Socioecological and Societal Impacts of the Elwha Dam Removal

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Abstract

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Through qualitative interviews with Park Service managers, Lower Elwha Klallam Tribal members and scientists, and residents of Port Angeles, this thesis explores the societal impacts of the Elwha Dam Removal Project. Interviews revealed how power dynamics between federal, tribal, and local stakeholder groups are actively reshaping the socioecological system of the Elwha River. A strong partnership between the Park Service and the Lower Elwha Klallam Tribe grew out of the process of dam removal, which enabled both to be the major beneficiaries of dam removal. The Park Service benefited by restoring the ecosystem processes of the Elwha River, which will create a healthier ecosystem for future park visitors to experience. The Lower Elwha Klallam benefited by utilizing their treaty rights to right the injustice of catastrophic salmon decline enabling an ecological and cultural revival for tribal members. Furthermore, the decline of resource extractive industries on the Olympic Peninsula made it difficult for Port Angeles residents to imagine how they would personally benefit from dam removal. Lastly, dam removal enabled the Elwha to reexplore its floodplain and recreate side channels. However, restoration of this vital ecosystem process caused an unexpected washout of two major campsites highly valued by Olympic National Park visitors and the only road into the Elwha

Valley. This loss was immediately identifiable while the long-term benefits of restored salmon runs and river ecology have yet to be fully realized. Park Service managers believe mitigating these unanticipated losses is the next step of recovery and such reparations will set a strong precedent for addressing the ecological dynamism that could be present in future dam removals in the Pacific Northwest as visitors witness the success of removal firsthand.

Introduction

In 2011, removal of two dams on the Elwha began and by 2014, both the 108' tall Elwha Dam and 210' Glines Canyon Dam were successfully removed (Mapes, 2013). To date, the Glines Canyon Dam is the tallest dam removed in the world (Sumner, 2017). Furthermore, the two dams had more retained sediment than any previous dam removal with approximately 21 million m^3 of sediment impounded (East et al., 2015). For a century, these dams simplified the lower floodplain of the Elwha River and caused a 75% decrease in the river's salmon populations (Brown, 1995). Now that the dams have been removed, the ecosystem processes of the river are recovering and salmon are beginning to spawn above the dam sites (Liermann et a., 2017).

Ever since the dams were created, tribal members of the Lower Elwha Klallam have fought against the dams due to their impacts to salmon runs and concerns about safety ever since the Elwha Dam blew out during construction in 1912 (Crane, 2011). Those who benefited from the dam were largely the descendants of western settlers who made their livelihood out of timber harvests and they were the ones most concerned about the effects dam removal would have on their livelihoods. When the federal government decided to pursue dam removal, the concerns of settler descendants manifested into a contentious political conflict that lasted nearly 20 years where elements of this struggle are still present (Mapes, 2013). Within this social system, management decisions made to recover the rivers ecosystem processes will largely shape the future ways society interacts with the Elwha River.

Historic Background

Since time immemorial, the Lower Elwha Klallam people lived along the Elwha River and present-day Port Angeles. In 1855, the Lower Elwha Klallam were signatories to the Point No Point Treaty. Under the treaty, the Klallam ceded their lands and were required to settle at the Skokomish Reservation, but they retained their rights to fish, hunt, and harvest in their usual and accustomed lands. Many of the Lower Elwha Klallam people refused to relocate and struggled to remain at the mouth of the Elwha River and the shores of Port Angeles (Crane, 2011). The Elwha and Glines Canyon Dams were built in 1913 and 1927 respectively, based on the visions of entrepreneur Thomas Aldwell (Figure 1). In his 1950 autobiography *Conquering the Last Frontier*, Aldwell reflected on his belief that the electricity generated from these dams would establish a prosperous, industrial future for Port Angeles. Throughout construction, Klallam needs were disregarded and they were powerless to stop the dams from decimating natural resources vital to their culture and livelihoods (Harguth, 2013). In building the dams, Aldwell largely succeeded at achieving his goals. The dams provided electricity to Port Angeles decades before the city was linked to the regional power grid, which powered lumber mills that facilitated the booming growth of Port Angeles' resource extractive economy (Crane, 2011). Since their creation, the Elwha and Glines Canyon Dams were able to circumvent legal requirements for fish passage as the state government lacked enforcement capacity (Harguth, 2013). Instead of installing fish passage on the dams, Aldwell negotiated a deal with Washington's fish commissioner to have a hatchery built below the dam sites to offset salmon losses (Crane, 2011). However, shortly after construction, the hatchery failed to stem salmon declines in the river and was closed in 1922 (Blumm & Erikson, 2012). Dam building led to the

full-scale collapse of the river's legendary salmon runs and the complete erosion of a highly productive shellfish beach at the mouth of the river.

Ever since the dams were constructed, the Lower Elwha Klallam Tribe had been fighting for their removal (Mapes, 2013). Not only was the Tribe opposed to the environmental impacts of the dams, but they were concerned about the safety of the dams ever since the Elwha Dam blew out during construction in 1912 (Crane, 2011). The Lower Elwha Klallam Tribe's political position changed with the passage of the Electric Consumers Protection Act by Congress in 1986, which required the Federal Energy Regulatory Commission (FERC) to account for fish and wildlife protections when relicensing dams (Mapes, 2013). After Glines Canyon Dam's license expired in 1976, the Lower Elwha Klallam Tribe allied with environmental organizations to intervene in the relicensing process by filing a lawsuit against the dam owners (Blumm and Erikson, 2012; Chaffin and Gosnell, 2017). Citing the Federal Power Act (16 U.S.C. § 797a), a license cannot be given to dams within the boundaries of national parks. In 1938, Congress created Olympic National Park and in doing so, Glines Canyon Dam now resided within the park's boundary (Blumm & Erikson, 2012). Since the dam was built prior to the park's creation, it was allowed to continue operations under its original license. After the license expired though, FERC could not legally relicense Glines Canyon Dam because it was now within Olympic National Park (Mapes, 2013). The Elwha Dam was never licensed and under the Federal Power Act (16 U.S.C. § 803(j)), FERC is required to consider fish and wildlife protections for any license application (Sumner, 2017). Licensing of the Elwha Dam would be contingent on endangered species protections of salmon, but fish passage installation can frequently be more expensive than the power the dam generated or the cost of removal (Sumner, 2017). Since it was

economically infeasible to install fish passage, the dam owners decided to negotiate the terms of dam removal (Mapes, 2013). Ultimately, the Federal Power Act made it economically infeasible for the Elwha Dam to be licensed and against federal law to relicense Glines Canyon Dam.

