

https://unsplash.com/photos/gray-fish-jumping-over-body-of-water-surrounded-with-plants-9vkJPfh9Anw

**Title:** Salmon, Society, and Success: A case study on the intersections of colonialism, ecological degradation, and the power of social action.

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**Abstract:**

Using a case study approach, this lesson examines colonialism as an ongoing force affecting nature, culture, and society by focusing on decades of tribally led efforts resulting in recent federal approval of four Klamath River dams. Chinook Salmon are not only endangered keystone species among the Pacific Northwest, but they also play invaluable roles to the communities that rely on them. Using the Four-Dimensional Ecology Education Framework (4DEE) combined with aspects of environmental sociology, this module encourages students to critically examine the causes and consequences of salmon population decline. Further, students will evaluate the decision-making involved in the largest dam removal by critiquing different stakeholder perspectives through a role-playing activity. With the conclusion of this module, students will recognize the opportunity imposed by climate change as a vehicle for social action and the integration of various forms of knowledge as a driver in making more equitable ecological decisions for our futures.

**Four Dimensional Ecology Education (4DEE) Framework:**

Core Ecological Concepts:

1. **Organisms-** Abiotic & biotic features of the environment
2. Community- Biodiversity
3. Biosphere- Global Climate Change

Ecology Practices:

1. Natural History- As an approach, making observations & connections
2. Quantitative reasoning- Data analysis and interpretation
3. **Critiquing investigations-** Evaluating claims, argument from evidence
4. Working collaboratively
5. Communicating and applying ecology

**Human-Environment Interactions:**

1. Human dependence on the environment- Ecosystem services
2. **Human accelerated environmental change**- Anthropogenic impacts, intentional and unintentional, global climate change, environmental toxicology: biomagnification – bioconcentration
3. **How humans shape & manage resources/ecosystems/the environment-** Natural resource management**,** conservation biology**,** ecological stewardship
4. **Ethics-** Sustainability as a normative, socially constructed, aspirational goal, environmental justice

**Cross-cutting Themes:**

1. Structure & function
2. Systems
3. Spatial & temporal- Range, native / alien / invasives

**List of materials that will be included:**

Background reading for students

Example slides

Jigsaw resources

Role play descriptions

List of extra resources (videos, etc)

**What students do:** Students will use a case study to understand the ecological and cultural significance of salmon within the Klamath River Basin and thereby gain insight into the ways human-induced change and historical issues of colonial decision-making have impacted these salmon populations. Students will then evaluate the process of political decision-making about whether to remove or not remove dams through role-playing activities based on the perspectives of multiple stakeholders.

**Student-active Approaches:** jigsaw, think-pair-share, role-playing activities.

This lesson provides a template of how to structure a Jigsaw (Tomaswick, 2017) where students will become experts of different causes/consequences of salmon loss. The jigsaw method is an active learning technique that involves dividing students into groups, where each group member learns and becomes an expert on a different segment of the material. They then teach their segment to another group so overall the entire class has been exposed to the full range of material, therefore, promoting engagement and comprehensive understanding through collaboration. The template provides resources of the various topics for different levels of students using either popular science or peer-reviewed resources. By posing the question “what would you need to know” this lesson illustrates an approach that can be applied to many other decision-making scenarios. Role-playing activities can also be used with a variety of socio-ecological case studies, allowing students to better understand the complementary and competing perspectives that influence decision-making.

**Society Learning Goals**: (taken from course source for ecology)

Biological Diversity

* How can you explain the change of biodiversity over short and long (geological) timescales?

Species-Habitat Interactions

* How do species interact with their habitat?

Impacts of Humans on Ecosystems

* What impacts do humans have on ecosystems?
* What can or do humans do to mitigate negative impacts they have on ecosystems?

Impacts of Ecosystems on Human Health and Well-being

* How do humans depend on ecosystems for their health and well-being?

