

---

# Land as material, knowledge and relationships: Resource extraction and subsistence imaginaries in Bristol Bay, Alaska

Social Studies of Science  
2018, Vol. 48(5) 715–739

© The Author(s) 2018

Article reuse guidelines:

[sagepub.com/journals-permissions](http://sagepub.com/journals-permissions)

DOI: 10.1177/0306312718803453

[journals.sagepub.com/home/sss](http://journals.sagepub.com/home/sss)



**Bindu Panikkar and Jonathan Tollefson**

Environmental Studies Program, Rubenstein School of Environment and Natural Resources, The University of Vermont, Burlington, VT, USA

## Abstract

This article examines the social, historical and political constitution of land and resource imaginaries in Bristol Bay, Alaska. We compare the dynamics of these different imaginaries in the region within the early permitting debates concerning the proposed Pebble Mine to understand the contemporary politics of defining and constructing ideologies of extractive resource use. We show that the civic epistemologies and ontologies embedded in different social, scientific and political practices help explain environmental actions and outcomes. We demonstrate that the contested fields of social imagination allow for resource exploitation – commodification, extraction and profit – that endangers nature, but also allow for building alternative imaginaries and constructions of land and value as key components of environmental justice and land sovereignty initiatives. Contestations can also highlight problematic and unjust resource practices that disenfranchise and destabilize subordinate industries, poor communities, indigenous lands and subsistence or renewable resource use. These divergent discourses, and the deliberative valuations of alternative futures that they contribute to, are not effectively considered in Alaska's large mine permitting process.

## Keywords

environmental justice, indigenous sovereignty, land use, resource extraction, subsistence

Kahiltna Terrane, an ancient sedimentary basin in the Bristol Bay Region of Southwest Alaska, was formed when the oceanic Pacific Plate collided with the North American plate 90 million years ago. The Terrane remained relatively insignificant until contemporary technological capacity and metrics of value remade its material features into exploitable

---

## Correspondence:

Bindu Panikkar, Rubenstein School of Environment and Natural Resources, The University of Vermont, Aiken Center, 81 Carrigan Drive, Burlington, VT 05401, USA.

Email: [bindu.panikkar@uvm.edu](mailto:bindu.panikkar@uvm.edu)

resources and made the region attractive for development. The mining company Cominco Alaska was the first to launch exploration in the region in 1986, examining color anomalies of the terrain by aircraft. Two years later, Cominco filed a mining claim with the State of Alaska. Exploration continued in the region each summer until 1993, at which point the calculated resource deposit included three million metric tons of copper and eleven million ounces of gold contained within one billion metric tons of ore – a significant but not world-class find. Cominco's initial explorations went relatively unnoticed until 2001, when Northern Dynasty Minerals Ltd. optioned the claim and expanded exploration activity, resulting in the discovery of the larger and deeper Pebble East deposit in 2005. By the time the Pebble Partnership submitted its initial permit applications to the state in 2006, estimates of Pebble's mineral potential had ballooned to 107 million ounces of gold, 36 million metric tons of copper and 2.5 million metric tons of molybdenum, making it one of the largest copper and gold deposits in the world (Pebble Limited Partnership, 2011, 2012).

Early designs of the mine site showed that the complex would span twenty square miles of state land in the Bristol Bay watershed. The excavation would rank as the largest open pit mine in the country, while still relying on additional underground block caving to access deeper, higher-grade minerals. It would be a massive industrial undertaking, one that would entail clearing large areas of land for supporting infrastructure such as new fossil fuel power plants, ports and containment ponds. Pebble would also require the construction of a 104-mile restricted access industrial road and an adjacent pipeline corridor to reach ports on Cook Inlet, 50 miles of which would pass through Bristol Bay Native Corporation lands (Pebble Limited Partnership, 2011).

The Pebble deposit is tightly nestled between the ecologically rich and socially significant headwaters of the Kvichak and Nushagak Rivers, two of the eight major rivers that feed Bristol Bay. The deposit area is a flatland dotted with glacial ponds and salmon spawning streams, interspersed with ranges of hills rising one to two thousand feet high. Every summer some 30 to 40 million adult sockeye salmon return to the bay and swim upstream for renewal; they form the backbone of Bristol Bay's world-renowned, century-old salmon industry, which is responsible for almost half of the wild sockeye salmon yield worldwide and represents the major economic driver in southwest Alaska. Beside salmon, the region also hosts a full array of Arctic wildlife, fish and birds – more than 260 species, according to US Environmental Protection Agency (EPA, 2014) statistics. Indeed, when Teck Cominco held ownership of the claim, they considered the region too environmentally sensitive to develop. A resident of one of the several dozen Bristol Bay Native communities explains:

[W]e never heard about what the plans that they had were ... Cominco Teck thought it was located in the wrong place, with too much water and habitat. So they pulled back on it, and finally sold their interest to Northern Dynasty.

The Pebble discovery, and the infrastructure prospects that it implied, afforded new significance to the flatlands north of Bristol Bay. But the region is neither undeveloped nor uninhabited. Bristol Bay is also home to 31 Yup'ik, Dena'ina, and Alutiq communities whose life in and use of the region long predate Bristol Bay's commercial industries. Bristol Bay Native relationships to the land and sea are mediated by subsistence hunting,

fishing and gathering, and community members draw from over 150 species of wild plants and animals for subsistence activities (EPA, 2014; Pebble Limited Partnership, 2011). To these communities, the mine represents a threat to lives, livelihoods and cultures that are intimately linked to Bristol Bay's ecological well-being. The late Bobby Andrew, an elder, subsistence hunter and fisherman from Dillingham, and a leading voice of the association of eight Alaska Native village corporations in Bristol Bay known as Nunamta Aulukestai (Caretakers of the Land), remarks: 'Fighting for the future of our renewable fish and wildlife resources is a central part of our culture'.

Understanding the construction of land and resources in Bristol Bay depends, in part, on modeling these land use, power and knowledge debates between Bristol Bay's two dominant resource industries: commercial salmon fishing and sub-surface mining. However, these dominant industries are joined by a longstanding subsistence culture practiced by Bristol Bay Native communities, which exists alongside and apart from the ways of knowing and valuing land within the commercial salmon industry and the region's undeveloped mineral wealth.

The Pebble controversy is a story that takes place in a hybrid world, where visions of the land as a site of extraction and profit are in continual conversation with other approaches to land and traditional knowledge. While mineral extraction is not new to Alaska's resource landscapes or to state economic logics, the possibility of profitable mineral operations in Bristol Bay does represent a shift in on-the-ground land use calculations while also introducing new orientations to land and the self. These changes to the Bristol Bay human and natural environment are compounded by the trajectories of risks to health and livelihood that mineral extraction poses. In short, contamination at Pebble could enter into the body by way of salmon and other subsistence resources, shifting people's relationships to land from ones of mutual sustenance to ones of unknown, unseen danger.

The ongoing debates concerning the proposed mine, especially during its most publicly visible years between the announcement of the site development plan in 2006 and a preemptive but ultimately temporary veto by the EPA in 2014, were in many ways a venue to determine what forms of land use, knowledge and valuation could be considered as legitimate bases for environmental and developmental decision-making in the region. By the 2014 EPA decision, it would become clear that anti-mining coalitions, drawing upon a diverse and geographically broad base of support, had the potential to challenge the primacy of Alaska's extractive resource cultures through venues outside of the official public engagement processes set out under the National Environmental Policy Act and the State of Alaska's large mine permitting process. Resistance by land activists and commercial, recreational, and subsistence fishers challenged the dominance of mineral extraction, and asserted the importance of renewable resources and subsistence-based land imaginaries and knowledge systems. To some extent, these found purchase within the state regulatory apparatus through a hybrid approach to science and traditional knowledge production – and, in the case of the 2014 EPA decision, through the strategic use of the Clean Water Act.

Different regimes of land and resource use, as they apply to industrial-scale resource development, are mediated through Alaska's Department of Natural Resources' Large Mine Permitting Program. Permitting is a phase where the economic, environmental and social viability of a natural resource is examined and contested; it is a space where a

newly identified mineral resource has a chance to prove its viability and gain material identity and social standing for its potential as a useful commodity. In this capacity, the permitting process generates new knowledge, meaning, risk potentials and value. It is a space where deliberate constructions of the environment are produced by speculation, rather than exploitation – where environments exist for their *imagined* potential. Imagined potential and speculation, too, are as socially and historically derived as the sociopolitical impacts of the mine itself. Such speculation, as Davidov (2014) points out, may also reinstate other regimes of economic and social value – for instance, the fisheries and subsistence activities of Bristol Bay.

