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Portugal
Basanta Kumar Das,
Central Inland Fisheries Research Institute
(ICAR), India

*CORRESPONDENCE

Olivia Zimmerman
✉ olivianz@uw.edu

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Addressing inequities and meeting needs of Indigenous communities in floodplain management

Olivia Zimmerman^{1,2*}, Tanya Eison^{1,3}, Robert Carey⁴ and Phillip S. Levin^{1,4,5}

¹School of Marine and Environmental Affairs, University of Washington, Seattle, WA, United States, ²Washington State Department of Ecology, Olympia, WA, United States, ³Affiliated Tribes of Northwest Indians, Portland, OR, United States, ⁴The Nature Conservancy (United States), Arlington, VA, United States, ⁵White House Office of Science and Technology Policy, Washington, DC, United States

Anthropogenic impacts have altered and degraded global ecosystems. Integrated resource management offers an important solution to enhance collaboration, holistic thinking, and equity by considering diverse perspectives in decision making. In Washington State, Floodplains by Design (FbD) is a floodplain management and habitat restoration program that emphasizes bringing together diverse stakeholders and supporting conversations between local, state, and Tribal governments while enhancing environmental justice in the region. Marginalized communities continue to be disproportionately impacted by environmental disturbances. Our project interviewed Tribal natural resource managers to assess the degree to which they felt FbD was supporting their community's needs. Our research asked three questions: (1) What Tribal needs and inequities associated with floodplains are identified by Tribal natural resource managers? (2) Are these needs and inequities being addressed by FbD? and (3) How can FbD better address these needs and inequities moving forward? We found that while the integrated approach of FbD was driving solutions in some realms, there are ways in which the program could better support needs and address inequities in Tribal communities. Specifically, we found that conventional responses to environmental challenges are rooted in modernist paradigms that have created persistent dualities, including that of human-nature and human-nonhuman. Such a paradigm is in conflict with wellbeing and self-determination of Tribal cultures that are deeply connected to Pacific salmon. In closing, we provide insights on these mechanisms and offer solutions moving forward.

KEYWORDS

floodplain management, climate adaptation, environmental justice, Tribal sovereignty, integrated management, salmon

1 Introduction

Humans and their use of terrestrial, aquatic and marine biomes have transformed the structure and function of global ecosystems resulting in major alterations to climate, biodiversity, biogeochemical cycling and geomorphic processes (Halpern et al., 2008; Ellis et al., 2013). Responding to such dire, complex anthropogenic impacts requires integrated,

collaborative, and holistic efforts (Pinkerton, 2000; Thomas et al., 2006; Levin et al., 2009, 2016; Beier et al., 2017). Despite acknowledgement that integrated management is critical, in practice, management of landscapes is often narrowly constrained (Foley et al., 2013), characterizes humans as independent of and external to ecosystems (Caillon et al., 2017; Poe and Levin, 2017), and manages each use sector independently of other relevant sectors (Crowder et al., 2006; Pigford et al., 2018; Bellanger et al., 2021).

While sectoral management is still dominant, a number of examples are emerging that highlight the practical value of integrated management. In Belize for example, Arkema et al. (2014) demonstrated that an iterative, collaborative, and community-based approach to coastal zone management resulted in increased program capacity, enhanced support from stakeholders, and an effective solution that was “developed by and for Belizeans”. Similarly, in a U.S. desert ecosystem, Arizona’s Sonoran Desert Conservation Plan revealed that a balance between biological conservation goals and thoughtful economic development can support successful protection of both cultural and natural resources (Huckelberry, 2002). Likewise, in the Beaufort Sea, the Integrated Oceans Management Plan prioritized collaborative efforts between Indigenous, local, and federal governments and other non-regulatory parties to minimize resource conflicts and prioritize multi-benefit ecosystem-based management (Ayles et al., 2016). These cases, among many others, reveal that solving complex environmental problems often requires integrated, cross-sectoral approaches to achieve equitable management that balances the needs of diverse parties (Wiedemann and Ingold, 2022).

A clear candidate for integrated management is riverine floodplains. Globally, riverine floodplains are among the most biodiverse and ecologically important ecosystems on earth (Opperman et al., 2010). Floodplains compose the low-lying ground that surrounds rivers, and are flooded during periods of high river flow (Meitzen, 2018). Fluvial dynamics associated with flooding generates a diversity of habitat types and contributes to a high level of spatial and temporal habitat heterogeneity that supports high species richness (Tockner and Stanford, 2002). Ecotones across a range of spatial scales and the connectivity among ecotones further contribute to the maintenance of their biodiversity (Ward et al., 1999). Floodplains also provide critical ecosystem services to human populations (Costanza et al., 1997). Intact floodplains create intricate landscapes which absorb excess waters during periods of high discharge, providing nature-based solutions to flooding (Turkelboom et al., 2021). Additionally, they act as natural filters by removing excess sediments and nutrients, improving water quality thereby decreasing treatment needs. Floodplain forests sequester carbon and create stability in the soil, reducing erosion (Perosa et al., 2021). Intact floodplains create important habitat for economically and culturally valuable species (Ward et al., 1999). For example, in the U.S. Pacific Northwest floodplains are crucial habitat for ESA-listed salmonids (Bellmore et al., 2013). With growing impacts from climate change, healthy and intact floodplains are increasingly important for climate mitigation and adaptation (Colloff et al., 2016).

