

# 2016 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.*

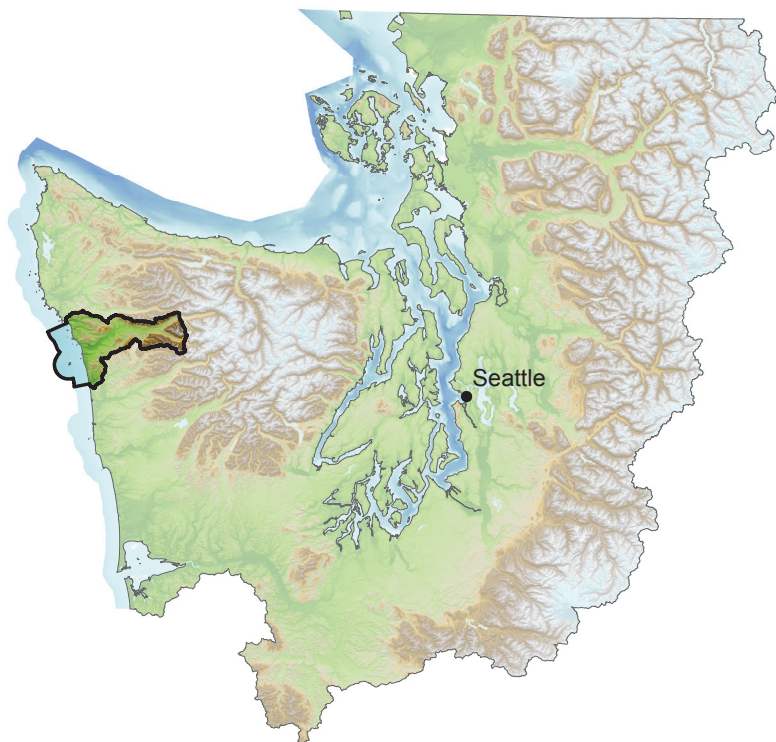
**- RICHARD SHERIFF,  
HOH TRIBE**



## Hoh Tribe

*Chalá-at: People of the Hoh River*

The Hoh River Indians are a federally recognized Tribe located about 28 miles south of Forks and 80 miles north of Aberdeen. The original Hoh Indian Reservation was 443 acres but through property acquisitions, the Tribe now has a total of 908 acres in Trust, which includes 648 acres of productive forestland. The Reservation has approximately one mile of beach front running south from the mouth of the Hoh River toward Ruby Beach. The Hoh Tribe is a river-based fishing community that is dependent on the fish, wildlife, and other natural resources of the Hoh River watershed for their subsistence and commercial economy. Protection of the watershed's functions is therefore key to meeting the cultural and economic needs of the Tribe.



# Land Management Limits Salmon Production

The Hoh Tribe's Area of Concern comprises portions of WRIAs 20 and 21 along the west side of the Olympic Peninsula 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 there, 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. This Area of Concern is dominated by state and private forestlands and includes the Hoh Rain Forest, a large temperate area protected from major anthropogenic changes within the Olympic National Park.

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 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 Olympic National Park, but downstream of the

park, considerable habitat problems exist.

A limiting factors analysis conducted by the Washington State Conservation Commission identified several factors limiting salmonid production in the basin: fish-access problems from culvert passage and cedar spalts; increased stream sedimentation; altered riparian areas; scoured, incised channels with few spawning gravels; and large woody debris.<sup>1</sup>

A Watershed Plan was developed to address these limiting factors with specific actions and management strategies. The strategies involved:

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

## Landscape-Scale Problems Difficult to Address

A review of key environmental indicators for the Hoh basin area shows a reduction in the number of forest practice applications, and the removal of forest road barriers and invasive species, but degradation of water quantity and quantity, degradation of freshwater shoreline habitat conditions, and degradation of floodplain and riparian processes. In general, there is a shortage of staff at all levels (e.g., federal, state, tribal, county) needed to address the issues and implement actions to restore and protect habitat and to monitor and enforce compliance of existing regulations. In addition,

funding shortfalls for large-scale projects contribute to the slow pace of progress.

There is a misconception that the Hoh watershed is relatively pristine and its fish stocks are healthy, but the system has been heavily impacted by timber harvests, road construction, infrastructure protection and other anthropogenic influences.

In spite of efforts to improve fish access, current and past logging practices continue to degrade fish habitat, water quality, hydrologic function and other ecological processes.

Review of the trend for these key environmental indicators since the 2012 State of Our Watersheds Report shows improvement for some indicators and a steady loss for others in habitat status:

Tribal Indicator	Status	Trend Since SOW 2012 Report
Water Quality	Between 2006 and 2015, all but one of the major salmonid (Chinook, coho and steelhead) tributaries to the Hoh River had summer water temperature values which exceeded the Washington State numeric water quality standards. These exceedances will likely have a significant impact on salmonid survival and production in these watersheds.	Declining
Water Quantity - Peak Flows	From 1960, peak flows have shown an increasing trend on the Hoh mainstem. If this trend continues as anticipated under predicted climate change conditions, this may pose a significant impact to salmonid runs.	Declining
Water Quantity - Low Flows	From 1960, low flows have shown an decreasing trend on the Hoh mainstem. If this trend continues as anticipated under predicted climate change conditions, this may pose a significant impact to salmonid runs.	Declining
Timber Harvest	From 1996 to 2010, 24 square miles (1.7 square miles/year) of forestlands were harvested in the Hoh Tribe's Area of Concern. Since 2010, an additional 1.6 sq miles (2010-2014 0.4 square miles/year) of forestlands have been permitted for harvest which may indicate a slower rate of activity, although Forest Practice Applications do not cover all the activities on the ground. Most of the recent activity has been in the Goodman Creek watershed and in areas that are predominately private forestlands.	Concern
Forest Roads	As of 2014, about 47% of the 764 culverts identified under the Road Maintenance and Abandonment Plans (RMAP) in the Hoh Area of Concern have been repaired, while the other 53% remain to be repaired by 2021.	Improving
Road Densities	6 watersheds, representing 72% of the land area, may not be properly functioning because of road density values that exceed 3 miles/square mile.	Declining
Shoreline Modifications / Freshwater	The mainstem of the Hoh River has over 3.7 miles of riprap between river miles 1 and 37. Since 2012, there have been at least 4 new riprap projects, and there is no indication that any riprap was removed.	Declining
Invasive Species	A multi-year effort initiated in 2002 by the Hoh Tribe to control the invasive knotweed plants along 30 miles of the Hoh River riparian zone has resulted in the eradication of about 99.5% of the plants. However, other invasive species such as Scotch broom, herb Robert and Reed canarygrass continue to spread in the watershed.	Concern