Following the success of the lawsuit, Congress, the Department of the Interior, the Lower Elwha Klallam Tribe, and the dam owners negotiated a compromise that formed the foundation of the Elwha River Ecosystem and Fisheries Restoration Act ubiquitously known as "The Elwha Act" (Chaffin and Gosnell, 2017). This congressional act was passed in 1992 and called for the "full restoration of the Elwha River ecosystem and native anadromous fish" (Congress, 1992). Under the Elwha Act, the Department of the Interior purchased both dams for $29.5 million dollars and would manage river recovery (Congress, 1992). Importantly, dam operators were not required to pay for the environmental damages or mitigation of the dams (Mapes, 2013). To mitigate potential impacts to the water quality of Port Angeles from sediment discharge, a water treatment facility was constructed (Park Service, 2005). Due to federal recognition of treaty rights, the Tribe was recognized as co-managers of the river with federal agencies in a relationship defined by the sharing of power as both parties worked to achieve mutually beneficial outcomes (Harguth, 2013).

Theoretical Background and Analysis of Socioecological Systems, Power Structure, and Worldviews Shaping the Elwha Dam Removal

As required by the Elwha Act, a set of alternatives were evaluated to determine the best approach to restore salmon runs (Park Service, 1995). Loomis (1996), conducted a contingent valuation survey of the alternatives to restore salmon in the river. By comparing the perceived

costs and benefits to Clallam County and Washington residents through his economic analysis, he concluded that the public would be willing to pay for dam removal (Loomis, 1996). The Park Service was named the leading agency to plan and manage the removal of the dams (Park Service, 1995). To ensure full recovery of the Elwha River, Park Service management developed a plan utilizing processed-based restoration. Processed-based restoration restores the physical and biological conditions necessary to reestablish river ecosystem processes by addressing the anthropogenic factors that caused the disruption, matches solutions to the scale of problem, and explicitly identifies expected outcomes (Beechie et al., 2010).

The Elwha Act was explicitly focused on the ecological outcomes through dam removal. However, dams are highly interlinked to social ecological systems through historical identities and cultural values of local communities (Fox et al. 2016). Since their creation, the Elwha Dams have been the symbol of progress for the white loggers, fishers, and merchants of Port Angeles, who regarded them highly for the power and economic opportunities they provide (Mapes, 2013). When the Elwha Act was passed, Port Angeles residents feared dam removal would impact the local economy and their livelihoods (Chaffin and Gosnell, 2017). Additionally, dam removal proposals, such as this one, can threaten people's sense of historical continuity and lead to fervent local backlash when communities do not like the future they imagine without dams (Fox et al. 2016). This framework demonstrates that natural landscapes, even those drastically altered by human activities, are intrinsically linked to societal politics as different groups hold divergent beliefs in who is allowed to utilize and benefits from these ecosystems (Mansfield et al., 2015). These beliefs are informed by the contrasting values people hold for the ecosystem and create divergent visions of that landscape's future. These imagined futures

for an environmental landscape and the way humans interact with it are defined as socio-ecological futures. Competing visions of socioecological futures for a space can lead to conflicts that will likely be resolved to benefit those with the most political power (Mansfield et al., 2015). On the Elwha, the Park Service served as the lead federal agency in charge of river recovery and the Lower Elwha Klallam Tribe served as co-equal managers due to their treaty rights. As such, these two groups hold the primary decision-making power and they are most able to actualize their socioecological futures.

Tangent to the passage of the Elwha Act was the aftermath of the spotted owl controversy. The spotted owl controversy is not directly related to dam removal, but it shaped the political environment at the time of the Elwha Act's passage. Due to concerns over unsustainable harvest of old growth forests in Washington and the impacts this had on endangered species, government agencies enacted stricter regulations on commercial timber operations, sparking fierce opposition from loggers (Dietrich, 1992). From this controversy, residents on the Peninsula increasingly were opposed to the actions of the federal government because they believed these regulations would impact their livelihoods. This line of thought extended to the Elwha Act and opposition arose out of Port Angeles because non-tribal residents believed removal would jeopardize their economy and way of life (Chaffin and Gosnell, 2017). Additional concerns arose over a rising shift in society where people were increasingly recognizing the importance of preserving wildlife and ecosystems (Dietrich, 1992). Often, this perspective runs counterpoint to the values held by the resource extractive communities on the Peninsula and their livelihoods. While declines in the timber industry are not solely the result of implementation of state and federal regulations, this narrative persists

(Whitehead, 2008). Political opposition to dam removal from the logging community led to funding delays for the removal project, which stalled the project for nearly 20 years after the Elwha Act's passage (Crane, 2011). Funding for dam removal was received in stages from 2000 to 2010 with the final funds being provided through the 2009 American Reinvestment and Recovery Act (Blumm & Erikson, 2012). With funding secured, dam removal began in September of 2011 and both were fully removed by 2014 (Mapes, 2013).

Since the dams were removed, river recovery has been proceeding at a rapid pace. Within 2 years, 35% of the sediment trapped in the reservoirs (11 metric tons) has been eroded with most of it settling at the river's mouth to create a sandy beach (East et al., 2015; Warrick et al., 2015). After 5 years, 65% of the sediment in the reservoirs had eroded and passed through the river system (Ritchie et al., 2018). Studies on salmon populations in the Elwha indicate salmon populations, which have been bolstered by a tribal hatchery program, are beginning to utilize areas of the river that were previously blocked by the dams (Liermann et al., 2017). Despite promising salmon returns and beach regeneration, recovery of the Elwha River is still ongoing. For the first three years after dam removal, sediment being washed out of the reservoir has impacted salmon spawning conditions in the Elwha floodplain (Peters et al., 2017). The progeny of coho and chinook salmon that spawned in non-impacted conditions have yet to return, but strong returns will be indicative to the long-term success of the dam removal project. To aid in salmon recovery on the river, the Lower Elwha Klallam Tribe has agreed with the Park Service and Washington Department of Fish and Wildlife to place a complete moratorium of fishing on the Elwha River. As salmon recover, the Tribe is expected to resume subsistent fishing.