Despite their value, floodplains have been heavily degraded. Habitat alteration, flow and flood control, species invasion and pollution have dramatically affected floodplain ecosystems, and in North America and Europe, 90% of floodplains are functionally extinct (Tockner and Stanford, 2002). In the last several centuries, the

land surrounding rivers in the United States has been developed resulting in rivers being straightened, deepened, and channelized, and riverbanks becoming armored to protect human structures from floods (Christin and Kline, 2017). These alterations have made human communities more vulnerable to flood impacts, and this impact is increasing as climate changes (Arnell and Gosling, 2016; Ferdous et al., 2020). Inland flooding can also disproportionately impacts those without the resources necessary to mitigate, adapt, or rebuild from floods (Messenger et al., 2021).

The ecological, social, and economic importance of floodplains in concert with the complexity of the threats they face requires an integrated approach to their management. Floodplains by Design (FbD) was created in 2013 in Washington State, US as a response to this need (Floodplains by Design, 2019). The program is a public-private partnership between Puget Sound Partnership, Washington State Department of Ecology, the Bonneville Environmental Foundation, and several environmental NGOs including American Rivers and The Nature Conservancy. FbD aspires to integrate the social and ecological dimensions of floodplains enabling communities and the environment to thrive. Specifically, FbD seeks to co-create solutions with local communities to (1) accelerate floodplain restoration and (2) reduce flood risk (Floodplains by Design, 2019). The FbD program prioritizes multi-benefit and collaborative approaches to floodplain restoration by shifting away from siloed floodplain management, often inefficient and conflict-prone, and toward partnership-based projects that optimally prioritize ecological benefit and human risk reduction. Since its founding, FbD has received \$165 million in funding from Washington State Legislature for its grant program, designating it an important flood management resource in the state.

Threats from flooding are growing globally as climate change impacts intersect with increased habitat fragmentation and development (Löschner et al., 2017). However, flooding disproportionately impacts marginalized communities, and in particular, communities of color (e.g., Messenger et al., 2021). While socioeconomic factors have long been thought to play a key role in pollution and natural disaster vulnerability (Hallegatte et al., 2020), research has indicated that race can be the strongest predictor for environmental hazard exposure when controlling for income (Gilio-Whitaker, 2019; Tessum et al., 2021). Further, white communities have been found to gain wealth following impacts from natural disasters via aid services, while non-white communities lose significant wealth, enhancing wealth disparities (Howell and Elliott, 2019). As climate change impacts shift water cycles, many populations will experience increased vulnerability to flooding but communities of color are expected to be disproportionately impacted (Handwerker et al., 2021; Gourevitch et al., 2022). For example, Black communities in the Carolinas are seven times more likely to experience inland flooding than white communities (Handwerker et al., 2021), and Latinx communities in Washington State are twice as likely to live in a flood-prone zone than their white counterparts (Messenger et al., 2021). Indigenous communities in North America experience disproportionate exposure to anticipated flood sites (Chakraborty et al., 2021), and are less likely to receive federal aid to recover from extreme weather events (Messenger et al., 2021). Further, due to the entangled (Sakakibara, 2020) and reciprocal (Coté, 2022) relations many Indigenous communities have with the nonhuman world, impacts from climate change will further disrupt Indigenous food

sovereignty and self-determination (Keleman Saxena et al., 2016; Whyte, 2017; Settee, 2020).

Indeed, Indigenous communities are particularly posed to be disproportionately affected by climate change impacts across ecosystems (Norton-Smith et al., 2016). In coastal Alaska, erosion and flooding impact 86% of Alaska Native villages due to their low-lying coastal locations (Robinson, 2004). These coastal hazards are compounded by melting sea ice and disrupted food sovereignty (Sakakibara, 2020; Green et al., 2021), and colonial approaches to managed retreat (Flavelle and Goodluck, 2021; Jessee, 2022). In the American Southwest, regional droughts have set into motion a series of impacts to natural processes that threaten Indigenous health and livelihoods (Hand, 2008). Water shortages cause widespread die-off of native plants that stabilize the sand dunes that cover one third of the Navajo Nation's lands. Reduced vegetation leads to lessened grazing opportunities for livestock and increased dust storms, which are hazardous to health. The economic impact of outsourcing livestock feed has resulted in the purchase of low-cost hay, which is often contaminated with non-native seeds from dominant species that systemically shift the region's ecology (Hand, 2008). Throughout the United States, Davies et al. (2018) found that Indigenous communities are among the most likely to be highly impacted by wildfire. Indigenous communities are unarguably on the frontlines of climate change impacts, and the complexities resulting from climate change impacts that threaten Indigenous lifeways.

