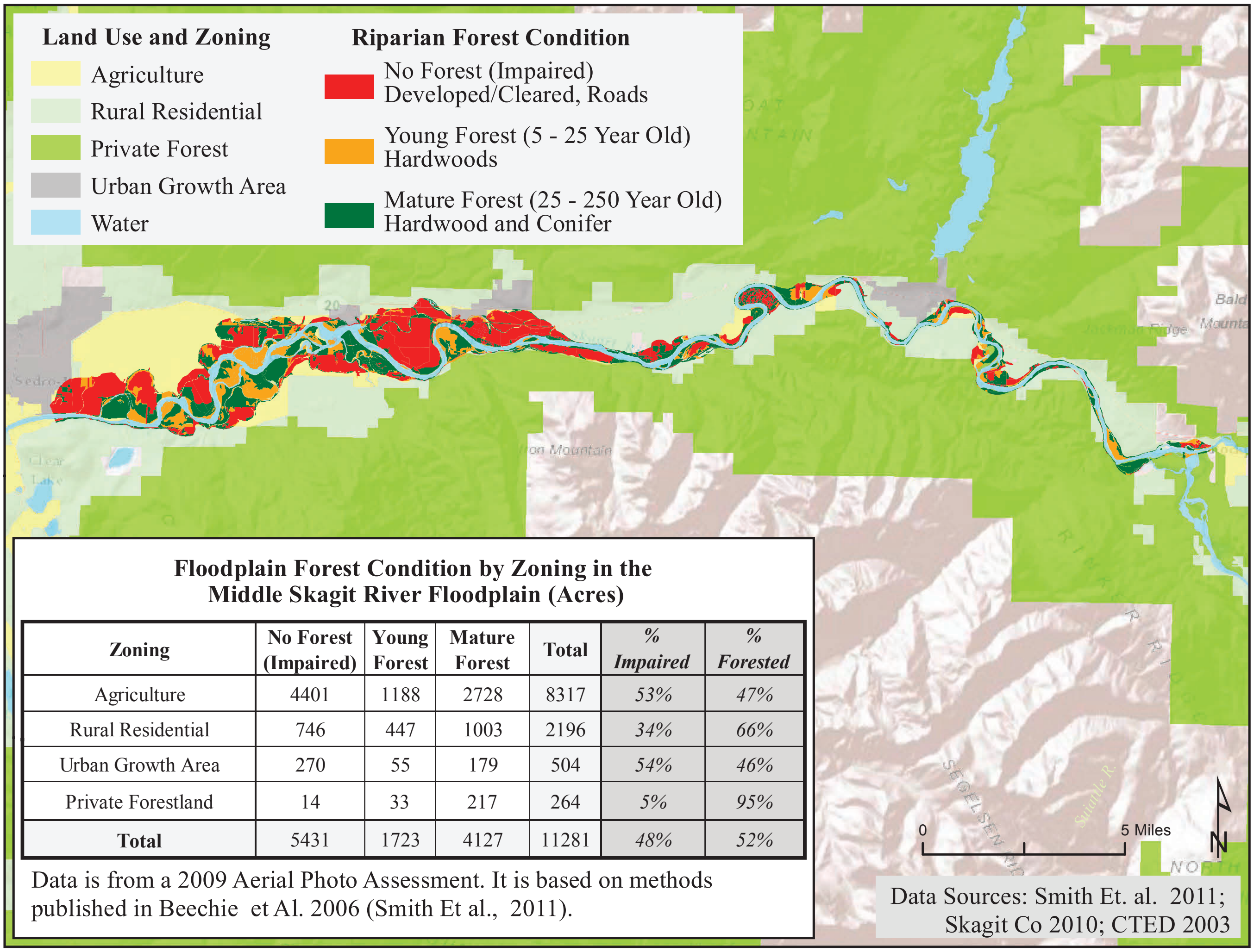




If impervious surfaces continue to expand as they did from 1986 to 2006, impacts will intensify throughout the lower Skagit delta and floodplain. The core of Mount Vernon and Burlington will be heavily impacted by impervious surface (12-50%). Burlington east to Sedro-Wooley will be heavily impacted, and north and east from Sedro-Wooley will be potentially impacted (7-12%). Impacts will also continue to intensify in and around Anacortes and along most of the shoreline of Fidalgo Island.