By employing a variety of qualitative methods, including 80 interviews with members of industrial, state, federal, civil and scientific communities throughout Alaska and an interpretive analysis of numerous administrative, scientific, regulatory, media and public documents, we undertake a historical and cultural analysis of the evolution of different land and resource imaginaries within the discourses of Pebble's permitting in Bristol Bay. We draw from the frameworks of sociotechnical imaginaries and civic epistemologies (Jasanoff, 2005; Jasanoff and Kim, 2009) to unpack the abstractions of knowledge and practice within the making of land and resource imaginaries. Using these frameworks we examine the 'historically and politically situated, culturally specific public knowledge-ways' that shape resource imaginations (Jasanoff, 2005). In particular, we examine the ways knowledge practices embedded within scientific and civic epistemological cultures lend meaning to Bristol Bay's living and nonliving components – the collective systems of meanings, value, visions and expectations assigned to local social-ecological and resource systems, and, crucially, the strategies used by multiple engaged groups to legitimize different approaches to knowledge and environmental decision-making situated within multiple material and discursive practices. Here, we examine the boundaries of knowledge and legitimacy constructed through extractive approaches to land use, as well as the boundaries redrawn by activists and local communities to allow for active democratic imaginings of Bristol Bay's resource futures. With this in mind, our study concludes with a treatment of local resistance to state-centric regional planning processes and the complex hybrid discourses that emerge at the border between Western and indigenous knowledge systems and land imaginaries.

The study rests on an analysis of the contested land imaginaries and discourses represented by subsurface mineral extraction, commercial extractive fishing and Native subsistence practices. The Pebble controversy, here, allows us to ask several questions: How are profit-driven, extractive and ecologically damaging approaches to land use and value imposed upon a region and its people? How are local people shut out of decisions affecting their lives, livelihoods, and ways of knowing and relating to the land? Finally, what avenues are open for the active construction of knowledges and discourses that promote and protect local lives and practices, while also remaining legible to Alaska's permitting regime? At their core, these are questions about who holds power to define the terms of land use policy, land planning and material conditions on the ground; they point to Pebble as a story of the ontologies and epistemologies of land use planning, as they play out at the boundary between Western and Alaska Native constructions of land and knowledge.

## Constructions of land and resources

Particular resources have the capacity to hold value, significance and meaning, insofar as they can be seen through patterns of social relations, land use practices and knowledge construction (Wehling, 2006). Profitable resources, as they are viewed by state and industry accountants, are co-constructed alongside local land imaginaries and cultures – that is, by the active work of specific social groups to define and construct themselves in relation to the material landscape, in specific places at specific times. Individual resources and the broader landscape of resource discourses exist within dynamic, socio-politically and economically constructed conditions. The landscape of meanings attached to a specific place shifts, however, as particular aspects of a site's natural resources assume dominant significance and value. Which resources are given importance and value is not the direct product of local supply to meet local demand; resource value, rather, is discursively constructed, and has long been shaped by contested social, political and economic discourses. Through these socially and politically contested processes, dominant resources come to stand in for the place itself. At the same time, they overshadow other resource characteristics, and limit the land and resource possibilities of a place to fit to a narrow set of imaginative boundaries. These imaginaries show how a raw substance is transformed into a resource and how it is given life, meaning and political and economic value. The dominance of extractive, profitable resources in Bristol Bay, here, can be seen as an artifact of power and discursive practice, co-produced alongside the hegemonic economic, political and epistemic systems of the day, and as contests over state-building, national and sub-national identities (Jasanoff, 2005; Jasanoff and Kim, 2009).

The logics of global capitalism often dictate which resources gain dominant standing and have the capacity to produce short-term profit for private enterprise and for the state. Even as these dominant extractive and profitable constructs render nature productive and valuable for human use, however, they exist in a rich environment of other (pre)existing discourses that are inseparable from questions of social, environmental and cognitive justice. Davidov (2014) reminds us that the processes of social organization that allow for resource exploitation – commodification, extraction and profit – also provide terrain for alternate imaginaries, indigenous sovereignty and the legibility of local knowledge practices. Dominant land and resource imaginations therefore must contend with alternative regimes of value, and themselves may spur the organization of strategies that unite and empower local environmental and conservation movements. These alternate resource imaginaries need not be uniformly opposed to and incompatible with extractive profiteering and extractive imaginaries and practices; in fact, there can be broad differences within coalitions in their material valuations and approaches to land and its resources. These counter-discourses and social or civic deliberative valuations, in turn, may work to build alternate imaginations and relationships to land, and may forefront environmentally friendly development strategies or development initiatives with higher precautionary risk thresholds. Through these contested fields of social imagination, resources gain potential and standing, are given coherence and identity, and are subjected to auto-alterations, both mundane and radical, within historical time (Barad, 2012; Castoriadis, 1997; Gaonkar, 2002).

Hébert and Brock (2017) take special care to document the construction of alternative visions of the land promoted by anti-Pebble activists in Bristol Bay, particularly the mapping projects undertaken by Bristol Bay communities as acts of redefining and ‘assembling new publics in opposition to resource-extractive designs’. Holley and Mitcham’s (2016) work and Hébert’s (2016) analysis of ‘overflows’ show, too, how participants in Pebble’s early dialogue processes effectively contested official interpretations of scientific data and appropriated Pebble’s data for their own ends. ‘Anglo American was incorrect in assuming that all participants would interpret the science to reveal the mine as safe’, write Holley and Mitcham (2016). Rather, ‘stakeholders were able to develop their own interpretations’. In Hébert’s (2016) telling, the inability of the process to contain participant interaction and understanding spurred generative effects and ‘new visions that remake spatial, social, and temporal relations in the face of imperilment’.

Subsistence cultures hold a strong collective identity in Alaska and Bristol Bay, and the frameworks of community, identity, attachment and local civic epistemologies contribute to a strong incentive to mobilize around place. Groves (2015) argues that if attachments are a constitutive part of how people inhabit particular environments, then disrupting those attachments can do damage to both individual and collective well-being, and can erode forms of agency embedded in attachments to place and the collective. This rupture in local identities, and erasure and displacement of local resource flows and indigenous resource practices, limits the capacity of Native communities to negotiate a future for themselves and their children and reveals the spatial and cultural dimensions of environmental injustices. Hence, alternative constructions of land and value can also be seen as key framing components of environmental justice and sovereignty initiatives to reconstruct and redesign the flow of everyday resource use and to highlight the problematic and unjust resource practices that disenfranchise poor communities, deplete indigenous lands and destabilize subsistence or renewable resource use. Schlosberg and Coles (2015) link this work to a ‘new environmentalism of everyday life’, focused on a ‘new materialism’ that restructures power and politics by replacing unsustainable material flows and practices with productive and sustainable alternatives. This is visible in the work of anti-Pebble groups to (re)define Bristol Bay as the ‘largest wild fishery in the world’, to counter visions of Bristol Bay as the site of the world’s largest gold/copper deposit.

Resource conflicts are entangled with questions of social justice, and constitute a platform for imagining more just, sustainable, inclusive and environmentally efficient economies and societies. Local movements linked to resource practices provide a strong foundation for an intersectional politics across race and culture, for renewable and sustainable practices, and for the democratization of resource use (Ageyman et al., 2016). These attachments are relational and originate in peoples’ interaction with the physical, political and environmental worlds around them. Deliberative valuations that arise naturally and locally through sustained practice may promise a more democratic approach to land and resource imagination and use than one based solely on economic dictates.

Pebble’s material and symbolic power came to be possible precisely because of Alaska’s complex history of imaginative frameworks, settlement patterns, and land use policy, driven by specific visions of resource wealth. But how did the gold and copper of

the Pebble deposit, in particular, emerge as emblematic in the early 2000s, rather than upon Pebble's initial mapping in the 1980s? And how did they interact with land discourses centered on commercial and subsistence fishing? In the sections below, we trace the making and remaking of land discourses and imaginaries in Bristol Bay through conflicts over land use and knowledge construction around the Pebble permitting process. In particular, we look to the organizing strategies, discursive practices, and modes of valuation imposed by the State of Alaska and the Pebble Partnership to exercise authority over the material terms at play in the Pebble debate, as well as the alternate approaches promoted by communities in the Bristol Bay region.