**Lesson Learning Goals:**

* Students will integrate complex social and ecological issues through consideration of a real-world case study of the Klamath-dam removal
* Students will recognize roles and perspectives of different stakeholder groups in federal decision making
* Students will strengthen science literacy skills
* Students will formulate arguments based on literature and popular media

**Lesson Learning Objectives:**

* Explain the connection of salmon and their ecology to culture, economies, and policy
* Compare and contrast environmental racism and settler colonialism as structures driving inequities and describe the outcomes
* Discuss the ecological impacts of settler colonialism within the context of the study
* Analyze sources of information (peer-reviewed for upper levels) to discuss connections between salmon, climate change, and society
* Critique and defend arguments for dam removal from different stakeholder perspectives
* Comprehend the different forms of knowledge that have combined to lead to dam removal
* Understand the impact of social action as a vehicle for change and resistance

**Background:**

Connection of Climate Change, Colonialism, and Traditional Ecological Knowledge

Global climate change is overarchingly the most egregious crisis facing society right now and it is generally understood that humans are the culprits of this change (Trenberth, 2018; IPCC, 2023). Largely, climate change is a product of unsustainable practices of capitalist societies, specifically coinciding with the boom of the industrial revolution and the rise of political and economic systems (Martinez, 2005). It is well accepted that those communities contributing the least to these systems are often the communities that disproportionately bear the burden and are most vulnerable to the extensive impacts of anthropogenic climate change (Füssel, 2010; Althor et al., 2016).

**Environmental racism** is a form of systemic racism whereby marginalized Black, Indigenous or communities with people of color (BIPOC) are disproportionately burdened with health hazards through policies and practices that force them to live in proximity to unsafe environments or climates (Alvarez, 2023). Environmental racism can be traced back in history, but it is most notably tied to colonialism and racial segregation (Bullard 2000; Pulido, 2000).

**Settler colonialism** is a structure that aims to dominate human relationships with the environment by acquiring political control over another country (i.e. land, water, air) through occupying it with settlers, and exploiting it for capital (Whyte, 2018; Norgaard, 2019). Settler colonialism as a structure is a process resulting in the removal and erasure of indigenous peoples that pre-exist settler nations. Bacon (2019) offers the term “**colonial ecological violence**” which allows for a broad analysis of the diverse ways settler colonialism disrupts Indigenous eco-social relations, and generates specific risks and harms for Native peoples and communities. Examples of eco-social aspects of indigenous elimination can include physical forms of genocide through poisoning of water, cultural through the disruption of passing ecological knowledge among generations, political through termination of land access or erasure by renaming culturally significant places (Bacon, 2019).

Within this module, we will focus on the interconnectedness of settler colonial structures and environmental injustice as they relate to climate change, resource management and culture. As we are all faced with the climate crisis, there is room to use this climate emergency as a strategic opportunity not only for tribes to retain cultural practices and return to traditional management, but for all land managers to remedy inappropriate ecological actions, and for enhanced and successful collaboration in the face of collective survival. Within the presented case study, will highlight the power of tribally-led movements in inducing social action and political change for more sustainable futures for all residents, native and non-native.

The Karuk people are an indigenous Native-American tribe residing along the Klamath River in northern California. Within Karuk territory, the effects of climate change have already become excruciatingly apparent. The tribe has been forced to incessantly respond to these environmental consequences, but also to simultaneously plan for the future (Butz et al, 2015). Tribes have been key leaders in responding to climate change through both **mitigation**, efforts to stop further climate change, and **adaptation**, developing responsive measures for coping with the unfolding ecological and atmospheric changes. The Karuk Climate Adaptation Plan (Karuk Tribe, 2019) was developed following the Karuk Climate Vulnerability Assessment (Karuk Tribe, 2016) which was completed in 2016. Tribes can often be found leading the way in climate change policy and adaptation strategies, through participation in the political process, engaging in sustainable land stewardship, and being at the forefront of many climate change activism efforts.

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One way tribes can influence the conversation and provide valuable information is through traditional ecological knowledge**. Traditional Ecological Knowledge** (TEK) is the on-going accumulation of knowledge, practice, and belief about relationships between living beings in a specific ecosystem that is acquired by indigenous people over hundreds or thousands of years through direct contact with the environment, handed down through generations, and used for life-sustaining ways. This knowledge includes the relationships between people, plants, animals, natural phenomena, landscapes, and timing of events for activities such as hunting, fishing, trapping, agriculture, and forestry. It encompasses the world view of a people, which includes ecology, spirituality, human and animal relationships, and more (Charles & Cajete, 2020). TEK has become increasingly recognized by non-native scientists and policy makers as a more holistic approach to tackling the climate crisis through community-based adaptation and mitigation actions that sustain resilience of social-ecological systems (Williams & Hardison, 2013; Raygorodetsky, 2020). Alongside the environmental benefits, implementing TEK provides a unique political opportunity for tribes to lead the way, as often the goals of the Forest Service’s management plan can simultaneously be achieved through Karuk tribal management. Other resources on TEK can be found here through the Ecological Society of America’s TEK section (https://www.esa.org/tek/resources/).