The Hoh Tribe is concerned that the failure to address climate change issues may negatively impact the natural and cultural resources that tribal members depend on. Also of concern is the continuing and planned increase in military activities in the watershed and their potential impact on human and environmental health. One positive development is the acquisition and protection by Hoh River Trust of 7,000 acres of primarily riparian lands in the watershed.

The Tribe continues 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 habitats they occupy.

## 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.

While the Hoh River basin continues to support native runs of salmonid species, there are significant fish habitat threats, both anthropogenic and natural. Land-use practices particularly associated with forestry activities continue to alter watershed processes, resulting in stream-channel degradation. Streamflow changes and high water temperature values may be the result of forest activities or climate change. The protection and restoration of fish habitat is needed to ensure that the currently declining salmon runs return to a healthy status.

While the Hoh Tribe continues to advocate for increased resource protection, inadequate support from state and federal regulatory agencies is an ongoing hindrance.

In an effort to address rapidly declining



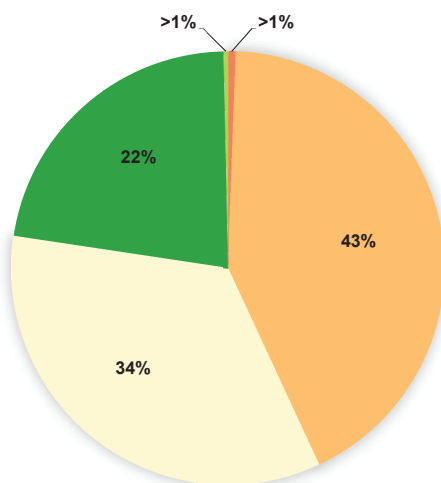
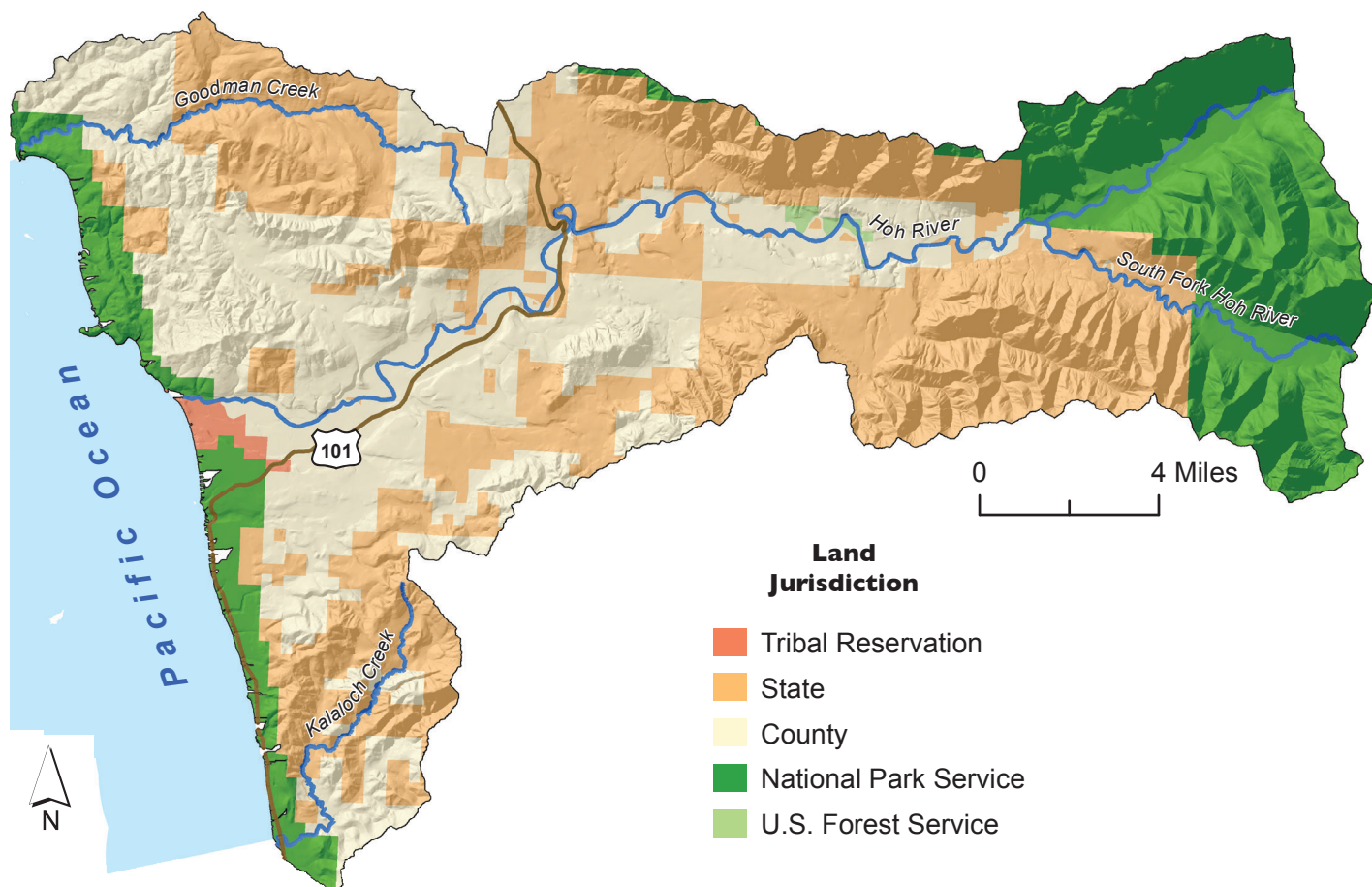
Hoh tribal fisheries technician Ruben Hernandez and his daughter Kandace walk along the Hoh River during a summer program designed to connect tribal children to the whole river, not just the part in their village.