In this paper, we explore the degree to which Floodplains by Design and associated floodplain management supports Tribal needs and addresses inequities to Tribal communities. To this end, we asked the following three questions: (1) What Tribal needs and inequities associated with floodplains are identified by Tribal natural resource managers? (2) Are these needs and inequities being addressed by FbD? and (3) How can FbD better address these needs and inequities moving forward? In addition to these questions, we also assessed how our participants thought about climate change resiliency in relation to the community for which they worked.

2 Methods

To investigate the degree to which the Floodplains by Design program is meeting the needs of Tribes in Washington State, we conducted semi-structured interviews (Smith, 1995) with natural resource managers from signatory Tribes that entered into treaty agreements with the U.S. government. In 1854–1855, Tribes throughout the territory that is now Washington signed these treaties which ceded millions of acres of land to the United States while simultaneously reserving the rights of the Tribes to continue fishing, hunting, and gathering in their “usual and accustomed places” (United States v. State of Washington, 1974). Usual and accustomed places refers to any area adjudicated to have been reserved for fishing by one or more Tribes through treaties as recognized by United States v. State of Washington (1974), commonly referred to as the Boldt Decision, affirmed the right for treaty Tribes to take fish, established treaty Tribes as co-managers, and set conservation standards that restricted the ability of the state to regulate treaty fishing practices.

As co-managers, treaty Tribes are jointly responsible for fisheries management in the state. Any management decision that may affect the habitat of treaty reserved fisheries, reduce their populations, or

limit the harvest for a treaty Tribe in Washington infringes on these reserved rights (Treaty Rights At Risk, 2011). Washington floodplains are habitat that can affect the reserved rights of treaty Tribes if not managed properly. For this reason, we focused on interviewing treaty Tribes that have received FbD funding for a project in the floodplains of their “Usual & Accustomed” places as described in the Boldt Decision. Importantly, Usual & Accustomed places do not coincide solely within reservation boundaries but are defined by the current Hydrological Unit boundary classification system in Washington (State Wide WRIA Finder, 2022). Thus, we focused on Tribes where an FbD project occurred within the watershed of a Tribe's Usual & Accustomed place because of the reserved right of taking fish.

This project included 14 Tribes across a breadth of geographies and cultures. We focused our interviews on Tribal natural resources managers who had well-established relationships with Tribes and thus were employed or contracted by the Tribe for a minimum of 2 years. Tribal natural resource managers were selected for the study's participants due to the short timeframe of the study (18 months), which did not allow for development of deep, trusting, and reciprocal relationships with Tribal community members. This decision was made following consultation with our FbD partners and their Tribal liaison, and extensive review of literature about equitably developing mutually beneficial research collaborations (Kovach, 2009; Castleden et al., 2012). We identified 109 participants that met our eligibility requirements of currently working for a Tribe and having been there for at least 2 years. Participants were recruited via employee directories listed on Tribal government websites. We then employed snowball sampling (Naderifar et al., 2017) to identify additional participants.

Twenty-one interviews were conducted between May and September 2021, and 20 were analyzed. One interview was omitted from the analysis because the respondent was no longer working with a Tribe. The number of participants was determined by reaching saturation in interview responses (which occurred at approximately $n = 14$), indicating that additional responses were not likely to provide new or significant insights, thus insuring a comprehensive exploration of our research questions. Interviews were conducted via Zoom video conferencing, were recorded with consent, and subsequently transcribed. Interview duration ranged from 24 to 77 min with an average of 49 min. Though some natural resources managers we interviewed were Tribal members, they were not speaking on behalf of the Tribal community. All responses were from the perspective of Tribal staff, regardless of Tribal affiliation. Our participants skewed toward coastal and Puget Sound geographies, and we recruited fewer participants east of the Cascades (see results).

2.1 Coding methodology

We coded interviews using Dedoose software (Salmona et al., 2019). We first used open coding (Bernard et al., 2016) to identify Tribal concerns, inequities, and values. This round of coding resulted in hundreds of codes, with axial and selective coding being used to inductively aggregate codes of similar meaning into themed larger codes (Saldaña, 2021). Authors (OZ and TE) coded interviews independently, and compared codes on a subsample of the interviews to ensure intercoder reliability (Cheung and Tai, 2021).

With coding complete, we focused analysis on identifying the needs and inequities experienced by Tribes, the degree to which FbD

is addressing these needs and inequities, and how FbD could better address needs and inequities in the future. The analyses we conducted were directly responsive to the FbD program. We divided each reported need into one of three categories: ‘institutional,’ ‘social,’ and ‘biological’ (cf. McGinnis and Ostrom, 2014). This distinguished among needs that were based upon policy/legislative action, human wellbeing and cultural concerns, and biophysical mechanisms.

We used regression analyses to explore relationships between demographic attributes of our interview subjects and number of needs and inequities they reported. We also conducted a co-occurrence analysis to assess the frequency with which concepts co-occur within the same statement or overlap in two consecutive statements.

