













Centering relationships to place for more meaningful research and engagement

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Research has the potential to simultaneously generate new knowledge and contribute meaningful social-ecological benefits; however, research processes and outcomes can also perpetuate extractive patterns that have manifested the climate, biodiversity, and social justice crises. One approach to enhance the societal value of research processes is to strengthen relationships with places of study and the peoples of those places. Deepening relational engagement with the social-ecological context and history of a place can lead to more accurate results and improved public trust in the scientific process and is particularly important for natural scientists who work at the interface of nature and society. We provide three actionable pathways that range from individual to systemic change to enhance place-based relationships within research systems: 1) deepen reflection and communication about relationships with places and peoples; 2) strengthen collaboration among research teams and partners; and 3) transform systems of knowledge creation to foster place-based roots. Action on any of these proposed pathways, but especially action taken across all three, can build empathy and connections to place and people, strengthening the meaningful impact of research both locally and globally.

place-based relationships | meaningful research outcomes | transformation | relational research | decolonize research

Centering relationships with places, including understanding changes through time and visualizing possible futures, is critical to generate meaningful research outcomes that extend beyond academic audiences. Too often, research processes bypass opportunities to deepen relationships with places of study due to time, capacity, funding, or personal constraints. This omission of social-ecological contexts in research and research-informed activities (e.g., restoration, conservation, climate change adaptation) can perpetuate harmful practices such as parachute science, erode public trust, generate increased tolerance for environmental degradation (e.g., shifting baselines) and result in inaccurate findings and solutions (1–4). We contend that researchers who reflect on, build, and communicate their relationships to places of study and the peoples of those places are more likely to minimize these harmful consequences and, instead, generate more accurate and meaningful research outcomes.

Advancing relationship-building during research processes is particularly important in the context of the climate, biodiversity, and social justice crises, which share the commonality of extractive human behavior toward the natural world and each other (5). Mitigating and adapting to these crises require researchers

to recognize and shift away from extractive paradigms and toward systems that emphasize relationality and reciprocity (6). While fundamental research continues to be important, addressing these crises is urgent and requires additional emphasis to create meaningful research outcomes.

To this end, we prompt researchers to deepen their connections with places of study and their associated peoples and partners by meaningfully building relationships with social-ecological contexts. Places of study can include, but are not limited to, the location of research institutions and field-based programs, communities where researchers live and work, field sites, and conference or research event locations. Peoples and partners associated with these places of study can encompass individual community members, user groups, organizations, and governments whose reach overlaps with the place of study and who are part of the past and present social-ecological contexts (7). We provide three actionable pathways that describe “how” researchers might advance this relationship building, ranging from individual reflections to collective actions and systemic transformations across research contexts (Fig. 1). We argue that following these pathways can generate meaningful research outcomes. What constitutes a meaningful research outcome is inherently dynamic and best articulated by those

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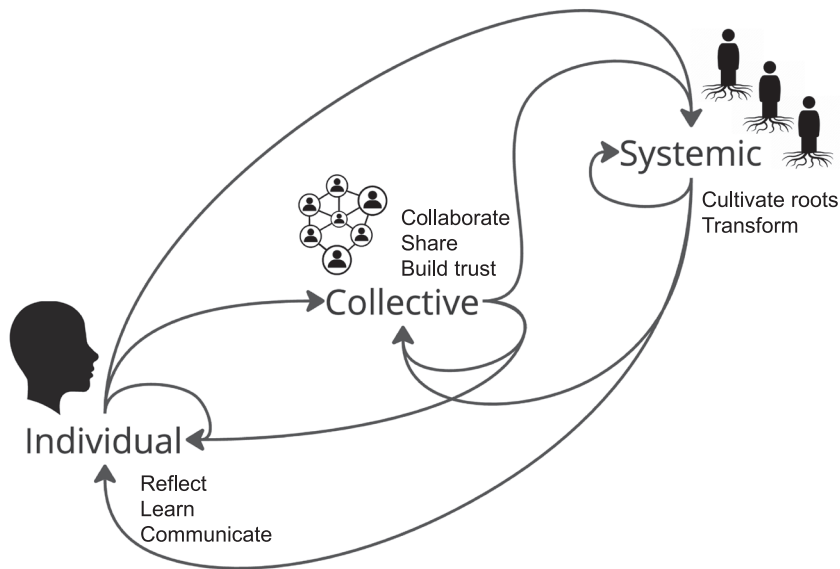


Fig. 1. Three scales that researchers can iterate among to implement the proposed pathways and avenues to deepen relationships with places of study. The arrows depict how researchers can journey across the intersecting scales based on entry points that match their capacity and interests. For example, natural scientists who engage in collaborative projects may be inspired to deepen their reflexive skill sets, which might make them aware of systemic transformations they can contribute toward. Questions, actions, and resources that accompany these pathways are illustrated in Table 1.

affected by research findings, including but not limited to stakeholders, communities, research partners, and participants. Here, we use the term “meaningful research” to refer to applied research processes that aim to fulfill societal or community needs in an authentic, reciprocal, and relational way. Meaningful research processes resist performative and tokenistic dimensions of research creation and, instead, aim to generate outcomes that advance the knowledge base and provide societal benefits (8).