habitat conditions and severely impaired riverine processes, the Hoh Tribe is initiating the development of a Hoh watershed restoration plan. This plan will be used, in part, to seek funding for more environmentally compatible alternatives to common infrastructure protection techniques, such as riprap bank armoring.

Other efforts include implementation of the Hoh Water Adventure which provides Hoh Tribal members with the opportunity to learn about cultural and natural resources, as well as management concerns and strategies.

# Hoh Tribe

## Hoh River Watershed and Independent Tributaries



The Hoh Tribe's Area of Concern comprises portions of WRIs 20 and 21 along the west side of the Olympic Peninsula from Goodman Creek south to Kalaloch Creek. The largest basin in the area is the Hoh River's, which originates at the Hoh Glacier on Mount Olympus. From there, it flows westward through 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.

This Area of Concern is dominated by state and private forestlands and includes the Hoh Rain Forest, a large temperate area protected from major anthropogenic changes within Olympic National Park.

Within the park, the Hoh and South Fork Hoh rivers have some glacial input. The discharges of streams outside the park are rainfall dominated with a mean annual precipitation in the range of 140

to 165 inches, the highest in Washington state. This basin supports all five species of Pacific salmon as well as steelhead and cutthroat trout.<sup>1,2,3</sup> The Hoh River, some adjacent shoreline and tributaries are designated critical habitat for bull trout.<sup>4</sup> There are whitefish, numerous species of lamprey, cottids, stickleback, Olympic mudminnow, and possibly several species of dace that are indigenous to the Hoh Tribe's Area of Concern.<sup>5,6</sup>

Several factors limit salmonid production in the basin downstream of the park.<sup>7</sup> These include fish access problems from culverts and cedar spalts, increased stream sedimentation, elevated stream temperatures, altered riparian areas, as well as scoured, incised channels with few spawning gravels and large woody debris. The WRIA 20 Watershed Plan includes specific actions and management strategies for addressing these limiting factors.<sup>8</sup>



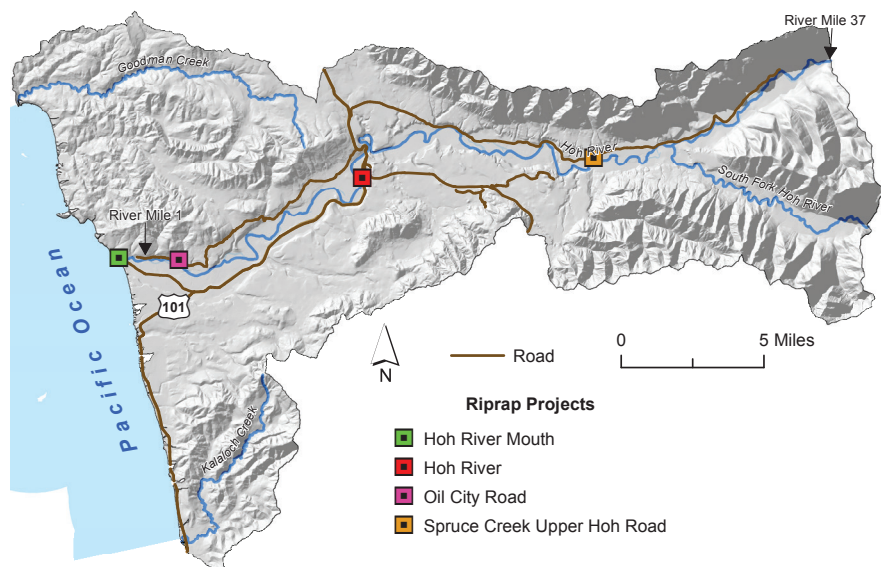
# River Bank Riprap

*The mainstem Hoh River has over 3.7 miles of riprap between River Mile 1 and 37. Since 2012, there have been at least four new riprap projects as well as extensions and modifications to existing ones. There is no indication that any riprap was removed.*

Some river banks in the Hoh Area of Concern have been altered and hardened by the placement of riprap and retaining walls made of rocks and other materials. These are placed to control and minimize streambank erosion but they have a number of negative impacts on the surrounding environment. One of the goals of the WRIA 20 Watershed Management Plan is to restore the natural function of stream channels by reversing stream-channel degradation, increasing floodplain storage and improving aquatic habitat conditions.<sup>1</sup> 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.<sup>2</sup>

By 2012, the mainstem Hoh River had over 3.7 miles of riprap

between River Mile 1 and 37. Since then, there have been at least four new riprap projects completed, as well as extensions and repairs to existing projects. In the lower Hoh River, wood was placed on a layering of rocks used for riprap on the riverbank. At another site, to protect the lower Oil City Road being threatened by the Hoh River, Jefferson County placed riprap on the road's right of way to avoid getting an emergency Hydraulic Project Approval to do in-channel work. The intention behind the project was that as the river eroded the bank, the riprap would fall into place on the riverbank to stop it from further eroding. That riprap was insufficient to protect the road. The county eventually obtained an emergency hydraulic permit and brought in additional riprap and heavy equipment to protect the section of road being threatened.