### **Pebble's extractive land and resource imaginaries**

To understand how extractive approaches to land and value gained resonance in Bristol Bay, we look backward, four years before the 1988 discovery of Pebble West, to the State of Alaska's first Bristol Bay Area Plan in 1984. The Bristol Bay Area Plan was designed to '[determine] management intent, land and resource use designations, and management guidelines that apply to all state lands in the planning area' (Alaska Department of Natural Resources [Division of Mining, Land, and Water, Resource Assessment and Development Section], 2005). This original planning document acknowledged the importance of the region for diverse habitats, and the state co-classified the majority of Bristol Bay land as 'habitat and public recreation' or 'habitat and mineral development'. When the first Pebble deposit was identified in 1986 it became clear that the 1984 habitat protections would present a roadblock to development. The acceleration of development at the Pebble site in the early 2000s thus coincided with the end of the 1984 plan's twenty-year shelf life. The new Area Plan, completed in April 2005, redrew the boundaries of vast swaths of Bristol Bay lands, opening them to mineral use and development and setting the stage for the Pebble permitting process to begin. The 2005 Plan declared mining and mineral exploration as the only designated use on 9.4 million acres of the Bristol Bay drainage area, which amounts to nearly 80% of state-owned land in the region, while also restricting the protection of inland habitats. The diverse uses of the habitat and practices, such as subsistence and recreation were, in this way, moved to the background, to make room for mineral exploration and extraction. As the 2005 plan makes clear, by the time Pebble entered into public awareness in the early 2000s, the set of Bristol Bay land use possibilities legible to the state had shifted to favor extractive land use and mineral profit. Attorney Geoffrey Parker (2014, personal communication), who represented the Bristol Bay tribes opposed to the Pebble mine, comments:

By 2004, people realized that in order to develop Pebble we have to peel off the habitat classification, and have to peel off public recreation classification, and solely leave minerals as it trumps everything else.

At the same time as the state reordered land use priorities in Bristol Bay, Alaskan politicians and regulators, with the support of the mining industry, worked to extend state control over the mine permitting and environmental assessment process itself. In Alaska, the National Environmental Policy Act process – which sets out federal standards for

environmental protection and impact assessment – is often seen as ‘federal overreach’, and as Pebble neared the permitting stage, the state worked to further consolidate its National Environmental Policy Act authority. These policies, discussed below, also worked to solidify the state’s ability to script how resources are used and imagined in Bristol Bay.

In 2013, the Alaska legislature passed Senate Bill 27, giving the Alaska Department of Environmental Conservation and Alaska Department of Natural Resources the statutory authority to evaluate permits, make jurisdictional determinations, and allow timely permits for responsible development. State primacy limits federal activity and enables ‘one-stop permitting’, unless the project is sited on federal lands. Michelle Bonnet, Director of Alaska’s Department of Conservation, claims that state primacy functions to ‘balance its citizens needs with their use of lands and water resources – and, consequently, to maintain productive natural resources while considering industrial growth and development, while providing the protections provided by the Clean Water Act’ (Hale and Ross, 2013). In a state that is highly dependent on and supportive of resource extraction, moves to centralize the permitting process have contributed to community concerns that Pebble would be assured an easy stamp of approval were it to enter the permitting stage.

House Bill 77 (HB77), introduced to the state legislature by Alaska Governor Sean Parnell in 2013, attempted to further solidify state control over natural resource decisions through several avenues. HB77 would have limited public participation in land use decision-making by restricting public comment on the issuance of water and general land permits, as well as by limiting the public’s capability to make appeals to the agency or to the court unless the party had a financial or real estate interest in the affected area. HB77 also granted unlimited extensions of temporary water use permits, as well as indefinite approval for water appropriation without the requirement to assess potential harm to fish or habitat, for nearly any activity on state land. Pam Miller (2014, personal communication), of Alaska Community Action on Toxics, notes:

If the public becomes too unruly, too effective at limiting whatever development or project that the industry would like to move forward with, then the state, simply on industry’s behalf, shuts out the public. Whether that’s limiting public participation in decisions about permits or limiting our rights to do public litigation, citizen suits; making those things more impossible; and making them more risky because of the fee structures ... I think that’s what the state has really been after. The effect is to shut the public out of decisions.

Tribal governments and other entities actively opposed the bill, and HB77 became a central issue during the Pebble campaign. Some of Pebble’s opponents dubbed it ‘The Silencing Alaskans Act’; community conservation organization Cook Inletkeeper (2013) called HB77 ‘a gift bag full of fish and game habitat rollbacks for large mining corporations’. The committee received more than 1,500 letters, resolutions and petitions, and many others attended the public hearings, called in to local radio shows, or wrote newspaper articles opposing HB77. The bill passed Alaska’s House of Representatives in 2014, but failed to make it through the state senate. For some activists, the HB77 controversy underscored the importance of open public process. Water rights lawyer Hal Shepard (2014) commented:



... because HB77 was merely tabled, this does not mean that it is entirely dead – there’s always next session and more bills. Alaskans must, therefore, remain vigilant and ensure that any future efforts to change the use of the state’s water and other natural resources is conducted using a transparent public process, and includes a consultation process with tribes when the proposed changes are significant in scope or would affect subsistence uses and tribal interests.

The construction of land as an extractive and profitable space is not an isolated process. Meaning and value, as applied to particular resources, come to be defined in conversation with other relevant resource discourses in the region. Oil dominates Alaskan economics and identity – and it is impossible to consider the significance of gold or copper without placing them in the context of Alaska’s contemporary oil economy. Despite the historical importance of minerals as a driver of Alaskan settlement, the Alaskan economy has been driven by oil – ‘black gold’, rather than yellow – since the discovery of vast reserves on the North Slope and the 1977 completion of the Trans-Alaska Pipeline System. But Alaska today is a fading oil empire. Annual crude oil production has fallen by more than two-thirds since its peak in 1988 (USEIA, 2018). In addition, recent years have seen a decline in oil prices, and the state estimates that direct employment in oil and gas industries will fall ten percent by 2024. Employment in mining-related fields, by contrast, is expected to rise by just over five percent.

The Pebble Partnership has promoted mine development in the context of Alaska’s oil challenges, and situates itself as a multi-metal mine with prospects beyond copper, including molybdenum, used in gun-barrels as an alloy, rhenium, used in high performance jet fighters, and selenium and tellurium, used in technologies such as wind turbines, hybrid cars, and solar power (Pebble Limited Partnership, 2011). Indeed, the demand for minerals such as copper and molybdenum is at an all-time high, and by 2020 annual global copper consumption is predicted to nearly double to 27 million tons. US Geological Survey researchers have estimated that firms would need to bring into operation 35 new copper deposits by the next decade to capitalize on that demand (Edelstein, 2012). In the words of the Pebble partnership, on its webpage ‘Why mine’, ‘[the] less our country relies on outside sources of energy, the more control we have for our destiny’ (Pebble Limited Partnership, 2017). These ideations of value form the core arguments surrounding Pebble’s symbolic power and the decisions made by the state as to how resources gain power and standing. As we will see, however, the Pebble Partnership’s work to frame the mine’s resource potential as a friendly complement to sustainable economies and as a boon to state coffers has not gone uncontested.

## **Land and renewable resource imaginaries in Bristol Bay**

Despite the long history of mining as a central component of Alaska’s settlement and development, Bristol Bay’s human and natural economies are tightly bound in the region’s storied salmon stocks. Indeed, the economic and ideological weight of the Pebble mineral deposit could only be challenged by Bristol Bay’s thriving commercial salmon industry, which produces a full 50 percent of the global wild sockeye salmon catch. Bristol Bay’s preexisting industry sets the region apart among the state’s many potential low-grade, industrial-scale mines. The proposed Donlin mine in the Yukon-Kuskokwim Delta, nearly as large as Pebble and with a comparable risk potential, is

nearly unknown outside of Kuskokwim River villages or state planning offices in Anchorage precisely because the Yukon-Kuskokwim Delta lacks a comparable renewable resource industry.

The discursive and material power of Bristol Bay's preexisting salmon fishery conditions the epistemic and ontic field in which Pebble has come to operate. It provides an alternative set of land imaginaries that are rooted in both the lived experience of indigenous subsistence cultures as well as through the work of commercial fishers from Alaska to Seattle. Bristol Bay's value, for the multiple communities that live or make their living on Bristol Bay's land and waterways, lies in the material and economic returns provided by a healthy ecosystem, rather than through the singularity of extraction and the sacrifice of land in exchange for momentary profit. In the section below we examine these complex relationships to Bristol Bay salmon and the human and natural ecosystems the fish represent and support, as they were built and transformed by the commercial, recreational and subsistence fishers of Bristol Bay.

Salmon are Alaska's premier catch, and are joined by pollock, halibut and crab as the most important species for the Alaska seafood industry in terms of volume and value. From 2013 to 2015, however, the price of Alaska pink and sockeye salmon fell by over 50 percent, due to large increases in yield from farmed salmon. Farmed salmon tends to be more consistent than wild catch, and is produced and sold year-round – though Alaska represented 80 percent of US salmon production in 2014, it accounted for just 10 percent of the global salmon supply (Bell, 2016). But Alaska salmon is marketed as a distinct product from farmed salmon; it has the highest value compared with other fishing industries in the state and amounts to a third of the dollar value of Alaska's total catch (Warren, 2016). At the state level, Bristol Bay salmon fisheries have for years been the largest source of Alaskan fishery employment, and Bristol Bay alone accounts for the equivalent of 10,000 jobs spread across Alaska and the Western US (Bell, 2016; Knapp et al., 2013).

