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Research

Immeasurable sovereignty: Indigenous well-being, fishery science, and sustainable governance

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ABSTRACT. Well-being and equity are increasingly identified as integral to environmental governance and improved sustainability outcomes. Greater consideration of these dimensions has generated calls for more data and new methodologies capable of collecting, evaluating, and converting social and cultural data into formats deemed more useful to decision makers. These efforts expose gaps and challenges related to an over reliance on quantitative data, especially when it comes to adequately accounting for the well-being of Indigenous communities. Located along the western shore of Nanvarpak (Lake Iliamna) in southwest Alaska, this paper examines Indigenous conceptions of well-being and provides insights on how to better account for the well-being of Indigenous communities in sustainable governance. Carried out in partnership with the Tribal Nation of Igyaraq (Igiugig), we draw on ethnographic and interview data to identify and examine three foundational elements of Indigenous well-being: (1) land relations or *nunaka* (my land, my birthplace), inclusive of one's responsibility to ensure continuation of a way of life defined by connections to ancestral lands; (2) sovereignty; and (3) effective governance. We pay special attention to the implications of Indigenous well-being as primarily expressed and achieved through enactments of sovereignty and nation-building. We draw attention to the need for greater investment in diverse scientific expertise and data but caution against assuming that more science will lead to better governance. There is a need to acknowledge the ways in which dominant Western science-policy structures do not serve Indigenous communities. Our research suggests that you cannot adequately account for Indigenous well-being without explicit consideration of governance, and the often taken for granted value assumptions and political conditions that quietly frame policy debates and scientific understandings of what data are considered useful and what impacts are considered acceptable. This paper demonstrates the fundamental importance of centering sovereignty in not only well-being and equity considerations, but as a central tenet of ethical scientific inquiry and environmental governance more broadly.

Key Words: *equity; indicators; Indigenous stewardship; Indigenous well-being; sovereignty; sustainable governance*

INTRODUCTION

Well-being and equity are increasingly identified as integral to environmental governance and improved sustainability outcomes (Alexander et al. 2021, Cochrane 2021, Dawson et al. 2021, NMFS 2023, NASEM 2024, Micha and Kelling 2025). This recognition comes amidst myriad U.S. and global examples of conservation solutions and top-down management decisions harming local and Indigenous communities. Examples range from displacement from traditional areas, dismissal and erasure of Indigenous knowledge and values, and erosion of cultural practices and livelihoods essential to cultural and community wellness (e.g., Capistrano and Charles 2012, Klain et al. 2014, Bennett et al. 2018, 2019, Blythe et al. 2018, Todd 2018, Carothers et al. 2021).

Calls for systematic inclusion of well-being and equity considerations in evaluation of natural resource management processes and outcomes have reenergized debates surrounding how to properly account for social and cultural values, benefits, and losses that are not easily measured or quantified (Satterfield et al. 2013, Crosman et al. 2022, Bennett 2022, Gregory et al. 2023, NASEM 2024). This has generated calls for "more science" (Gregory et al. 2006), including more data and new methodologies capable of collecting, evaluating, and converting social and cultural data into formats deemed more useful (i.e., reducible, measurable, comparable) in resource management and decision-making contexts.

Indicators are frequently identified as a promising tool to measure cultural phenomena and provide "scientifically useful data" (Singer 1982) despite documented shortcomings associated with reducing complex phenomena to overly simplistic metrics stripped of context essential to adequate well-being assessments (Poe et al. 2014, Breslow et al. 2016, 2017, Sterling et al. 2017, 2020, Leong et al. 2019, Donkersloot et al. 2020a). Cooper (2015:1792) notes repeated instances of "damage done by the imposition of standardizing schemes that set about dismembering an exceptionally complex and poorly understood set of relations and processes in order to isolate a single element of instrumental value." He further describes how measurement, often perceived to take the politics out of science, is "inherently political" and can "remake the world" in part because science involves work that sets up values and then makes their origin invisible (Cooper 2015). This means that impacts to communities can remain unaccounted for in science and decision making because they do not fit nicely into top-down data collection and classification systems that, as Nguyen (2024:98) contends, "aren't neutral [but instead] the result of political and social processes which involve [taken-for-granted] decisions about what is worth remembering and what we can afford to forget."

Despite considerable progress in developing approaches that can address these gaps and disparities, management decisions remain heavily reliant on quantifiable data that often render invisible social and cultural values and impacts. The potential for

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misapplied measures is especially pronounced in Indigenous communities and serves as an impetus for this work (Adelson 2000, Poppel et al. 2007, Taylor 2008, Donatuto et al. 2011, Satterfield et al. 2013, García-Quijano et al. 2015, 2023, ICC Alaska 2015, Amberson et al. 2016, Breslow et al. 2016, 2017, Lyons et al. 2016, Black 2017, Woodhead et al. 2018, von der Porten et al. 2019, Tsosie and Claw 2019; First Alaskans Institute 2007, *unpublished report*).

In previous work we assessed the utility of well-being indicators, many of which were equity-based indicators, in Alaska fisheries (Donkersloot et al. 2020a). We documented risks associated with creating metrics without cultural grounding and guidance from those whose well-being is being assessed. We also highlighted a need for more diverse measures of what constitutes sustainable and successful fishery governance (Donkersloot et al. 2020a). It is well-documented that mainstream approaches to well-being are often hamstrung by data gaps and an overreliance on quantifiable data that is easily comparable across scales and contexts. Common examples include indicators based on population, education, income, or employment. In commercial fisheries, well-being may be captured with metrics such as revenues, port of landings, ex-vessel values, and infrastructure.

More recently, deficit-based metrics, such as households experiencing personal disruption, unemployment, or poverty have been applied to better account for impacts to vulnerable populations in decision making (Colburn et al. 2016). These have been helpful in bringing attention to impacts on underserved populations, including ethnic minorities, but they are inadequate when working with Tribal Nations as political institutions with distinct Indigenous epistemologies, ontologies, and legal orders. Such approaches have also been identified as problematic in that they negate the strengths of Indigenous communities and are ill-equipped to adequately account for what matters to communities, especially Indigenous communities that often emphasize self-determination, and secure connections to traditional lands, waters, and foods as central to well-being (Taylor 2008, Donatuto et al. 2011, Coulthard 2014, García-Quijano et al. 2015, ICC Alaska 2015, Black 2017, McGregor 2018, Todd 2018, Tsosie and Claw 2019, Wayner 2022, Dawson et al. 2025; First Alaskans Institute 2007, *unpublished report*).

These examples reflect what Mark Cooper (2015) describes as "problems of measurement" whereby we intend to measure what we value but end up valuing what we can measure (Murray et al. 2016). A recent National Academies of Science, Engineering, and Medicine (NASEM) report further explains how the tendency for contemporary governance to emphasize goals "that are more easily measured [can in turn] reinforce the importance of the things it purports to measure" resulting in governance action becoming increasingly oriented toward goals that are more easily measured (NASEM 2024:11; see also Stephenson et al. 2017).

POSITIONALITY, RELATIONALITY, AND RESEARCH FOCUS

We are a team of Indigenous and non-Indigenous researchers and practitioners committed to transformative scholarship and decolonizing and Indigenizing methodologies, including the dismantling of power relations underpinning the traditional researcher-subject paradigm (Tuhiwai Smith 1999, Kovach 2009, Koster et al. 2012). We support Indigenous-led and community-centered approaches. This research was undertaken on the traditional lands of the Igyararmiut. Igiugig Village Council (IVC) is a partner in this project; Tribal leaders co-authored this paper; we acknowledge the sovereign Tribal government of IVC as a co-author of this paper reflecting the importance of formal consent, endorsement, and close collaboration of Tribal governments in research and publications about their/our Nation. Collectively, our team is committed to following the four R's in research: relationship, responsibility, reciprocity, and redistribution (Harris and Wasilewski 2004). The four R's represent core Indigenous values as research protocols that require continual reflection to ensure that research priorities and design are informed by and reflect community needs and values.

In this paper we examine Indigenous conceptions of well-being and provide insights on how to better account for the well-being of Indigenous communities in sustainable governance. As part of this effort, we consider the question of when standardized, quantifiable data are important for equitable, science-based, sustainable management, and when they are not (National Research Council 2011). Located along the western shore of Nanvarpak (Lake Iliamna) in southwest Alaska, this research was carried out in partnership with the Tribal Nation of Igyaraq and addresses the following questions.