Spruce Creek



Hoh River Mouth

Nic Pfeffer-Jaggart, Hoh Tribe (2)



Hoh River Project

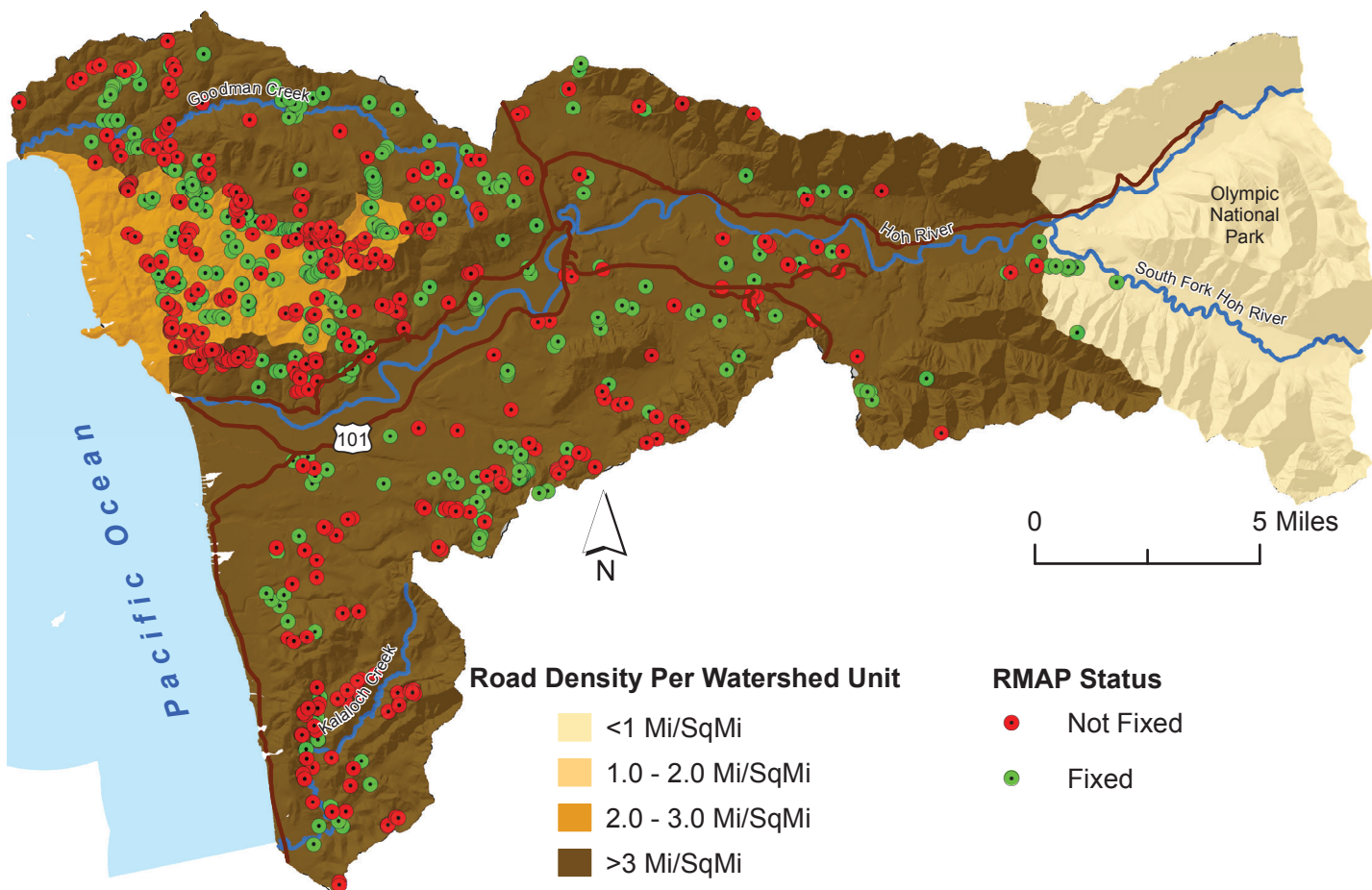


Oil City Road Project

Warren Scarlett, Hoh Tribe (2)

# Impact of Roads

As of 2014, about 47% of the 764 culverts identified under the Road Maintenance and Abandonment Plans (RMAP) in the Hoh Area of Concern have been repaired, while the other 53% remain to be repaired by 2021. Also, six watersheds, representing 72% of the land area, may not be properly functioning because of road density values that exceed 3 miles/square mile.



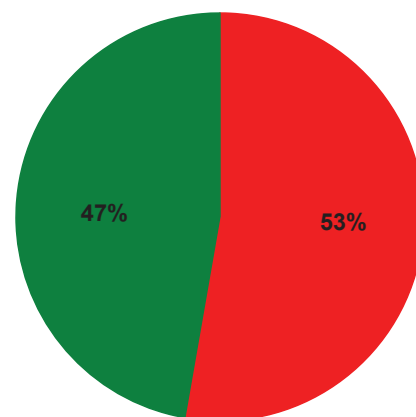
If not properly constructed or maintained, forest roads can be a source of sediments to streams, which degrade fish habitat and water quality.<sup>1</sup> The sediment contribution per unit area from roads is often much greater than all other forest activities combined.<sup>2</sup> Also, many culverts at forest road crossings may constitute fish barriers. One of the goals of the WRIA 20 Watershed Plan is to reverse stream-channel degradation.<sup>3</sup>

In order to reduce the adverse effects of roads, Washington State Forests and Fish Law requires most forest landowners to have a Road Maintenance and Abandonment Plan. The RMAP is a method to evaluate forest roads, identify areas that do not meet forest practices rule standards, and schedule needed upgrades and/or repairs. As of 2014, the RMAP data shows that about 47% of the identified 764 culverts in the Hoh Area of Concern were fixed and

another 53% were yet to be repaired. This appears to show that road repairs on both state and private forestlands in this area are on schedule to be completed as mandated by the RMAP program. This will have a positive impact on fish habitat and water quality in the Hoh Area of Concern.