The economic impact of Bristol Bay fisheries also extends far beyond the Bristol Bay region. Nearly one-third of Bristol Bay fishers, and two-thirds of fish processing workers, live in Washington, Oregon and California, while nearly all the Bristol Bay seafood companies and much of the fishing fleet active in Bristol Bay are based in Seattle. Just five percent of Bristol Bay seafood processors are local residents from the Bristol Bay Borough, while 87.4 percent of the processors hail from outside Alaska entirely (Knapp et al., 2013). The majority of the Alaskan salmon are also sold abroad (Krieger, 2016). These economic ties likely explain a portion of the broad support enjoyed by Pebble's opponents, as well as the material power of Bristol Bay's salmon beyond the region.

Bob Shavelson, director of conservation advocacy organization Cook Inletkeeper (2014, personal communication), says that salmon have come to represent something intrinsically Alaskan: They are the 'glue that binds Alaskans' regardless of 'economics, social [factors,] ... religion or culture'. But despite the shared focus on salmon, and despite allying with Bristol Bay Native activists in opposition to the Pebble plan, commercial fishing is by no means equivalent to subsistence use. The same factors that explain the powerful global resonance of Bristol Bay salmon also condition Bristol Bay commercial fishing as an extractive industry: That the majority of salmon processing

takes place in Seattle, and that the majority of fishery profits flow to Seattle-based companies, mark Bristol Bay as a resource colony, whether its primary value lies in salmon or in copper. While Bristol Bay fisheries are economically significant, the Bay also holds ecological, social and cultural value, and it provides diverse ecological services that are not captured in yearly catch or employment statistics.

Bristol Bay's commercial, recreational and subsistence fishers did not always see eye to eye. The influx of sport fishermen and lodge construction, with accompanying fears of intensifying use, dominated local concerns prior to Pebble, and it was only the specter of mine development that brought Bristol Bay's disparate fishing communities into a tenuous alignment. In the Bristol Bay region, more than twenty native corporations, village councils, tribes and cities, including the Bristol Bay Native Corporation and the Bristol Bay Native Association, opposed Pebble development. Pebble also drew limited local support, notably in the village of Iliamna, where exploration efforts were based, as well as the Alaska Peninsula and Twin Hills Native Corporations and the tribes of South Naknek and King Salmon, which contended that Pebble should be allowed to go through the established permitting process.

The emerging resistance coalition that unified around Bristol Bay salmon may not have found a strong public voice without the support of Robert Gillam. The richest man in Alaska today, Gillam's sprawling wilderness retreat sits just 25 miles from the proposed Pebble mine site on the shores of Lake Clark. His total financial support for the anti-Pebble campaign is estimated in the millions (Lasley, 2016). In 2008, Gillam spent \$820,000 promoting Ballot Measure 4, the Clean Water Initiative, which would have made it difficult to permit large-scale metal mines across much of Alaska and would have presented a major roadblock to development at the Pebble site – had it passed. Gillam helped make the anti-Pebble campaign a national and international success, and his funding aided in mobilizing media and public opinion into an effective boycott and divestment campaign centered on the iconic importance of salmon (Hardin, 2012). In response to increased public pressure, Mitsubishi, Anglo American, and Rio Tinto backed out of Pebble in the early 2010s, and more than 50 major jewelers worldwide, including Tiffany & Co, Zales and Boucheron pledged to boycott gold mined at Pebble. Even with Gillam's support, however, resistance remained rooted in the long-term work of local elders and activists, and the networks of support built through years of cooperation. The strategic alliance between commercial and subsistence fishers opened new doors for long-term local activists. Bobby Andrew (2014, personal communication) explains:

One of the big working partners was NRDC – Natural Resources Defense Council. Whenever they had a meeting, they invited us. We attended the meetings with either Rio Tinto or Anglo American [with NRDC]. ... I think it was in 2007–2008, somewhere around there, we started attending the shareholders meetings of Anglo American. Some of us bought shares in order to go in there and speak. ... In the very beginning we had a meeting with Sir Mark Moody, and Cynthia Carroll, and a bunch of their attorneys, as well as their copper division, and we told them exactly where we stood. And it took many years to convince them that they should pull out, which they eventually did. ... The way I look at it today, with where we're at, we're a very small group from a small village. If you're persistent, you could change the minds of a great big [corporation] with a lot of money.

## Scientific imaginaries of the land and resources

Mediating questions of the viability of mineral resource development in Bristol Bay required a metric and a method that could be identified as an objective reading of natural realities. Scientific methods and science-producing organizations have historically taken on the role of producing official knowledge, with consequences for the power and resonance of indigenous knowledge systems at the colonial frontier. 'Science and technology do not merely change how we live our lives', writes Epstein (2008). 'They also lend power to those who speak in their name, and they offer new tools for establishing what counts as credible or true'. Material realities, here, are constructed through a complex set of boundary building practices that dictate land use and power using not only legal measures but also specific scientific and technical knowledge bases. These arrangements of legal and scientific processes intersect within the multitude of permitting and Environmental Impact Statement documents. In Bristol Bay, scientific data collection can be thought of as a specific set of performed practices, integrating multiple individuals, institutions, and ideologies in order to produce a coherent reading of the landscape that fits within the narrow bounds of Impact Statement requirements and scientific best practices.

The Pebble Partnership has been collecting data on various environmental parameters since 2004. Pebble's Environmental Baseline Document (EBD) consists of 27,000 pages, with biophysical and social data from Bristol Bay and Cook Inlet between 2004 and 2008 (Pebble Limited Partnership, 2012). These data were submitted to the regulatory agencies and the public in a series of public presentations, as well as in an online webcast aired in February 2012. Scientific data collection undertaken in Bristol Bay has been a huge enterprise. In the words of Pebble's then-CEO, John Shively (2014, personal communication):

When we were fully staffed here we had about six or seven of our own people, but we had over 40 different companies, consulting companies that did work for us. ... Often in a large project like this the owning company will go to two or three consulting firms and spread out the work a little bit. What we did is said that we need to spread out more than that. Like for fish, we had three different consulting firms just for fish. We had consulting firms that dealt with water and then we had a consulting firm that did quality checks on the original consulting firms. So literally over time I think there were hundreds of scientists, at one time or another, that had a piece of work on this project. We have more information than any mine has ever collected and ... we are very comfortable with the quality of it, and I think it will stand up to scrutiny.

But Pebble's EBD data did not go unchallenged. Stratus Consulting hired the Center for Science in Public Participation (CSP2), based in Bozeman, Montana, to review Pebble's EBD data. CSP2 found the baseline hydrological data and the modeling package used by Pebble Limited Partnership not well suited to measure interactions between surface water and ground water, and the model parameters often conflicted with values measured in the field. Stratus Consulting (2012) also identified a number of major gaps in extreme event data, and noted that the document included limited data on precipitation and winter stream flow, which are essential to understand water profile in the region. Kendra Zamzow (2012), a geochemist who reviewed Pebble's water quality data, found that

there was no consolidation of data on water quality and fish habitats, that not enough samples were collected outside of potentially impacted areas, and that ground water monitoring data were less extensive. Fish biologist Carol Ann Woody (2015; Woody and O'Neal, 2012), who has conducted extensive research in Bristol Bay, also reviewed Pebble's salmon escapement data. '[EBD data] do not show how many fish spawn there', Woody (2014, personal communication) recalls:

The Pebble studies were conducted in the mainstream habitats rather than the headwaters. One of the main concerns was that the EBD was hard to follow, verify, or repeat, due to lack of detail in methodology, poor presentation, and lack of interpretation of results.

Sara O'Neal (2012), of Fisheries Research & Consulting, found that data were not collected in more than half of the tributaries that fell within the study area, that Pebble's interpretation of the data was often contradictory, and that the study failed to take into account the complexity of the habitat – in short, that the Pebble Limited Partnership's data collection process drew upon narrowly defined criteria in order to understand the ecological abundance of the region. Shively (2014, personal communication) dismissed these criticisms, saying:

You have to understand that the opposition is not required to tell the truth, and they often don't. ... It's easier to terrify people about size. The Bristol Bay area is about the size of the state of Ohio, and what we will have as facilities is what would be a very large airport. And so this idea, that you could take an area that's the size of an airport and destroy a fishery [the size of] the state of Ohio is pure fantasy. And so we have to deal in facts, the opposition does not. ... What we believe is that when we get into the permitting process – that's where the science is judged. ... and it's judged on a rational [rather than] an emotional basis ....

The scientific knowledge production practices around Pebble's EBD worked to police the bounds of legitimate knowledge to fit to a set of procedural scientific practices. Building a scientifically sound picture of the Bristol Bay environment meant extracting and abstracting particular readings to fulfill the criteria set out in state and federal permitting requirements. It enforced a version of knowledge production in which narrow, assessment-driven scientific data collected by recognized experts was made to fit within the bounds of the Environmental Impact Statement process. Can discrete, individually measured factors accurately assess risk? Can technocratic adaptive strategies safely mediate the boundaries of risk (Beck, 1992), especially when the implications of proposed solutions are far from clear?