While the primary goal of river recovery under the Elwha Act is the revitalization of the Elwha's ecological functions, these management decisions have societal implications that will play out over time. The level of success of salmon recovery on the river will determine the extent to which tribal and recreational fishing can occur on the river in the future. Another uncertainty is the impact river recovery will have on tourism to Olympic National Park and Port Angeles. Within the last 10 years, visitation to Olympic National Park has been increasing (Park Service, 2019). However, there has been no research to determine how much of this visitation is to the Elwha Valley or the role of Elwha River recovery on these numbers. Additionally, access to the Elwha Valley has been severely limited since the removal of the dams. In November of 2015, only a year after the removal of Glines Canyon Dam was completed, strong winter floodwaters washed out a segment of the Olympic Hot Springs Road, which is the only road into the Elwha Valley (Figure 2). The washout of this road has prevented Park visitors from driving to major trailheads and has cut off the Park Service's access to the Elwha Ranger Station. Following the first washout in 2015, subsequent winter flooding destroyed the Altair and Elwha Campgrounds, which were two popular campgrounds with approximately 70 drive-in sites (Mapes, 2016). These campsites were built in the 1930s within the Elwha's floodplain, which was less active at the time because Glines Canyon Dam reduced the flow of the Elwha River.

Given the contentious political fight to remove the dams and ongoing manifestation of benefits through ecological recovery, there has been little research to understand the societal impacts of the Elwha Dam Removal Project. To understand these societal impacts, it is necessary to understand the socioecological system in which these changes are playing out and

how the power dynamics between groups is actively shaping the future of this system. As such, this project will address the following research questions:

1. What is the role of tribal-federal partnerships in meeting recovery goals on the Elwha?
2. How is the Tribe, the Park Service, and Port Angeles benefiting or being impacted by river restoration?
3. How are the unexpected consequences of dam removal being addressed?

Methods

Since this study's questions revolve around the complex social phenomena of the specific dam removal process on the Elwha River, a case study research methodology was the most suitable approach (Yin, 2003). Case studies are appropriate when "A 'how' or 'why' question is being asked about a contemporary set of events, over which the investigator has little or no control" (Yin, 2003). Here, it is important to understand *how* members of the groups of interest were involved in the removal process, *why* they acted in this manner, and *how* they ultimately benefited or were impacted by the newfound socioecological system resulting from dam removal. Case studies also require an appropriate scope of time and relevant actors (Yin, 2003). This study concerns actions that occurred after the passage of the Elwha Act in 1992 with a strong focus on the actions and perceptions formed after dam removal physically began in 2011.

Interviewing Methodologies

To explore these questions, I used semi-structured key-informant interviews. The initial interviewees I selected were the lead managers of the dam removal project from the Park Service. This was justified because these interviewees were highly knowledgeable about the

removal project and well connected to others involved in the removal (Dexter, 1970). I selected further interviewees through snowball sampling by asking interviewees to provide referrals to those they felt most knowledgeable and connected to the process of dam removal (Biernacki & Waldorf, 1981). Reliance on key-informants enabled me to build trust with interviewees and yielded a more comprehensive assessment of the norms, attitudes, and evaluations of groups (Dexter, 1970). Snowball sampling led to a large number of interviewees from the Park Service at the start of the project, but referrals to individuals who did not work for the Park Service yielded more interviewees from other groups. It is important to note that those working for the Park Service and with the local non-profit also reside in Port Angeles or adjacent communities. However, they were distinguished from other Port Angeles residents as they were highly knowledgeable about the institutions they work for, which have actively played a role in the removal process.

In total, I conducted 18 interviews across four groups (Table 1). To protect confidentiality in my reporting, I assigned each interviewee group an abbreviation to represent their affiliation and a number to differentiate individuals within that group. Additionally, I kept individual's positions within a group anonymous to prevent recognition through occupational identification. Interviews lasted 1-2 hours and were conducted solely in person. After each interview, I would write a brief theoretical memo to identify emergent themes (Miles et al. 2014). Then, I used these themes and my research questions to draft a list of questions specific to the next interviewee. These questions were open-ended and theoretically driven in order to elicit information grounded in the experience of the interviewee (Galletta & Cross, 2013). The semi-structured design of the study enabled interviews to be flexible and guided by the

interviewee (Brady, 1976). With the interviewee's permission, I recorded the interviews to ensure accuracy of responses in my reporting and to allow me to actively engage with the interviewee (Dreifus, 1997). I then transcribed interviews in their entirety and coded them using ATLAS.ti software.

Table 1. Breakdown of Interviewee Categories.

Primary Group Association	Group Abbreviation	Number of Interviewees
Park Service Managers and Scientists	PS	8
Port Angeles Resident	PA	5
Lower Elwha Klallam Tribal Members	TR	3
Non-Tribal Scientist employed by LEKT	TS	1
Local Non-profit Organization	NP	1

Qualitative Data Analysis and Case Exploration

In a qualitative case study, it is important to define "What this study is a case of?" (Ragin and Becker, 1992). However, as I analyzed my results, it was important for me to recognize interviewees held differing perceptions and worldviews, which necessitated an inductive analysis. The reason for this inductive approach is to avoid the biases I bring as an outsider and requires me to withhold preconceptions of the case that might interfere with conceptual development (Ragin and Becker, 1992). For example, over alignment with the beliefs of one interviewee group could likely interfere with my analysis of another the experiences of a member from a different group. In qualitative research, interviewing data are most suitable for this approach as it will enable me to inductively piece together the lived experiences of interviewees (Harper, 1992). Through this, I can create a more holistic idea of the current social and political system taking place on the Elwha.

As such, I approached the analysis in a systematic and inductive process based in Grounded Theory (Corbin & Strauss, 1990; Bryant & Charmaz, 2007). This method required me to withhold preconceptions and let the themes emerge throughout interviewing and analysis (Carvalho, 2014). First, I reviewed interviews in their entirety and analyzed with theoretical memos to identify themes and patterns across interviews (Braun & Clarke, 2006; Miles et al. 2014). To determine which of these themes was most salient, it was necessary for them to meet a certain metric. For a theme to be included in the results, the themes needed to be 1) important to the interviewees 2) addressed across interviewee groups and 3) provide practical advice for this case and potentially to future dam removals. Using this metric, I identified three overarching themes that holistically represented the social phenomena of dam removal that fit within the scope of the case (Creswell, 2003). With these themes identified, I conducted a final analysis using ATLAS.ti, which consisted of 75 codes across seven code groups. Only after these themes were identified could an appropriate theory be invoked and the specific social phenomena the study belongs to be justified (Wilson, 1992).