3 Results

3.1 Participants

Participants ranged from 32 to 75 years of age ($\bar{mean} = 51$, $SE = 2.8$), and were 75% male ($N = 15$), 25% female ($N = 5$). On average, participants worked for their Tribal government for 17.5 years ($\bar{SE} = 2.7$, range 2.5–40 years). Seventy-five percent ($N = 14$) of our respondents worked for Tribal governments on the West-side of the Cascade mountain range (i.e., Western Washington), and 25 % of respondents ($N = 6$) worked for Tribes on the East-side of the Cascade mountains. About 43% ($N = 6$) of participants from Western Washington lived on the Pacific Ocean coast, and 57% ($N = 8$) resided by the Salish Sea, including the urban and periurban Puget Sound corridor (Figure 1).

Participants held a range of positions in Tribal governments: Director of Natural Resources (20%), Fisheries Biologist (15%), Environmental/Wildlife Program Manager (15%), Consultant (10%), Environmental/Restoration Planner (10%), Technical Services/Watershed Coordinator (10%), and Other (15%; comprised of an Ecologist, Hydrologist, and Tributary Projects Lead). For confidentiality purposes, the names of the Tribal governments involved in this research are anonymous.

3.2 Tribal needs

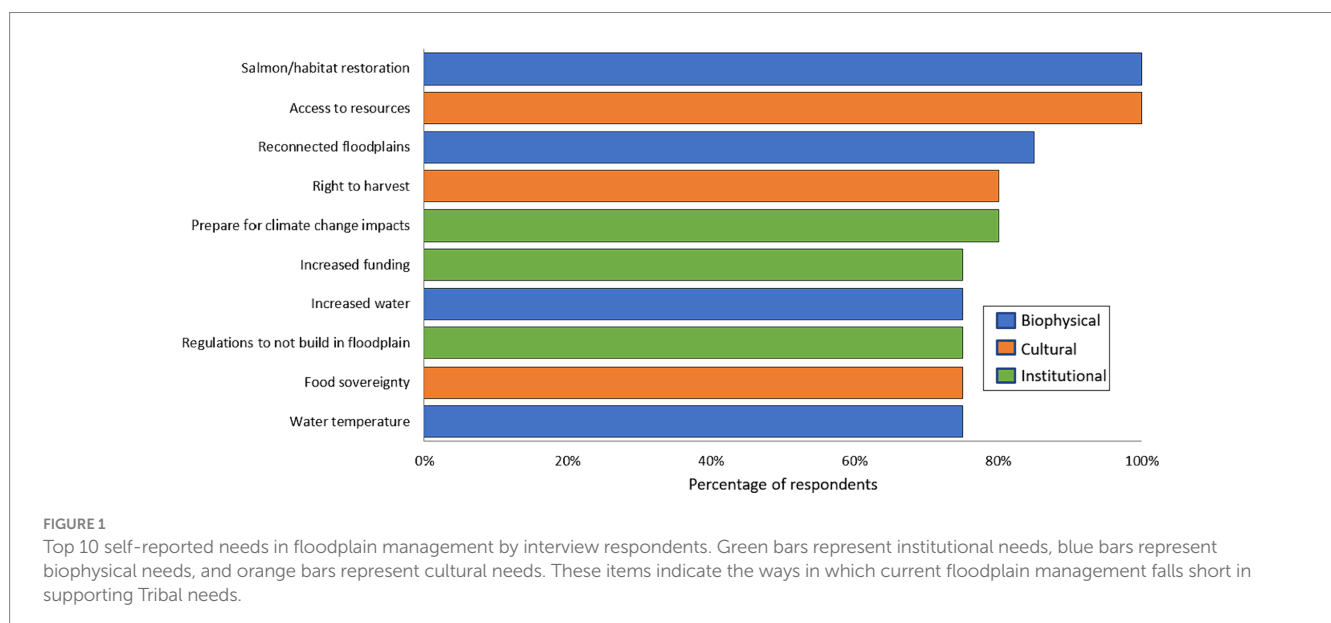
Our interviewees identified 46 Tribal needs relating to floodplain management (Supplementary Figure 1). On average, respondents reported 18.4 needs ($SE = 0.9$). The number of Tribal needs reported by interviewees did not vary with age ($r^2 = 0.04$, $p = 0.41$), gender ($r^2 = 0.08$, $p = 0.24$), or years in their position ($r^2 = 0.02$, $p = 0.56$).

Every Tribal resource manager we interviewed identified restoration of salmon habitat as a need (Figure 1). Additionally, a number of other needs that are directly related to salmon or access to salmon were mentioned by more than half of interviewees (e.g., access to resources, right to harvest, food sovereignty, water temperature, fish barrier removal, water quality, increased aquatic habitat; Figure 1). In general, the importance of salmon habitat was linked to the cultural importance of salmon. For instance, one Tribal resource manager highlighted the connection of their Tribe to salmon: “We’ve lost 90% of the [salmon] run, or 95%, that our people used to depend on ... who we are as a people is connected to what the land and the fish do and say.” Other respondents emphasized that the fate of tribes is deeply connected to salmon: “If we lose salmon, that’s like cutting off our legs for Tribes,” and “... the loss of fish is significant and it is deadly.”

