Dam Removal and NEPA: Case Studies from the Elwha and Klamath Rivers

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Introduction

Throughout the 19th and 20th centuries, dam-building in the US was viewed as a significant indicator of progress and a symbol of conquest over nature (McCool, 2007). The American West has a storied history of water development, due in part to its highly arid environment as well as to remnant ideologies of manifest destiny and the idea that technology and willpower could overcome any natural barrier to development (Reisner, 1993). Bruce Babbitt, former Secretary of the Interior, once remarked that we have, on average, constructed one dam every day since the signing of the Declaration of Independence (Cho, 2011), with peak dam construction occurring in 1960s (Lowry, 2003). Since then, public perception has shifted to become increasingly aware that the economic and social benefits of dams come with significant ecological costs. This shift coincided with several environmental laws including the Wild and Scenic Rivers Act of 1968, The Clean Water Act of 1972, The Endangered Species Act of 1973, and the National Environmental Policy Act of 1969. These laws played and continue to play a significant role in the political and social processes of dam removal.

Dam removals have occurred primarily to support this growing public value of ecosystem restoration. However significant controversy has surrounded many dam removal projects and the presence of ESA-listed species has been the primary driver of forward momentum toward dam removal. Salmonid species throughout the PNW were listed as endangered during the 90s and 2000s (Blumm and Erickson, 2012) and this played a central role in the Elwha River and Klamath Basin dam removal projects that will be discussed in this paper. Coupled with future environmental uncertainty associated with climate change, salmonids face looming hurdles toward continued survival in the PNW. Within riparian ecosystems of the Federal Columbia River Power System (FCRPS), this uncertainty is at the heart of a longstanding legal battle over continued hydropower operation and provisions for salmonid passage at several large dams.

This paper will first examine the social, economic, and political processes that preceded the NEPA analysis for two dam removal projects: The Elwha River project and the Klamath River project. It will then examine the NEPA process itself and consider how the distinct contexts of each project and the processes leading to them affected the NEPA and the ultimate success of the project. Based on conclusions drawn from these two cases, I will then discuss the implications for dam removal within the FCRPS in the context of the recent NMFS v NWS litigation holding that continued operation of FCRPS dams jeopardizes salmonid species. The FCRPS shares many similarities with the Elwha and Klamath projects yet is distinct in both its size and the number of stakeholders that would be affected by dam removal.

Literature Review

The literature on dam removal can be divided into three distinct perspectives which inform the multitude of stakeholder viewpoints preceding a dam removal project. First, there is the perspective of dam removal from an ecological standpoint. This perspective is almost completely biophysical, concerned only with biological and environmental components of a dam removal project. Research is concerned with effects on hydrologic regime of a river following removal, effects on species, and transport of sediment (Gregory et al. 2002). Dam removal has been shown to facilitate more significant flooding and bank erosion during higher rainfall events in the years following removal, but generally habitat for riparian animal and plant species is improved. Further, most river channels stabilize within a few years (O'Connor et al., 2015), and anadromous fish species greatly benefit from restored water temperature patterns and flood dynamics (Gregory et al., 2002). While there have been numerous small-scale dam removals in the past several decades, there exists a large degree of uncertainty surrounding large-scale dam removals (Hart et al. 2002). To better understand these processes, geomorphologists utilize mathematical models of sediment transport and erosion to predict the effects of dam removal (Pizzuto, 2002).

It is often the results of these simulations, coupled with post-removal field measurements, that inform effects analyses of future dam removals.

The second perspective within dam removal literature is the sociocultural perspective. This perspective is concerned with human experience associated with dammed rivers and includes native American tribes' rights, economic impacts of dams, hydropower and clean energy discourse, aesthetic values of natural rivers, and recreational values of reservoirs. Johnson and Graber (2002) argue that public support for a dam removal project is critical to its success and divisiveness of a project is exacerbated when the idea of dam removal is new to the community, when concerns of public safety are involved, and when outsiders to the community enter the negotiation process. For this reason, it is crucial for all parties to understand the complex social structure of any dam removal project and understand the variety of backgrounds and values involved. Gosnell and Kelly (2010) also discuss the economic and social components of dam removal in the context of the Klamath River project. Depending on one's social, economic, or spiritual values, attitudes toward a dam removal project may be near impossible to change, so adequate representation and recognition in the negotiation process has a strong influence on project success (Horangic, 2016).