Results/ Discussion

The Role of Tribal-Federal Partnerships in Meeting Recovery Goals

In 1992, the Lower Elwha Klallam Tribe became self-governing (Lower Elwha Klallam Tribe, 2019). From the standpoint of government to government relation, this removal project has largely defined the Lower Elwha Klallam Tribe's relationship with the Park Service. The Park Service was named the lead implementing agency of the removal project by the Department of the Interior, but they established a partnership with the Tribe in which both were co-equals through dam removal. Within the Park Service, there is a widespread recognition that the Tribe

was their most important partner and that “This project probably would not have occurred were it not for the Tribe wanting it to happen” (PS3). The Tribe was able to pursue legal action when the Park Service had no authority or political will to act as one manager explained,

> Well the Parks cannot take a position like that. I mean, we do not get involved until the Congress tells us. So, we cannot advocate one way or another about something like dam removal. You know, they are preexisting dams before we were a park. They were privately owned. They were grandfathered in. So, it was not the job of the Park to take a position until Congress mandated it. (PS3)

By intervening in the FERC process though a lawsuit, the Tribe was able to exercise its treaty rights for fish under the Boldt Decision (TR1). This forced the dam owners into settlement negotiations and the outcome of these negotiations became the terms of the Elwha Act. Throughout the process of crafting the legislation, the Tribe “did a lot of the groundwork for that process and for supporting the passage of the legislation” (TR1). The Tribe’s involvement assisted in the development and passage of the Elwha Act, which included a passage that would see the project lands of Lake Aldwell transferred to the Tribe following the conclusion of the removal project. This has not happened yet, but the Tribe continues to engage with the Park Service to oversee the land transfer (TR2). Additionally, the Tribe was instrumental in the effort to attain funding for the removal project. One Tribal member noted,

> We actually came up with the idea of using the 2008 stimulus funds for [dam removal] because the Tribe had the ability to move much more quickly. The federal agency had a problem because in order to get shovel ready projects, they had to go through the natural federal acquisition regulation guidelines on preparation for those things. So, they could only really get it for what they had in place and had already done the preparation work. (TR1)

The partnership between the tribe and the Park Service ensured the removal project was shovel ready once funding became available. By establishing a shovel ready removal plan, funds from the federal stimulus of 2009 were provided to the Park Service to begin dam removal (PS7).

Beyond leading the legal argument against the dams, the Tribe has been highly involved in hands-on restoration activities and scientific research taking place on the river. Tribal involvement in the Elwha's recovery was directed by the Tribe's River Resource Department. The River Resource Department developed annual funding agreements with the Park Service so that the Tribe could use federal funds to aid in restoration activities through 2016 (TR1). One way the Tribe utilized funding was to maintain a four-person revegetation crew who began combating threats of invasive species in the reservoirs prior to dam removal before the Park Service developed a team to revegetate the reservoirs (PS2). This team worked with the Park Service throughout the Park's seven-year program to revegetate the reservoirs. Now that the Park's role in revegetation concluded, one Park Service manager noted, "Unlike the Park [Service], they are going to be able to continue managing with grants. So, right now, they are the only ones that have a revegetation crew. That same four-person crew is still out there combating invasives" (PS2). In addition to the Tribe's revegetation work, the Park Service has been actively working with Tribal scientists to monitor the Elwha's recovery. Within this partnership, one Park Service manager said, "the Park contracts with the Tribe to do a bunch of the monitoring work. They operate the sonar systems, they operate the smolt traps, and they do spawning ground surveys. They started their own project with their own money to look at what lamprey are doing. So, they are critical part of the science" (PS4). As the Park Service wraps up their role in actively managing the Elwha's recovery now that ecosystem processes have been restored, the Tribe will become the primary entity monitoring the Elwha's long-term recovery. Continued monitoring efforts led by the Tribe will be critical for the ensuring that the river is meeting its long-term recovery goals.

The ability for the Lower Elwha Klallam Tribe to be co-equals in the Elwha's recovery is largely the product of their treaty rights as defined by the Boldt Decision and federal law. Under the Boldt Decision, treaty tribes in Washington were established as co-managers of Washington fisheries (Treaty Indians Tribes in Western Washington, 2011). On the Elwha, the Boldt Decision required that the Park Service actively engage the Lower Elwha Klallam Tribe throughout the recovery process, especially with relation to the recovery of salmon. In addition to the monitoring work conducted by tribal scientists, the Tribe was provided $16.4 million of federal funds to build and operate a tribal hatchery. The purpose of this hatchery was to supplement natural salmon return during the high sediment impacts phase of dam removal and to provide harvestable coho for the Tribe (TR1). Ultimately, this hatchery will be phased out once natural spawning salmon populations become established on the river. To further aid in the recovery of salmon, the Tribe and the Park Service agreed to place a complete moratorium of fishing on the river. This moratorium prevents recreational, commercial, and tribal fishing. Given the cultural importance of fishing to the Tribe, their commitment to obeying the terms of the moratorium demonstrates the Tribe's commitment to recovery of salmon. To tribal members, the fishing closure was a difficult decision born out of a deep respect for the river. One Tribal member clarified, "We cannot fish in our river until it is healthy. So, it has been seven years right? And so, you know, first it was five years we could not fish and then we added the two more years. So, we are probably going to have to add another two more years to not fish the river" (TR3).

In addition to aiding salmon recovery, members of the Park Service, tribal members, and non-indigenous tribal scientists hope the fishing moratorium will contradict prevalent racist sentiments held by some Port Angeles residents. Speaking from personal experience, one tribal

member noted they actively work to combat, “Misinformation and racism because there are a lot of people that I have met who think that, you know, salmon are on the decline because of tribal fisheries. I get that a lot and it is like, we have been doing this for 10,000 years. Come on! And salmon have declined for 150 years? Like, you know, maybe it is not the brown people” (TR2). Those with racist opinions against the Tribe believe salmon will not be able to recover within Washington because the Tribes fish them unsustainably. A large amount of prejudice against tribal fishing is likely due to the Fish Wars of the 1960s. During the Fish Wars, state agencies blamed tribal fishing for the decline of salmon in the Puget Sound region and actively persecuted tribal people (Burns, 1971). While not the primary goal of the moratorium, the Tribe hopes that by abiding by the moratorium of fishing, continuing salmon recovery efforts, and engaging in outreach with the Port Angeles community, they will prove these opinions wrong.

Under the Elwha Act, the Park Service was named the lead federal agency in charge of restoration, but in accordance with tribal treaty rights, they have diligently collaborated with the Tribe as co-equal partners throughout this project. In the process of managing Elwha recovery together, the Tribe and the federal government developed a strong partnership based on trust. Speaking of this partnership, one tribal member reflected, “I have worked with other tribes and there is just a lot more focus on cooperation, you know, on the government to government relationship between the tribal, federal, state, and municipal governments” (TR2). This project has defined the Tribe’s relationship with the Park Service and the federal government with trust playing an important role in this relationship. Many in the Park Service and the Tribe feel this partnership is strong and vital to river recovery. One tribal scientist opined, “I think if you look peninsula wide, I would venture to say that the Elwha Tribe probably

gets along with the federal government better than any other tribe on the peninsula because they have had to work together" (TS1).