The majority of Tribal needs identified by interviewees (54%) were related to institutional issues. Biological issues constituted 25% of the needs mentioned, and cultural needs composed 21%. However, in general, biological and cultural needs were more consistently mentioned by respondents than institutional issues (Supplementary Information).

3.3 Regional variation in reported needs

All respondents from east of the Cascades and from the Olympic Peninsula mentioned the need for fish barrier removal while only 38% ($N = 7$) of those in the Salish Sea region did. Similarly, increased water in systems, such as the need for reservoirs or keeping water in rivers, was mentioned by 2.6 times more managers east of the Cascades and from the Olympic Peninsula than from those from the Salish Sea area



(*N* = 20 vs. 7). In contrast, we found that some respondents from the Olympic Peninsula (*N* = 4) and the Salish Sea (*N* = 4) spoke of the need to alleviate damage to shellfish beds caused by flooding and ocean acidification as well as removal of shoreline armoring (*N* = 2 and 3, respectively), while no managers from the east side mentioned these needs.

3.4 Inequities

Our analysis of interviews revealed 41 Tribal inequities relating to floodplain management (Supplementary Information). On average, respondents reported 13.6 inequities (*SE* = 0.6). The number of Tribal inequities reported by interviewees did not vary with age ($r^2 = 0.04$, $p = 0.41$), gender ($r^2 = 0.03$, $p = 0.46$), or years in position ($r^2 = 0.03$, $p = 0.49$).

Every Tribal resource manager we interviewed identified loss of salmon as an inequity, and 95% of respondents (*N* = 19) stated that Tribal communities were disproportionately affected by climate change (Figure 2). As we saw with needs, many other inequities that are directly related to salmon or access to salmon were mentioned by more than half of interviewees (e.g., loss of culturally significant species; decreased opportunities to harvest; loss of fishing income; ceremonial and cultural impact from salmon loss; Figure 2). Eighty-five percent of respondents (*N* = 17) stated that correcting past and ongoing management failures fell upon the Tribal community they worked for. As one respondent stated: “When we talk about equity and justice, [many] city and county jurisdictions do not have the staff that Tribe’s hire. They do not have your biologists that are on the ground looking for restoration projects, or your funding specialist going after and managing the grants. It seems like the state, the counties and the cities, have been dependent on Tribes to provide those restoration activities ... Tribes [conduct restoration projects] because it’s the only way to protect their treaty rights, and there’s an obligation by the federal government to protect those treaty rights.”

Again, we saw that many inequities were linked to the loss of salmon habitat, and particularly how current resource management

drives the ongoing suppression of salmon populations through habitat degradation and climate change impacts. One respondent stated: “On our side of the mountains, the watersheds are dependent on snowpack and the disappearance of snowpack can have detrimental impacts on the salmon that we depend on as part of our culture. Then you start adding in the constant development. This land is changing from how we historically used it. As a Tribal member, we cannot take our treaty rights and change from salmon to bass because that’s not our way of life. We’re a salmon people.”

Another respondent emphasized how negative impacts to floodplains are perpetuated through Western value systems: “[I want] to highlight the fact that people look at the impacts on who is in the floodplain and who uses the floodplain. They do not think about how [infrastructure is] destroying aquatic species by degrading the floodplains. [This relates to] environmental justice for Indigenous people who rely on that resource. People who aren’t walking in those shoes do not see what I call the ‘collateral damage.’”

The plurality of Tribal inequities identified by interviewees (38%) were related to institutional issues. Cultural issues constituted 36% of the inequities mentioned, and biological inequities composed 25% (Supplementary Information). However, in general, biological and cultural needs were more consistently mentioned by respondents than institutional issues.

3.5 Co-occurrence

Our examination of the co-occurrence of codes revealed important connections (Figure 3). The quality of aquatic habitat frequently co-occurred with such diverse topics as colonial land management, ecosystem impacts from climate, flood infrastructure, hydrological shifts and salmon abundance. We found that enhanced resilience to climate change co-occurred frequently with salmon abundance, Tribal values and ways of being, human health and wellbeing, and aquatic habitat quality (Figure 3). Diminished resilience to climate change often co-occurred with colonial land management and policy, ecosystem