The third perspective is closely related to the second but concerns broader institutional power relations, legal frameworks, and sources of funding associated with dam removal. Blumm and Erickson (2012) examine five dam removal cases, including the Klamath and Elwha projects, and find that having a strong political champion greatly reduces the length of time between project proposal and completion. This is unsurprising, considering dams are often profitable for their owners and may provide cheap power or irrigation to residents of states in which the dams operate. Many hydroelectric dam removals have been proposed in connection with FERC relicensing procedures (Chaffin and Gosnell, 2017) or in tandem with increasing recognition of the dam's effect on endangered anadromous fish species (Blumm and Erickson, 2012). Section 7 of the ESA prevents federal actions that jeopardize listed species or damage critical habitat to these species (Bowman, 2002). Either of these actions requires consultation with the National Marine Fisheries Service (NMFS) or the US Fish and Wildlife Service (USFWS), and often results in these agencies' prescribing mandatory action to improve habitat or remove the species from jeopardy. This often leads to dam owners considering dam removal as an alternative.

These three perspectives inform the NEPA process for individual removal projects. NEPA is the legal framework for federal agency action and was utilized in the Elwha and Klamath projects as a result of political, social and economic negotiations. The ESA required project dams to improve fish passage facilities, so agencies conducted the NEPA process to analyze the environmental, social, and economic impacts of possible actions to meet these requirements. Coupled with existing momentum from various stakeholders and political actors, the dam removal alternative was chosen in both cases. NEPA contains substantive and procedural components, but the procedural section has been repeatedly affirmed as the only legally enforceable component. NEPA requires agencies provide a venue for public involvement in the analysis process, and requires agencies analyze the environmental effects of their proposed action as well as a suite of representative alternatives that fulfill the same purpose and need. Further, NEPA requires the use of best available science in environmental analyses, and agencies often draw from the literature discussed above to estimate effects on the ecosystem. Framing dam removal and its alternatives in the same document allows for more direct comparison of the social, ecological, and economic effects of each action. NEPA's framework provides this comparison, and in the following examples, it demonstrated that removal offered substantial benefits compared to leaving dams in place with the construction of fish passage infrastructure.

Methods

The two primary research questions of this paper are:

1) What are the social and political processes leading to dam removal as a proposed action?
2) What is the NEPA process for dam removal?

These questions will be answered by examining a variety of legal and law review documents, as well as government publications, white papers, guidelines, and several popular press and personal blog articles. The latter two of these document types often argue from a biased perspective, but in the context of this essay I am seeking the perspectives of community members and stakeholders, so these biases serve to supplement the other, more neutral document types.

To answer question one, I reviewed several law review articles to gain context on the legal and historical relevance of each dam removal. These also offered implications for future dam removal projects by considering the multitude of important factors that influenced each project's success. I also reviewed government publications related to both removal projects to better understand agency perspectives, best practices for agencies considering dam removal, and the importance of formal agreements associated with each project. Case law further informed my analysis of the pre-NEPA process by providing the legal bases for dam removal and the relevant laws the drove significant agency action. Last, several popular press news articles and blog posts provided insight into the community perspective on each project and helped inform my interpretation of the degree of controversy associated with the removals.

To answer question two, I looked primarily at NEPA documents associated with each project. Building on the context and interpretation provided by the literature examined for question one, I reviewed the EISs and associated documents to understand how legal requirements, economic priorities, and varying goals of stakeholder groups were incorporated into the NEPA process. The processes leading to NEPA for each project were different in number of ways, and I examined how these differences affected the final EIS and project outcome. I also examined the importance of the formal agreements and laws associated with each project and how these were incorporated into the final EIS.

Considering the conclusions drawn from these two questions, I briefly discuss the implications for dam removal within the FCRPS. Numerous components of both the Elwha and Klamath removal projects can be examined in the context of the larger and more controversial hydropower dams on the Columbia and Snake rivers. I reviewed the most recent case law of the longstanding NMFS v NWF case and discuss potential outcomes and resolutions considering the various stakeholders, agreements, ecological science findings, and economic factors associated with the Klamath and Elwha projects.