The Tribe is highly cognizant of their role as co-leaders of Elwha recovery. Their passion and dedication to this project stems from deep cultural values and identities tied to the river. Each Tribal interviewee stated that, "we are salmon people." One tribal member elaborated, "I mean the fishing life, it is an inspiration for a lot of what we do. I mean, the rivers are central to life in a tribal community" (TR2). This is why the Tribe fought against the dams ever since they were built. They were powerless to prevent its construction and they were not beneficiaries of the dams as their reservation did not receive electricity until decades after Port Angeles received power from the dams (Mapes, 2013). It was not until their treaty rights were affirmed through the Boldt Decision that they were able to gain a legal mechanism to use against the dams. To the Lower Elwha Klallam Tribe, it was their duty to oversee dam removal as one tribal member clarified,

> There is not a tribal member that does not have a close tie with the Elwha River… I mean it is the most important thing to us and it was an embarrassment having two hydroelectric dams in the river and watching the salmon run slowly disappeared. So, the first time we had a chance to do something about it, we took it and we ran with it. We kept going until we got it done. (TR1)

Now that the dams are removed and ongoing recovery led by the Park Service is concluding, the Tribe feels that they are at the vanguard of river recovery.

The Gains and Unanticipated Losses of Ecological Dynamism

The Beneficiaries of Ecological Recovery

The primary benefit of dam removal is the recovery of the Elwha River's ecosystem processes anadromous fish populations. However, these are long-term benefits and full

realization of these benefits is could take up to 25 more years. To date, natural salmon spawning has been severely impacted by the release of sediment that has accumulated behind Glines Canyon Dam (Peters et al., 2017). Now that high sediment loads have passed, "the fish that have spawned in 2016, 17, 18 spawned in pretty good conditions and we just have not seen their progeny come back yet… but I am guessing it is going to be much better than it was last year or the year before. So, we will get a little glimpse at what we hope will happen" (PS4). Despite sediment impacts to salmon spawning, there is evidence that salmon are accessing the river beyond the dam sites (Liermann et al., 2017). This data was confirmed by Park Service staff who said, "You are starting to see salmon return in small numbers return to spawn and go up past the two dam sites, farther up into the Elwha Valley" (PS1). Interviewees who actively follow restoration noted return numbers when discussing their optimism about river recovery. The non-profit representative propagated information stating, "I have even heard people say that the numbers of fish that are returning are good. I mean to me, the big news is that different species of fish that are returning, how far they are getting onto the valley, and how fast they are getting there. It is way beyond expectations" (NP1). Similarly, tribal interviewees noted these returns were better than expected and cited these numbers when discussing the resumption of subsistent fishing in the near future (TR2). Given that salmon recovery is still an ongoing process, the benefits of salmon recovery have yet to be fully realized. The promising returns tribal and non-tribal scientists have observed though bodes well for the future of the fishery.

Yet, some interviewees from Port Angeles are not convinced about the status of salmon recovery. One Port Angeles interviewee, who opposed dam removal, stated, "It remains to be

seen if the fish will return. They expected there to be more, bigger fish, but that has yet to be seen. The fish might not come back… Ask me again in 25 years and my opinions might be different" (PA1). To this interviewee, the low returns is a salient critique of river recovery and realistically considers the uncertainty of restoration. Some Park Service interviewees noted this is a valid concern, especially when considering the ways in which climate change might jeopardize recovery. One Park Service member explained, "there is so much that affects salmon that occur outside of the Elwha from changing ocean conditions, changing water temperature and water chemistry due to climate change. You know, there is just so much that goes on that is beyond the span of control of the Park Service when it comes to salmon populations" (PS1). Beyond oceanic conditions, reduced waterflow on the Elwha River in the summer could inhibit salmon recovery. In light of the uncertainties of salmon recovery, Park Service managers believe their current work is critical for giving salmon recovery a change. One Park Service member clarified, "We are having declining populations all over the country. So, anything you can do to stem that to me is your priority. Let alone everything else that will come back as a result of a healthy river" (PS8).

Sediment release from the removal of Glines Canyon Dam may have impacted salmon runs in the short term, but it is also responsible for rehabilitation of an estuary at the mouth of the Elwha while simultaneously creating a new beach. Use of this beach by Port Angeles residents and tribal members was one of the most immediately identifiable social benefits of dam removal. However, it is difficult to place a value on this benefit as there are no data on visitation to the beach, but it is a popular destination for locals to recreate (PA1). On the eastern side of the river mouth, which belongs to the Tribe, there is approximately 90 new

acres of land (TR1). Beyond beach use, some tribal members hope that sediment releases from dam removal will facilitate the return of shellfish and crab to the shores adjacent to their reservation so that shellfish harvest can return again. One tribal member noted that sediment release has already improved tribal crabbing grounds on Ediz Hook, which is just east of the river. This tribal member further explained,

> You could see the changes in the near shore environment. There are now people crabbing west of Port Angeles… No one ever set pots anywhere west of the Hook because it was not worth the gas money to run out there. There was nothing there. And now it is not like big money, but it is worth it. You know, there are people that have pots. And this is just a few years after the dams have come out. (TR2)

As the beach has become established and continues to be utilized by tribal and non-tribal people, it is increasingly going to be recognized as a benefit of removal.