Ecological Consequences: Salmon & Climate Change

Salmon are a central species in the Karuk tribes’ story of colonial resistance and climate change resilience. The decline in Chinook Salmon populations within this region has been a specific concern for Karuk tribal members and others in the region for decades. Two species of chinook salmon are listed as endangered under the Endangered Species Act (ESA), one of which is located in Karuk aboriginal territory, seven species are listed as threatened under the ESA, and one species is a candidate for listing under the ESA (Lindley et al., 2007, NOAA n.d.).

Chinook salmon have a complex lifestyle that includes spawning and juvenile rearing in rivers followed by migrating to saltwater to feed, grow, and mature before returning to freshwater to spawn. This reliance on multiple ecosystems throughout their life cycles make Chinook Salmon particularly vulnerable to human induced stressors and threats.

Abiotic stressors related to climate change are already impacting salmon populations in big ways. Loss of snowpack reduces stream flows and increases the already rising temperatures within the waters. Warmer waters also make salmon more susceptible to predators, parasites, and diseases which in recent years led to multiple massive fish kills over the years of tens of thousands of fish (Yurok Tribal Fisheries Program, 2004). Warmer oceans also shift the range of other non-native fish populations that may become predators or in competition with native salmon populations. Ocean acidification may also disrupt food web dynamics by dissolving mollusk shells which remain an important food source for juvenile Chinook Salmon. Further, intense forest fires, increased flood, storm severity and sea level rise all contribute to the degradation or loss all together of critical salmon habitat (Rogers, 2022; David et al, 2018).

In addition to abiotic factors, humans directly impose further threats to these salmon populations through overfishing and the imposition of dams which exacerbate many of the abiotic stressors previously mentioned. As this region of California has a large role in agriculture, the dams often divert water to farmland, even during drought, further exacerbating already poor conditions. As a keystone species of the Pacific Northwest, the loss of Chinook salmon would severely disrupt the apex predators that rely on them as a vital food source, including orcas, bears, seals, and large birds of prey.

Salmon: Stewards of Ecological Balance and Cultural Tradition

A **keystone species** is a species that plays a crucial and unique role in maintaining the structure and health of an ecosystem, influencing the abundance and distribution of other species. Salmon are not just crucial for sustaining a balanced ecosystem; they have also been central to the socio-cultural fabric of native communities for millennia, a significance that remains into the present day. Salmon are ingrained into culturally significant ceremonies, community dynamics, and health, both mentally and physically. With the decline in traditional foods such as salmon largely attributed to but not limited to, fishing regulations, damming of rivers, climate aspects mentioned above, and poverty which forces dependency on processed American foods, Karuk people have had the largest diet shift in America (Norgaard, 2004).

Anthropological reports estimate that before European contact at the time of the gold rush (1850’s), the average Karuk consumed 450 pounds of salmon per person per year, or about 1.2 pounds per person per day. In 2005, salmon consumption was less than five pounds per person per year, nearly a 99% decrease (Norgaard, 2004). This correlates largely to Karuk people also having double the rate of diabetes compared to the United States national average. “It is ironic that today doctors around the nation are urging their patients to eat more salmon and adopt the kind of diet that the Karuk enjoyed for thousands of years,” concluded Dr. Norgaard. “But because of their poverty and the decline of Klamath salmon, the Karuk themselves are being forced into the kind of unhealthy diet that people in other areas are trying to get away from.” (Norgaard, 2019).