1. What does well-being look like in Igyaraq? How is well-being practiced, achieved, threatened?
2. What institutions or initiatives support well-being and livelihood sustainability in Igyaraq?
3. How can and should Indigenous well-being be accounted for in governance?
4. What forms of data and data collection are needed to account for equity and Indigenous well-being in governance of lands and waters?

Consideration of these questions brought to light crosscutting linkages between sovereignty, self-determination, and Indigenous well-being in Igyaraq. In this paper we center sovereignty as a foundational element of Indigenous well-being. We draw on Cornell and Kalt's (1998) use of the term "de facto sovereignty," which encompasses and delineates between sovereignty in fact and sovereignty in practice, that is, the rights and powers of self-governance and the ability to exercise sovereignty effectively. De facto sovereignty makes space for interrogating the implications of accounting for Indigenous well-being in the prevailing terms of Western science-policy arenas. We employ de facto sovereignty as an important frame of reference for understanding why it is critical to conceptualize and account for Indigenous well-being on Indigenous terms, (i.e., according to Indigenous values and protocols), and what is at stake when we do not. This requires consideration of the cultural character and values of dominant political institutions and legal orders (Todd 2018). In this paper we discuss how adherence to the unexamined and implicit cultural logic and language of Western science and policy filters well-being and equity considerations into data forms and categories that often exclude the strength and significance of Indigenous cultures and governing institutions in sustainable governance.

As a first step in challenging this norm, we adopt the term "land relationship planning" in place of the term natural resource management. Much like culture, tradition, and custom, language plays an important role in shaping our understanding of the world

and our place in it (Kimmerer 2013, Simpson 2014). Land relationship planning is the preferred term of the Igiugig Village Council and has been embraced by Indigenous Nations in Alaska and Canada seeking to reframe territory and land use planning in a language of relationality and cultural responsibility generally absent from Western management approaches and actions.[1] We adopt the term here to center the values and worldviews of our Tribal partner.

Defining equity and well-being

Well-being and equity are contested terms that can carry different meanings in different contexts. We define well-being as a way of being with others that arises when people and ecosystems are healthy, and when individuals, families, and communities equitably practice their chosen ways of life and enjoy a self-defined quality of life now and for future generations (Donkersloot et al. 2020a; see also McGregor 2008, Breslow et al. 2017). This definition explicitly situates well-being as relational and grounded in self-determination and intra- and intergenerational equity. Notably, this definition of well-being extends beyond the individual and is broad enough to account for the diversity of ways people express and practice their own well-being.

Equity can be broadly defined as fair treatment and distribution of opportunities, costs, and benefits across individuals and groups of people. Equity is multifaceted and encompasses procedural, recognitional, distributional, and contextual dimensions that influence each other (Sikor 2013, Sikor et al. 2014). For example, procedural equity requires consideration of who is involved in decision-making processes, that is, the procedure by which decisions are made and who has a voice in them (Friedman et al. 2018). Recognitional equity involves acknowledging the rights, knowledges, values, interests, and priorities of various and distinct individuals and groups and incorporating these into management considerations (NASEM 2024). Distributional equity refers to the distribution of both economic and non-economic costs and benefits. Finally, contextual equity refers to the historical, economic, environmental, social, cultural, and political contexts and circumstances that affect other forms of equity (Pascual et al. 2014).

Leach et al. (2018:3) note that equity "ensures that everyone has what they need for their well-being in any given context, implying more for those who need it" but there is no universal understanding of what is fair and equitable. The fisheries literature in particular is filled with examples of how what is deemed equitable can be based on a range of characteristics or criteria such as need, effort, performance, merit, competition, economic demand, historical precedent, or some other basis (Bennett et al. 2019, Gurney et al. 2021, Crosman et al. 2022).

Crosman et al. (2022) note that "although equity comparisons framed around stakeholders are common, they are often problematic… the term 'stakeholders' obscures differences in the basis and nature of claims between different groups. Specifically, the term diminishes customary, traditional, or treaty rights holders' claims to a 'stake' rather than a sovereign right." Equity comparisons cast solely in the language of "stakeholders" are flawed. They can shroud inequities through erasure of social and historical contexts, including colonization. The term stakeholder also conceals the ways in which Indigenous Peoples are impacted by management decisions as members of Tribes with a particular political status in the United States and diminishes their ability to effectively advocate and protect their ways of life (ICC Alaska 2015, Donkersloot and Agli 2024, NASEM 2024).

Equity in fisheries management is frequently positioned as a trade-off that needs to be balanced against competing management goals of economic efficiency and conservation effectiveness (Pascual et al. 2010, Cochrane 2021, Klein et al. 2015 as cited in Furman et al. 2023). This contrasts with Indigenous framings of equity embedded in worldviews that embrace a relational perspective whereby equity considerations encompass the well-being of both human and more-than-human kin and ecologies (McGregor 2018, Crosman et al. 2022). As told in the story below by co-author and Igiugig Village Council President, AlexAnna Salmon, in this view, equity is not a zero-sum game where the benefits to one come at the expense of another. Rather, equity in Indigenous terms is grounded in mutual flourishing and agency (Kimmerer 2013).

> *What I love about the Yup'ik way of life is that our inner spirit has a* yua. *And the word for the universe is* Ellam yua*, it's like the spirit of the world. That little piece of grass out there has a* yua *and it's equal to mine. So, who is to say I deserve that piece of grass? That grass can decide, it's got a mind of its own, it can give itself to me if it wants to. Everything carries this energy and that's a really humbling worldview.*

IGIUGIG / IGYARAQ LANDS AND WATERS

Igiugig Village Council (IVC) is one of 229 federally recognized Tribes in Alaska. As the only government in Igiugig, IVC provides important village infrastructure and services (e.g., landfill, fuel, water treatment). The village's population is roughly 70 people. The people of Igiugig, the Igyararmiut, are of primarily Yup'ik, Dena'ina (Athabascan), and Aleut heritage. Igyaraq (Igiugig in Yugtun) carries the meaning of "like a throat swallowing water," a reference to its geographic location on the western shore of Lake Iliamna where the Lake feeds into *Kuicaaq* (Kvichak River), which drains into Bristol Bay in southwest Alaska. *Nanvarpak* (Lake Iliamna) is the largest lake in Alaska and home to the largest wild sockeye salmon run on the planet. It is also home to other anadromous fish species (e.g., other Pacific salmon, lamprey), many resident fishes (e.g., rainbow trout, grayling), and one of only a few populations of freshwater seals in the world (Ferrer et al. 2024).

The Bristol Bay commercial salmon fishery, the most valuable wild salmon fishery in the world, is economically and culturally important to the six federally recognized Tribes of the Lake Iliamna region. Many villages in Bristol Bay have experienced a large loss of their access rights to these vital fisheries since the State of Alaska implemented a market-based limited entry management system in the mid-1970s. Alaska's Limited Entry System transformed access to what is a common use resource into individualized, alienable units of wealth that as commodities have left villages for myriad reasons, not least of which is immediate need of cash income (CFEC 2012, Meredith 2018, Coleman 2019, Donkersloot et al. 2020b, Donkersloot 2021; see also Alaska Constitution, Article VIII). A handful of Igiugig residents hold commercial salmon fishing permits today providing valuable opportunities and benefits to other residents and the broader community (Watson et al. 2021). These include multigenerational

connections to culture and place, cash-income opportunities (crew and small-scale processing jobs), and the development and transmission of many practical, political, and place-based skills, knowledge, and values (SASAP [date unknown]).

Igiugig is also well known for its world-class sport fishing opportunities. Roughly 25 nonlocal sport fishing lodges currently operate on the Kvichak River. Some lodges have operated in and around Igiugig for decades, but their growing number in more recent years has raised concerns related to crowdedness, local displacement on the river, quality of life, nonlocal land ownership (e.g., lodges purchasing Native allotments[2]), continued access to culturally important places and resources, and ecosystem impacts (e.g., impacts to rainbow trout populations).