For those in favor of dam removal, the ongoing ecological gains has only cemented their belief that dam removal was the right choice. These opinions were summarized by one Park Service employee,

> What was it worth? Like, was the cost of losing those campsites worth dam removal? Absolutely. To me, my personal opinion, not park opinion, but yes. I mean we are talking about restoring the ecosystem versus providing a place for someone to camp. I mean to me, those are not even in the same realm. I mean they are two very separate things. (PS8)

Other Park Service managers and Port Angeles residents expressed similar opinions that ecological recovery of the river was far more valuable than the unanticipated loss of recreational opportunities into the Elwha. This sentiment was further shared by the Tribe as one tribal member noted, “you know, since the ceremony of the dam removal, it has been an awakening culturally” (TR3). One non-tribal scientist working for the Tribe reflected that removal of the dams was a celebrated victory by the Tribe, “Of course the Tribe is thrilled. I feel

like it has resulted in a bit of a cultural resurgence and a lot of pride. You know, it was a long-fought battle. Lots of tribal members went to DC to fight the battle and try to get these dams out" (TS1). To the Tribe, the recovery of the river was priceless. Perhaps the greatest cultural gain for the Tribe was the rediscovery of their Creation Site, which had been inundated underneath Lake Aldwell. Knowledge of the Creation Site's location and physical characteristics had been passed down through the stories of tribal elders. Upon visiting the Creation Site for the first time, one tribal member noted the importance of this discovery, "To so many out there, it was a myth. To be able to feel the spiritual tie to the land, and know, yes, this is real, the stories that you have heard, they are true. It is very, very powerful and very humbling" (Mapes, 2012). Partners with the Tribe recognize how important these cultural gains are. In reflecting on their experience working with the Tribe, one Park Service manager said, "The river itself is a cultural resource for them… what I heard [from them] going forward is that we need our river back to be healthy. We will not be healthy until our river is back. Well now the river is coming back and the mood is up here" (PS8). As the river continues to recover, these gains will continue to benefit the Tribe as they go through the healing process.

The Unintended Consequences of Dam Removal

The washout of the Olympic Hot Springs Road and the campsites was largely caused by the increased dynamism of the Elwha River following dam removal. These losses were largely unanticipated by Park Service managers as one manager noted, "There was certainly a vision that there would be two campgrounds and a road when we were done" (PS4). The Park Service was aware "the floodplain would become more active" following dam removal, but the impacts dam removal would have on the campsites, the road, and the Elwha Ranger station following

the completion of the project were unclear (PS8). Moreover, as one Park Service manager explained, these losses were unexpected:

> The idea that the river would wipe out the campgrounds and the road, that was not on anybody's radar screen. We had a contingency plan for dealing with the historic district, but even if we did have a contingency plan for the road and campgrounds the river was way ahead of us. (PS4)

Even if the Park Service could have predicted the washout, funding structures prevented them from being proactive in preparing for the possibility of a washout and only enabled them to be reactive after the washout occurred (PS3). This manager continued by explaining that this is why "We took no active measures. So, that is why Altair Campground is gone, the Elwha Campground is basically history, and the road washed out" (PS3). Yet, even if measures were taken to prevent the washouts, it seems unlikely there was a way to do this without inhibiting the recovering ecosystem processes of the restoration.

By some metrics, increased dynamism on the Elwha River is indicative of natural ecological processes reasserting themselves, Park visitors and Park staff felt personally affected by the loss it caused. The campsites were heavily utilized and highly valued by Park visitors. As one Park Service manager explained: "It was not just that it was a big campground, but there had been families going there since the '30s… There were generations of people who remember camping in the Elwha… All of that is gone" (PS4). Accordingly, generational use of the campsites by Park visitors manifested as a cultural valuation of the campsites. In light of these losses, the Park Service is concerned that visitors will be too focused on current losses as opposed to the potential gains. In summarizing the opinions of the community, NP1 agreed with this conclusion stating, "Rather than looking at what could be up to a 30-year restoration of the ecosystem as opposed to the right now losses of campgrounds. Yeah, I think that is what

people are reacting to." These losses risk shifting public opinion against the dam removal. One manager explained, "The road access definitely has people uptight. People really, really love Elwha Valley and they really want access… You know, we have lost two campsites in the Elwha and the road is washed out. So, there is plenty of things that if you did not like dam removal that you can point to, to say it was a mistake" (PS8). Furthermore, the Park Service is worried about the way these losses shape public opinion of them as an agency and their ability to manage the balance the recreational and ecological purpose of Olympic National Park. One Park Service manager noted,

> I think there are some people that this would play into their narrative that the park does not want people in, you know, does not want people to come in and visit the park. That they want to wall it off and keep it away from people… It is an us versus them kind of thing. (PS1)

Moving forward, the restoration of access is a top priority for the Park Service.

Dam Removal Exacerbated Previous Losses for Communities Dependent on Timber Economy

Many residents in Port Angeles continue to be highly concerned about decline of the timber economy on the Olympic Peninsula, which they largely blame as a result of the Spotted Owl Controversy (PA1). With this decline, the two mills in Port Angeles closed. This led to a general consensus that "There really is no dominant industry here" (PA5). While unrelated to dam removal, many Port Angeles residents feel federal timber regulations are responsible for the decline (PA5). This created anti-federal sentiments against the Park Service, which were exacerbated when the Elwha Act was passed in 1992 when the tensions of the Spotted Owl Controversy were at their maximum. These dams were responsible for the success of Port Angeles over the last century and represented the city's self-reliant nature. With the Elwha Act,

"there was a strong feeling of the mighty federal government was stepping in to take away something" (PA5). The Park Service is aware of these opinions,

> I think a lot of people worried about just the intrusion of government into the local area. So, I think if you have to look at it in a greater context of what is going on. It is not just the removal of the dams, it is all of the things that are impacting the timber economy and this was just seen as sort of one additional sort of blow to the timber industry by a lot of folks. (PS1)

The negative atmosphere of these opinions, which existed before the current losses, is another reason the Park Service is anxious about the washout. In light of these losses, it is difficult for Port Angeles residents to envision a future on the Elwha that benefits them.

Actualization of a Socioecological Future

As the lead federal agency managing the restoration project, the Park Service is highly suited to make their socioecological future for the Elwha a reality. In this role, Park Service managers frequently stated that the Park's actions are guided by their mission to "preserve unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations. The Park Service cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world." (Park Service, 2018). Applying the Park's mission to the current status of Elwha recovery yields a dual purpose: the restoration of the river ecosystem and its anadromous fish, but also the restoration of access for recreational activities. One Park Service interviewee confirmed this conclusion explaining that restoring access to the Elwha is a top priority because "the Parks belong to the people and they have a right and an expectation to be able to go up and use their Parks" (PS1). Park visitors are

still able to use the road to access the Elwha Valley, but only by foot or on bike. The Olympic National Park website has this ongoing warning for visitors of the Elwha,

> The road washout adds varied mileage to all trails below. One-way distances are now 1.8mi to the unstaffed Elwha Ranger Station; 2.3mi to Altair Picnic Area; 6.5mi to Whiskey Bend Trailhead and 7.8mi to Boulder Creek (Olympic Hot Springs) trailhead. It is 20.4 miles round trip to Olympic Hot Springs, no longer a day hike. (Olympic National Park Service, 2018)

This warning demonstrates how restricted access to major trailheads out of the Elwha Valley has become. Additionally, one Park Service manager explained the Park Service feels beholden to the public because

> This is an important project for the Park Service. Being able to access it not just for what the park has up there, but also for the public to be able to get in and see what they spent $350 million on is important. People will argue that you can just hike in, but that only addresses those of us that are young enough and healthy enough to hike in and see how their money was spent. But on a project like this, everybody should be able to get in and see it (PS4).

