The Beginning of the World's Largest Dam Demolition: Iron Gate Dam

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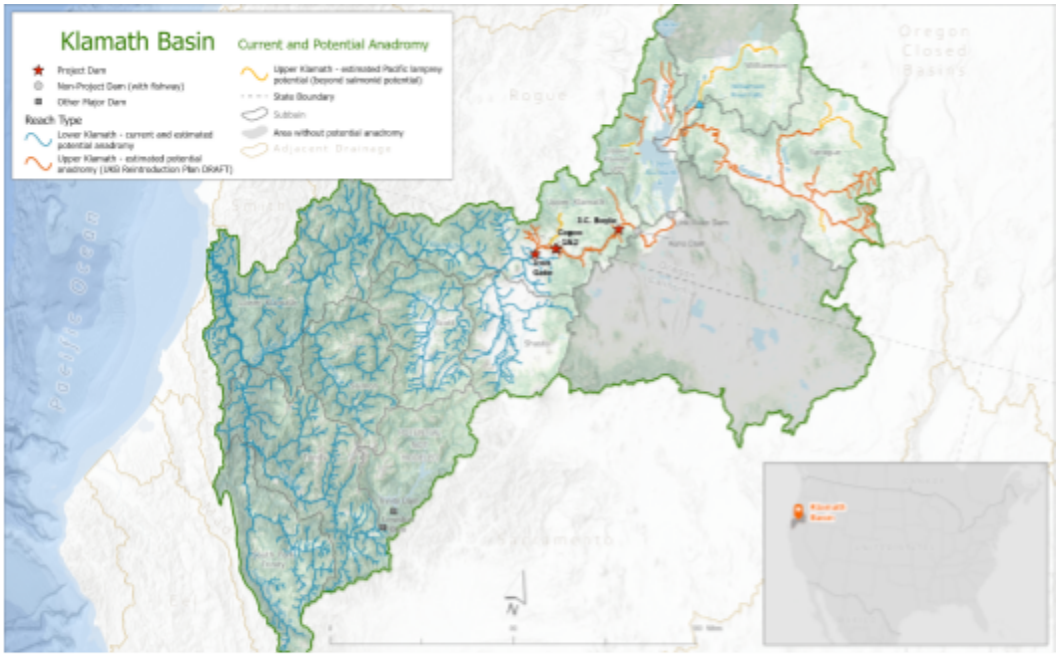


(*Preparing the Klamath Basin for Dam Removal*, 2020)

Abstract

In November 2022, the Federal Energy Regulatory Commission approved the plan to remove four dams on the Klamath River in California and Oregon, enabling a 15-year settlement agreement involving California, Oregon, the nearby Native American Tribes, PacifiCorp, fishing industry, and other stakeholders. By the end of this year, 2024, all four dams are planned to be removed, and restoration work will continue beyond 2024. This paper aims to explore the history of the Klamath River and its dams, including the conservation and tribal injustice issues associated with the dams. With the planned demolition of the dams this year, there will be significant changes to the environmental flow and habitat, which will help restore food sovereignty to nearby tribes. This paper will discuss habitat restoration, tribal justice, and future challenges associated with the dam removal in addition to producing a graph of the general environmental flow before and after the completion of the demolition.

I. Introduction

The Klamath Basin flows west from southern Oregon into northern California, covers an area of more than 12,000 square miles, and empties into the Pacific Ocean. It's home to about 114,000 people, including four Native American tribes, Karuk, Lamath, Hoopa, and Yurok tribes. Additionally, it supports and provides spawning grounds for various anadromous fish species, such as Chinook salmon, coho salmon, and steelhead trout (NOAA, 2022).

With the long history of water rights conflict in the Klamath Basin, the world has its eyes on the Iron Gate Dam, as it will soon become the first out of four dams approved to be removed by the Federal Energy Regulatory Commission (Governor's Office, 2022). This paper examines the historical water conflict in the Klamath Basin that led to the removal of the Iron Gate Dam and the river flow regime without restriction by the dam.

II. Environmental Impacts of the Iron Gate Dam

Like all dams, Iron Gate Dam has several negative environmental impacts, such as the disruption of migration patterns and loss of spawning habitat for the fish population. The high nutrient concentration below the Iron Gare Dam triggers the growth of algae and aquatic plants that attach to the dam, dissolving oxygen and increasing the pH level creating an alkaline environment detrimental to salmonids. The process is known as "nutrient spiraling," where the dying and decaying algae and macrophytes float downstream, leading to continuous high nutrient input into the summer months (Asarian et al., 2009).