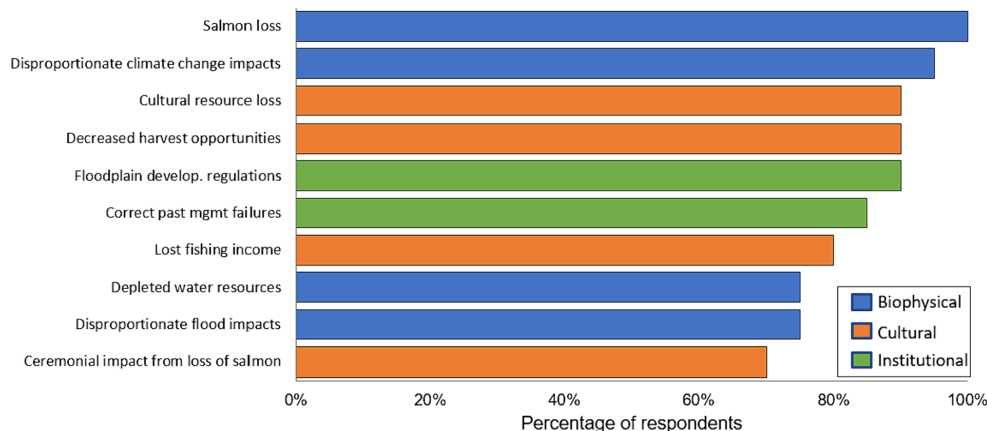


FIGURE 2 Top 10 self-reported inequities in current floodplain management by interview respondents. Green bars represent institutional inequities, blue bars represent biophysical inequities, and orange bars represent cultural inequities. These items indicate the ways in which current floodplain management currently perpetuates, or fails to eradicate, inequities to Tribal communities.



FIGURE 3
Co-occurrence chart for our top 10 codes. This tool observes associations between concepts by looking at the frequency that two concepts either occur in the same statement or overlap in two consecutive statements. This is a useful mixed methods analysis that can identify important associations, but which requires observations of the quotations within which these codes are embedded to best understand the relationship between the codes. The gradient bar (right) indicates the spectrum of co-occurrence frequency, with white being zero and deep purple being 60. Of note, the same codes are on the x and y axis so there are replications across this figure.

impacts due to climate change, human challenges and needs for adaptation, hydrological shifts impacting habitat, and structural financial limitations.

3.6 Are needs and inequities being addressed by Floodplains by Design?

Our interviews revealed that FbD was meeting the needs of 6 of our 20 participants (30%). However, 3 said FbD was not meeting their needs (15%), and 6 respondents indicated that FbD supported Tribal needs in some ways and fell short in others (30%). Five respondents indicated that they did not feel qualified to answer the question, 1 of whom said they were unfamiliar with the program.

Four of our 20 respondents had an FbD grant at the time of interview (20%), and 14 of 20 respondents worked for Tribal communities which have received an FbD grant previously (70%). Sixty-seven percent of those reporting that FbD was not supporting their needs or addressing inequities had never received an FbD grant, but 15% had a grant at the time of interview indicating that although the majority of grant applicants who did not feel adequately supported by FbD had not received funding for the program, a small portion received funding and still did not find adequate support. Of the 6 respondents who stated FbD was meeting community needs and addressing inequities, 1 had a grant at the time of interview and all 6 of them had received a grant from the program at some point.

Tribal managers that felt that FbD was meeting their needs often reported support in institutional domains such as providing funding for levee setbacks or to move infrastructure out of the floodplain. Importantly, funding that supports land acquisition was prominently discussed in our interviews; many respondents stated that this was the only way to ensure permanent protection of floodplains while zoning regulations continue to allow for development in floodplains. The program also received high praise for pursuing an integrated, holistic approach. Many interviewees stated that FbD’s multi-benefit thinking at the ecosystem level is unique in floodplain management programs, and that this is where all natural resource management efforts should be heading.

We heard a diversity of responses from those who did not feel that FbD was addressing their needs. Many felt that efforts were falling short despite the program’s intention to prioritize integrated floodplain management and support salmon habitat restoration while also moving people and property out of floodplains. This sentiment was evident in applications that developed collaborative, multi-benefit projects and community relationships (as stated in the funding guidelines manual) but still did not receive grants. Respondents interpreted this to mean that the program is more focused on urban and high-income areas and less interested in rural locations, likely due to the emphasis on flood risk reduction which inherently increases in more densely populated regions.

Additionally, these Tribal managers felt grant rejections were evidence that reviewers do not prioritize multi-benefit projects the

way the program claims. These interviewees felt that this lack of support conflicts with the legal mandate for governments to support treaty rights. As one respondent stated: “Tribes [invest in habitat restoration efforts] because it’s the only way to protect their treaty rights and there’s an obligation by the federal government to protect those treaty rights. Yet Tribes are still asked to provide a match on something that the federal government should be carrying out. Tribe’s aren’t complaining about having to carry it out, but I think this is an equity issue when it comes to finances.”

Other Tribal managers we interviewed felt FbD needed a better strategy to ensure that funds were not primarily allocated to areas with more “political funding or human base,” such as the Puget Sound corridor. Though FbD aspires for a proactive rather than reactive approach, these respondents did not feel this value was illustrated by the way they allocated funds since, as one respondent stated, “it is cheaper, easier, and better for the environment to protect something before it becomes destroyed instead of after the fact.”