Results

Elwha River Project

The Elwha River is the largest river on the Olympic Peninsula in Washington State. It drains an area of 321 square miles with a total of 70 miles of river and tributaries. The Elwha Dam was constructed 4.9 miles from the mouth of the river in 1910 and created the Lake Aldwell reservoir. Glines Canyon dam was constructed 8.5 miles further upstream and was completed in 1927. This dam created the reservoir known as Lake Mills. The primary purpose of the two dams was to supply power to the lumber mills and the growing population of Port Angeles located just east of the mouth of the Elwha river (Blumm and Erickson, 2012). The Lower Elwha S'Klallam Tribe has lived in the area since before European contact and has historically relied upon the Elwha River for food and cultural practices. After completion, the Glines Canyon Dam and the Elwha Dam produced 28 megawatts of power for the region, primarily for lumber mills and industry.

Both dams were constructed without fish passage facilities in violation of Washington State law (Blumm and Erickson, 2012). This eventually led to a mitigation agreement with the Washington Department of Fish and Wildlife in 1975 to fund downstream salmon rearing

infrastructure and regulate flows to allow spawning. In the years preceding this agreement, however, salmon populations were significantly affected, with all but one species eliminated from the ecosystem. At the same time, the upstream ecosystem remained in nearly pristine condition, and Congress established Olympic National Park directly upstream of Glines Canyon Dam in 1938.

When the Glines Canyon Dam's Federal Energy Regulatory Commission (FERC) license expired in 1973, some spoke out against the renewal process, arguing that hydropower operation contradicted the conservation goals of the national park (Chaffin and Gosnell, 2017). This led the Lower Elwha S'Klallam Tribe, USFWS, NOAA Fisheries, environmental groups, and the National Park Service to intervene in the relicensing process in 1986. Many argued that removal of both dams would enhance tribal sovereignty and reduce government interference in the tribe's affairs, as well as restore the ecological integrity of the river. Lumber mill operators and residents of Port Angeles opposed these groups and argued that removal would raise electricity costs and weaken the local economy. Much of the controversy lay in FERC's legal jurisdiction to relicense a dam within the confines of a national park, and proponents of dam removal appealed FERC's relicensing procedures to the Ninth Circuit in 1990 (Blumm and Erickson, 2012). FERC eventually released a draft EIS in 1991 stating that removal of the Glines Canyon and Elwha Dams was feasible and would restore the ecological health of the river. It further claimed that electricity customers could get electricity from the Bonneville Power Administration (BPA) for less than was currently charged for Elwha hydropower projects. However, arguments between opponents of removal, environmentalists, and federal agencies continued until Congress passed the Elwha Act in 1992 giving Interior final decision-making authority (Wunderlich et al. 1994).

As a result of the Elwha Act, Interior determined that removal of both dams was the preferred action to restore the Elwha's ecosystem. The National Park Service, as lead agency, released a draft EIS in 1993 which adopted most of FERC's first draft EIS. The final EIS was released in 1995 and considered the alternatives of dam retention with fish passage facilities, removal of both dams, removal of only one dam, and no action. Funding for purchasing the dams was acquired from Congress by 1998, and additional funding for removal was acquired over the next eleven years through several championing congressional representatives (Blumm and Erickson, 2012). In 2010, the National Park Service had secured adequate funds and awarded contracts for removal of both dams.