Road density values were over 3 miles/square mile in most watersheds outside Olympic National Park, where the values were less than 1 mile/square mile. A total of six watersheds, representing 72% of the land area, may not be properly functioning because of high road density values. This is the direct result of the network of roads built notably for harvest of timber. Several studies have correlated road density or indices of roads to fish density or measures of fish diversity.<sup>4</sup> Increases in fine sediment in fish spawning habitat were found when road density exceeded 2.5% of the Clearwater watershed.<sup>5</sup>

## RMAP Culvert Repair Status





# Forest Practice Activities

From 1996 to 2010, 24 square miles of forestlands were harvested in the Hoh Tribe's Area of Concern. Since 2010, an additional 1.6 square miles of forestlands have been permitted for harvest, which may indicate a slower rate of activity, although Forest Practice Applications do not cover all the activities on the ground. Most of the recent activities have been in the Goodman Creek watershed and in areas that are predominantly private forestlands.

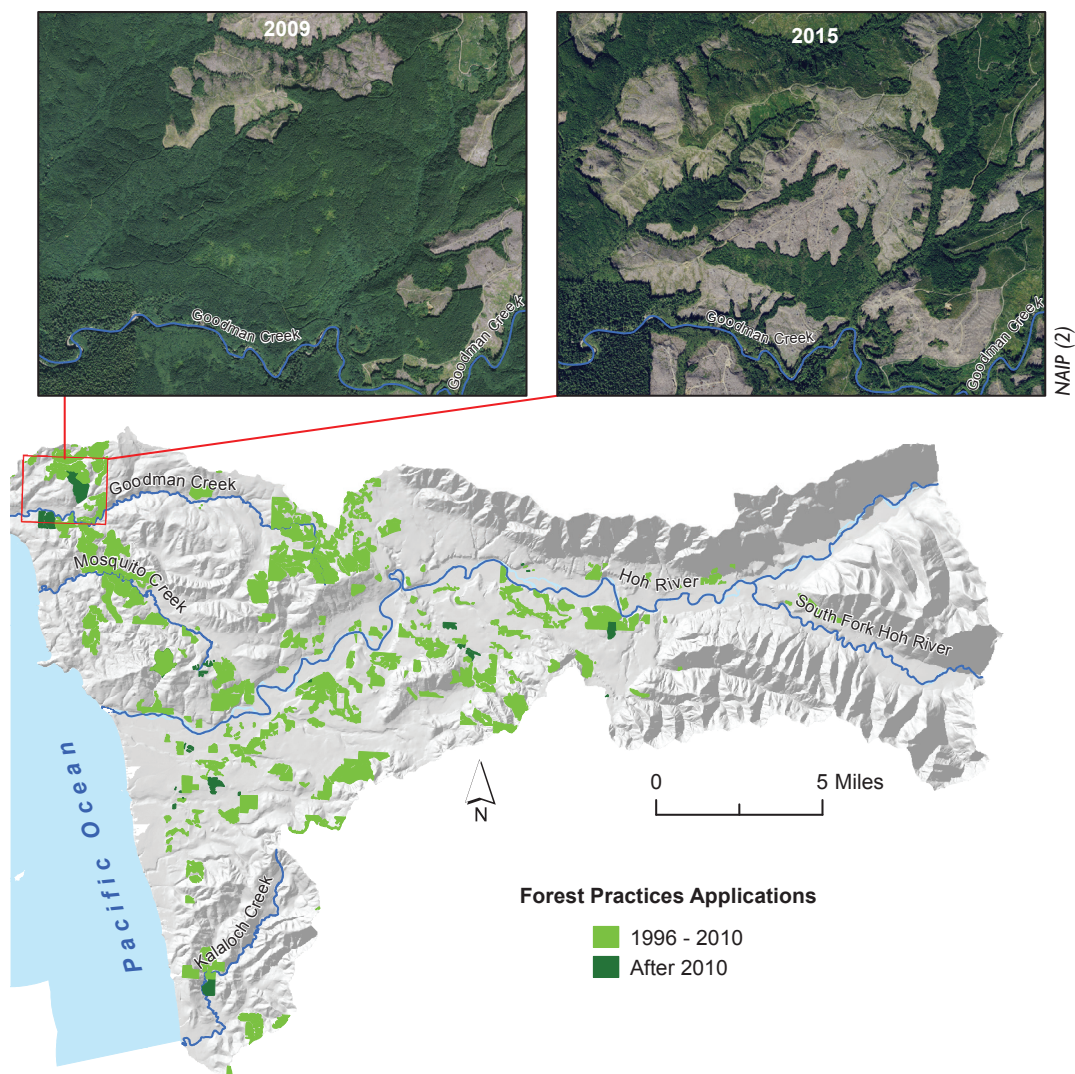
Forest practice activities within the Hoh Tribe's Area of Concern directly influence watershed vegetation through creating access to, as well as removal and re-establishment of, forest vegetation. The removal of vegetation has resulted in poor large woody debris and riparian conditions in the basin.<sup>1,2</sup> Debris flows are common and devastating, resulting in scoured, incised channels with few spawning gravels for salmon. The WRIA 20 Watershed Plan recognizes the loss of forest as a watershed threat.<sup>3</sup>

Forest practice applications filed for the purposes of clear-cutting commercial timber products show that between 1996 and

2010, about 24 square miles of forestlands were harvested in this area. Since 2010, an additional 1.6 square miles of forestlands have either been harvested or will soon be harvested, which may indicate a slower rate of activity, although Forest Practice Applications do not necessarily cover all the activities on the ground. A large proportion of the recent forest practice activities have been in the Goodman Creek watershed and in areas that are predominantly private forestlands.