Agriculture and Rural Residential Lands Determine Forest Condition in the Middle Skagit River Floodplain

According to the Skagit River Chinook Recovery Plan, the floodplain needs to supply a consistent source of organic inputs and large woody debris for Chinook habitat in the Skagit mainstem. This requires a floodplain dominated by forest cover. Land use in the middle Skagit River is preventing the establishment of forest cover. The floodplain is 48% impaired (maintained clear of forest cover) and only 52% is forested. Agricultural lands alone make up 73% of the middle Skagit River floodplain, and they are 53% impaired. Rural Residential lands make up an additional 19% of the floodplain, and are 34% impaired.



Floodplain Forest Condition by Zoning in the Middle Skagit River Floodplain (Acres)

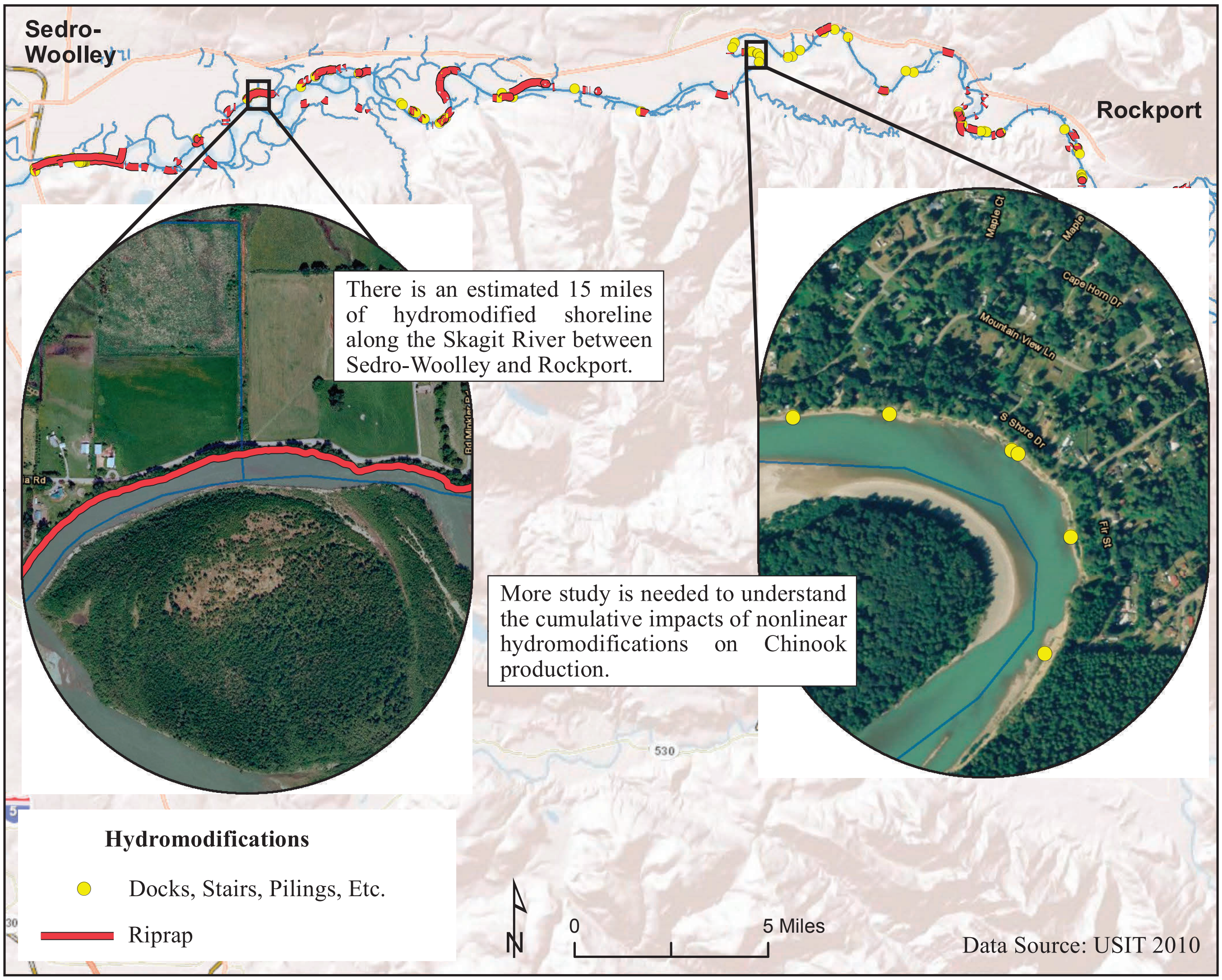
Zoning	No Forest (Impaired)	Young Forest	Mature Forest	Total	% *Impaired*	% *Forested*
Agriculture	4401	1188	2728	8317	*53%*	*47%*
Rural Residential	746	447	1003	2196	*34%*	*66%*
Urban Growth Area	270	55	179	504	*54%*	*46%*
Private Forestland	14	33	217	264	*5%*	*95%*
Total	5431	1723	4127	11281	*48%*	*52%*

Data is from a 2009 Aerial Photo Assessment. It is based on methods published in Beechie et Al. 2006 (Smith Et al., 2011).