More than anything, Igyaraq and Igyararmiut rely on and value their land-based culture and continuation of their traditional Indigenous hunting and fishing way of life. Igiugig residents are involved in elaborate trading and sharing networks extending from Point Hope, Alaska to the Lower 48 states (see for example Holen 2014, Trainor et al. 2021; see also Reedy 2023). Indigenous ways of life are fundamental to the spiritual, economic, social, and cultural existence of Alaska Native Peoples. Inadequately termed "subsistence" in colonial state and federal governance and management systems, Indigenous or tribal rights are not recognized above other "rural" rights of use (Berger 1985, Anderson 2007, 2016). In legal terms, subsistence refers to customary and traditional uses of wild resources. For Igiugig, subsistence is much more; it is *yuuyaraq* or the Yup'ik way of being. *Yuuyaraq* embodies a way of life in which sharing is central, sharing of food, of stories, of knowledge (Fienup-Riordan et al. 2018). Moose, caribou, berries, birds, and other fish and game are integral to this way of life, but salmon hold a special place as a cultural keystone species connected to identity, security, and wellness (Lukawiecki et al. 2024). Co-author, AlexAnna Salmon, notes that *neqa* is the Yup'ik word for both fish and food, an indication of its significance in the order of things.

> *The word for food in Yup'ik is neqa. Which is the very same word for fish. We are a fish people. It's in our DNA, it's who we are, it's what we do, it's our form of wealth, it knits our social fabric together, it's really the backbone of everything. It's the why we need to reduce our carbon footprint, it's the why we need to stay tied to the land.*

Gram-Hanssen (2021) reviews the historical and ongoing impacts of colonization on the village of Igiugig. These impacts include attempts to displace Indigenous languages and cultures, the settling and dispossession of Indigenous lands, and loss of access to and stewardship of traditional waters, lands, and resources that have been reclassified and managed as commercial, sport, and subsistence resources under the fragmented authority of various state and federal agencies (see also Berger 1985).

Tribes in Alaska are sovereign governments with the inherent right to self-govern but most lack territorial sovereignty (i.e., they do not have a land base). The Alaska Native Claims Settlement Act (ANCSA) was a seminal piece of legislation in this regard. Enacted in 1971, the settlement recognized 43.7 million acres of Indigenous land title, roughly 10% of lands in Alaska, and provided $962.5 million in compensation (roughly US$3.00 per acre) for extinguishment of Alaska Native claims to additional lands based on aboriginal title. Native lands conveyed through ANCSA did not go to Tribes. Instead, land was conveyed to newly created for-profit Native corporations. ANCSA created 13 regional for-profit corporations (12 regions in Alaska and one for those living outside of Alaska) and over 200 for-profit village corporations. ANCSA was the first settlement of aboriginal land claims that chose a corporate model and made land a corporate asset (Berger 1985).

ANCSA lands do not have the status of Indian Country like Indian reservations in the contiguous United States do. Prior to ANCSA, reservations in Alaska were a tool available to Tribes to protect their traditional ways of life by creating a buffer against non-Native encroachment (Illingworth [date unknown], Anderson 2007, 2016). ANCSA ended reservations in Alaska, with the exception of the Metlakatla Indian Community who chose not to take part in ANCSA. ANCSA failed to explicitly protect Alaska Native hunting, fishing, and gathering, punting these protections to future legislation but with clear guidance that they "expect[ed] both the Secretary [of Interior] and the State [of Alaska] to take any action necessary to protect the subsistence needs of the Natives" (U.S. Congress 1971; more below).

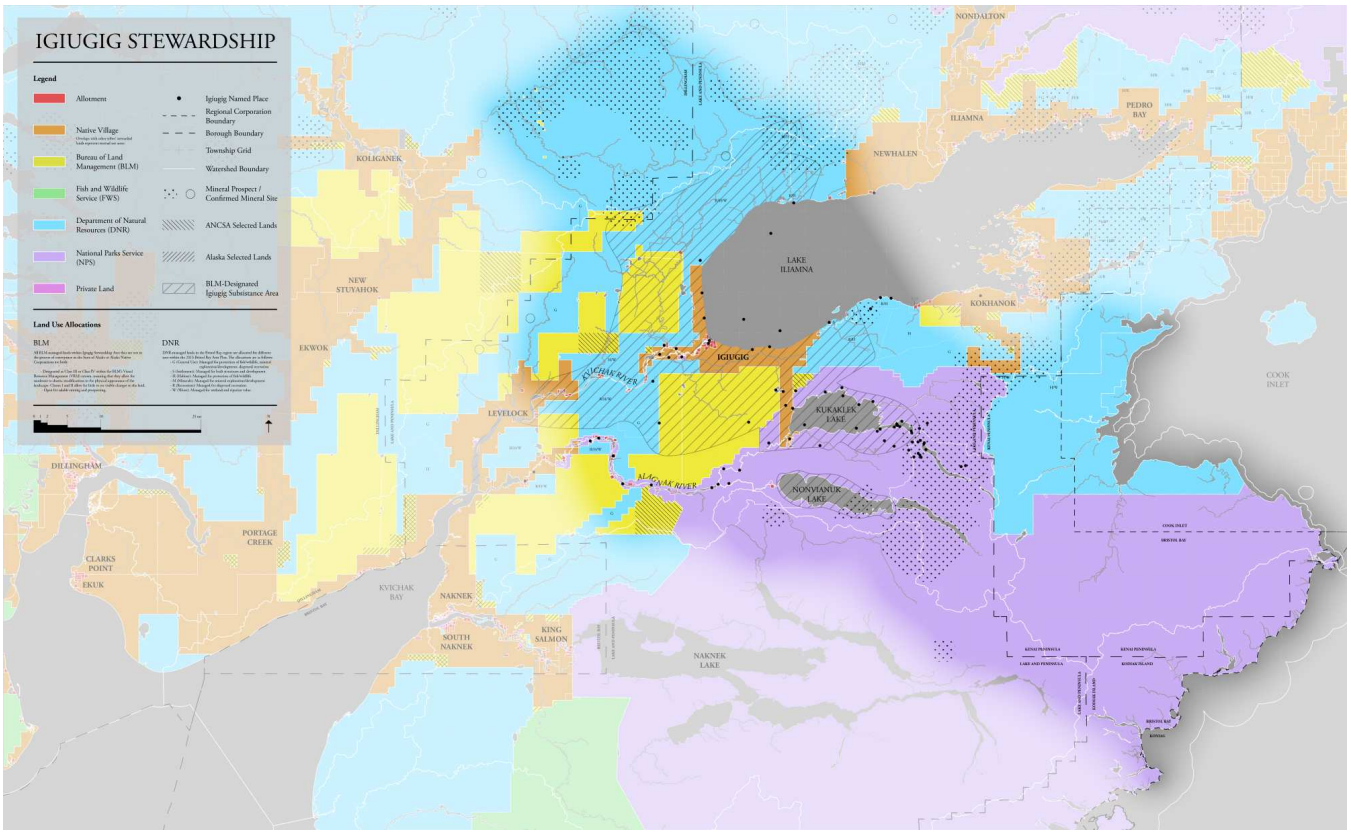
ANCSA purportedly extinguished aboriginal land claims but it did not eliminate Tribal sovereignty nor the federal trust responsibility, a well-established legal and moral obligation of the United States to ensure the protection of Tribal and individual Indian lands, assets, resources, and rights (Anderson 2007, 2016). The trust responsibility originates from the unique, historical relationship between the United States and Indian Tribes.

Today, Tribes in Alaska continue to exist as political sovereigns, but they have limited jurisdiction over their land base. They are nations largely without territory and part of a unique and sometimes fraught political landscape as citizens of sovereign Tribes (e.g., Igiugig Village Council), and shareholders of for-profit village (e.g., Igiugig Native Corporation) and regional (e.g., Bristol Bay Native Corporation) Native corporations.

Through ANCSA, IVC selected 66,000 acres of their/our highly important traditional homelands surrounding the village. These lands were conveyed to the newly created Igiugig Native Corporation (INC). INC as the village corporation owns the surface estate of these lands, while Bristol Bay Native Corporation, the regional corporation, owns the subsurface rights. Village and regional Native Corporations received title to land under ANCSA but secured no riverine or offshore rights (Berger 1985).