Mental health, much like physical health, is deeply interconnected with the health of ecosystems and cultural practices. Factors that contribute significantly to mental health and psychological well-being include a positive self-image, strong belief systems, interaction with preserved natural environments, and a robust sense of personal and cultural identity (Mirowsky and Ross 1989; Thoits 2010). Both access to an intact natural environment and participation in one’s culture are widely recognized as vital for psychological well-being. While we know that true, we also know that negative experiences such as awareness of environmental degradation or lack of sufficient contact with the natural environment can have strong consequences on mental health, which in turn largely become an environmental justice issue (Downey and Van Willigen 2005). As values are tied strongly the natural world, the loss of a key species, like salmon, causes extensive disruptions of social, cultural and spiritual systems. Specifically, as it relates to this case study, the inability to participate in traditional fishing practices threatens ones’ sense of self identity (Norgaard, 2014; Willette et al, 2016). This collective feeling of powerlessness and loss of self-efficacy not only is an individual problem but a community wide that stems from environmental injustices rooted in colonialism.

To Dam or Not to Dam

As previously mentioned, the large decline in salmon populations in the Pacific Northwest can be fundamentally attributed to the insertion of dams. In general, the structure of a dam presents an obstacle for free-flowing water which can trap sediment and logs which provide crucial food and habitat. This buildup of sediment may also bury rocks along the riverbed which provide essential habitat for fish to spawn. Additionally, dams largely revolve around specific, but limited human needs, releasing water for agricultural or recreation , but not necessarily for non-human needs. These significantly alterations of the natural ebbs and flows of the system negatively impact the formation and maintenance of other complex habitats downstream, as well as allowing for stagnant water behind the dam which can lead to algal pollution, decreased water-oxygen levels, an increased water temperature which further provide ample condition for deadly diseases and algal blooms. These conditions of poor water quality were the cause of the 2002 Klamath river fish kill where more than 34,000 Chinook salmon died leaving tribes, environmental groups, fisherman and other stakeholders at a devastating loss (Yurok Tribal Fisheries Program, 2004). While water rights have long been an issue in the Klamath Basin (i.e. Droughts resulting in large problems for both fishing and agriculture where rotating shutdowns of water have disturbed both groups), this excruciating event led to extensive partnerships working to see the dams removed.

The Klamath River is the site of several hydroelectric dams, including four dams owned by the PacifiCorp power company. Collectively, the four dams produce an annual average of 82 megawatts of electricity which can provide power to roughly 70,000 homes. From one perspective, hydropower is applauded as a “clean” form of renewable energy but comes with an environmental cost. PacifiCorp federal licensing has expired, the renewal process was of the utmost interest among all stakeholders including Native American tribes, commercial fishermen, farmers, conservation groups, PacifiCorp power company, state officials, the Department of the Interior, and many others. To obtain relicensing, PacifiCorp would need to fit dams with fish ladders and other mandated updates. This led to the 2010 signing of the Klamath Hydroelectric Settlement Agreement (KHSA) by PacifiCorp and more than 40 other stakeholders, which ultimately leads us to the present day where after many years of ecological degradation and political activism, the decision has been made to move forth with the largest dam removal in history, taking down four of PacifiCorp's Klamath River dams. PacifiCorp would pay for part of the dam removal, but California and the federal government would need to provide additional funding.

The Future of the Klamath River Basin

The removal of these dams started in 2023 with the final removal of all four by the end of 2024. This will open 400 miles of river that will provide spawning habitat for the endangered salmon species. Alongside years of conflict, tribally led activism, and other political battles that led to this decision, there were various environmental checkpoints as well. The salmon that inhabit these waters are not only listed as endangered among the endangered species act, but they also represent an **endemic** (meaning only found in this small region) group of salmon. Therefore, further potential disruption of the rivers went through years of environmental assessment in accordance with the endangered species act. Following the removal of the first dams, a variety of agencies and tribes on a technical team are equipped with real-time river gauges to manage flows. As dams are removed, there is concern for sediment build up, therefore the goal of these agencies is to maximize sediment flow while also maintaining water quality for hatchery fish to migrate downriver. Within these discussions, it is important to communicate that restoration is not linear. Ecology experts predicted short-term impacts on the salmon population with increased turbidity yet the long-term benefits to the entirety of the ecosystem is much greater. The building of the dams and blocking the river created an environmental disaster and reversing that damage is not going to happen overnight.