Klamath River Project

The Klamath River Basin drains more than 15,000 square miles of temperate rainforest and high desert in Oregon and California. The Klamath Rivers is historically significant as a cultural resource and source of salmon and sucker fish for the Klamath Indian Tribes. Beginning in 1913, the US Bureau of Reclamation began construction of a series of dams and irrigation canals on the Klamath River to provide electricity to the growing population of settlers in Oregon and California seeking gold, timber, and fertile farmland (Blumm and Erickson, 2012). By 1925, the first two dams were completed 198 miles upstream of the Klamath River's mouth, blocking seventy-five miles of spawning habitat in the upper Klamath basin. A third hydroelectric dam was completed in 1958 to supply the increasing demand for water and power. Under threat of lawsuit by the California Fish and Game Department, the dams' owner Pacificorp ordered construction of a fourth dam to control water flows and regulate fish habitat downstream. The resulting Iron Gate Dam, completed in 1962, stood 173 feet tall and produced 18MW of power. Today, the four Pacificorp dams produce roughly 81MW of power and supply irrigation and electricity to 1400 farms and 70000 homes in the Klamath Basin. With no fish passage facilities, the dams block anadromous fish access to 300 miles of the upper river and its tributaries.

The two main stakeholders in the Klamath basin are the farmers who benefit from inexpensive water for irrigation and the Klamath Tribes whose water and fishing rights are

recognized to date back to “time immemorial” (Gosnell and Kelly, 2010), and were officially recognized in an 1864 treaty (Blumm and Erickson, 2012). However, early settlers in the area above Upper Klamath Lake claimed irrigation rights under first-come first-served basis in disregard for existing tribal use. The Department of the Interior authorized the 1905 Klamath Irrigation Project to drain significant parts of the Klamath River for agricultural production and flood control (Gosnell and Kelly, 2010), which began the dispute over water rights that drove construction of the four Pacificorp dams and the ongoing controversy over their removal. In 1957, the Klamath River Basin Compact was signed by Oregon and California to prioritize irrigation over all other uses (Blumm and Erickson, 2012). This drove a further influx of farmers seeking cheap water and power and put increasing pressure on the native fish species.

In 1971 the Lost River and shortnose suckers were identified as species of concern, and in 1983 Klamath Tribes’ water rights were upheld in the Supreme Court (*United States v Adair*). This guaranteed tribes enough in-stream water to support continued fishing in former reservation lands, however the case did not specify a particular amount. Both species of concern were recognized as endangered under the ESA in 1988, and several years of tribal and commercial fishery decline followed (Blumm and Erickson, 2012). By 1997, the Coho salmon was listed as threatened in the basin while demand for irrigation supply remained steady. The controversy over water supply and fishery health came to a climax between 2001 and 2002 when, in 2001, a severe drought forced Reclamation to shut off irrigation to maintain adequate river flows and avoid jeopardizing endangered native fish species (Gosnell and Kelly, 2010). The decision was widely criticized, and Reclamation issued a new water management plan in 2002 to restore water supply to irrigation customers. Historically low flows later in the season led to the worst fish die-off in history in which more than 30,000 adult salmon and other species perished (Gosnell and Kelly, 2010).

Negotiations between Tribes, irrigation districts, California and Oregon, and several NGOs and private companies began in 2005 to find an equitable solution to the numerous challenges posed by the Klamath project (Horangic et al. 2016). The FERC license for the Klamath Hydroelectric Project expired in 2006, and a 2007 EIS found that mitigation costs to improve fish passage would cost roughly $300 million. After several years of negotiation, the Klamath Basin Restoration Agreement (KBRA) was signed by California, Oregon, and the Klamath Tribes in 2010. The agreement created a process for ecosystem restoration through removal of the four Klamath dams, as well as provision for irrigation to Klamath irrigation customers. The Klamath Hydroelectric Settlement Agreement (KHSA) was negotiated between 2008 and 2009 as a forum to study and plan the dam removal process, including sources of funding for the project (Horangic et al. 2016). The final EIS for removal of the four dams in the KHSA was released in 2012, and the KHSA was signed in 2016.

Discussion

Elwha River Project

The Elwha and Glines Canyon removal project spanned more than 20 years from start to complete removal. However, in comparison to the Klamath project, negotiations for dam removal on the Elwha were relatively uncomplicated. There are a number of reasons for this. The number of stakeholders involved in negotiations was small and only included local industry stakeholders from Port Angeles. The upper river is also within the boundaries of Olympic National Park so removal and restoration were coherent with National Park Service goals. Further, funding was acquired over a longer period of time, so no single party was required to contribute a burdensome amount.