3.7 How can Floodplains by Design better address these needs and inequities moving forward?

Overall, respondents felt that FbD is doing well in some areas but can improve in others. All respondents who felt that the program was not adequately supporting Tribal community needs or alleviating historical and ongoing inequities expressed that the benefits and burdens of local floodplain management should be more equally distributed among communities. These respondents suggested that FbD and other floodplain management programs could support this goal by adjusting their evaluation metrics to ensure Tribal wellbeing and needs are valued using non-colonial measures of wellbeing. In particular, those who felt that FbD was not meeting their needs perceived the program to continually prioritize moving humans and property out of floodplains over salmon habitat restoration, and interpreted this as an indication that not all human dimensions are being considered. As one respondent stated: “The Tribal communities are compassionate and they understand the importance of taking care of Mother Nature around us. To Tribal communities, Mother Nature is a living, breathing being. She’s a person, and they refer to salmon as people. The salmon people.”

Based on the responses we heard during our interviews, funding that supports land acquisition of Tribal governments should be prioritized to optimally ensure Tribal needs are being met in floodplain management. Additionally, government funded aquatic restoration programs like FbD can reconsider match requirements in Washington State since these efforts are mandatory to successfully uphold Tribal treaty rights. A renewed focus on FbD’s intention to have a proactive rather than reactive approach to environmental restoration by shifting funding to non-urban and less wealthy areas is also important since, as we heard from a participant, “it is cheaper, easier, and better for the environment to protect something before it becomes destroyed instead of after the fact.” Additionally, community-based, co-produced, and collaborative efforts must continue to be invested in in Tribal communities to ensure FbD efforts center community needs.

Since the conclusion of this study, the FbD program has initiated a process to waive match requirements for the 2025–2027 biennium.

Match will be waived for applicants that can demonstrate their project area is in a location with a median household income below 80% of the state median, or for those who can demonstrate their project area is identified as disadvantaged on the White House’s Climate and Economic Justice Screening Tool (CEJST, 2022). All land within the boundaries of Federally Recognized Tribes is identified as disadvantaged on the screening tool, so all Tribal applicants will now have the match requirement waived for current and future FbD proposals. This decision was made due to extensive feedback from applicants and current FbD grantees, and indicates FbD’s ability to be adaptive and responsive to Tribal needs. To continue working toward better addressing Tribal needs and inequities in the future, FbD should support future evaluations and assessments with Tribal communities and Tribal natural resource staff that will inform the program’s funding guidelines, criteria, evaluation protocols, and program priorities. The waiving of match requirement for select applicants indicates flexibility in FbD programming, which will remain essential in optimally addressing Tribal needs and inequities moving forward.

4 Discussion

Floodplains and the people who inhabit them face a daunting array of challenges, and the plight of climate change may amplify issues such as flood risk, racial and ethnic inequities, and the loss of ecologically and culturally important species (Collins et al., 2018; Weiskopf et al., 2020). Conventional responses to these challenges are rooted in modernist paradigms that deconstruct complexity into more manageable components resulting in persistent dualities, including that of human-nature and human-nonhuman (West et al., 2020). While management action grounded in modernist paradigms has achieved some success, it is susceptible to missing critical elements that underpin management efficacy (West et al., 2020). Here, we assessed the degree to which a floodplain management program has supported Tribal needs and addressed inequities. Our interviews highlighted that floodplain management reflects institutional barriers to considering human-nature interconnectedness. For Tribal cultures that are deeply connected to Pacific salmon, the legacy of modernist paradigms may be manifested in challenges to wellbeing in these marginalized communities.

Tribal natural resource managers identified diverse needs that highlight the importance of holistic approaches to floodplain management. For instance, our analyses of co-occurrence revealed a high degree of overlap in human dimensions (e.g., Tribal values) with biophysical themes (e.g., changes in hydrology, salmon abundance) and institutional concerns (e.g., colonial land management, harvest management). Tribal managers also highlighted critical needs that crossed conventional management sectors. For example, managers often discussed reducing flood risk to communities concurrently with salmon restoration and improvement of infrastructure. Thus, while interviewees intermingled these needs in single statements, they would require agencies such as FEMA and The Washington Department of Ecology to address flood risk, Tribal, State and Federal fisheries agencies to address salmon, and Department of Transportation, US Army Corps of Engineers, and other entities to address infrastructure needs in a collaborative setting.

The needs reported by floodplain managers often reflected Tribal inequities they observed. In most cases, Tribal needs and inequities were linked directly or indirectly to salmon. Our results demonstrate that the impacts of reduced access to salmon are significant and broadly diminish Indigenous health and wellbeing. When access to traditional foods such as salmon are disrupted by management regimes rooted in colonialism, it perpetuates food injustice as the needs of the dominant culture are prioritized over those of Indigenous peoples (Whyte, 2017). While such prioritization may not be intentional in programs such as FbD, the Tribal resource managers we interviewed indicated that it does occur and negatively impacts community resilience.