The processes by which knowledge of the land is constructed and validated conditions the definitional boundaries of concepts such as 'resources', 'impacts' and 'risks', and activists often need the help of trained experts to decode the version of the environment presented through established science. Activists and environmental organizations have no choice but to speak that language of scientific knowledge-making – or else to find skilled translators. Below, we look at some of the localized forms of knowing and knowledge production undertaken in Bristol Bay. This joint work of scientists and local knowledge practitioners effectively challenged both norms of knowledge production and assumptions about land use encoded into the permitting and

assessment process. The knowledge and planning strategies discussed below, in this way, work to reframe what can be 'known', and how.

## **Restructuring science and land planning in relation to local sovereignty and knowledge**

The campaign opposing Pebble relied, in part, on the work of a team of scientists and experts to assess Pebble's environmental and risk data, as well as to identify and fill a number of significant gaps in Pebble's data. Frickel et al. (2010) use the term 'undone science' to refer to areas of research that are systematically left incomplete, often with consequences for public understanding of risk and impact. In Bristol Bay, expert consultants attempted to 'do' the science that Pebble and the state had left 'undone' – and, in so doing, to independently verify or contest the readings of the land implied in state and industry data.

These strategies were structured under a series of documents that brought together expert consultants, environmental nonprofits, and Bristol Bay activists and residents. In 2004, before Pebble gained notoriety, Bristol Bay Heritage Land Trust executive director Tim Troll, along with the Nature Conservancy and the Bristol Bay Native Association, developed the Nushagak River Traditional Use Area Conservation Plan based on the traditional knowledge and subsistence practices of Yupik residents. As part of this project, Troll visited five villages in the region – Koliganek, New Stuyahok, Ekwok, Aleknagik and Dillingham – and sat with community members to document place names, hunting and fishing locations, and streams where salmon and other species of fish are abundant. After Pebble announced its western deposit, Troll and the Nature Conservancy expanded on the project to include an ecological risk assessment of open pit mining in the Nushagak-Mulchatna watershed (Ecology and Environment Inc., 2010) and the 'Standards and practices for environmentally responsible mining in the Nushagak River Watershed', a position statement based on the findings of the 2010 risk assessment (Nushagak-Mulchatna Watershed Council (NMWC), 2011). Both documents drew on the 2007 traditional use plan (NMWC, 2007). To Troll, the goal of the 2010 report was 'to articulate, for those coming into the region, what informed consent and prior notice look like'.

Salmon conservation work, meanwhile, coalesced around a particular state land management procedure of the *Anadromous Waters Catalog*, which tracks waterways important to the 'spawning, rearing, or migration' of anadromous fish and that specifies which bodies of water are afforded protection under the related Alaska Statue (Alaska Department of Fish and Game, 2017). Waters listed in the *Catalog* require additional assurances that development will not harm fish populations; conversely, waters that are not included in the *Catalog* are assumed to not play host to anadromous fish. Salmon protection in Bristol Bay thus required a deliberate exercise to document anadromous streams for inclusion in the *Catalog* and for protection. According to Troll (2014, personal communication):

If there's a model that predicts there's salmon here, this population, this life stage location, it creates at least a presumption that they are there, and the presumption should be in favor of the

fish. It's a rebuttable presumption .... [That] doesn't mean that a mining company can't come in and take more than is reserved for salmon, but it does elevate the notice process, it does elevate the adjudication process to a level where the public is aware of it.

Here the scientists who catalog salmon in the region do the work of ensuring protection both for the fish and the streams. Salmon become part of the official narrative of head-water streams; they become part of the adjudication process, providing them a status of existence or membership within human community that is recognizable and legible to state officials. In so doing, the probability of their survival increases.

Scientist Carol Ann Woody has come to be a central figure in Bristol Bay's community science network. Woody came to Bristol Bay first with the US Geological Survey, and later again with the National Parks Service and the Fish and Wildlife Service. She explains why there is an abundance of salmon spawning streams and habitat in the region (2014, personal communication):

Bristol Bay is a great habitat for [salmon]. But the whole region, the glaciers left this really porous rock, and there's lots and lots of ground water. And the ground water is the key factor here. Because we get winters that go to 40 below for extended periods, and you got teeny little eggs that are this big in the ground, they're only buried about this deep, 10 cm, 20 cm deep and if you freeze the dam there they die. But the ground water never freezes; it usually is a constant warm temperature of 2 to 4 degrees. There's ground water everywhere there and that's what feeds a lot of those systems, it goes through the porous gravel and it keeps a lot of these little eggs alive and sustains them. It also provides a preliminary habitat for fish because fish will burrow down in the gravel and hang out there, all the little guys.

A report Woody co-authored with Sarah Louise O'Neal (2012) showed that even small amounts of copper are toxic to fish, affecting their sense of smell and the capability of salmon to navigate a return to their spawning grounds (McIntyre et al., 2012; Scannel, 2009). Pebble proponents, however, contend that the science is not conclusive, and that natural fluctuation in copper levels is of greater significance:

The science is basically where they've taken fish in a lab situation and just added [copper], and does not replicate nature. The copper uptake is very different in nature than in a controlled lab environment. And the irony is that salmon need copper in order to survive. We all do. (Pebble Limited Partnership Official, 2014, personal communication)

The Center for Science in Public Participation also emerged as a key site for science and knowledge production in conversation with community needs. Zamzow (2011a) studied water issues, impacts associated with Pebble's exploration phases (Zamzow, 2010), acid rock drainage and metal leaching (Zamzow, 2011b, 2011c) and seismic risk at the mine site (Higman, 2008). Their work was conducted outside of the response to Pebble Limited Partnership's baseline data. Most recently, Dave Chambers at CSP2 has demonstrated significant ongoing contamination, improper closure procedures, and insufficient reclamation work at Pebble's decommissioned exploratory drill sites. Of the 107 sites they tested, two-thirds had experienced environmental contamination (Zamzow and Chambers, 2016).

Pebble does not acknowledge the legitimacy of these approaches to scientific work. Instead, Pebble Limited Partnership accuses community-based scientists of practicing ‘advocacy science’ and maintains that the issues they raise are easily managed by technological and engineering fixes:

It’s nonsense. There is no such thing as citizen science as opposed to corporate science. Science is science. .... They’ve looked at where fish go, we’ve looked at where fish go and so they either go or don’t go. How they use that to terrify the people in the region about what we’re going to do, that’s not science. And that’s when they get into advocacy and their scientists like [name] are advocates. (Pebble Limited Partnership Official, 2014, personal communication)

The joint strategies of Bristol Bay activists and engaged experts was most clearly expressed in the Citizen’s Alternative Bristol Bay Area Plan (Bristol Bay Heritage Land Trust, 2013), initially drafted by Parker, Troll, and Anderson of the Wild Salmon Center, with input from six tribes and several environmental groups. The Citizen’s Alternative Plan emerged following a contested legal process in which Bristol Bay tribes sued the state of Alaska to revise its 2005 Area Plan. When the court-mandated revisions failed to meet the protection standards demanded by local communities, activists and expert consultants worked to integrate the work of the NMWC with multiple scientific studies to form a comprehensive land planning document that foregrounded subsistence and local use practices. The Citizen’s Alternative Plan, though consistent with the state, federal, local and tribal efforts to balance conservation and development, asserts the importance of local voices in managing natural resources and ways of life in the region. Accordingly, the Alternative Area Plan introduced a ‘subsistence’ land use designation, emphasized increased protection for habitat and precaution when making land use decisions that significantly affect salmon, suggested that all waters in the Bristol Bay region be considered anadromous until proven otherwise, and demanded prohibition of metallic sulfide mines in Nushagak and Kvichak watersheds. The Alternative Plan expanded habitat designations; in contrast, the state definition of ‘habitat’ and ‘use of resources’ privileges exploitation unless the land is in a critical condition to require such protection.

Pebble activists are tasked with a complex exercise in boundary negotiation to challenge definitions of land-as-profit while simultaneously working within existing neoliberal economic and regulatory structures. These local, alternative land planning documents are a vital part of Alaska’s long history of conflicts over land sovereignty. Bristol Bay’s alternative planning documents, in their capacity to challenge the state by employing ‘the state’s own data’ (Hébert and Brock, 2017), draw on a robust hybrid tradition to navigate the border between repudiating state control over knowledge production and acknowledging its power to affect immediate land decisions. They decentralize knowledge construction as it is applied to land use planning at the moments of question definition, data collection, and policy recommendation, and reorient knowledge and place-making with local priorities and knowledges as their central, generative frameworks.