Most of the impaired floodplain forest needing restoration and the healthy floodplain forest needing protection fall on agriculture and rural residential lands. Guided by recommendations in the Skagit River Chinook Recovery plan, the floodplain forest condition data used in this assessment was collected for the Skagit Watershed Council to target priority reaches for Chinook habitat restoration and protection actions (Smith Et al., 2011). According to the Chinook Recovery Plan, in addition to targeting for restoration actions and conservation purchases, Floodplain riparian habitat protection also requires an adjustment of land use regulations. Agriculture areas can no longer remain exempt from the riparian area protections provided in the Shoreline Management Act (SMA), and small forestland owners (on both agriculture and rural residential lands) can no longer remain exempt from the riparian protections of the Forests and Fish Agreement (SRSC; WDFW, 2005). Closing these exemptions will help targeted restoration and protection efforts result in positive habitat gains, as opposed to those efforts simply providing a buffer against future habitat loss.

Hydromodifications on the Middle Skagit River Continue to Limit the Productivity of Chinook Salmon

Sub-yearling juvenile Chinook have been shown to use hydromodified riprap banks at densities 5-times lower than natural banks (SRSC; WDFW, 2005; Beamer and Henderson, 1998).The Skagit Chinook Recovery Plan recognizes that riprap armoring of river banks to control channel migration and erosion negatively impacts Chinook productivity, and recommends no new construction of riprap without mitigation. Since 1998, at least 1 mile of riprap hydromodification has been added to the already 14 miles of riprap shoreline along the middle Skagit River. This is in addition to at least 88 nonlinear modifications like boat docks, stairs, or cars dumped into the river. This evidence suggests that instead of a net loss or no net gain in hydromodification in the middle Skagit, there has been a net gain in modified shoreline in the first 5 years of the Skagit Chinook Recovery Plan.

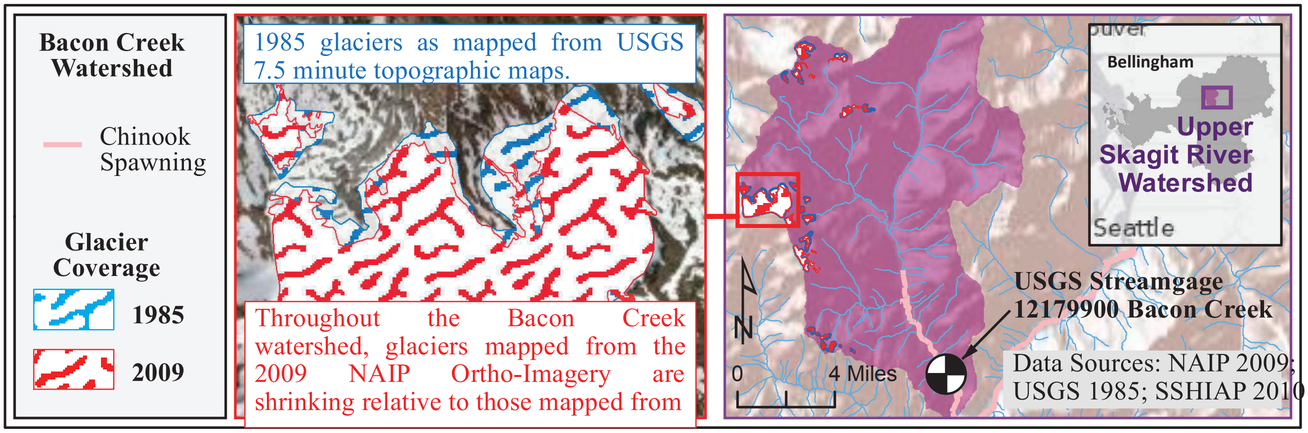


The Skagit Chinook Recovery Plan calls for removal and/or relocation of dikes and levees wherever possible. Beginning with the Skagit Chinook Recovery Plan and continuing with the Skagit Watershed Council, a strategy for acquiring floodplain parcels and removing riprap has been developed in the middle Skagit River. Much of the strategy remains conceptual, however, and there is no clear evidence of riprap removal in the middle Skagit River since 2005.