A study in the Hoh watershed revealed that timber harvesting significantly impacts peak and mean daily flow of streamflow at

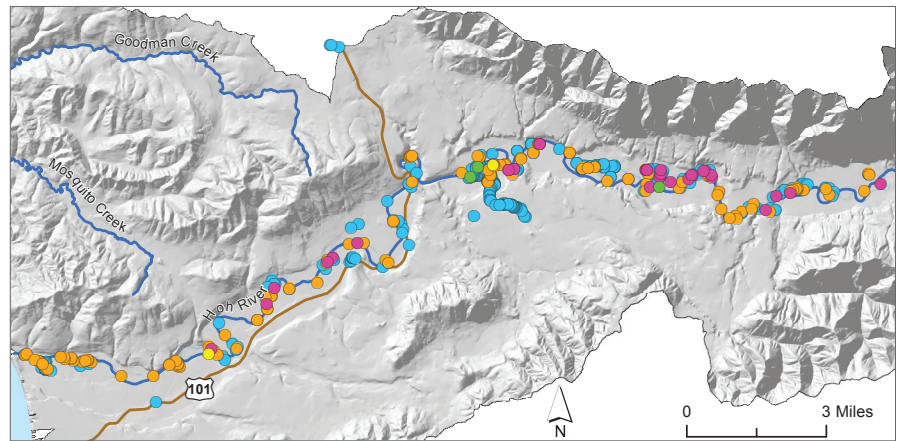
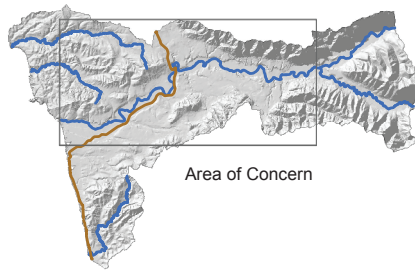
multiple watershed levels.<sup>4</sup> Similarly, reductions in hydrologic maturity with the resultant degradation of floodplain habitat and altered flow regime are significant habitat factors limiting salmonid production in this basin.<sup>5</sup> Aggradation and excessive sedimentation also occur in these watersheds. These conditions may be improved by altering timber harvest rates. The failure to effectively manage these natural resources could have a significant impact on the cultural values attached to them by tribal members.



Data Sources: NAIP 2009,<sup>6</sup> NAIP 2015,<sup>7</sup> SSHIAP 2004,<sup>8</sup> WADNR 2011,<sup>9</sup> WAECY 2011<sup>10</sup>

# Invasive Species

A multi-year effort initiated in 2002 by the Hoh Tribe to control invasive knotweed plants along 30 miles of the Hoh River riparian zone has resulted in the eradication of about 99.5% of the plants. However, other invasive species like Scotch broom, Herb Robert, and Reed canarygrass continue to spread in the watershed.



Hoh River Invasive Species Distribution 2014

- Canada Thistle
- Reed Canarygrass
- Herb Robert
- Scotch Broom
- Knotweed

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.<sup>1</sup> The Hoh River's support of relatively healthy wild salmon populations could be threatened by invasive knotweed (*Polygonum spp.*) species found in its riparian zone if treatment does not occur. These plants are a problem because they are known to displace native species and alter riparian vegetative communities, disrupt nutrient cycling and reduce quality of litter inputs, and can cause long-term changes to the structure and functioning of the riparian forests and adjacent fish habitats.<sup>2,3</sup>

Knotweed stem counts show a reduction in the sizes and distribution of the plants.<sup>4</sup> Sites with at least six years of data 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 particularly in the Owl Creek and Lindner River bars. It is estimated that by 2011, about 99.5% of the plants had been eradicated on 30 miles of the river and its floodplain. These results show the effectiveness of the control measures.

In a 2014 survey, knotweed made up only 18% of the treated sites, and 65% of the stems were under 3 feet and single-stemmed.<sup>5</sup> Reed canarygrass (*Phalaris arundinacea*) was more broadly distributed than the previous year, constituting 58% of treated sites. Other species found and treated were Scotch broom (*Cytisus scoparius*) and herb Robert (*Geranium robertianum*).

Overall, although significant progress has been made in the control of knotweed in the Hoh River riparian zone, other invasive species like Scotch broom, Herb Robert, and Reed canarygrass continue to spread in other parts of the watershed.



Herb Robert

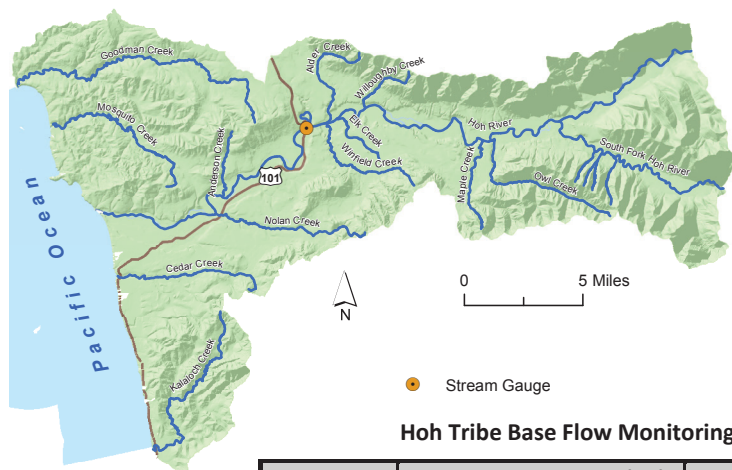
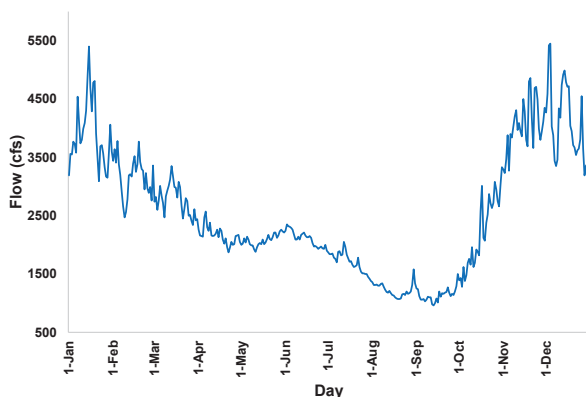
Jill Silver, 10,000 Years Institute