The specific practice of community-oriented science in Bristol Bay arguably worked to blur the boundaries between Western scientific knowledge and traditional land-based knowledge rooted in subsistence practices. Troll’s work on local land use plans based on



subsistence use interviews is perhaps the clearest example. But the practice of knowledge production in Bristol Bay contrasts with Pebble science at a more fundamental level than just the identity of its practitioners or the sources of its data: They differ, crucially, in their foundations in practice, experience and embodiment.

Pebble science is strongly tied to the requirements of regulatory and permit agencies. Measurement, here, is the central activity, used to understand the various biophysical phenomenon of the region – without situating the data within the experienced complexity of the land and the people who exist in and alongside it. When considered in aggregate, the work of local knowledge producers and allies like Troll and Zamzow, by contrast, is arguably based in practices of relating to the land or territory first, and the demands of impact assessment processes second. But such community-based scientific practices remain subjugated as knowledge systems, with their authority and standing under continuous challenge. Stronger procedural inclusion of knowledge that arises out of democratic and citizen initiatives may hold the promise of building land practices and valuations out of the hybrid discourses that emerge in the spaces between different systems of knowledge and land use – rather than out of the domination of one form of knowledge and land imaginary over another. In 2010, based on these preliminary assessments, six federally recognized tribes in the Kvichak and Nushagak River watersheds, along with the Alaska Independent Fisherman's Marketing Association, delivered a landmark petition to EPA Administrator Lisa Jackson and EPA Region 10 administrator Dennis McLerran to protect the Kvichak and Nushagak River drainages and Bristol Bay from metallic sulfide mining under Section 404(c) of the Clean Water Act (Hobson, 2010). In effect, the petition sought federal intervention prior even to Pebble's permit decisions – a request that was audacious and unprecedented. Parker (2012) explained the objective of such an early prohibition:

It will eliminate frustrating situations in which someone spends time and money developing a project for an inappropriate site and learns at an advanced stage that he must start over. In addition, advance prohibition will facilitate comprehensive rather than piecemeal protection of wetlands.

In response to the request from the tribes, the EPA initiated a scientific study looking at the potential impacts of large-scale mining on the Bristol Bay region. In January 2014, after three years of research, two independent peer reviews, and two rounds of public comment, the EPA concluded that a mine like Pebble could result in lost salmon habitat and degradation of the ecosystem, and could risk an environmental disaster. It was a landmark decision that halted a major development project before permit applications had been submitted. But the EPA process was also unique in its treatment of the hybrid nature of life of the Bristol Bay region. In a rare acknowledgement of the complexity of subsistence life, the EPA's (2014) Bristol Bay Assessment placed special emphasis on the multiple meanings – economic and non-economic – of subsistence livelihood and culture, along with hard data on subsistence use and volumes:

In the Bristol Bay region, the subsistence way of life is irreplaceable. Subsistence resources provide high-quality foods, foster a healthy lifestyle, and form the basis for social relations.

Alaska Natives are the majority population in the Bristol Bay region, and salmon has been central to their health, welfare, and culture for thousands of years.

That the 2014 EPA document took subsistence use into consideration was not just due to the benevolence of the agency nor some inherent quality of subsistence resource use, though both certainly helped. Rather, the resonance of indigenous approaches to the land as they appeared in the EPA document was the result of an accumulation of material and discursive power, accomplished through the diverse tactics of Bristol Bay tribes, citizen scientists, lawyers and environmental activists to build complex hybrid discourses of Western science and indigenous land use, on the one hand, and legibility and legitimacy within state-centered planning processes on the other. Highlighting the politically motivated nature of permitting, however, Scott Pruitt's EPA reversed the agency's prior restrictions in May 2017, allowing Pebble's permit applications to move forward after lengthy legal battle.

### **Land as habitat and knowledge: Do subsistence imaginaries have standing?**

Subsistence is Alaska's original economy and a vital part of Alaska Native culture and rural Alaskan living. To many, subsistence is a chosen way of life, a lifestyle, a philosophy, and an ideal of self-sufficiency. It is also a necessity for many rural communities. Though it provides a large portion of rural Alaskan nutrition, subsistence is difficult to quantify, as it is not considered as part of employment or Gross State Product data. The 1980 Alaska National Interest Land Conservation Act, which set aside over two hundred million acres of Alaskan land for conservation and established Native Alaskan subsistence use priority on most federal lands, does not define subsistence itself, but defines subsistence 'uses' as follows:

the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter or sharing for personal or family consumption. (Bureau of Land Management, 2018)

But subsistence is not devoid of economic pressures. In an ethnographic study of subsistence practices of both Yup'ik Natives and non-Natives in Bethel, Hansel (1996) reveals that many subsistence activities, such as moose and goose hunting, have significant monetary cost when gas, equipment, ammunition, food and other expenses are considered. This is an additional burden, given that many subsistence foods are not monetized, and that many of the delicacies of the region are illegal to sell or do not have commercial value (Hansel, 1996). Subsistence land imaginaries represent more than a subset of resource use but rather represent an essential component of human, cultural and cosmological meaning.

Regional identity and local knowledge systems in Bristol Bay are based in part on the joint construction of the land and the practice of subsistence. 'It's not just the fishing, it's not just the fish', says Kenai-based anthropologist Alan Boraas. 'It's the social

dimension and the spiritual dimension of what it is to live on the land, catching wild salmon and other food resources in the manner of their ancestors' (2014, personal communication). Subsistence is an economic-cultural-historical practice in which social identity and relationships with the land are built and practiced in tandem. To the late Harvey Samuelsen, local leader and subsistence fisherman, 'land is the heart of our culture. Without the land, we are nothing' (NMWC, 2007). Subsistence renders the performance of relating to the land embodied, meaningful and intelligible, and subsistence is central to the work of building traditional knowledge skills through the active process of continually relating to the land. The land and ecosystem, in this way, can be thought of as a source and mediator of human knowledge. Land-based relationships, mediated by subsistence practices, thus imply a radically different orientation toward the land than the profit motivations of extractive resource development or even the solely utilitarian definition of subsistence as defined by the state. Land as a knowledge base, a source of culture and a guarantor of food and water represents something far more vital than a tract of property or a picturesque setting for a profitable resource.

While subsistence users draw upon multiple resources – including agricultural products, game and numerous species of fish – salmon emerge as the key link between subsistence and market economies, connected through the commercial and recreational fishing industries. Salmon and threats to the largest wild salmon economy were the central imaginaries that provided the foundation for an intersectional politics of alliance building between local subsistence fishers, commercial fishing industries, sport fishers and tourism enterprises, and that imaginary even resonated at the national level. However, vital as subsistence practices are in Bristol Bay, their precariousness was not enough to capture the (economic) imaginations of broader US culture.

The 2005 Area Plan revision process, in which Bristol Bay tribes successfully sued to have their challenges and criticisms of the plan taken into account, emerged as a rare arena in which indigenous approaches to land, based in subsistence use and relationality, were afforded space in the state's land planning procedures. But that space soon proved insufficient to radically alter Bristol Bay land designations, and today Bristol Bay land use is still driven by a management plan that fails to protect habitat and subsistence practices. The Alternative Area Plan's 'subsistence' category and the extensive documentation of traditional knowledge that undergirded the locally-produced Conservation Plan have yet to be substantially considered by state or federal land planners.

Experiential or embodied knowledge, which is specific to the Bristol Bay social-ecological system, is neither as portable nor as transmutable as the procedural practice of state and corporate scientists. Community strategies that relied upon hybrid knowledge production, in this case, constituted an organized, creative response to these limiting conditions. But where the alternative planning documents that emerged from the region in the early 2010s sought to translate traditional knowledge into a form that was legible to state and federal audiences, planners in Anchorage and Washington did not meet them halfway. Local epistemologies, as well as issues of justice, uncertainty and power, are frequently removed from public debates, and are not meaningfully incorporated into environmental decision-making. Environmental justice activists here demand not just consideration of their cultural identities and civic epistemologies within the regulatory system, but also epistemic justice and 'the right to be respected in their

capacities as knowers' (see Fricker, 2007; Ottinger, 2016). While the state's environmental assessment process asks only for local input on possible risks associated with large project development, the documents produced under the NMWC instead ask: How should we manage our land? What does responsible development look like? It is this power to ask, as well as to answer, that the permitting process works to limit. Narrow definitions of knowledge production, in this way, must be seen as a tool of systemic epistemic injustice.

To complicate matters further, it is only through a colonial lens that the practice of subsistence can be thought of as wholly 'unscientific'. Subsistence provides deep ecological knowledge, land skills and robust understandings of complex ecosystem functions, but 'science' on the ground is more than the accidental agreement between subsistence-based knowledge and peer-reviewed data. Ann Fienup-Riordan, longtime collaborator with the Calista Elders Council in their project to articulate and preserve traditional ecological and subsistence knowledge, remarks that 'The Yup'ik people have no word for science, yet their tools were so well designed that they allowed the Yupiit to live in a land no one else would inhabit ... [T]he Yup'ik way of life – both past and present – is grounded in deep spiritual values and scientific principles' (Fienup-Riordan, 2008). Conversations around hybridity are, in this way, not simply a question of science and non-science, but rather must treat these categories in their full, intimate entanglement.