Additional review of past and future permitting of these hydromodifications needs to be conducted. It is clear that existing protection measures are not adequately protecting valuable instream and riparian habitat.

Shrinking Skagit Watershed Glaciers Threaten Salmon

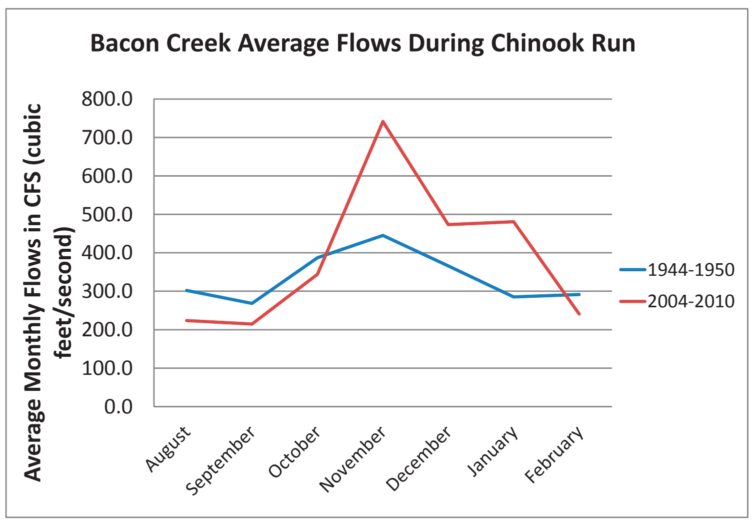
The upper Skagit River watershed is significantly influenced by glacial coverage. In the fall and winter, glaciers increase the ability of the mountains to hold and store precipitation as snow. In the summer, glacier and snow melt help to moderate low flow conditions in the watershed's streams and rivers. Since 1993, the Skagit River has experienced a net loss of 400 billion gallons of ice, or one month of continuous flow for the basin (Riedel, 2011). Long-term evidence of shrinking glaciers in the Skagit River watershed and the resulting impacts means that the Viable Salmon Population recovery parameters are in jeopardy.



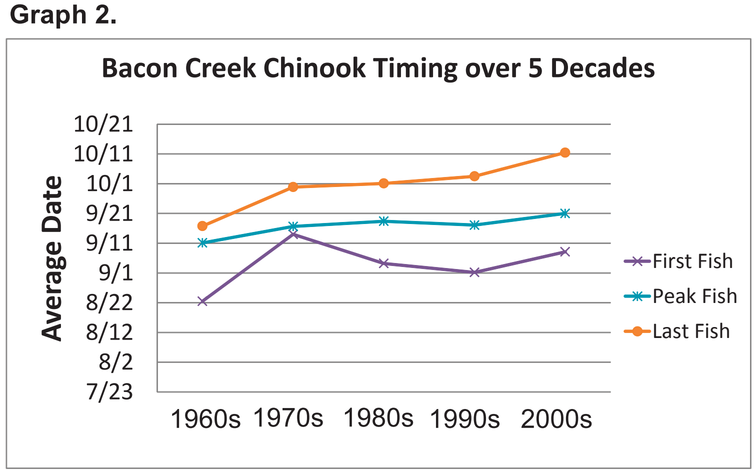
Summer low flows can adversely affect Chinook and other salmonids through dewatering of off channel habitat, increased stream temperature, increased predation, and reduction of available mainstem habitat. Conversely, flooding has been identified as having the greatest impact on egg to migrant fry survival due to scour and sedimentation of vulnerable embryos in the gravel (SRSC; WDFW, 2005).

The hydrograph of Bacon Creek – a glacially influenced upper Skagit River tributary – shows average monthly flows during the time periods of 1944-1950 and 2004-2010. Graph 1 highlights two trends that have the potential to impact Chinook recovery efforts. The August to October time frame occurs during Chinook spawning, and November to January is the egg incubation window. During the spawning window, flows have been reduced by almost 1/3, reducing access to the river and available habitat. During the incubation period, flows have almost doubled, putting egg to fry survival at risk. Chinook are responding to the changing flows as can be seen in the Graph 2.

Graph 1.



Graph 2.



Summary

The challenges facing the recovery of salmon and other species are not limited to one particular habitat problem. A combination of problems and the accumulation of habitat impacts throughout the Skagit River system are hastening the decline of Skagit River salmon. The Skagit Chinook Recovery Plan recognizes the multitude of habitat problems, and has targeted recommendations to fix them. These recommendations need to be implemented in order to restore the Tribe's treaty-protected resources.