From an ecological standpoint, dam removal on the Elwha was likely to be successful in bringing back anadromous fish with little uncertainty regarding other effects to the ecosystem. The dams themselves were smaller in size, so they held a smaller volume of sediment than the Klamath dams. The coastline on which the mouth of the river would deposit sediment was relatively unpopulated and removal would have little effect on manmade or natural habitats on the coastline. In general, the EIS claims few uncertain effects on the river's geomorphic structure as a result of sediment release, while claiming near immediate improvements in habitat for endangered fish species. Ecological uncertainty is inherent in every dam removal project (Gregory et al. 2002) and can be a source of hesitation and stalled negotiations when uncertainty is large. It seems that the near guaranteed improvement to endangered species habitat largely outweighed the uncertainty of removing the centuries-old dams, and so little controversy arose regarding ecological effects.

The social and economic components of the Elwha dam removal were more significant in prolonging the project. Tribes historically fished in the river and were affected by declining fisheries. At the same time, the growing timber industry in Port Angeles received most of their electricity from the hydropower generators on the dams. Proponents for both sides left made little headway in negotiations until the first draft EIS claimed timber mills would be guaranteed power from BPA at the same rate. The final EIS claims a number of other benefits associated with removal of both dams including creation of construction jobs for local residents to remove the dams, economic benefits from improvements to the marine fisheries, and improvement to Port Angeles' harbor due to increased release of sediment from the river. The timber industry had been declining for several decades preceding the proposal, so the promise of guaranteed jobs and provision of equal cost electricity was a powerful draw for Port Angeles residents. Further, environmental groups and federal agencies partnered with Tribes early on which likely increased Tribes' trust in the negotiation project and willingness to cooperate with project opponents (Horangic, 2016).

Perhaps the most significant driver of the project's success was the ESA. Once native fish species in the Elwha River were listed as endangered, dam operators were required to act to improve fish passage. Despite the timber industry's initial protest, the ESA supersedes economic interests when it comes to jeopardized species, so action was legally required in order to improve habitats (Blumm and Erickson, 2012). It seems the dam retention alternatives were included primarily to satisfy industry stakeholders, despite their significant economic disadvantage. Determining who had jurisdiction over the dams was also a primary cause of the lengthy project. When Glines Canyon Dam's FERC license expired, environmental groups and Tribes protested renewal by arguing that dam owners did not have jurisdiction over property in a national park. The eventual transfer of the dam to Interior proved this fact, but not before a decade of disagreement and court cases. However, once the Elwha Act was passed and jurisdiction was transferred several years later, the EIS process was straightforward with much less controversy. Funding for the removal also contributed to the project's timespan, as funds had to be allocated by Congress and it was difficult to allocate $30 million for dam acquisition and an additional ~$300 million for removal and restoration. Funding was acquired in small chunks in the years following the release of the final EIS, due at least in part to a changing political climate and attitude toward removal (Blumm and Erickson, 2012).

Klamath River Project

The Klamath River project was similarly controversial and, despite the conclusion of the NEPA process in 2012, is still under development with removal set for completion in 2020. The "Definite Plan" for removal of the four Klamath dams in the project was released in June 2018 (Kober, 2018) and outlines the procedures for dam removal and river restoration. This was seen as the most recent of significant milestones on the road to complete river restoration that began

in earnest in the late 90s. In contrast to the Elwha dam removals, however, stakeholders on the Klamath project come from a wide geographic area with a variety of values and economic interests. The ecological impacts of the four Klamath dams are also more easily identifiable, giving removal proponents more direct evidence for their case.

From an ecological standpoint, the four Klamath dams have had severe effects on riparian ecosystems since the dams were constructed. Dams blocked salmon passage to upper 300+ miles of river and tributaries and the EIS cites several existing detrimental effects that removal would address, including frequent toxic algal blooms, higher than average water temperature, and degraded marine and estuary ecosystems downstream. As with any dam removal project, high volumes of sediment stored behind dam structures pose a significant threat to downstream ecosystems following removal. However, these effects would likely be limited in duration and the negative impacts would be outweighed by long-term improvements. The Klamath dams are much further upstream than the Elwha and Glines Canyon dams were, so there is a higher degree of uncertainty regarding ecological effects of removal on distal habitats. Opponents of the Klamath dam removals have seized upon this factor as one reason not to continue the project, which has delayed the removals to some degree. Indeed, even as a vocal proponent of dam removal, former Interior Secretary Bruce Babbitt (2002) argues environmental effects of dam removal should be studied in-depth beforehand and monitored afterward to ensure negative consequences are mitigated. The 3000+ page final EIS for the project is strong evidence that proper analysis was conducted.