As the Park Service begins the process to restore road access, they want to ensure it is done in a way that does not inhibit the ecosystem functions of the river (PS8).

Multiple Park Service interviewees felt that restoring access to the Elwha Valley is more important than providing a recreational opportunity; they believe that by allowing the public to witness the outcomes of dam removal, the project's success will set a precedent and inspire a greater awareness of dams and the possibility of a future without them. While there is no quantitative evidence to prove this claim, Park Service interviewees readily provided anecdotes of meeting people who changed their minds after witnessing the river's ecological recovery following dam removal. Current ecological gains have emboldened the Park Service's commitment to the project and belief that ongoing ecological gains will positively influence public perceptions of the dam removal. One manager summarized,

> The river is coming back, fish are coming back, you can see it. You can see that the delta is building out. You know, doing all the studies, they are seeing the nearshore fish comeback, the clams, the crabs, the salmon, the eagles, you know, everything is coming back. And that is going to have a big positive influence. (PS8)

However, another manager felt that ecological gains from dam removal were not enough to sway the opinions of those against dam removal. This manager elaborated,

> I do not know if people change their opinions very readily. It seems like people are pretty set in their opinions. You do not really change people's opinions with facts. You need more than just facts. You need a narrative. You need a story in a way that it ties into their worldview in order to be able to allow them to see themselves in the future that you envision. (PS1)

In order for road access to be restored, the Park Service has publicly acknowledged that the road will likely need to be realigned on the valley wall outside the floodplain (PS2). However, not all Port Angeles residents are convinced that restoring road access to the Elwha Valley is the right decision because creation of a new road it is likely to cause damage to the environment. One Port Angeles resident explained, “they are determined to build that road and keep that access open, but instead, it is like wilderness starts where the road ends. Right? So just end the road at Madison Falls” (PA4). A Park Service manager countered this opinion by stating, “People will argue that you can just hike in, but that only addresses those of us that are young enough and healthy enough to hike in and see how their money was spent. But on a project like this, everybody should be able to get in and see it. So that is going to mean realignment of the road somehow” (PS4). Since reparation of road access is still years away, this is still an ongoing conversation and opinions are actively changing. The non-profit representative provided an example from a discussion at a recent board meeting,

> Some of the board members thought, "No, that is new road construction through old growth habitat for spotted owl and marbled murrelet. I mean, how can we support that?" Whereas I and others argued that, “Hey, we just had a $325 million dollar

> investment in restoring the Elwha Watershed. The Park has put up an incredible interpretive display on the old dam site. It is a really, really popular place for locals to go to recreate." I said, "I think it would not do well for future environmental efforts if the one of the organizations that was a primary proponent of dam removal after two much loved campgrounds have been washed away by floods to then come back and say, now let's not have any motorized traffic into the valley. And the board came around with that thinking and kind of agreed." (NP1)

To those working for the non-profit, some were willing to concede the potential environmental impacts that would occur from the Park Service's vision of restored access to the Elwha.

Conclusion and Recommendations

Since the beginning, the Lower Elwha Klallam Tribe has been opposed to the Elwha Dams. Unfortunately, the Tribe was unable to find political grounding until their treaty rights were affirmed through the Boldt Decision. By invoking their treaty rights and allying with a coalition of environmental organizations, the Tribe was able to successfully usher the passage of the Elwha Act, which eventually led to dam removal. Managers from the Park Service readily acknowledged that the dams likely would not have been removed if it were not for the Tribe's legal intervention. Furthermore, this dam removal project provided a pathway for the Tribe to exercise their sovereignty while simultaneously creating a space for state and federal agencies to recognize the Tribe as co-equal managers of the river and its fisheries. What resulted was a strong partnership between the Tribe and government agencies. Together, they have benefited by restoring ecosystem processes that will hopefully allow them to actualize a shared socioecological future where salmon runs have been recovered. This dam removal project offers an example of how government agencies and environmental organizations can partner with a Tribe to achieve mutually beneficial large-scale ecosystem recovery. Success of this

partnership is dependent on developing trust and facilitating a forum where tribal sovereignty can be exercised.

With any large-scale restoration project, it is important to recognize that ecological dynamism can lead to unexpected benefits and consequences despite meticulous planning. Furthermore, managers must realize that any action taken to restore ecological functions will have social effects. When going forward with a project, it is essential to develop an adaptive process and funding to deal with a more dynamic system. For the Elwha, managers made a considerable effort to address the impacts high sediment loads would have on Port Angeles' water supply and the fishery, but funding was not available to immediately address the road and campsite washout. The losses caused by the washout were largely unavoidable and similar projects could face similar trade-offs. As part of the adaptive process for recovery actions, managers should to carefully consider possible trade-offs and develop a protocol to work with local communities to address loss. This does not necessarily have to be a method to prevent the loss entirely. Instead it could be a way of accepting the loss and facilitating a conversation that enables those affects to envision themselves in a post-recovery future.

Figure 1. Map of the Elwha Watershed and the Two Dam Sites. Retrieved from US Geological Survey: https://www.usgs.gov/media/images/map-elwha-river-state-washington