Some of the challenges to habitat recovery are:

- Approximately 56% of documented Pacific Sand Lance and Surf Smelt spawning habitat has been modified by human development.
- Continually high levels of fecal pollution in the Samish watershed are forcing conditional closures of shellfish harvest in Samish Bay.
- Impervious surfaces in the Skagit River basin increased by 25% between 1986 and 2006.
- Floodplain forest cover is 48% impaired in the Skagit River floodplain between Sedro-Woolley and Rockport, and most impaired floodplain forest falls on agricultural lands.
- There remains an estimated 15 miles of hydromodified shoreline along the Skagit River between Sedro-Woolley and Rockport.
- Since 1993, the Skagit River has experienced a net loss of 400 billion gallons of ice, or one month of continuous flow for the basin (Riedel, 2011).

All of these conditions combined mean that recovery of salmon and shellfish resources remains in jeopardy.

Salmon habitat in the Skagit River basin and along the Skagit-Whidbey basin nearshore was completely altered during the 20th century and now a fight is under way to protect what is left and to restore some pieces of what was lost. At the same time, this area continues to be home to over 100,000 residents with different perspectives on what is needed of the river going forward. For the Upper Skagit Tribe, what is needed is an environment that supports increasing numbers of returning salmon, and healthy shellfish beaches. Development and implementation of policy at the federal, state and local government levels will need to improve for either to happen.

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2012 State of Our Watersheds Report

Report Development Process

The 2012 "State of Our Watersheds" (SOW) Report is the third edition in a series of reports to depict salmon and steelhead habitat conditions in western Washington. Previously, reports were produced for years 2004 and 2005, analyzing uniform datasets across the Water Resource Inventory Areas 1-23. In this report, a different approach was taken to better reflect tribal focus. The 2012 edition is a composite of analyses conducted for our member tribes on critical areas and habitat indicators within their watersheds.

The report is intended to provide a basic assessment of habitat conditions and gauge progress toward habitat recovery. The 2012 SOW is structured to provide a benchmark in time for habitat conditions and highlight habitat categories that require more protection or further regulatory relief. From a broader perspective, it is anticipated that the report's basis assessment will be used in other processes to focus more involved and detailed analyses on how habitat protection and/or recovery is progressing. The report offers a picture of the status and trend of the habitat conditions and a progress check on the implementation of the 2007 Puget Sound Salmon Recovery Plan.

The 2012 SOW report began in summer of 2009, with the Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) proposing a new report format. The purpose of the format change was to develop a more meaningful and relevant report for the tribes to their current situation. NWIFC staff and tribal representatives worked jointly to develop a basic assessment approach to analyze current habitat recovery and protection efforts within western Washington. The proposed approach was presented to the NWIFC Commissioners during their November 2009 regular Commissioner's meeting, at which the project was overwhelmingly approved and endorsed.

The project commenced in November 2009 and continued until August 2012. The first phase was to complete two pilot chapters: Tulalip and Skokomish, followed by the completion of the remaining eighteen tribal chapters and two regional reports. The two regional reports used the common set of indicators selected by each region's tribes. The SSHIAP program started each chapter by meeting with each tribe's natural resources staff for the express purpose of learning about their area and habitat concerns. By the end of these tribal meetings, the tribes had identified their area of concern or focus area and selected a set of indicators to be analyzed. An important caveat in the selection of the indicators was the availability of data. If the data was not readily available, an alternative indicator was then selected. SSHIAP proceeded to complete the analysis of the indicators and produced a draft document for tribal review. The tribe then

completed various levels of review from staff level to policy to produce their final chapter. The analysis uses an array of data and sources including the tribe's own data, the Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) data, Washington State and Federal data.

Overall, the tribes are committed to the principle that the key to salmon recovery and sustainability is the preservation and enhancement of aquatic habitat. Our desired outcome for the SOW report is to bring to light the management decisions that are being made to protect salmon and steelhead habitat and those being imposed on the tribes' treaty-protected hunting, gathering and fishing rights. In addition to the final report, the SSHIAP program will retain the data and documents used to complete this report and be ready to update the report as new data or information arises.

Future additions to this report will include new additional pages to the tribal chapters and new chapters such as Oceans, San Juan Islands and an assessment of habitat improvements at the 10-year planning window for the Puget Sound Chinook Salmon Recovery Plan.

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