The most significant source of controversy throughout this project's lifespan was the conflict between irrigation customers and Klamath Tribes and allies. Hydropower customers and dam owners also contributed to the controversy. On one side, federally recognized Tribal fishing and water rights gave Klamath Tribes significant control over dam operations, especially considering the Tribes' declining health since dams were installed and the climactic 2002 fish die-off. On the other, the growth of farming communities in the valley steadily increased demand for water and power to support farm livelihoods. Neither side's argument rested solely on aesthetic or wilderness values as were those associated with dam removal on the Elwha in Olympic National Park. Removal or retention of the Klamath dams would likely result in significant economic hardship for farmers or Tribes, respectively. As a result, negotiations involved a number of different stakeholders, politicians, and lobbyists to ensure all sides were heard. The high degree of uncertainty also had a strong influence on the contentious negotiation process. Johnson and Graber (2002) argue that individuals are most likely to adopt the ideological stance of others when they are uncertain about the facts or the outcome of the situation, and when others are similar to themselves. Applied to both sides of stakeholders, it is easy to understand the inherent divisiveness of a project with this degree of uncertainty.

As with the Elwha removal project, listing of native fish species under the ESA was the strongest legal driver of action in the Klamath Basin. Especially following the 2002 salmon die-off, Pacificorp had little room to continue operations as they had been. The 2005 FERC relicensing process put further pressure on dam operations when FERC required $300 million improvements to dam fish passage. Pacificorp appealed the requirements but eventually requested FERC begin the negotiations that would eventually become the KHSA and would seek to balance river restoration and provision of irrigation and power to farmers. Funding for the project was another significant source of contention, especially considering the Klamath's location in both Oregon and California, and stakeholders from areas represented by several different congressional representatives. Implementation of some aspects of the KHSA would require ~$750 million, and a politically gridlocked Congress failed to authorize the agreements by their deadline in 2016 (Chaffin and Gosnell, 2017). Meanwhile, Pacificorp amassed enough funding from state bonds and ratepayer fees to remove the dams, which bolstered environmental and Tribal arguments for dam removal. Like the Elwha dam removals and many others throughout the country (Babbitt, 2002), the eventual settlement for removal of the Klamath dams was driven by local organizers

and funded in part by the dam operators themselves. Such ideologically divisive issues are likely to experience substantial opposition at higher political levels, so final negotiations are most effective at the local or state level. The final EIS contains sprawling provisions to accommodate the KHSA, KBRA, and existing Tribal, irrigation, and power agreements, as well as four alternatives to the proposed "complete removal" action. It is difficult to imagine the NEPA process for a project with a wider range of stakeholders and environmental effects, especially if it spans more than two, politically similar, states.

FCRPS

The FCRPS is a vast facility of multi-purpose hydroelectric dams spread across the Columbia River's mainstem and its major tributaries (US Bureau of Reclamation, 2018). Power from FCRPS provides about one third of the power used in the PNW and a 2014 biological opinion (bi-op) found that continued operation of the FCRPS dams jeopardized 13 endangered or threatened species in the Columbia River Basin (Miller, 2018). The bi-op offered several alternatives to improve fish habitat, including increasing water flows and improving fish passage facilities. This bi-op is part of a longstanding series of court cases between NMFS and NWF, as well as a number of other plaintiffs. Plaintiffs argue that dam operations violate the ESA, including those offered by the bi-op to eliminate jeopardy status of salmonid species. An April 2018 ruling sided with plaintiffs by finding NMFS and its bi-op did violate the ESA by jeopardizing salmonid species.