When the state redrew land boundaries in the mid-20th century, under Alaska's statehood agreement and the ANCSA compromise, it introduced sets of borders that were foreign to the land practices of Alaska's first peoples. The tracts allotted to Native villages were often insufficient to support subsistence livelihoods, requiring village residents to rely on land outside their sovereign territory (Ross and Gould, 2006). New land boundaries that are insufficient for subsistence survival create new dependencies, putting Alaska Native populations in constant threat of a combined loss of lifestyle and livelihood when land designations change. Not only do communities rely on subsistence access to federal lands, but also the ecosystems, watersheds and animal migration routes that cross these land use boundaries as well. Land use decisions that apply to adjacent areas thus have the potential to impact access to Native-owned subsistence grounds as well as the subsistence resources in nearby regions (Gallagher, 1987). For these reasons, the construction of a large industrial mine on lands adjacent to – but not overlapping – Native-owned land has the potential to threaten subsistence cultures, knowledge, and economics. Pebble would represent a forcible reevaluation of the calculus of land use in the region, whereby alterations to topographies and use driven by extractive profit come to supersede the forms of land use implied in the body of the salmon and the practice of subsistence. 'It is more than saying "you are taking away my food"', Heather Kendall Miller (2014, personal communication) argues. Activists are saying that 'development is going to extinguish who I am as a person'.

## Conclusion

State-led land planning emerged out of a history and ideology of 'land' as a source of profit, from the trappers and prospectors who made up Alaska's first European inhabitants

to contemporary economic structures that tie state budgets to the successful exploitation of the earth's resources. These traditions emphasized the rational, scientific management of discrete land resources in order to maximize production and profit (Scott, 1999). Written into governance through decades of regional land planning documents and into the landscape by decades of industrial scarring, land-as-extraction-site can be thought of as a form of what Mukerji (1994) terms 'geo-politics': A process by which 'the state uses technological means to transform the land into both a resource for administration and symbol of state power' (Epstein, 2008).

Despite a long and entrenched history of extractive ideologies, and the adeptness with which colonial land imaginaries persist, indigenous land imaginaries and the resistance movements that surround and support them continue to have broad historical resonance and power. The continued practice of indigenous modes of relating to the land is a result of both the resilience of subsistence practitioners and the continued relevance of subsistence practices and worldviews to contemporary, hybrid lives. It is in the hybrid spaces between Western science and subsistence imaginaries where we can see the work of cognitive justice enacted in service of concrete material goals, and it is in the navigation of these discursive and strategic boundaries that the tensions between and within knowledge regimes are made strikingly clear. Conceptions of subsistence-based approaches to land today have emerged in part as a mode to subtly claim definitional control over the land and its 'resources' and to reframe knowledge production and land planning as community-based, participatory projects. Unfortunately, the large mine permitting process is often structurally and epistemologically unable to consider these divergent discourses and the public imaginations of alternative futures they support and constitute. The Pebble case is one example of many in global debates between development, conservation, land use and indigenous sovereignty. With recent changes to state and federal land management priorities in Alaska's increasingly desperate economy, it remains to be seen whether the successes of the coalitions that arose to defeat Pebble will be repeatable.

### Acknowledgements

We are grateful to Karen Hébert, Sergio Sismondo and other anonymous reviewers for their close reading of the manuscript and insightful comments on earlier drafts. Thanks especially to Benjamin Lemmond, for his contributions to the research process. Our gratitude to the many Alaskan families who supported our work.

### Funding

This project is funded by the National Science Foundation Award # 1642226.

### References

- Agyeman J, Schlosberg D, Craven L and Matthews C (2016) Trends and directions in environmental justice: From inequity to everyday life, community, and just sustainabilities. *Annual Review of Environment and Resources* 41: 321–340.
- Alaska Department of Fish and Game (2017) Anadromous waters catalog. Available at: <https://www.adfg.alaska.gov/sf/SARR/AWC/> (accessed 2 March 2017).

- Alaska Department of Natural Resources (Division of Mining, Land, and Water, Resource Assessment and Development Section) (2005) *Bristol Bay Area Plan for State Lands*. Juneau, AK: Alaska Department of Natural Resources.
- Barad K (2012) Nature's queer performativity. *Qui Parle* 19(2): 121–158.
- Beck U (1992) *Risk Society: Towards a New Modernity*. New Delhi: SAGE.
- Bell C (2016) Determining salmon prices. *Alaska Economic Trends: Alaska Department of Labor & Workforce Development* 36(11): 5.
- Bristol Bay Heritage Land Trust (2013) Citizens Alternative Bristol Bay Area Plan for State Lands. Available at: [http://www.bristolbaylandtrust.org/wp-content/uploads/2013/05/BBAP\\_May\\_final.pdf](http://www.bristolbaylandtrust.org/wp-content/uploads/2013/05/BBAP_May_final.pdf) (accessed 6 September 2018).
- Bureau of Land Management (2018) Alaska federal subsistence. US Department of Interior. Available at: <https://www.blm.gov/programs/natural-resources/subsistence> (accessed 6 September 2018).
- Castoriadis C (1997) Radical imagination and the social instituting imaginary. In: Curtis D (ed.) *The Castoriadis Reader*. Oxford: Blackwell, 319–337.
- Cook Inletkeeper (2013) The silencing Alaskans act (HB 77): Anti-salmon, anti-democracy, anti-Alaskan. Available at: <https://inletkeeper.org/wp-content/uploads/2017/10/Inletkeeper-HB-77-Fact-Sheet.pdf> (accessed 2 March 2017).
- Davidov V (2014) Land, copper, flora: Dominant materialities and the making of Ecuadorian resource environments. *Anthropological Quarterly* 87(1): 31–58.
- Ecology and Environment Inc. (2010) An assessment of ecological risk to wild salmon systems from large-scale mining in the Nushagak and Kvichak Satersheds of the Bristol Bay Basin. Report for the Nature Conservancy, Ecology and Environment Inc, Lancaster, NY.
- Edelstein DL (2012) Copper. Report for US Department of Geological Survey, June. Available at: <http://minerals.usgs.gov/minerals/pubs/commodity/copper/myb1-2010-coppe.pdf> (accessed 6 September 2018).
- Environmental Protection Agency (EPA) (2014) *An assessment of potential mining impacts on salmon ecosystems of Bristol Bay, AK*, January. Report for EPA Region 10. Seattle, WA: EPA.
- Epstein S (2008) Culture and science/technology: Rethinking knowledge, power, materiality, and nature. *Annals of the American Academy of Political and Social Science* 619: 165–182.
- Fienup-Riordan A (2008) Yuungnaqpiallerput – The way we genuinely live: Masterworks of Yup'ik science and survival. Available at: <http://www.yupikscience.org/1intro/index.html> (accessed 22 October 2017).
- Frickel S, Gibbon S, Howard J, et al. (2010) Undone science: Charting social movement and civil society challenges to research agenda setting. *Science, Technology, & Human Values* 35(4): 444–473.
- Fricke M (2007) *Epistemic Injustice: Power and the Ethics of Knowing*. Oxford: Oxford University Press.
- Gallagher TJ (1987) Native participation in land management planning in Alaska. *Arctic* 41(2): 91–98.
- Gaonkar DP (2002) Toward new imaginaries: An introduction. *Public Culture* 14(1): 1–19.
- Groves C (2015) The bomb in my backyard, the serpent in my house: Environmental justice, risk, and the colonization of attachment. *Environmental Politics* 24(6): 853–873.
- Hale MB and Ross SG (2013) The State of Alaska's effort to become the primary agency to Section 404 permits. Available at: <https://dec.alaska.gov/media/6724/soa-effort-to-become-primary-404-agency.pdf> (accessed 2 March 2017).
- Hansel C (1996) *Telling Our Lives: Ethnicity and Discourse in Southwestern Alaska*. Oxford: Oxford University Press.