The State of Alaska, while in recent years has recognized Tribal sovereignty,[3] has failed to meaningfully demonstrate this recognition, and in fact repeatedly demonstrates its opposition (see State of Alaska 2017, Brooks 2023, Ruskin 2024). Strikingly, the State of Alaska maintains the authority to manage fish and game on ANCSA lands. Figures 1 and 2 show how Igiugig's traditional lands and waters overlap with and extend beyond the boundaries of village corporation lands. These figures also show village corporation lands, Native allotments, and state and federal lands in the region. We share Figure 1 with permission from Igiugig Village Council as an example of decolonial cartography that articulates Indigenous self-determination in relation to place (Rose-Redwood et al. 2020). Igiugig's stewardship map exemplifies the "remaking of worlds" and reassertion of Indigenous lands and life irrespective of and in resistance to colonial framings (Rose-Redwood et al. 2020).

Fig. 1. Igiugig's Stewardship Map. This map depicts Igiugig's homelands. The various colors indicate land owners today (e.g., National Park Service [purple], Bureau of Land Management [yellow], Alaska Department of Natural Resources (blue), Village Corporations [orange]). The dots represent Igiugig Named Places. Note the intentional absence of distinct boundary lines marking Igiugig's traditional lands. Instead, the outer areas blur as they overlap with other Nations' homelands. Igiugig Village Council is careful not to define ownership and encourages other Nations to map their traditional homelands. Shared with permission from Igiugig Village Council.



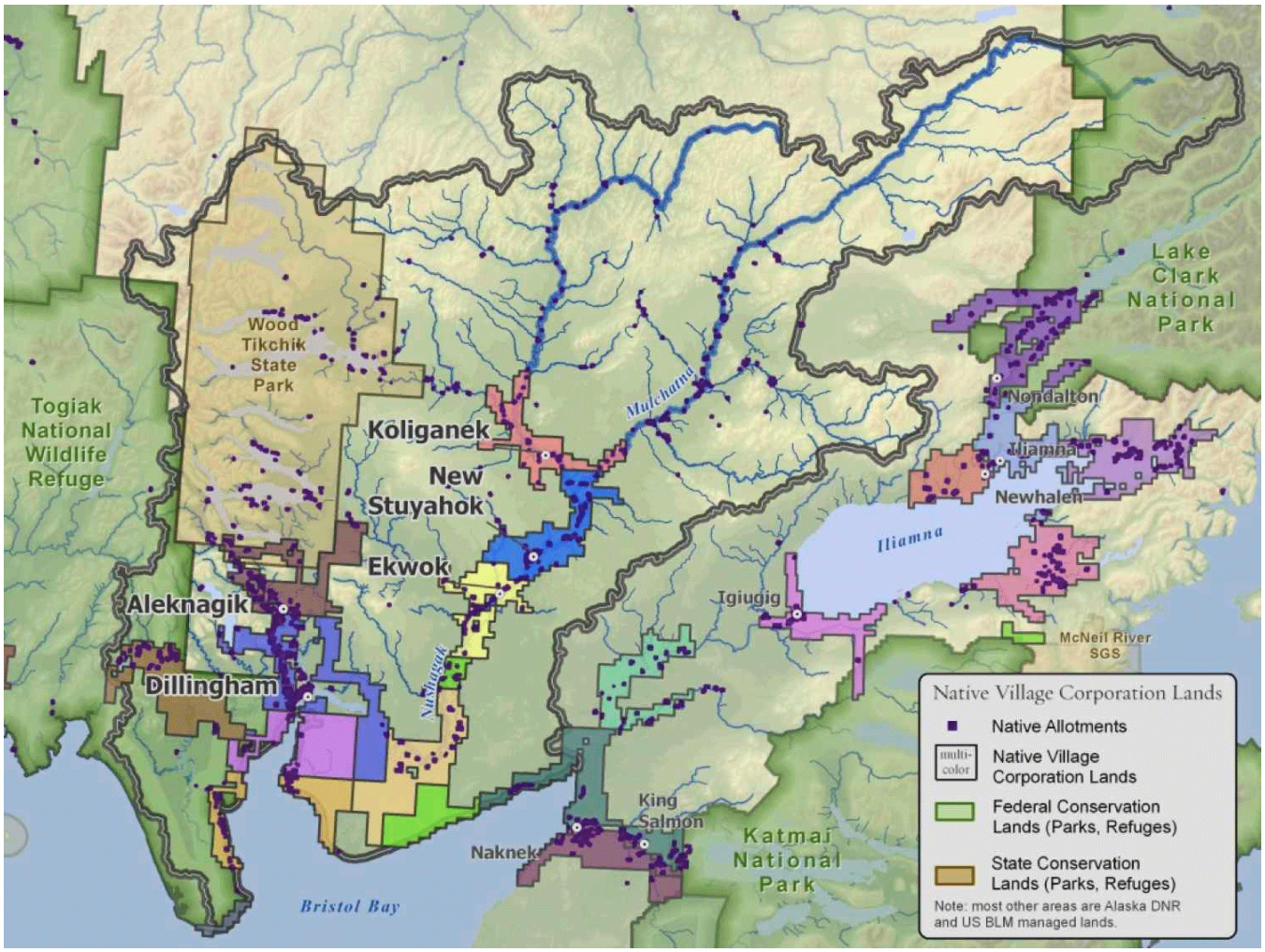
In 1980, Congress passed Alaska National Interest Lands Conservation Act (ANILCA). ANILCA was meant to protect the subsistence needs of Alaska Natives that ANCSA failed to address as discussed above. Title VIII of ANILCA created a rural subsistence preference rather than a Native preference. The "rural priority" was a compromise between the federal government and the State of Alaska (Anderson 2007). However, the State of Alaska's Constitution includes provisions for equal access to natural resources for all citizens making a rural preference in violation of State law. This has resulted in a dual state and federal management system for subsistence with the rural preference only applicable on federally managed lands and waters (Thornton 2010).

Today, Tribes must often protect their ways of life and access to subsistence resources through various state and federal agencies and bureaucratic processes ranging from the Federal Subsistence Board, National Park Service, Alaska Board of Fisheries, Alaska Board of Game, and North Pacific Fishery Management Council, among others. It is within this patchwork of land ownership, conflicting interests, and inconsistent recognition of Tribal sovereignty, responsibilities, needs, and values that Igiugig Village Council has invested heavily in developing and implementing a comprehensive vision to ensure that future generations are able to remain in place and continue *yuuyaraq,* the Yup'ik way of being (Fienup-Riordan et al. 2018). This vision has pushed IVC to the forefront of a decades-long effort to prevent the development of Pebble Mine, a large-scale open-pit copper and gold mine located on State of Alaska lands near the headwaters of Bristol Bay River systems. More broadly, this vision has inspired a suite of Tribally led initiatives to secure a sustainable, self-determined future for descendants of the village. Much of this rests on exercising sovereignty absent land sovereignty.

METHODS AND MATERIALS

This paper draws from an extensive literature review and original ethnographic research, including interviews with 12 people carried out in 2021 and 2022 (following ethical protocols of IVC as well the University of Alaska Fairbanks Institutional Review Board [Approval # 1750143]). Our literature review focused on three topical areas: Indigenous well-being and stewardship; equity and fisheries; and the science of measurement. This paper also draws on several Tribal and community plans and documents shared with the project team. These include IVC project and

Fig. 2. Alaska Native Claims Settlement Act (ANCSA) Village Corporation Lands in the Bristol Bay Region. Village corporation lands are shown as multi-colored shapes. Igiugig's village corporation lands are pink-shaded and located on the western edge of Lake Iliamna. Shared with permission from Bristol Bay Heritage Land Trust.



research proposals, memos, maps, and Tribal ordinances as well as many reports (Salmon 2019, *unpublished manuscript*; IVC 2020, 2021, 2024, *unpublished reports*).