As it stands, FCRPS operation is in violation of the ESA and action is legally required to prevent jeopardy to listed species. This may entail substantial improvements to fish passage infrastructure at most of its dams, which would likely pose an enormous capital investment by BPA, Reclamations, the Army Corps of Engineers, and other parties. Revenues collected by BPA from sale of electricity throughout the region pay for continued operation of the dams, so it is possible rate payers would be stuck with the bill of improving fish passage facilities. The Columbia Basin Project also provides irrigation for a large portion of central Washington and is responsible for more than half a billion dollars in agriculture revenue. This demonstrates the enormous momentum associated with continued operation of the FCRPS dams. At the same time, it is unlikely that anything but substantial transformation of dam operations will improve the likelihood of salmon species survival in the Columbia Basin.

The FCRPS project has many similarities to the Klamath removal project. Both projects have a large number of stakeholders with opposing ecological and economic interests. Both projects also involve multiple dams across a wide range of physical terrain far from the main stem of the river's mouth. For these reasons, there is both a high degree of ecological uncertainty regarding the effects of dam removal (if dam removal were proposed on the Columbia) and a wide range of stakeholders who would be economically affected by the dams' removal. However, the Columbia Basin is significantly larger than the Klamath Basin in every respect discussed in this essay. If the barriers to expedient and respectful negotiations regarding habitat improvement and stakeholder needs are scaled, it is difficult to imagine a dam on the Columbia River removed in my lifetime.

At the same time, the ESA's language is clear and the NMFS v NWF cases have repeatedly affirmed FCRPS's violation of the ESA. Action is required to improve the FCRPS in the short term, while longer term solutions are certainly being considered. One central component of the recent case was the finding that NMFS's bi-op did not adequately consider the effects of climate change on future species viability. With the uncertainty that climate change will bring to salmonid habitat in the Columbia Basin, present operation regimes will likely be inadequate in the future even if they don't presently jeopardize species (Jensen, 2016). In this context, it is also difficult to imagine an outcome that does not consider removal of one or multiple FCRPS dams. However, this would take a tremendous amount of political will and cooperation, especially

considering the wide geographic area of the Columbia Basin. An agreement similar to the KHSA or the Elwha Act would certainly be necessary as a framework for considering the perspectives of all relevant stakeholders and informing the NEPA process for dam removal and its alternatives.

Conclusion

After multiple decades of dam building in the American West, ecosystem scientists, Native American tribes, and environmental groups are becoming increasingly supportive of dam removal to restore riparian ecosystems. However, significant barriers to dam removal exist, including longstanding stakeholder investments based on hydropower and irrigation, uncertainty regarding ecological effects of removal, and difficult negotiations between stakeholders with opposing ideals. The Elwha and Glines Canyon Dams in Washington State, and the four dams associated with the KHSA on the Klamath River offer case studies on the social, environmental, and legal processes preceding NEPA analysis, and the EISs that result from these processes. Dam removal on the Elwha River encountered a variety of obstacles as a result of differing stakeholder values but was ultimately successful. Dam removal on the Klamath River has encountered significantly more opposition, partially as a result of the wide range of stakeholder values and environmental impacts, as well as changing political power and sources of funding throughout the life of the project. NEPA analysis was eventually completed for the Klamath project, and it seems likely removal will occur by the end of 2020. Characteristics of these pre-NEPA negotiations and the NEPA analyses themselves can be applied to the ongoing case of ESA-listed species jeopardy within the FCRPS. Courts hold that action is required to prevent jeopardy to salmonid species, but the vast network of stakeholder groups in the region poses an enormous hurdle to accomplishing large-scale changes within the system and improving the ecosystem. It remains to be seen how FCRPS will meet court-mandated requirements, but it seems likely that a future EIS will include dam removal as an alternative to meet these requirements.

References

Babbitt, Bruce. “What Goes Up, May Come Down.” *BioScience* 52, no. 8 (2002): 656–58.

Blumm, Michael C., and Andrew B. Erickson. “DAM REMOVAL IN THE PACIFIC NORTHWEST: LESSONS FOR THE NATION.” *Environmental Law* 42, no. 4 (2012): 1043–1100.

Bowman, Margaret B. “Legal Perspectives on Dam Removal.” *BioScience* 52, no. 8 (August 1, 2002): 739–47.