The decision to proceed with the largest dam removal project in history is largely something to celebrate, although the work does not end here. Not only are there ecological challenges, in restoring a healthy ecosystem that has been dammed for decades, but there are management actions that must be considered to promote justice for native communities. The success of this project doesn’t simply end in dam removal but has a long journey that includes incorporating tribal management of on and off-reservation lands to promote traditional knowledge sovereignty and in turn a healthy ecosystem. Climate change can be used as a strategic opportunity to reconcile with decades of ecological injustice and forced assimilation of indigenous communities through returning lands to traditional management. Fortunately, there are current partnerships such as those with the company Resource Environmental Solutions (RES) which oversees the restoration of the reservoir footprints and newly formed river in close partnership with the Yurok Tribal Fisheries Department. Tribal members have been collecting native seeds and propagating native plants in nurseries for over five years now. Over the next several years over 17 billion seeds will be planted— over 53,000 thousand pounds of native vegetation planted to assist in restoring the reservoir bottoms (NOAA, 2024). In Yurok restoration engineer Brook Thompson’s words, “We’re all focused on finding solutions to bringing our salmon back home and creating a healthy life for them. Creating a healthy life for salmon means creating a healthy life for us as people.” Additionally, the Kuruk tribe has also put together a knowledge sovereignty action plan with many strategies applicable to these restoration efforts at the national, regional and local levels (Kuruk Tribe, 2019).

As this is an ongoing case, I encourage you all to continue to engage with current practices, conflicts, news, etc. I have provided a current list of resources to my knowledge, but this does not truly scratch the surface of what is, and what is to come as the Klamath River will soon run free.

**Intended Audience:** This module provides adaptations for various levels including upper-level, lower-level, and non-majors biology, environmental science, sustainability or ecology courses.

**Required Learning Time:** Intended for either 2 ~1hr class sessions or would work great in a longer 2 hr lab!

| Activity | Description | Estimated time | Notes |
| --- | --- | --- | --- |
| Preparation for Pt 1 | | | |
| Pre-class materials | Background for students | ~30mins | encourage students to engage with the provided reading through concept maps, bringing questions to class, etc. |
| Pt 1: Colonialism & Nature | | | |
| Introductory lecture | Overview & historical context of environmental racism + case study, settler colonialism & salmon | ~15 mins | Example lecture slides are provided. I especially highlight showing the following video: https://www.youtube.com/watch?v=E5x5\_a0eQAI stopping around 5mins to get the background without allowing them to know the full ending of the story |
| Jigsaw in groups | Students will be grouped & given a topic with corresponding article. | ~20 mins | The articles will be provided for different audiences, non-majors or intro level popular science articles/tribal management report & upper-level peer reviewed articles and government reports. See S2. |
| Student sharing & discussion | Each group will share their findings | ~25 mins | Manage time to allow each group to share & leave some discussion space at the end. |
| Pt 2: The power of Social Action | | | |
| Pre-Activity Discussion | Think-pair-share within small groups of ideas around what students would need to know in order to make a dam removal decision | ~15 mins | Share in small groups & ask to share main points with class |
| Role-play Stakeholder debate | Analyze their “character” then debate topics & concerns | ~30 mins | Stakeholder descriptions found in S3. |
| Concluding lecture & discussion | Dam removal & social action, success & future directions of restoration efforts | ~15 mins | Some discussion questions are provided. This section will likely evolve as the case continues. Leave room here for new developments both politically, ecologically & socially. Some resources have been provided to continue to be updated on some of the news developments. |
| Exit Reflection | Students submit short remarks |  | This can either be online or quick write in person for short reflection on the potential future for this project. What precedent might the dam removal set for social action? Policy? Consequences for the ecological system? For the various stakeholders? |

S1. Guiding questions for students while exploring various consequences of salmon loss include but are not limited to: What is your topic, what is causing it, results, how might climate change impact this, who is this impacting & how is it impacting them? How does it connect to ecology? Policy? Etc. can you think of / give an example of an ongoing solution. This could be shared aloud or put into a PowerPoint template that students are expected to share with class as part of the jigsaw discussion.