Additionally, the water release from the Iron Gare Dam is warmer during the fall and cooler temperatures during the spring, negatively impacting salmon spawning and rearing downstream (Van Vleck, Deukmejian, and Kennedy 1986). Most importantly, the Iron Gate Dam, including Copco 1, Copco 2, and J.C Boyle dams, was not constructed with fish ladders that allow anadromous fish to access the upper reaches of the Klamath Basin and removed hundreds of miles of potential habits (NOAA, 2022).

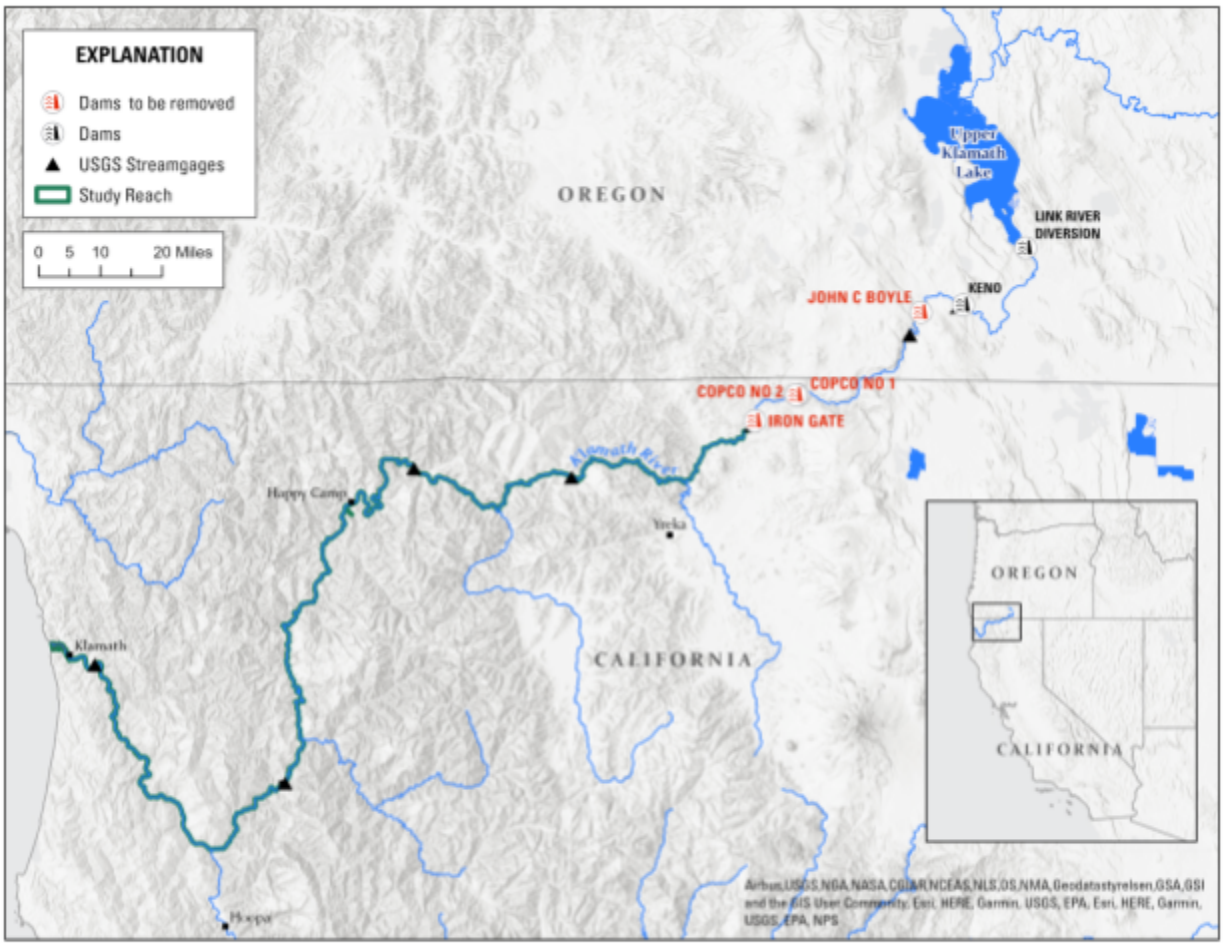
The dam's presence and subsequent operation also led to water quality degradation caused by sediment and pollutant accumulation. Before the dam's construction, the Klamath River

transported sediment downstream, contributing to the natural sediment balance in the river system. However, the dam disrupts this process by trapping sediment, causing it to accumulate in the reservoir. As a result, downstream sections of the River are deprived of necessary sediment inputs, leading to erosion, loss of habitat, and altered ecological conditions. For example, according to PacificCorp's report on the Klamath Hydroelectric Project, "At the peak flow, the threshold elevation was inundated by 2.7 feet of water, which could have killed new seedlings by drowning, scour, erosion, or event burial by sediment" (PacificCorp, 2004).