Chaffin, Brian C, and Hannah Gosnell. “Beyond Mandatory Fishways: Federal Hydropower Relicensing as a Window of Opportunity for Dam Removal and Adaptive Governance of Riverine Landscapes in the United States” 10, no. 3 (2017): 21.

Cho, Renee. “Removing Dams and Restoring Rivers.” *State of the Planet* (blog), August 29, 2011. https://blogs.ei.columbia.edu/2011/08/29/removing-dams-and-restoring-rivers/.

Final Environmental Impact Statement (EIS) on Elwha River Ecosystem Restoration Implementation, Nov 1996
https://www.nps.gov/olym/learn/nature/upload/elwhafinaleis1.pdf

Gosnell, Hannah, and Eric Clover Kelly. “Peace on the River? Social-Ecological Restoration and Large Dam Removal in the Klamath Basin, USA” 3, no. 2 (2010): 22.

Gregory, Stan, Hiram Li, and Judy Li. “The Conceptual Basis for Ecological Responses to Dam Removal: Resource Managers Face Enormous Challenges in Assessing the Consequences of Removing Large Dams from Rivers and Evaluating Management Options.” *BioScience* 52, no. 8 (2002): 713–23.

Horangic, Alexandra, Kate A. Berry, and Tamara Wall. “Influences on Stakeholder Participation in Water Negotiations: A Case Study from the Klamath Basin.” *Society & Natural Resources* 29, no. 12 (December 1, 2016): 1421–35.

Jensen, Thomas. “Highlights from National Wildlife Federation v. NMFS: Climate Change Impacts and Shifts in ESA and NEPA Analyses.” *Holland and Hart* (blog), May 10, 2016
https://www.hollandhart.com/highlights-from-national-wildlife-federation-v-nmfs-climate-change-impacts-and-shifts-in-esa-and-nepa-analyses

Johnson, Sara E., and Brian E. Graber. “Enlisting the Social Sciences in Decisions about Dam Removal”. *BioScience* 52, no. 8 (2002): 731–38.

Klamath Facilities Removal Final Environmental Impact Statement, Dec 2012.
https://klamathrestoration.gov/sites/klamathrestoration.gov/files/Additonal%20Files%20/1/4/Volume%20I_FEIS.pdf

Kober, Amy Souers. “Plan Released for Klamath River Dam Removal.” *American Rivers* (blog), 2018. https://www.americanrivers.org/2018/06/plan-released-for-klamath-river-dam-removal/.

McCool, Daniel. “The Politics of Dam Removal and River Restoration”, in *Environmental Politics and Policy in the West*. Rev. ed. Boulder, Colo: University Press of Colorado, 2007.

Miller, David. “Ninth Circuit Affirms Injunction Order for Federal Columbia River Power System to Prevent Harm to Listed Salmonids.” *Endangered Species Law and Policy* (blog), April 9, 2018. https://www.endangeredspecieslawandpolicy.com/2018/04/articles/conservation/ninth-circuit-affirms-injunction-order-for-federal-columbia-river-power-system-to-prevent-harm-to-listed-salmonids/.

National Park Service. “Timeline of the Elwha 1992 to Present - Olympic National Park” 2018. https://www.nps.gov/olym/learn/historyculture/timeline-of-the-elwha-1992-to-present.htm.

NOAA Fisheries. “West Coast Salmon & Steelhead Listings” 2018. https://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/salmon_and_steelhead_listings.html

O’Connor, J. E., J. J. Duda, and G. E. Grant. “1000 Dams down and Counting.” *Science* 348, no. 6234 (May 1, 2015): 496–97.

Pizzuto, Jim. “Effects of Dam Removal on River Form and Process.” *BioScience* 52, no. 8 (2002): 683–91.

Reisner, M. *Cadillac desert: The American West and its disappearing water*. Penguin, 2010.

US Bureau of Reclamation. “Federal Columbia River Power System Biological Opinion” 2018. https://www.usbr.gov/pn/fcrps/index.html

Wunderlich, Robert, Brian Winter, and John Meyer. “Restoration of the Elwha River Ecosystem.” *Fisheries* 19, no. 8 (1994): 11–19.