S2. Jigsaw resource list

| Salmon, Society & Succes Jigsaw Resources | | |
| --- | --- | --- |
| Topic | Lower-level | Upper-level |
| Human health (physical) | *“Tribe Fights Dams to Get Diet Back”*  https://www.washingtonpost.com/archive/ppolitic/2005/01/30/tribe-fights-dams-to-get-diet-back/f76ac86c-4e1e-495b-9f99-d50a10110a16/  *Karuk Tribal plan*  https://karuktribeclimatechangeprojects.com/chapter-4/ | *"The Effects of Altered Diet on the Health of the Karuk People"* https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=eb96f89d18dbf8b516b835e8248a76940672c5d3 |
| Human health (mental) | *“Mental Health Impacts of Denied Access to Management and Culture”*  https://karuktribeclimatechangeprojects.com/chapter-5-mental-health-impacts-of-denied-access-to-management-and-culture/ | *"How Environmental Decline Restructures Indigenous Gender Practices: What Happens to Karuk Masculinity When There Are No Fish?"* https://journals.sagepub.com/doi/abs/10.1177/2332649217706518 |
| Disease Dynamics | *“As Thousands of Salmon Die, Fight for River Erupts Again”*  https://www.nytimes.com/2002/09/28/uu/as-thousands-of-salmon-die-fight-for-river-erupts-again.html   *"Biologists fear repeat of 2002 salmon kill in Klamath River"* https://www.oregonlive.com/environment/2015/08/biologists\_fear\_repeat\_of\_2002.html | *"The Klamath River Fish Kill of 2002; Analysis of Contributing Factors"* https://www.waterboards.ca.gov/waterrights/water\_issues/programs/bay\_delta/california\_waterfix/exhibits/docs/PCFFA&IGFR/part2/pcffa\_155.pdf   *"Distribution and habitat characteristics of manayunkia speciosa and infection prevalence with the parasite ceratomyxa shasta in the Klamath River, Oregon-California"* https://bioone.org/journals/journal-of-parasitology/volume-93/issue-1/GE-939R.1/DISTRIBUTION-AND-HABITAT-CHARACTERISTICS-OF-MANAYUNKIA-SPECIOSA-AND-INFECTION-PREVALENCE/10.1645/GE-939R.1.short |
| Fire regimes | *"Colonization, Fire Suppression, and Indigenous Resurgence in the Face of Climate Change"* https://www.yesmagazine.org/environment/2019/10/22/fire-climate-change-indigenous-colonization  *"Wildfire kills Klamath fish: ‘Everything that’s in there is dead.'"* https://www.hcn.org/articles/wildfire-kills-klamath-fish-everything-thats-in-there-is-dead/ | *"Wildfire Smoke Cools Summer River and Stream Water Temperatures"* https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2018WR022964 |
| Genetics | "Huge dam demolition could save salmon on the edge of extinction" https://www.nationalgeographic.com/environment/article/dam-removal-project-genetic-discovery-could-be-good-news-for-key-salmon-species | "The evolutionary basis of premature migration in Pacific salmon highlights the utility of genomics for informing conservation" https://www.science.org/doi/10.1126/sciadv.1603198 |

S3. Stakeholder roles to assign to groups of students

| Stakeholder Role Play Activity | |
| --- | --- |
| **Native Tribal Member:** salmon are essential to the tribe's identity, health & cultural resilience. They demand healthy water management for everyone. | **Wildlife Conservationists**: Conservationists are concerned with the water issues in the Klamath Basin because of the negative impact on fish and birds. The area is an important stop along the Pacific Flyway. |
| **Commercial Fishermen:** Commercial fishermen in the Klamath Basin have been economically devastated by the decline of fish populations due to the blocking of hundreds of miles of river. Most support the removal of the dams but are weary to the sorts of regulation on # of fish per season allowed with this transition. | **PacifiCorp**: PacifiCorp owns and operates the four hydroelectric dams that would be removed. The federal license for the dams has expired, and PacifiCorp would be required to install fish ladders, along with other improvements, before the dams could be relicensed. PacifiCorp has estimated that the required modifications would cost more than their part of the dam removal costs. |
| **Consumers of Electricity**: Consumers want a reliable supply of electricity at reasonable costs. If the hydroelectric dams in the Klamath Basin are removed, it could potentially increase the cost of electricity in the area. | **Farmers**: Farmers in the basin rely on irrigation to keep their crops healthy. Many farmers complain that the current system of water management in the Klamath Basin doesn’t work for them, because they can’t rely on a predictable supply of water. |
| **States of California and Oregon**: The removal of the dams is predicted to help both states’ ailing salmon fishing industries. Although the states will need to contribute $100 million each to fund the project | **Local Businesses**: The removal of the dams will change water dynamics, making areas of the river flow too fast for tourism and drain other parts so property values will decrease. |
| **Climate Activists:**  Maintaining the dams as a key step in reducing reliance on fossil fuels by transitioning to clean, renewable energy sources like hydroelectric power. Keeping the dams is crucial to cutting carbon emissions and combating global climate change. |  |