III. The Klamath River Dam Removal Project

The removal of the Copco #1, Copco #2, Iron Gate, and JC Boyle dams on the Klamath River in California and Oregon received final permission from the Federal Energy Regulatory Commission (FERC) on November 17, 2022 (California Natural Resources Agency, 2022). A 15-year settlement including California, Oregon, the Yurok and Karuk Tribes, PacifiCorp, fishing organizations, and other parties was made possible by removing four Klamath River dams. The deal attempts to address tribal justice while also enhancing fish populations and river health. With the final approval, the 2016 Amended Klamath Hydroelectric Settlement Agreement may now go into force. After FERC agreed in June 2021 to approve PacifiCorp's exit from the license, the license for the hydropower project was transferred to California, Oregon, and KRRC as co-licensees for dam removal while waiting for the plan's ultimate approval. This project would include the biggest dam removal ever (Ingram, 2022).

The Klamath River's four dams prevent “salmon and steelhead from reaching more than 300 miles of crucial spawning and rearing habitat in the upper basin”, leading to a decline in fish populations, as shown in Map 1 (California Trout, 2022b). Due to their inability to reach their native habitat, once plentiful species like the Upper Klamath-Trinity Rivers spring-run Chinook salmon today number fewer than 3%, which has been especially detrimental to the Tribes whose territory the Klamath runs through. Despite widespread support for the effort to remove the dams, some local landowners and ranchers who live close to the existing reservoirs continue to oppose it (California Department of Fish and Wildlife, n.d.).



Map 1: Location of Klamath River Basin, study reach, principle streams, dams, and hydroelectric facilities, California and Oregon (USGS).

Four PacifiCorp-owned dams will be taken over by the nonprofit Klamath River Renewal Corporation (KRRC), which was founded in 2016 to take ownership of them and oversee their demolition. The removal procedure will involve reclaiming previously flooded area and putting all essential mitigating measures into place while adhering to all relevant laws. In 2022, FERC approved a license transfer to KRRC, giving them the project responsibility. KRRC secured permits, developed deconstruction plans, secured bids, and contracted a design-build firm for most of the project. In March 2023, KRRC started enabling construction projects by constructing access roads for heavy equipment access. Crews will reinforce existing bridges and build new ones to allow access for further construction. These projects will continue through 2023 to prepare for reservoir drawdown in January 2024, followed by the removal of the dams during the

summer and fall of 2024. Klamath River Restoration (RES), a leading environmental solutions company, is working with Tribal partners on restoration activities, collecting native seeds, and preparing tributaries and habitats upstream of the dams to return fish. The first dam, Copco #2, will be removed between June and September 2023, followed by a reservoir drawdown in January 2024. By the end of 2024, all four dams will be removed, and restoration work will continue beyond 2024 (California Trout, 2022a).

IV. Changes to the River Flow Regime

The construction of the Iron Gate Dam resulted in significant alterations to the River's flow regime. The dam regulates the River's flow through controlled releases, leading to more stable and predictable water levels. While this may benefit certain human activities, such as irrigation and hydropower generation, it disrupts the natural flow patterns and the associated ecological processes. Removing the dams could restore natural flow patterns to the Klamath River.

To examine the natural flow region of the Klamath River near the Iron Gate Dam, I analyzed the natural streamflow patterns of the River according to the eflow.UC Davis website developed by Lane et al. in 2023, the Klamath River is classified as a groundwater river. Subsequently, I computed the instream flows by extracting functional metrics from the California Natural Flow Database webpage for the upstream and downstream sections of the River, precisely above and below the Iron Gate Dam. Then calculate, California Natural Flow Database provides the Average annual flow from the historical flow. Figure 1 shows a reference hydrograph that depicts the seasonal and interannual variation of the flow of a Groundwater river.