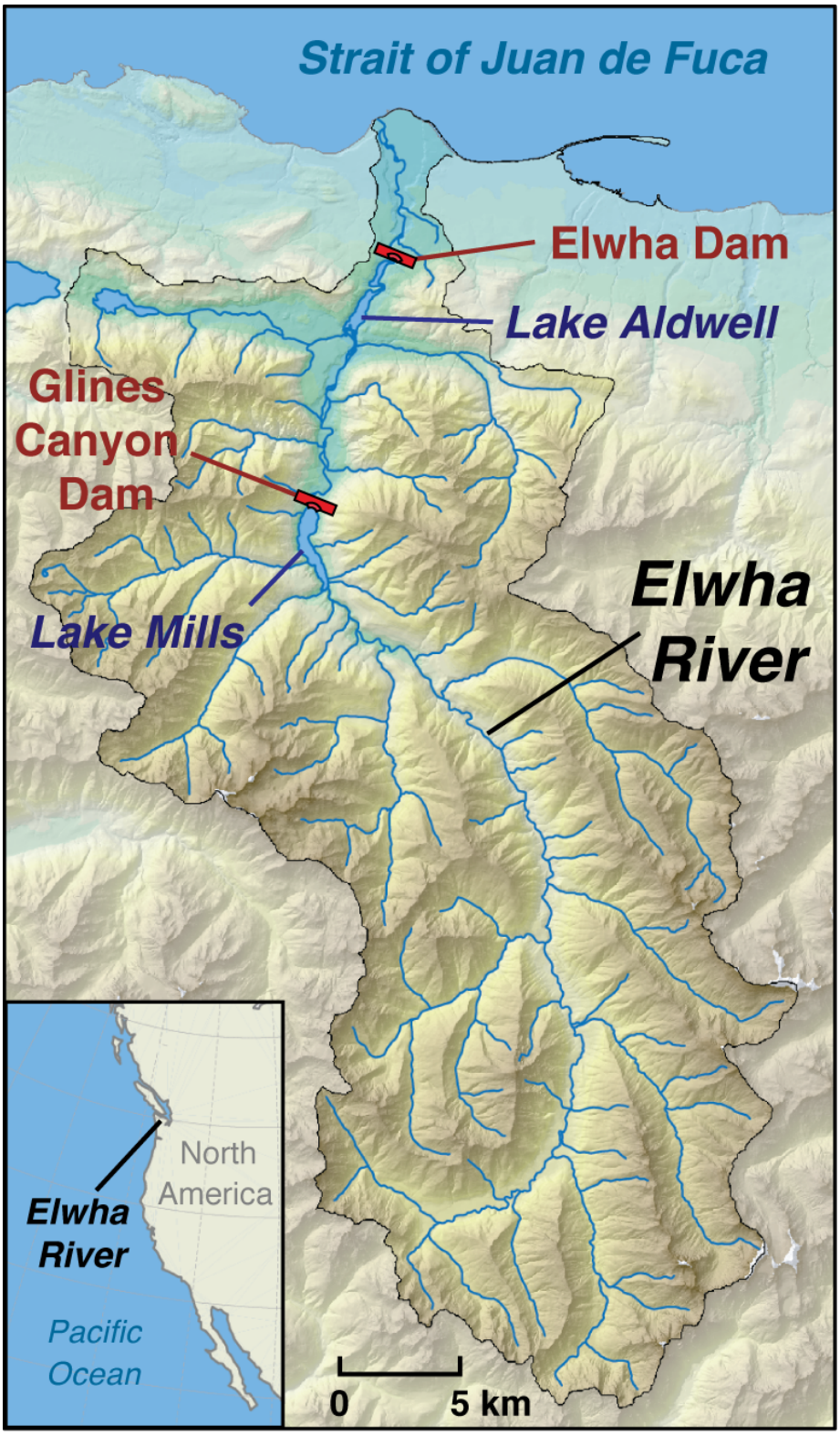
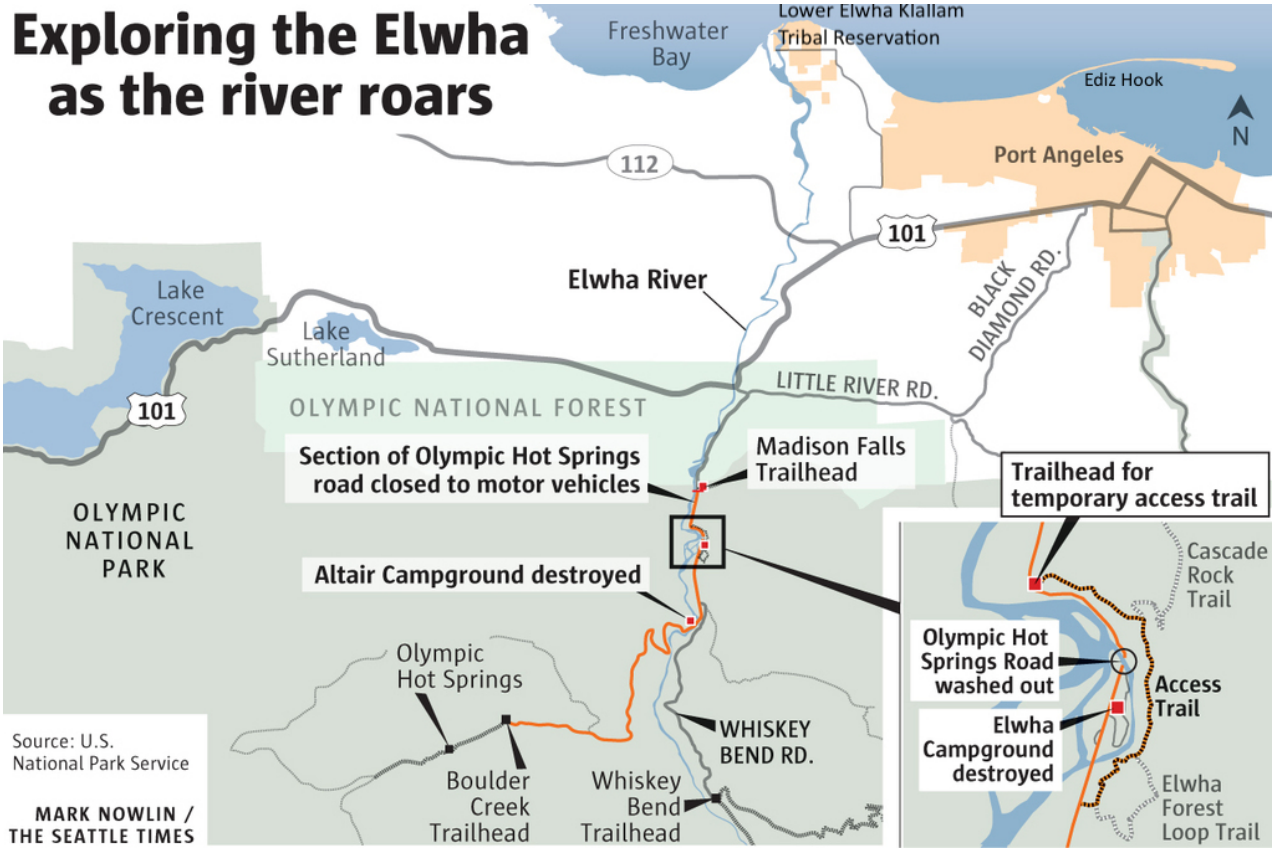


Figure 2: Map of Road and Campsite Washouts. Credit: Mark Nowlin / Seattle Times



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