# Hoh River Streamflow

Over the past half-century, the Hoh River peak flow values show an increasing trend while low flows are decreasing. If both trends continue as anticipated under predicted climate change conditions, this poses a significant impact to salmonid runs. In August 2015, base flow measurements were at record lows for tributary streams monitored since 2007 by the Hoh Tribe.

Mean Daily Flows For Hoh River, 1960 - 2014



Hoh Tribe Base Flow Monitoring

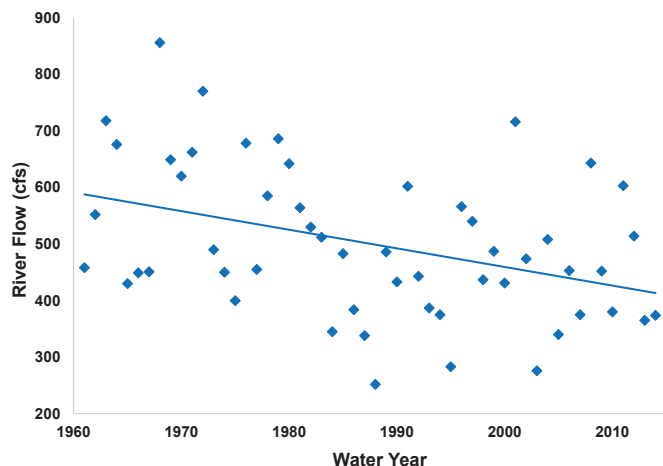
Creek	Average Lowest Flow (cfs) 2007-20014	Lowest Flow (cfs) August 2015
Anderson	0.67	0.39
Cedar	1.92	0.94
Elk	1.59	1.08
Nolan	1.35	0.61
Owl	7.22	7.87
Willoughby	1.54	0.31
Winfield	3.25	2.81

Over half a century of data from the Hoh River gauge at Highway 101 shows that the amount of the river's streamflow is changing. Peak flow values show increased winter streamflow while summer mean low flow values show a decreasing trend at precisely the time when streamflow is needed most and when water temperatures are at their highest. Both trends have been predicted to occur because of climate change and this may indicate that salmon habitat and other aquatic ecosystem functions are not being adequately protected. Low flows and high temperatures mean less suitable habitat for fish as well as impairment of upstream passage of salmon returning to spawn. High flows on the other hand, can scour eggs out of the gravel and create problems for emerging fry.

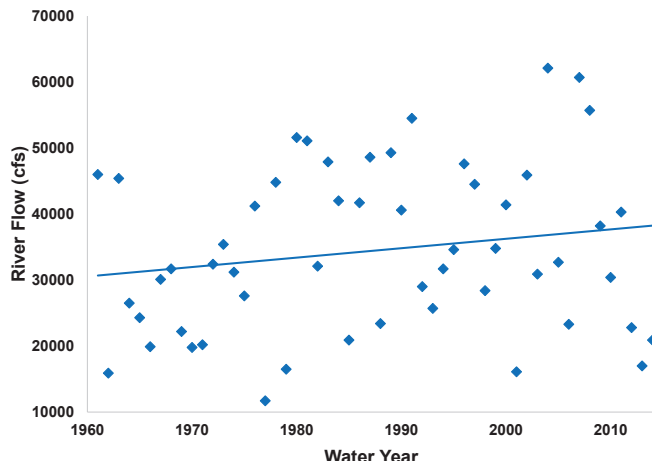
During a 40-year period, 7-day minimum flow of the Hoh River decreased on average at a rate of about 5 cubic feet per second (cfs) per year.<sup>1</sup> In August 2015, base flow measurements were at record lows for all seven tributary streams monitored since 2007 by the Hoh Tribe.<sup>2</sup>

If the low flow trend continues as anticipated under predicted climate change conditions, this may pose a significant challenge to salmonid runs. A recent study found that Chinook salmon populations could be particularly vulnerable to such streamflow changes because spawning fish may show up when rivers are at their lowest levels.<sup>3</sup> The WRIA 20 Watershed Plan recommends that options for maintaining salmonid runs in the face of extended or recurring low flow periods be evaluated for all watersheds.<sup>4</sup>