**Instructions for the pre-discussion activity in Pt 2.**

Consider the following *focal* question:

As a stakeholder, what would you need to know before making your decision to support the Klamath River Dam removal or not? (RANK THEM & EXPLAIN)

Think about the focal question above and generate a typed list of everything you would need to know to answer this question. Be as specific as possible, and think as broadly as possible. Remember, you’re not being asked to answer the question, just to lay out everything you’d need to know in order to come up with a really good answer.

Group students and give them time to share their lists. Suggest them to rank the most important things they would want to know before making the decision and group the rest of the list in ways that make sense to them. Suggest a starting point to think about the ways your decision may influence different aspects (ecologically? Socially? Food? Energy? Agriculture? Tax payers?). Each group will likely come up with something unique. Give time to share groupings/rankings of most important things to know aloud.

Acknowledgements:

I acknowledge my identity as a non-native scientist presenting on the decades of tribally-led movements, research, and colonial resistance of the tribes of the Klamath River area. This module was inspired by my own learning during my undergraduate education within the Environmental Studies Department at the University of Oregon on the eye-opening connections of salmon and society presented to me by Dr. Kari Norgaard (Professor of Sociology and Environmental Studies at the University of Oregon), Ron Reed (Cultural Biologist and Traditional Dipnet Fisherman, Karuk Tribe), and Dr. Jules Bacon (Assistant Professor of Sociology at Grinnell College). These clear connections between environmental degradation and colonialism were things that once were revealed, I could not unsee. With this module, at the least, I intend to use the privilege I have through my platform to open the eyes of students like myself who may not think about these connections of ecology, society, and justice by recognizing the many kinds of knowledge that come together to lead to successes such as the Klamath River Dam removal project. I hope this module can empower students with the knowledge and awareness to think critically about their own lives, how they fit into socio-ecological systems and ways to positively change these systems for the future of the environment and societies that rely on the environment in different ways. Environmental change is happening with humans as the primary culprits, but when we work together, we can effect social change for a more sustainable future. With this, I want to thank the many people committed to defending our lands, waters, and the biodiversity, both people and organisms, that come with it.

Modified from <https://qubeshub.org/community/groups/coursesource/publications?id=3604&v=1>

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Extra resources:

https://www.esa.org/tek/resources/

<https://www.youtube.com/watch?v=skokfZFMwI0&t=5s> (good 25 min summary)

<https://waterquality.karuk.us/Data> (interactive water quality data)

<https://caltrout.org/news/klamath-river-begins-to-find-its-way-home> (includes good view of how the restoration is working)

<https://klamathrenewal.org/>

<https://www.ucdavis.edu/climate/news/removing-dams-klamath-river-step-toward-justice-native-americans-northern-california> (written by native professor at UC davis in a pop science way. Really highlights salmon as a justice issue & history of native American movements in the region)

<https://youtu.be/e5lcP_9ateE> (14min)

<https://www.youtube.com/watch?v=E5x5_a0eQAI> (10min multiple dam removal perspectives, could be shoved in right after role play! Really hopeful ending to the video)

<https://lamalfa.house.gov/media-center/press-releases/congressmen-lamalfa-and-bentz-klamath-dams-are-engines-of-energy-and>

<https://calmatters.org/environment/2023/08/klamath-river-dams-demolition/> (stakeholder perspectives)

https://www.smithsonianmag.com/smart-news/the-largest-dam-removal-project-in-us-history-begins-final-stretch-welcoming-salmon-home-180983621/

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