Our team adopted a flexible and deeply participatory methodology to refine our approach and examine our research questions through semi-directed interviews, formal meetings, and many informal visits with village leadership and residents. Our research plans were greatly impacted by the COVID-19 pandemic. We respected the Tribe's sovereignty to protect their community from outside travelers during the pandemic. When the time was right, our external team members were able to visit the village of Igiugig in 2021 and 2022. During these visits we attended village meetings and gatherings, carried out interviews, and invited feedback on research plans and protocols. When travel was not possible, we shifted our methods to meet with project advisors and join meetings via Zoom or by phone.[4]

In-person interviews lasted between 1 and 2 hours and took place in people's homes or at the IVC office. With the consent of participants, all interviews were audio-recorded and transcribed. Interview data were then coded using qualitative data analysis software, Atlas.ti. We used a grounded theory approach to qualitative data analysis (Emerson et al. 1995, Bernard 2002, Corbin and Strauss 2008).

Our interview protocol included questions such as: What does wellness or well-being look like here? What does a lack of well-being look like? Are there community or cultural practices that promote well-being here? Are there specific community characteristics that have helped to foster greater individual well-being here? Does your community have adequate support and resources for achieving community well-being? Has this changed over time? If you were going to measure or assess the well-being of your community, what kinds of things would you want taken into account? What experiences or practices represent your way of life that you would want to include in an assessment? What are the challenges to ensuring well-being here?

Our protocol also included a series of questions asking participants to rank their level of satisfaction with certain topics on a scale of 1 to 5. Questions included: How satisfied are you

with your family's traditional hunting and fishing opportunities? How satisfied are you with your ability to make a living here? How satisfied are you with your influence over management of natural resources? How satisfied are you with your quality of life here as a whole?

Our team of IVC members and researchers with longstanding relationships with the community and region enabled the early identification of potential participants. These participants helped us identify other participants to include in our study. All participants were given the option to remain anonymous. Some elected to remain anonymous, others chose to be identified and are listed by name in the acknowledgements. All participants were given the opportunity to review and approve the use of interview data prior to publication. With the exception of our co-authors, we do not attribute specific excerpts to individual participants in this paper. We recognize that there is a diversity of views within Igiugig, but note shared consensus around the foundational elements of well-being discussed here. All participants were offered an honorarium for their contribution of time and expertise to this project.

In addition to interviews, our team met frequently with IVC leadership to document and directly engage in Tribal priorities in alignment with project objectives. One of these priorities centered on Tribal access and stewardship of traditional lands and trail routes that are unrecognized and managed by state and federal agencies. This work provided our team with a deeper understanding of the work undertaken by Tribes to steward and maintain access to traditional lands and waters.

Our project team was also involved in a community-wide cultural heritage strategic planning session, and two week-long youth culture camps; *Neqlercurvik* (Goose Camp), which takes place in the spring to celebrate the return of migratory birds, and a youth culture camp held in the summer hosted by the Bristol Bay Native Corporation (BBNC). Writing on her time spent with youth and Elders at the BBNC camp, co-author Harmony Wayner (2022:31) notes: "This afforded another rich opportunity to build relationships and learn from community members through participant observation. [W]orking with Elders, Tribal leaders, and youth contributed to understanding the region from multiple perspectives and helped facilitate this work."

Our team returned to Igiugig in 2023 to present findings and invite feedback from the community at a community gathering. We shared products developed in partnership with IVC including animated videos on the topics of Alaska Native hunting and fishing rights, well-being, sovereignty, and fishery science and sustainability.[5]

RESULTS

Here, we identify and discuss foundational elements of well-being in Igiugig. We explore three elements in particular: (1) well-being and *nunaka* (my land, my birthplace), inclusive of one's responsibility to ensure continuation of a way of life defined by relation to ancestral lands; (2) well-being and sovereignty; and (3) well-being and effective governance. These three elements intersect in meaningful ways and feature prominently and concurrently in response to questions concerning what Indigenous well-being looks like, how Indigenous well-being is supported and promoted, and how Indigenous well-being should be accounted for in sustainable governance.

Well-being and *nunaka*: happiness and homeland

> *In Yup'ik our word for happiness comes from being in your homeland.* Nuna *is land,* nunaka *is my land, my birthplace. So then* nunaniq *is happiness,* nunaniqvaa *is my how beautiful and how happy. It is the word for beautiful too.*

The linguistic similarities between happiness and homeland, *nunaniq* and *nunaka* in Yup'ik, is a prime example of the cultural significance of ties to traditional lands in Indigenous conceptions of what it means to be well. The excerpts below enable us to see how maintaining connections to *nunaka* is inherent and intrinsic to Indigenous well-being and identity.

> *[Fishing] is our livelihood. It's our culture. It makes us who we are. It makes us belong here as much as salmon belong here. It's the same as I belong, as my soul belonging here. We share the same water. ... It's like the tundra. It's my home. It belongs, I belong to it. The blueberry smell, I imagine that's what heaven smells like. When I die, I'll be in heaven smelling blueberries, oh that smell. It's just, it's so healing.*

> *When you're in your home you feel really content. And that is a level of happiness you can't get anywhere else. So for me, I grew up here with that connection and feel that type of contentedness. I want my kids to have that, that's why I'm raising them here. And once they have that grounding, they can go anywhere and know that this is their real true home for life. It's their inherent right to be tied here.*

These excerpts capture the importance of kinship ties and land relations in Indigenous well-being. Deep connections between *nunaka* and well-being are further evidenced in AlexAnna's comment below on interconnectedness and the Igyararmiut as a *people of place*.

> *I like that everything is interconnected - the people on the land and the water and families. You can be connected to everything all at once here, when you're physically here. This is something that's really important to well-being that I learned from being a* people of place *like most Indigenous Peoples.*

We interpret these connections to *nunaka* as not simply place-based practices, but in fact *place-making* practices in that they promote belonging and healing through reaffirmation of Indigenous People's relationship to land (Simpson 2014, Lyons et al. 2016, McGregor 2018, Rose-Redwood et al. 2020). The maintenance of ties to traditional lands are bound by "relational responsibilities," which Corntassel (2008:118) describes as the "interlocking and reciprocal responsibilities to one's family, [community], homelands, and natural world." In Igiugig, relational responsibilities take myriad forms that converge on maintaining a values system across generations. This values system supports renewal of sustainable human and more-than-human relations that define a way of life. It also supports the transmission of ancestral and cultural knowledge to future generations (Corntassel 2008). In the excerpt below, the transmission of traditional values underlies progress toward healing, whole nourishment, and improved well-being.

> *So what brings us together, like when we have our Goose Camp; it's healing, it's coming together, there's a lot of healing. One thing is, there's no one solution, it's something that has to be maintained and to me it's our value system - to me, culture fixes everything ... Like it really all boils down to culture; everything, the food we eat, the way we speak ...*

If culture defines well-being, cultural context is essential to adequately assessing, evaluating, and governing for well-being. In another story, we see how relational responsibilities forge intra- and intergenerational connections through food and sharing and how these acts are perceived to be the embodiment of physical, mental, and spiritual wellness.

> *My boy was sick yesterday and my mom brought a whole gallon of blueberries, and she goes, "this is really high in antioxidants, this is really healthy for him." He snacked on it and then this morning he woke up feeling good and he actually said to me, "Mom I'm all better, it was those berries Gram brought us." And it was really sweet like I know she's expressing her truest form of love by doing that, and he is actually healing, and he believes he is healing because of that food. For him to wake up and express that appreciation and attribute it to his grandmother... That's like a physical manifestation of well-being, he believes it was his medicine. So there's different ways, like there's the healthy part of being healthy for your body, but then there's a spiritual aspect of it and a mental state.*

These are ancient expressions of caring, healing, and love rooted in connections to traditional lands and foods. Fulfilling responsibilities to maintain multigenerational connections to *nuna* (land) or *nunaput* (our homelands) through traditional foods, language, and values is foundational to Indigenous well-being.

Land relations feature prominently in expressions of well-being in Igiugig, so too do relational responsibilities devoted to ensuring that people's day-to-day needs are met in the village. There is recognition that these needs must be met in order to maintain relations to ancestral lands in the future. Our research revealed many practical examples of how relational responsibilities are upheld and play out in everyday acts that contribute greatly to well-being in Igiugig. Examples included addressing housing needs, sharing traditional and store-bought foods, showing/teaching both youth and adults how to harvest and care for foods, and providing childcare for single parent households and foster families. Examples also include acts of speaking up in spaces where others feel uncomfortable speaking. These sometimes mundane practices carry meaning and value to each person's contribution to communal well-being.