Low Flow



Peak Flow

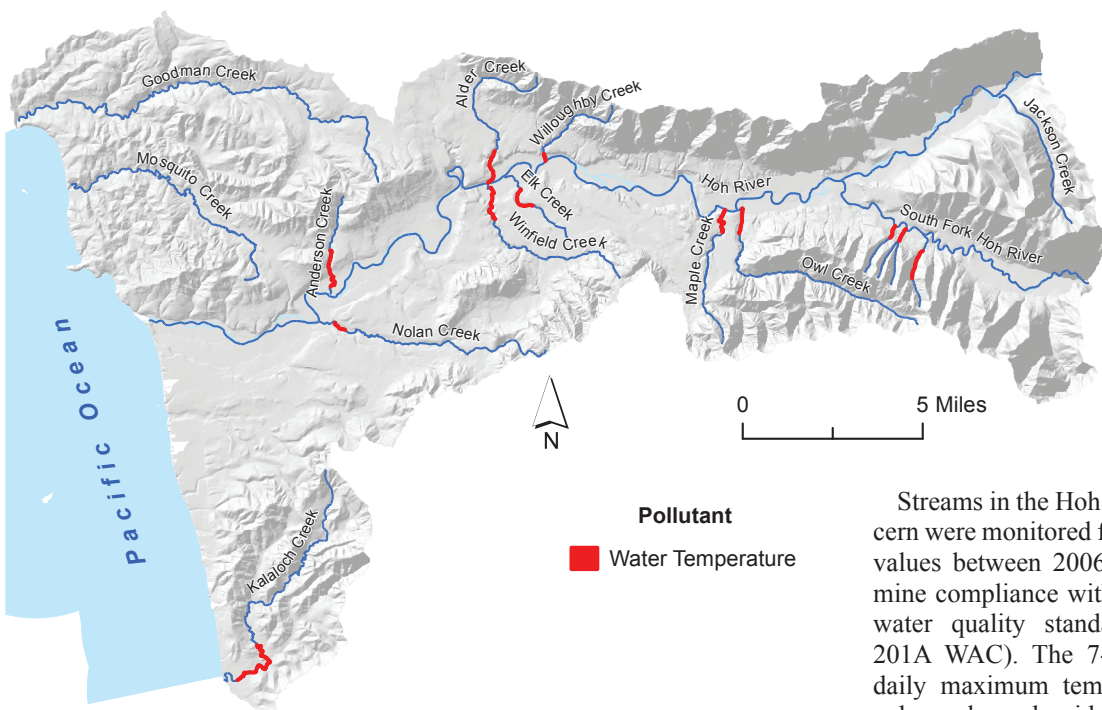


Data Sources: Hoh 2015a,<sup>5</sup> SSHAP 2004,<sup>6</sup> USGS 2015,<sup>7</sup> WADOT 2012,<sup>8</sup> WAECY 2011<sup>9</sup>

# Water Temperature

Between 2006 and 2015, all but one of the major salmonid (coho, Chinook, and steelhead) tributaries to the Hoh River had summer water temperature values which exceeded the Washington state numeric water quality standards. These exceedances will likely have a significant impact on salmonid survival and production in these watersheds.

## Impaired Waters for Temperature - 2012



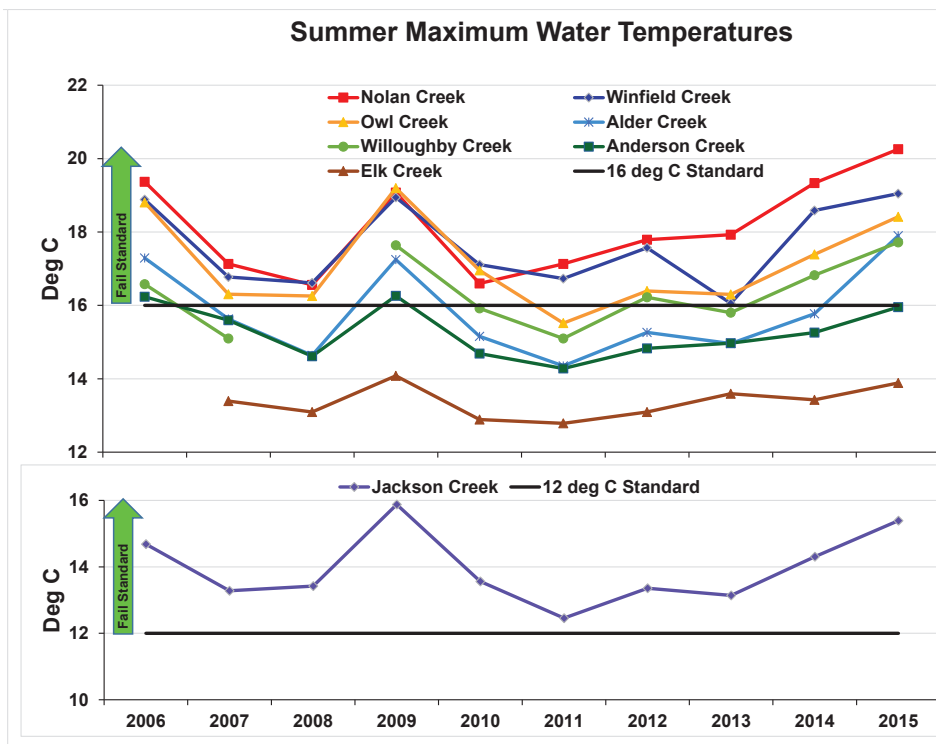
### Pollutant

Water Temperature

Streams in the Hoh Tribe's Area of Concern were monitored for water temperature values between 2006 and 2015 to determine compliance with Washington state's water quality standards (Chapter 173-201A WAC). The 7-day average of the daily maximum temperature (7-DADM) values showed widespread exceedances and therefore potential violations of the standards.

In all ten years for which data was collected by the Hoh Tribe<sup>1</sup>, Jackson Creek had temperature values that exceeded the 12°C standard for "Char Spawning and Rearing." Similarly, Nolan and Winfield Creeks exceeded the 16°C standard for Core Summer Salmonid Habitat in all years while Owl Creek had exceedances in all but one year. Other creeks had varying degrees of failures. The only exception to this general trend was Elk Creek whose relatively intact riparian vegetation may have helped to keep the water temperatures low. In 2012, 12 waterbodies in the Hoh Area of Concern were placed on the 303(d) list for water temperature pollution by the Washington State Department of Ecology.<sup>2</sup>

Generally, these exceedances were highest in 2015, which was also a year of record low flows. These water temperature impairments will likely have a significant impact on fish survival and production in these watersheds since salmonids require cool and well-oxygenated water.



Data Sources: Hoh 2015b,<sup>3</sup> SSHIAP 2004,<sup>4</sup> WAECY 2011,<sup>5</sup> WAECY 2013b<sup>6</sup>



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## River Bank Riprap

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## Impact of Roads

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