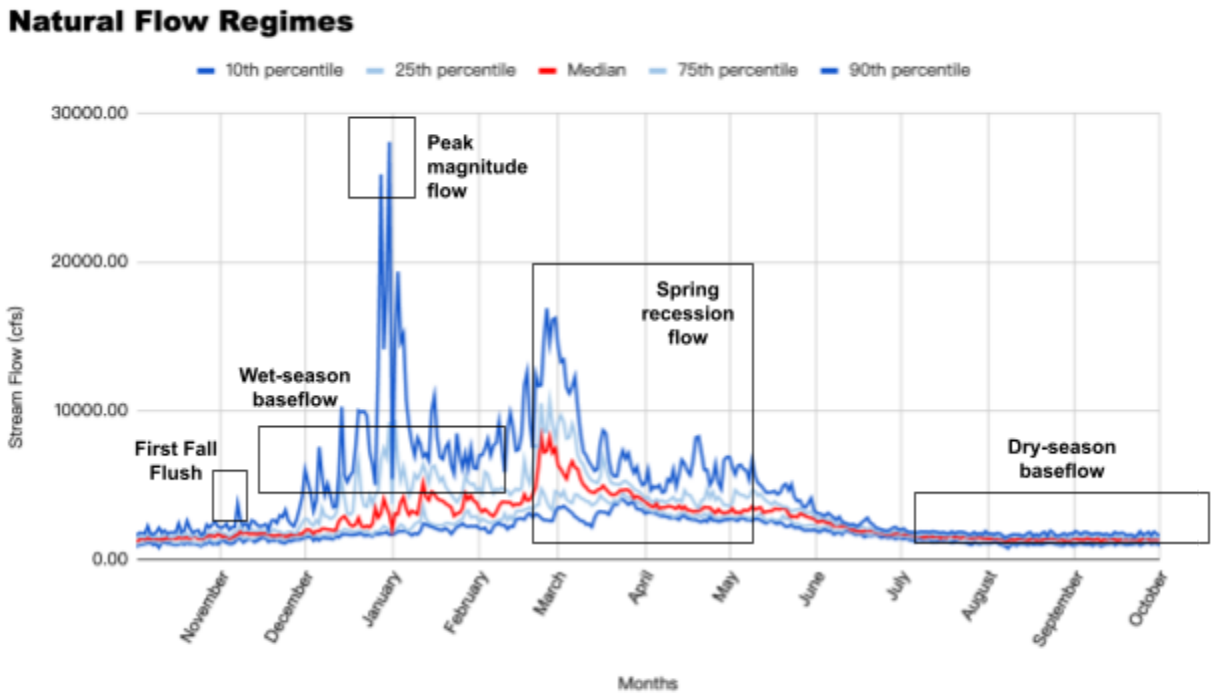


Figure 1: The natural flow regime of Klamath River at the Iron Gate Dam. The red line represent the median flow. The outer dark blue lines represent the 10th percentile flow and the 90th percentile flow. The inner light blue lines represent the 25th and the 75th percentile flow.

V. Environmental Justice Aspect of Dam Removal

The Klamath Tribe, the Modoc Tribe, and the Yahoiskin Band of Snake Indians are three Native American groups traditionally living near the Iron Gate Dam and the Klamath River. The Klamath River has always been essential to their economic existence, history, culture, identity, and spirituality. The River serves as a hub for the tribes by supplying them with food, transportation, opportunities for commerce, and many other necessities of existence. Salmon, steelhead, eulachon, lamprey, and green sturgeon were all present in large numbers in the rivers before the Klamath Reservation was created in 1855 (Yurok Tribe, 2016). Many fish species have been extinct today, and their tributaries only make up a small portion of what they once did (Sloan, 2011).

The Iron Gate Dam's removal would support Indigenous communities' sovereignty and right to self-determination. It would give tribes back sovereignty over the lands and resources that were

once theirs, enabling them to make choices that reflected their values regarding culture, the environment, and the economy. Removing the Iron Gate Dam would be a big step toward recognizing and protecting the sovereignty of Indigenous nations by honoring Indigenous rights and allowing autonomy in resource management (Sloan, 2011).

VI. Conclusion

In conclusion, removing the Iron Gate Dam in the Klamath Basin holds immense significance for the environment, Indigenous rights, and social justice. It represents a crucial step towards restoring the River's natural flow, revitalizing the ecosystem, and allowing fish species to access vital habitats. This action also acknowledges and respects Indigenous communities' cultural and spiritual connection with the Klamath River. By removing the dam, the government recognize and upholds the sovereignty of Indigenous nations, granting them control over their ancestral lands and resources. It demonstrates environmental justice, acknowledging Indigenous communities' historical injustices and allowing them to reclaim their cultural practices and exercise self-determination.

Removing the Iron Gate Dam contributes to broader social and environmental justice goals by addressing the negative impacts caused by the dam's presence and promoting the well-being of the ecosystem and the surrounding communities. It signifies a collaborative effort among various stakeholders, paving the way for a more equitable and sustainable future. In dismantling the Iron Gate Dam, we take a significant stride towards honoring Indigenous rights, restoring the River's natural balance, and fostering a healthier and more resilient ecosystem. This achievement represents the collective commitment to protect and preserve the Klamath River, its biodiversity, and the cultural heritage of the Indigenous peoples who have relied on its resources for generations.

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