> *Without [him] and others like him... [He's] like a key figure to me and partly why I haven't gotten in on the subsistence [management issues] because I'm not ready for it ... I'm way too emotionally connected ... A lot of people are volunteering their lives to champion this for their people.*

> *I knew taking in those kids that I would have the support that I would need when I would need it and when asked for. There wasn't any type of doubt in my mind, like if I needed time to do something that we need for the kids, it would be taken care of. There would be a plan to help take care of it.*

> *I know we're providing. We have a lot of single ladies who are doing their fish in the summer, and if it's hard for them to be getting fish you know then we send the boys out. So, they also contribute by helping others.*

> *One thing we have maintained is the relationships with each other through either traditional ways or just by virtue of the sharing. And I think you see that in our tribal governance and our structures - all of our entities, the school, the Native Corporation, the Tribal government - we have a system of sharing and then making sure we have affordable housing and all these other things. I mean, I've heard of some communities where there's no access for the next generation to live our way of life.*

In our research well-being was conceptualized as the continuation of an Indigenous way of life defined by traditional values and land relations. Some might try to reduce this way of life to measurements related to subsistence harvest levels, but in subtle and explicit terms, it is much more complex and articulated and practiced as a web of relationships and responsibilities. These relationships engender many intangible dimensions of well-being that are not always visible: healing, belonging, sense of place, sense of community. They also encompass an attentiveness to very real challenges to remaining in place and continuing one's way of life (i.e., lack of housing, childcare, etc.). There was broad recognition among participants that the village centers around Elders and children. This is a source of great pride in the village and fosters a sense of security, safety, and purpose, qualities that enable and encourage people to stay or return home knowing there is a place for them in *nunaka*.

Well-being and sovereignty

> *We want, as a sovereign community, to have our own Tribal law recognized, to have a say in what happens to our fish and game. It all comes down to sustainability and where you want to be in the future.*

The relationship between sovereignty and Indigenous well-being emerged as a salient theme in this research. Self-determination and sovereignty served as mainstays in discussions on how well-being is perceived, supported, and achieved. Sovereignty remains a peculiarly underexplored topic in well-being studies when considering the many ways Indigenous health and ways of life have been harmed and encroached upon by colonizing processes, institutions, and values; many of which remain prominent in fisheries management (Black 2017, Gordon and Datta 2022, Silver et al. 2022; see also McIvor et al. 2009, Wexler 2009).

Questions related to how well-being is achieved elicited frequent reference to initiatives spearheaded by the Tribe. These initiatives are summarized in Table 1 and range in focus from renewable energy to language revitalization to economic development, among others. We present these initiatives as examples of Igiugig's "deliberate efforts to decolonize and 'take back' community systems by shifting them toward enhanced autonomy and self-sufficiency in alignment with the values of self-determination and cultural integrity" (Gram-Hanssen 2021:7). These initiatives were often expressed in the language of nationhood. We present them here as individual examples of enactments of sovereignty and as

Table 1. Advancing well-being through nation-building in Igiugig.

Sovereignty Dimensions	Nation-Building Initiatives	Initiative Summary
Food Sovereignty	Local Foods Challenge	Initiated by local youth, the Local Foods Challenge was a community-wide 6-week commitment to eating only local and traditional foods (salt and oatmeal were permitted). The village spent 9 months preparing for the 6-week challenge by harvesting, processing, and storing traditional and locally produced foods (Wayner 2022). Youth surveyed homes weekly to monitor health impacts and other changes (e.g., blood sugar, sleep, energy, and mood).
Energy Sovereignty	RivGen Project	The RivGen project aims to reduce Igiugig's carbon footprint and dependency on diesel by generating emission-free electricity from river currents. Igiugig is the first community in the State of Alaska to install an in-river hydrokinetic energy generator, and the first Tribe in the United States to receive a permit from the Federal Energy Regulatory Commission to pilot the RivGen Project.
Language Sovereignty	Unglu; Wangkuta Qanriarait Nanvarpagmiut Yugestun; Yup'ik and Dena'ina Revitalization Programs	For years, Igiugig Village Council (IVC) has led development of language immersion and revitalization programs in the village and broader region. This effort includes Unglu, an early childhood education language immersion program for infants up to 5 years of age (*unglu* means "nest"). Unglu is part of a larger language revitalization program, Wangkuta Qanriarait Nanvarparmiut Yugestun ("We all speak Lake Iliamna Yup'ik"). IVC recently expanded their efforts to include Dena'ina language learning. IVC successfully advocated to the Lake and Peninsula School District to include Indigenous language learning as part of the school day. Other examples include launching the Igiugig Story Bridge website and publishing children's books of traditional stories as told by Elders in their Native languages.
Economic, Knowledge, Data Sovereignty	Telecommunications & Tribal Broadband; Indigenous Guardians Program	Igiugig is leading efforts in the region to bring high speed fiber optic broadband internet to 16 communities through the Southwest Alaska Long-haul Microwave and Optical Network (SALMONet). SALMONet will be wholly owned and operated by a Tribal consortium, and provide local employment, revenue, and infrastructure. IVC is developing their first Indigenous-led community-based environmental monitoring program in the Bristol Bay region. The program is guided by Indigenous values and priorities and builds Tribal capacity and expertise to identify and track environmental changes as the basis for climate resiliency and stewardship initiatives.
Cultural & Livelihood Sovereignty	Igyaraq's Cultural Center; Niraqutaq Qallemcinek; Neqlercurvik and Culture Camps	IVC is spearheading construction of a community Cultural Center. The Center will be located at Igyaraq, the site of the traditional village and near fish camp to reflect their identity as Igyararmiut. The site and space were inspired by the repatriation of 24 ancestors that were discovered to be housed at the Smithsonian Museum and repatriated in 2017 at a village site the Tribe nominated to the National Register of Historic Places in 2021. The Center will be a dedicated space to gather, potluck, celebrate, and heal. It is also envisioned as a space to properly house and care for ancestral artifacts that belong in the community. Niraqutaq Qallemcinek is a multi-year local history project that collects and organizes audio stories and related photographs from Igiugig residents as a way to share the social and cultural history of the region. Many of the stories have been translated to Yup'ik. IVC hosts village and regional culture camps to foster learning, community, and healing through culture. These include Neqlercurvik (Goose Camp), another at Kukaklek Lake, among others.
Territorial & Land Sovereignty	Land Acquisition, Unification, & Protection Strategies; Establishment of Tribal Stewardship Department	IVC has developed a multifaceted suite of strategies to acquire and protect traditional lands. These strategies include map making (see Fig. 1) and many technical and legal approaches to maintain, protect, and restore lands at risk of further fragmentation or being sold/developed by nonlocals. These strategies are outlined in detail in Salmon (2019) and IVC (2021). In 2022, IVC established their Tribal Stewardship Department, with personnel dedicated to advancing climate change adaptation and preparedness measures, coordinating Tribal perspectives for public comment opportunities, and advancing collaborative environmental monitoring initiatives with neighboring Tribes, as well as nonprofit entities, university researchers, and state and federal agencies with a presence in the region.

a collective example of decolonial worlds-in-the-making through reclamation of Igyararmiut knowledge, values, language, health, and culture (Rose-Redwood et al. 2020). The impressive initiatives outlined in Table 1 are expressions of what decolonization of Indigenous lands and lives looks like in Igiugig; together they "represent the cultural imperative of securing Indigenous governance of Indigenous Peoples and places" (Rose-Redwood et al. 2020:152).

IVC's land-focused strategies feature prominently among the list and consist of land acquisition, unification, protection, and measures to advance stewardship authority of traditional homelands. State and federal management of lands and waters was identified as a major threat to village well-being and sustainability. Igiugig is trailblazing innovative ways to reassert Tribal control and values over what is now a fragmented land base. IVC's approach includes establishing productive relationships with federal and state agency personnel to advance mutually beneficial environmental monitoring initiatives (e.g., reestablishment of a United States Geological Survey stream gage at the headwaters of the Kvichak River, reestablishment of sockeye salmon spawning habitat and abundance aerial surveys, and reestablishment of the sockeye salmon out-migrating smolt monitoring program).