- Hardin B (2012) Treasure hunt: The battle over Alaska's mega mine. *PBS Frontline*, 23 July. Available at: <http://www.pbs.org/wgbh/pages/frontline/environment/alaska-gold/treasure-hunt-the-battle-over-alaskas-mega-mine/> (accessed 6 September 2018).
- Hébert K (2014) The matter of market devices: Economic transformation in a southwest Alaskan salmon fishery. *Geoforum* 53: 21–30.
- Hébert K (2015) Enduring capitalism: Instability, precariousness, and cycles of change in an Alaskan salmon fishery. *American Anthropologist* 117(1): 32–46.
- Hébert K (2016) Chronicle of a disaster foretold: Scientific risk assessment, public participation, and the politics of imperilment in Bristol Bay, Alaska. *Journal of the Royal Anthropological Institute* 22(Suppl. 1): 108–126.
- Hébert K and Brock S (2017) Counting and counter-mapping: Contests over the making of a mining district in Bristol Bay, Alaska. *Science as Culture* 21(1): 56–87.
- Higman B (2008) *Seismic risk at the Pebble mine*. PhD Dissertation, University of Washington, Seattle, WA.
- Hobson J (2010) Southwest Alaska Tribes to EPA regarding 404(c). Nondalton Tribal Council. May 21, 2010.
- Holley EA and Mitcham C (2016) The Pebble mine dialogue: A case study on public engagement and the social license to operate. *Resource Policy* 47(March): 18–27.
- Jasanoff S (2005) *Designs on Nature: Science and Democracy in Europe and the United States*. Princeton, NJ: Princeton University Press.
- Jasanoff S and Kim SH (2009) Containing the atom: Sociotechnical imaginaries and nuclear power in the United States and South Korea. *Minerva* 47(2): 119–146.
- Knapp G, Guettabi M and Goldsmith S (2013) The economic importance of the Bristol Bay salmon industry. Report for the Institute of Social and Economic Research, University of Alaska, Anchorage, AL, April.
- Krieger R (2016) Residents in seafood processing. *Alaska Economic Trends: Alaska Department of Labor & Workforce Development* 36(11): 5.
- Lasley S (2016) Mining news: Alaskan for interior? Will Trump tap Palin, Gillam to lead federal land management agency? *Petroleum News*. Available at: <http://www.petroleumnews.com/pntruncate/637956253.shtml> (accessed 18 Sept 2018).
- McIntyre JK, Baldwin DH, Beauchamp DA, et al. (2012) Low-level copper exposures increase visibility and vulnerability of juvenile coho salmon to cutthroat trout predators. *Ecological Applications* 22(5): 1460–1471.
- Mukerji C (1994) The political mobilization of nature in seventeenth-century French formal gardens. *Theory and Society* 23(5): 651–677.
- Nushagak-Mulchatna Watershed Council (NMWC) (2007) Nushagak River Watershed traditional use area conservation plan. Report, NMWC, Bristol, November.
- Nushagak-Mulchatna Watershed Council (NMWC) (2011) Standards and practices for environmentally responsible mining in the Nushagak River watershed. Report, NMWC, Bristol.
- O'Neal S (2012) A review of Pebble Limited Partnership's environmental baseline documents: Resident fish and juvenile salmon habitat, distribution and assemblage. Report, Fisheries Research & Consulting, April. Available at: [http://pebblescience.org/pdfs/FINAL\\_Fish\\_Assemblage\\_Review\\_22\\_May\\_2012.pdf](http://pebblescience.org/pdfs/FINAL_Fish_Assemblage_Review_22_May_2012.pdf) (accessed 2 March 2017).
- Ottinger G (2016) Social movement-based citizen science. In: Cavalier D and Kennedy EB (eds) *The Rightful Place of Science: Citizen Science*. Tempe, AZ: University of Arizona Press, 89–103.
- Parker GY (2012) Efforts to conserve the Kvichak and Nushagak drainages. *Seattle Journal of Environmental Law* 2(1): 219–278.

- Pebble Limited Partnership (2011) Geology. Available at: <https://www.pebblepartnership.com/geology.html> (accessed 8 March 2017).
- Pebble Limited Partnership (2012) Environmental baseline document. Available at: <https://www.pebbleprojecteis.com/> (accessed 18 September 2017).
- Pebble Limited Partnership (2017) Why mine. Available at: <https://www.pebblepartnership.com/why.html> (accessed 8 March 2017).
- Ross J and Gould L (2006) *Native Americans and the Criminal Justice System: Theoretical and Policy Directions*. New York: Routledge.
- Scannel PW (2009) *Effects of copper on aquatic species: A review of literature*. Alaska Department of Fish and Game report no. 09-04, June. Available at: [http://www.adfg.alaska.gov/static/home/library/pdfs/habitat/09\\_04.pdf](http://www.adfg.alaska.gov/static/home/library/pdfs/habitat/09_04.pdf) (accessed 6 September 2018).
- Schlosberg D and Coles R (2015) The new environmentalism of everyday life: Sustainability, material flows, and movements. *Contemporary Political Theory* 15(2): 160–181.
- Scott J (1999) *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. New Haven, CT: Yale University Press.
- Shepard H (2014) Democracy is not dead in Alaska, but HB 77 is – For now. *Alaska Dispatch News*, 29 June. Available at: <https://www.adn.com/commentary/article/democracy-not-dead-alaska-hb-77-now/2014/04/17/> (accessed 23 September 2018).
- Stratus Consulting (2012) *Review of Pebble Limited Partnership's environmental baseline data: Hydrologic characterization*. Report no. SC12807, 25 May. Available at: <http://www.pebblescience.org/pdfs/2012.05.25.EBD.Hydro.pdf> (accessed 6 September 2018).
- US Energy Information Administration (USEIA) (2018) Alaska field production of crude oil. US Department of Energy. 8/31/18 Available at: <https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPAK2&f=A> (accessed 23 September 2018).
- Warren J (2016) Seafood harvesting jobs. *Alaska Economic Trends: Alaska Department of Labor & Workforce Development* 36(11): 5.
- Wehling P (2006) The situated materiality of scientific practices: Postconstructivism – A new theoretical perspective in science studies? *Science, Technology & Innovation Studies* 1: 81–100.
- Woody CA (2015) Assessing reliability of Pebble Limited Partnership's salmon escapement studies. Report, Fisheries Research & Consulting, June. Available at: [http://pebblescience.org/pdfs/Woody\\_EBD\\_EscapementFINAL27June2012.pdf](http://pebblescience.org/pdfs/Woody_EBD_EscapementFINAL27June2012.pdf) (accessed 2 March 2017).
- Woody CA and O'Neal SL (2012) Effects of copper on fish and aquatic resources. Report, Fisheries Research and Consulting, March. Available at: <http://www.pebblescience.org/copper-and-salmon.html> (accessed 6 September 2018).
- Zamzow K (2010) Potential impacts to water during exploration at the Pebble prospect, Alaska, 2009-2010. Report, Center for Science in Public Participation. Available at: <https://www.csp2.org/files/reports/Potential%20Exploration%20WQ%20Impacts%20-%20Zamzow%20Aug10.pdf> (accessed 6 September 2018).
- Zamzow K (2011a) Acid rock drainage and metal leaching at the Pebble prospect. Report, Center for Science in Public Participation. Available at: [http://pebblescience.org/Pebble-Mine/acid\\_drainage.html](http://pebblescience.org/Pebble-Mine/acid_drainage.html)
- Zamzow K (2011b) Critique of Pebble Limited Partnership preliminary water quality data for the Pebble prospect, Alaska. Report, Center for Science in Public Participation. Available at: <https://www.csp2.org/files/reports/Critique%20of%20PLP%20Water%20Quality%20Data%20-%20Zamzow%20May11.pdf>
- Zamzow K (2011c) Surface water quality near the Pebble prospect, Southwest Alaska, 2009-2010. Report, Center for Science in Public Participation. Available at: [http://www.csp2.org/files/reports/WQR%20-%20TNC\\_Water\\_Quality\\_Report\\_2011%20-%20Final%20Nov14.pdf](http://www.csp2.org/files/reports/WQR%20-%20TNC_Water_Quality_Report_2011%20-%20Final%20Nov14.pdf)



- Zamzow K (2012) A review of Pebble Limited Partnership's environmental baseline documents: Water quality. Report, Center for Science in Public Participation. Available at: [http://pebblescience.org/pdfs/Zamzow%20-%20Review%20of%20PLP%20EBD%20-%20Water%20Quality\\_20120524.pdf](http://pebblescience.org/pdfs/Zamzow%20-%20Review%20of%20PLP%20EBD%20-%20Water%20Quality_20120524.pdf) (accessed 2 March 2017).
- Zamzow K and Chambers D (2016) Investigation of reclaimed drill sites, Pebble prospect. Report, United Tribes of Bristol Bay, *Dillingham*, AK, and the Center for Science in Public Participation, Bozeman, MT. Available at: <http://utbb.org/wp-content/uploads/2016/11/CSP2-Pebble-Inspection-Summary-Report-DMC-3Nov161.pdf> (accessed 2 March 2017).

### **Author biographies**

Bindu Panikkar is an Assistant Professor at the Rubenstein School of Environment and Natural Resources at the University of Vermont.

Jonathan Tollefson is a Master's Student at the Rubenstein School of Environment and Natural Resources at the University of Vermont. He has worked as Bindu's research assistant for her projects in Alaska since 2016.