The importance of salmon has been codified by federal, state and local governments (State of Salmon, 2020), and is a critical driver of floodplain policy (Goodsell, 2021). Indeed, all actors involved in floodplain management in the Pacific Northwest are concerned with salmon in some capacity, whether the existence of salmon creates an obstacle in their development aspirations and management plans (Barbarossa et al., 2020) or their restoration and conservation is the goal (Schindler et al., 2016). Thus, salmon connect varied knowledge systems to facilitate interplay between social groups, stakeholders, and agencies engaged with floodplains. Salmon provide an “object” (cf. Parker and Crona, 2012; Nel et al., 2016) for floodplain managers and Tribes to center mutual interests and values without diffusing them. This fostering of shared knowledge can help move beyond established cultural or institutional norms, and can play a key role in enhancing equity within environmental management (Mazzocchi, 2006; Morgan, 2020). While modernist Western governance often deemphasizes human-nature interconnectedness, the conceptualization of salmon as a boundary object can help support more holistic and relational approaches to floodplain management.

Management which is rooted in modernist and colonial epistemologies and deconstructs social-ecological systems can privilege settler values over the cultural needs of Indigenous peoples. Such settler values include ownership (Moreton-Robinson, 2015), financial prosperity (Harfoot et al., 2018), and dominative land relations (Liboiron, 2021). While many Pacific Northwest Indigenous communities regard both their biologically living and nonliving surrounding environment as relations (Coté, 2022), Western cultures have considered humans and nature separate and as a result, have constructed a society largely detached from the natural world (Cronon, 1996). A society established on separation of humans and nature faces inherent obstacles in shifting from a utilitarian (Manfredo et al., 2020) to reciprocal (Kimmerer, 2015) orientation in environmental management. A shift in the epistemology underpinning programs like FbD, and the policies that guide such programs, so that they more fully engage human-nature interconnectedness is key to improving management so that it better meets Tribal needs and enhances equity.

Management efforts that emphasize human-nature interconnectedness in integrated management programs should be driven by communities. Donatuto et al. (2016) provide a helpful model for centering Tribal needs and integrating seemingly diverse domains in environmental management. In collaboration with the

Swinomish Indian Tribal Community, Donatuto and team developed non-colonial indicators of health. The development of these indicators was grounded in Indigenous knowledge, and placed Indigenous experiences at the center of health assessments. The six non-physiological health markers developed by Donatuto et al. (2016) enhance self-determination while emphasizing the proper scale and focus of needs. Such a framework may enhance equity in programs like FbD, particularly when knowledge is co-produced and based on a foundation of intentional relationship-building that centers community priorities. Braiding Indigenous and Western knowledge systems (cf. Hopkins et al., 2019) provides a promising avenue for equitably operationalizing integrated management for the benefit of people and nature.

Our research focused on the perspectives and perceptions of Tribal natural resource managers. Importantly, Tribal natural resource managers do not speak on behalf of the Tribes they work for, and their perspectives are strictly provided as Tribal employees. This may be viewed as a limitation to this research, since we did not work directly with Tribal community members due to timeframe limitations of our study. While the average tenure of Tribal managers we interviewed exceeded 17 years, future work directly with Tribal community members that is built on reciprocal and ongoing relationships (Castleden et al., 2012; Hoover, 2017), is likely to reveal additional and perhaps different insights. Such a study is an important next step in this work.

The wellbeing of humans and nature are inseparable in many Indigenous cultures (Kimmerer, 2015; Whyte, 2017; Barker, 2019; Donatuto et al., 2020; Liboiron, 2021; Coté, 2022; Atleo and Boron, 2022), and our research indicates that this reality has not been fully incorporated into regional floodplain management. Integrated management efforts are vital for addressing both the complex problems (Ellis et al. 2013) and problematic framing (Guernsey, 2021) of the Anthropocene. However, to enhance both the efficacy and equity of integrated management efforts, holistic frameworks that prioritize human-nature interconnectedness and the needs of marginalized communities are needed. This will require carefully co-created solutions which do not assimilate Indigenous knowledge into Western frameworks but create space for different knowledge systems and values to equitably and respectfully inform one another (Tuck, 2009; Reid et al., 2020). For programs like FbD, this may require attention to how well program management and evaluation matches the intention of a program. Our work highlights that iterative pluralistic, collaborative, and adaptive management conducted with Tribes will support just environmental governance that is rooted in community needs (Kimmerer, 2002; Alonso-Yanez et al., 2019; Turnhout et al., 2020). With this shift, we have the best chance of confronting the challenges faced by floodplain (and other) ecosystems and meeting the needs of all communities connected to them.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Human Subjects Division in the Office of Research. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

OZ: Writing – review & editing, Writing – original draft, Software, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. TE: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. RC: Writing – review & editing, Supervision, Project administration, Funding acquisition, Conceptualization. PL: Writing – review & editing, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

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Conflict of interest

RC is employed by the Nature Conservancy, one of the NGO partners in Floodplains by Design.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fclim.2024.1306542/full#supplementary-material>

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