IVC's multi-faceted approach also includes securing funds to purchase individual Native allotments at risk of being sold to outsiders, pursuing legal pathways to transfer village corporation lands to the Tribe as Trust lands, and vigilance regarding opportunities to participate in public commenting associated with land relationship decisions. IVC has also passed Tribal ordinances to protect surrounding lands from development in conflict with Tribal values (Salmon 2019, *unpublished manuscript*; IVC 2021, 2024, *unpublished reports*). To continue to pursue this suite of work, IVC established a Tribal Stewardship Department in 2022 and, via ordinance in 2024, The Kuicaak Fund, named after the river that sustains us/them. IVC is also working to acquire more land to support community growth as people return home (e.g.,

housing, office space, community and cultural space, etc.).[6] Since ANCSA extinguished Aboriginal title and conveyed lands to Native corporations, not Tribes, purchasing privately owned Native allotments from individuals provides the only path for IVC to reacquire Tribal lands within village boundaries. Many Native allotments are located on premium lands such as fish camps and hunting grounds and are at high risk of being sold to outsiders or being reduced to smaller, fractionated plots because of decisions associated with the need to accommodate multiple heirs. Restoring land relations through these initiatives is a remarkable display of indefatigability and to reestablish sovereign lands within and against legal and political systems that undermine ties to ancestral lands, contribute to generational displacement and disconnection, and place sacred lands at perpetual risk.

Indigenous sovereignty shares many common features with Indigenous well-being in that both are expressed as concepts and practices encompassing much more than access to resources or a healthy land base. Sovereignty is not a synonym for having a voice in decision making. In fact, Indigenous voices are often trying to be heard and understood in policy and governance spaces that dismiss the utmost importance of culture in people's lives and often treat Tribes as stakeholders rather than political sovereigns.

> *As far as fisheries, like our subsistence way of life, it's still really healthy here, but I don't take it for granted because I can see the writing on the wall or where it is headed … We don't have control. If we had control, we could fix things.*

> *I honestly have an issue with the State of Alaska and any State entity in that they have not recognized Tribal sovereignty. So, it's not so much that I want to influence the Alaska Department of Fish and Game (ADF&G), it's that we need to be our own ADF&G of our own Nation, and have the language of nationhood and deal directly with the federal government.*

The distinction between sovereignty and having a voice in decision making is important partly because of the attention surge in improving equity and representation of Tribal, minority, and other underserved communities in management and decision-making processes (White House 2021a, 2021b, 2022, Carlson-Van Dort 2023, NMFS 2023). Such efforts are overdue but increased participation in top-down management systems does not a priori improve well-being or lead to improved sustainability outcomes. A high level of participation is not the same as the rights and powers of self-governance. A high level of participation may be as much an indication of severe distributional inequity as it is a sign of improved procedural equity.

The nation-building initiatives presented above are costly endeavors, some years in the making and some exceeding the capacity of a small Tribe. Many of these initiatives (e.g., language revitalization, broadband, environmental monitoring) exemplify IVC's broader efforts to provide capacity for Tribes in the region to work cooperatively, to receive and leverage federal funds and investments, and build inter-Tribal trust and "mutual flourishing" (Kimmerer 2013) through the lens of sovereignty. Many of the initiatives are the first of their kind for the village and region and are illustrative of "sovereignty in practice" (Cornell and Kalt 1998) and IVC's governance approach.

Well-being and effective governance

Governance plays an important role in promoting and/or threatening well-being. We previously discussed the complexity and classification of land and resource management in Alaska as a threat to well-being in Igiugig and elsewhere in Alaska (see also Berger 1985, Todd 2018, Carothers et al. 2021, Esquible et al. 2024, Herrmann 2024). In our research, participation in state and federal management systems was often identified as negatively impacting well-being. Reasons ranged from lack of representation, influence, and understanding to the financial cost of participating, travel and time commitments (missing out on seasonal, subsistence, and community harvests and celebrations), and unaccounted for participation costs (e.g., stress, anguish, anxiety, fatigue). Here we briefly discuss Indigenous well-being in relation to governing institutions. We pay particular attention to IVC's governance approach, local perceptions of what constitutes effective governance, and how these contribute to well-being in Igiugig.

IVC's approach to governance encompasses many qualities associated with good governance: transparency, legitimacy, accountability, and responsiveness (Bennett et al. 2019). IVC's approach is a "values first" approach, that is, governance guided by shared values that inform outcomes and processes of local decision making. This does not mean that everyone agrees all the time, but it is reflective of a long-term commitment to "collective leadership" (Gram-Hanssen 2021), and inclusive community planning that brings the village together and forward to determine the future they want. For example, nearly 25 years ago Igiugig was at risk of losing its school because of low enrollment numbers.[7] School closures are often considered to be the death knell of a community in rural Alaska. In response to the dire situation, the village gathered to collectively address the question: What does Igiugig need to do to be a place where young people want to belong? Over the years, the community has continued to gather to ask and answer similar questions to ensure that Igyararmiut, the people of Igiugig, remain a "people of place." IVC's approach to decision making has been successful and garners IVC a high level of trust, respect, and legitimacy in the community in part because the decision makers bear the cost of their own decisions (Cornell and Kalt 1998). Many of these direction-setting gatherings resulted in the nation-building initiatives presented in Table 1.

IVC's governance approach fosters strong community and cultural cohesion partly because of the Tribe's ability to "maintain a strong cultural match between its governing institutions and the prevailing ideas in the community about how authority should be organized and exercised" (Cornell and Kalt 1998:4). Decision making at the village level remains grounded in traditional ways and values. These traits are part and parcel to effective and capable governance in the village (see Cornell and Kalt 1998 for discussion on effective governance). They were often mentioned as integral to the Tribe's successes, and as a basis for the village's earned reputation as a "model of possibilities." Ironically, this success sometimes keeps hidden the real need for expanding capacity and investment in Tribal institutions and governance.

> *[The] things we pursue here, for all the right reasons, it's all important, but we're running beyond our capacity … We don't have time to rest or breathe … What Igiugig is*

taking on compared to regional entities, like what's happening here is a very heavy lift in terms of capacity, it's all the irons in the fire.

DISCUSSION

In our research, relationality emerges as a defining feature of Indigenous well-being and good governance in Igiugig. Relationality underlies many difficult-to-quantify dimensions of Indigenous well-being: sense of belonging, ability to fulfill cultural responsibilities, spiritual enrichment, self-determination, and healing in relation to *nunaka*. The emphasis on relationality and the interconnectedness of human and more-than-human kin and ecologies in Indigenous conceptions of well-being points to the need for greater inclusion of diverse data, knowledge, and values in sustainable governance and decision making. Rendering well-being impacts solely through isolatable, measurable indicators or other economic valuations is inadequate and harmful. Such narrow valuations often eclipse what matters most to communities. These approaches create false equivalencies, and mask if not perpetuate inequities by ignoring cultural values and contexts (Crosman et al. 2022). This research makes clear that the impacts of a governing logic that fails to account for what may be difficult to measure are disproportionately shouldered by Indigenous communities (McGregor 2018).

Decolonial, ethnographic, and narrative-based methods, approaches, and data are critical in accounting for the diversity of values, needs, and trade-offs at play in sustainable governance and decision making (Tuhiwai Smith 1999, Wilson 2008, Kovach 2009, Fienup-Riordan et al. 2013, Tsosie and Claw 2019, Rose-Redwood et al. 2020). Social scientific expertise can help improve policy outcomes by assisting decision makers in accounting for this pluralism and in spotting and navigating tacit assumptions that often privilege existing powerholders and undermine efforts to advance equity and well-being considerations in environmental governance. Such expertise can also help illuminate ethical and political dimensions of research and research methodologies that are especially important when engaging Tribal Nations and Indigenous Knowledge systems grounded in Indigenous epistemologies and ontologies (Simpson 2014, Moon and Blackman 2014, Moon et al. 2019a, Moon et al. 2021, West and Schill 2022).

In this paper, we draw on ethnographic and other qualitative methods to describe and ascertain important dimensions of Indigenous well-being. This qualitative assessment accounts for contextual and relational components fundamental to accounting for well-being as a policy objective, but which too often fall to the wayside when assessments are limited to simplistic quantifiable indicators. Severe shortcomings in social scientific capacity and expertise in U.S. fishery science-policy arenas are well-documented and will undoubtedly impede efforts to address data and knowledge gaps and limitations (Kast 2022; see also Stephenson et al. 2017; Kast et al., *unpublished report*).

The underrepresentation of social sciences within U.S. fishery science and management serves as a practical constraint and an epistemological one in that lack of appropriate capacity can reinforce a governing culture that overvalues particular kinds of science, data, and evidence (NASEM 2024; see also Moon et al. 2019b). This underrepresentation perpetuates the undervaluing of social scientific information and increases the potential for decisions to be made without proper treatment of cultural considerations and consequences (Satterfield et al. 2013). These constraints are not new and certainly not unique to the U.S. Calls for greater consideration of social scientific information date back many decades (see Stephenson et al. 2017).

In an effort to partially remedy these shortcomings we identify several questions that should be systematically addressed in assessments of equity and well-being. How is the assessment or approach accountable to the communities or groups involved in the study? Does the assessment or approach maintain the integrity of what is being shared? Who ultimately defines, classifies, and interprets what constitutes relevant data and information? Does the assessment or approach minimize or marginalize cultural values, meanings, or diversity? These questions encourage critical reflection of the cultural assumptions and power relations underpinning research and decision-making processes and outcomes. They raise additional and complex political, legal, and ethical questions when meaningfully addressed.

Although we draw attention to the need for greater investment in diverse scientific expertise and data, we caution against assuming that more science will always lead to better governance (Gregory et al. 2023). Our research suggests that you cannot adequately account for Indigenous well-being without explicit consideration of governance. In particular, this research highlights the immeasurable role of sovereignty in Indigenous conceptions of well-being, and in successful efforts to advance the well-being of Indigenous communities.

In Indigenous worldviews, expressions and examples of well-being are often interchangeable with expressions and enactments of sovereignty; be it food sovereignty, language sovereignty, knowledge sovereignty, and so on. Indigenous well-being was often conceptually indistinguishable from Indigenous sovereignty. Immeasurable in this sense does not mean unknowable. Our point here is that Indigenous sovereignty and well-being should not be reduced to simplistic quantifiable measures. Complex, relational, and contextual dimensions are irreducible but knowable in qualitative ways. Inclusion of less simplistic measures is necessary for sustainable governance.

The salience of sovereignty bears a number of implications for accounting for Indigenous well-being in sustainable governance. At the most basic level, this includes consideration of the ways in which Tribal sovereignty is upheld or constrained in broader science-policy arenas (e.g., Free, Prior, and Informed Consent [FPIC] as enshrined in the United Nations Declaration on the Rights of Indigenous Peoples [UNDRIP] and the Collective Benefit, Authority to Control, Responsibility, and Ethics [CARE] Principles for Indigenous Data Governance).[8] Following recognition, greater investment in and support of effective governance by Tribal institutions is sorely needed as a central tenet of sustainable governance (Cornell and Kalt 1998). This is less about data gaps than interrogation of and action to address often taken-for-granted value assumptions and political conditions that can undermine Indigenous institutions but that quietly frame policy debates and scientific understandings of what is considered useful data and what constitutes acceptable impacts (Gregory et al. 2006).

The prime role of sovereignty in Indigenous conceptions of well-being in Igiugig aligns with a growing body of research that suggests that recognition, especially legal recognition, of Indigenous rights, needs, and livelihoods is essential to improving well-being and sustainability outcomes more broadly (Capistrano 2010, Capistrano and Charles 2012, Klain et al. 2014, Bennett et al. 2018, 2019, Tsosie and Claw 2019, Dawson et al. 2021, Bennett 2022). Indigenous sovereignty is increasingly identified as a central tenet of successful environmental governance. In their review of 169 case studies around the globe, Dawson et al. (2021) examined how different forms of governance relate to conservation effectiveness and found that "equitable conservation, which empowers and supports the stewardship of Indigenous Peoples and local communities, represents the primary pathway to effective long-term conservation of biodiversity, particularly when upheld in wider law and policy" (Dawson et al. 2021:1).

More broadly, Cornell and Kalt (1998) examine the role of sovereignty in successful economic development in Indian Country. The authors compare nation-building approaches with income and job creation approaches and review multiple examples of successful reservation development in the United States. The authors conclude that "among the most powerful arguments for tribal sovereignty is the simple fact that it works. Nothing else has provided as promising a set of political conditions for reservation economic development, produced the success stories, or broken the cycles of dependence on the federal system as sovereignty, backed by capable tribal institutions, has done" (Cornell and Kalt 1998:10). These studies bring focused attention to the role of Tribal sovereignty and governance in improving outcomes for Indigenous communities, and for sustainable governance writ large. In this paper we show how engagement with Tribes as political sovereigns in both science and policy is paramount to adequately accounting for well-being and determining and interpreting appropriate objectives and measures of equitable and sustainable governance.

CONCLUSION

The primary aim of this paper is to identify how to better account for Indigenous well-being in science and governance. To do this we discuss three foundational elements of well-being in Igiugig. Our focus on *nunaka* highlights well-being as relational responsibilities and discusses many difficult to measure dimensions of kin and land relations. We also highlight Indigenous sovereignty and Tribal governance as prominent features of Indigenous well-being and sustainable governance. We provide many examples of how well-being is articulated through acts of self-determination in relation to place.

Through this lens we discuss the implications of assessing well-being according to Indigenous values, priorities, and protocols. In particular, we discuss the methodological, epistemological, and political implications of accounting for Indigenous well-being as primarily expressed and achieved through enactments of sovereignty and nation-building initiatives. The centrality of sovereignty here compels careful consideration of the forces at work that constrain and enable Indigenous-led and Indigenous-centered approaches to ethical inquiry and sustainable governance. We recognize recent work undertaken to improve equity and Tribal Consultation and engagement in fishery science and policy, yet we identify many unmet needs of Indigenous communities and peoples when it comes to adequate inclusion of Indigenous concerns and priorities in science and decision making (see White House 2021a, 2021b, 2022, Carlson-Van Dort 2023, NMFS 2023). Approaches to achieving well-being, equity, and sustainable governance must center Indigenous Peoples in design, implementation, and evaluation, and must reflect local and self-determined priorities and approaches (Dawson et al. 2025). We aim for our work to inform efforts by reorienting sustainable governance toward approaches and outcomes that center sovereignty and strengthen Tribal governance of lands, waters, and people.

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[1] See for example https://www.ilinationhood.ca/indigenous-land-use-planning

[2] The Alaska Native Allotment Act of 1906 authorized land transfers to individual Alaska Natives. Individuals could be conveyed 160 acres of "vacant, unappropriated, and unreserved non-mineral" land but they had to be able to prove, as head of household, their "continuous use and occupancy of that land for a period of five years." More than 10,000 Alaska Natives filed allotment applications before the law was repealed in 1971 with passage of Alaska Native Claims Settlement Act (ANCSA; BLM [date unknown]).

[3] In 2022, the Alaska State Legislature passed HB 123; An Act providing for state recognition of federally recognized tribes. HB 123 serves as a largely symbolic recognition and does not create a trust relationship between the State of Alaska and federally recognized Tribes. In 2017, the state affirmed the inherent sovereign of Tribal Nations in Alaska (see https://law.alaska.gov/pdf/opinions/opinions_2017/17-004_JU20172010.pdf).

[4] Many villages in Alaska, including Igiugig, implemented non-essential travel bans throughout the COVID-19 pandemic.

[5] https://www.youtube.com/@CoastalCulturesResearch

[6] Under ANCSA, acreage conveyed to Native Corporations was based on a per capita system that failed to allow or account for Indigenous populations to recover to pre-contact levels. ANCSA also excluded future generations based on a requirement that shareholders must be born on or before 18 December 1971. The end of the Native Allotment era also made no room for future generations to establish a relationship with their homelands.

[7] To receive state funding, Alaska state public schools must have a minimum enrollment of 10 students (AK Stat § 14.17.450).

[8] https://www.gida-global.org/care

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Data/code sharing is not applicable to this article because no data and code were analyzed in this study.

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