These pathways are not intended as a comprehensive list of all ways to deepen connections with places and people—a process that can occur in myriad ways. Rather, they emerged from our combined experience and perspectives as marine social-ecological researchers who conduct climate change research in the northeast Pacific (*Positionality Statement*). Several of our suggested pathways are already practiced to varying degrees within myriad research communities, particularly across the social sciences and community-based research programs (9). Our primary audience—natural scientists who are committed to or interested in working at the interface of nature and society and their associated research systems—can learn from and build on such existing practices. Our suggestions may provide particular value to natural scientists who are less familiar with reflexivity practices and research co-creation, who live in countries that are less engaged in reconciliation between Indigenous and non-Indigenous communities, or who wish to address problematic power dynamics between Global-North and South institutions (e.g., parachute science, 3). We contend that researchers from diverse natural science disciplines, from astrophysics to physiology, can benefit from implementing the following three pathways to build meaningful relationships among researchers and place.

1. Pathway 1: Deepen Reflection and Communication about Relationships with Places

Taking time to relate oneself and one’s research to the historical and contemporary contexts of a given location can deepen the reconciliatory value of research, build empathy and emotional connections with places and peoples, and

enhance transparency, accountability, and trust in the research process (4, 6, 10–12). Historical perspectives can also clarify past impacts and legacy effects on social-ecological systems today and aid in predictions of the future (2, 13). Here, we outline three opportunities for natural scientists to implement this pathway that expand upon existing reflexive and communication practices. This work will involve trade-offs for researchers as finite time and energy are reallocated to different endeavors; thus, Pathway 3 outlines opportunities to support and reward natural scientists who choose to center these individual reflection practices.

1.1. Consider Historical and Social-Ecological Context. We encourage natural scientists to learn, feel, and reflect on the historical and social-ecological contexts of their places of study and incorporate this context into research processes and communications (e.g., publications, courses, conferences, public events). This process can involve relating a study to information about the environment, history, and social-ecological system, where the material is used either as background context or embedded throughout the research process (e.g., motivate the research question, shape the data collection, or inform the analysis and results). A particularly generative approach to acquiring knowledge about history and context is through direct experience and immersion in communities, as direct personal experience can deepen emotional connection and understanding, strengthening researcher accountability and the potential for insight (14). Activities can include visiting museums or taking part in public activities while frequently visiting a place, learning local terms for cultivated foods, visiting a historically significant place or viewpoint, and meeting and working with local organizations and communities (Table 1). While many natural scientists are familiar with these activities, they may not consider this learning process an opportunity to transform perspectives, inform research goals, and broaden the implications and societal impact of research outcomes.

1.2. Expand Land Acknowledgments. Land acknowledgments are increasingly commonplace statements that precede public communications (e.g., conferences, meetings) and seek to recognize past and ongoing Indigenous presence in

spaces that have often excluded them. They are opportunities for researchers to reflect upon the often underrecognized Indigenous territories and seascapes in which research and communication events are situated and are an incremental step toward reconciliation between Indigenous and non-Indigenous communities. Land acknowledgments are an increasingly common practice in colonized territories and countries (e.g., Canada, Australia; 29).

To deepen the relational value of land acknowledgments, we encourage researchers to expand upon the relationships between research topics, places, and people. Among myriad topics, expanded land acknowledgments could reflect upon Indigenous foods, technologies, villages, cultural practices, social–ecological and natural history including missing species and other ecological changes, and language, placenames, and stories that relate the research context and researcher(s).

Through learning about and communicating some of the history, context, and meaning of places of study to Indigenous communities, expanded land acknowledgments carry the potential to shift this practice from a performative institutional script toward a personalized reflection with enhanced relationship-building and personal transformation outcomes (30). Such an expansion will depend on each researcher's identity, relationships with, and effort to learn about and grow relationships with Indigenous communities and vice versa (Table 1). For example, settlers in colonized nations carry responsibilities that are distinct from those of forcibly displaced peoples.

Despite the reconciliatory potential of land acknowledgments, there remain legitimate concerns associated with expanding them, such as appropriation, Indigenous erasure, and historical inaccuracies (29). Thus, we encourage researchers to approach expanded land acknowledgments with thoughtfulness and respect and seek out resources provided or recognized by local and Indigenous communities to understand the context (Table 1). We also recognize that land acknowledgments are most common in developing nations with histories of oppression and exclusion of the original inhabitants of the land. Expanded land acknowledgments may be harder to implement in contexts with complicated histories of colonization or where reconciliation is not embedded within sociopolitical discourse. There is still, however, a responsibility to seek a deep understanding of the historical, cultural, and social context where places of study are situated.

1.3. Expand Positionality Statements. Positionality statements present another opportunity for natural scientists to practice place-based reflexivity within research processes. Common across various social sciences, positionality statements are used to disclose a researcher's personal and professional background and reflect upon potential biases or worldviews that can influence their research (e.g., topic, epistemology, ontology, methodology, relation to participants, and communication; 11, 31). To date, positionality statements focus primarily on individual positionality, but we suggest they be expanded to describe other relevant contexts that can influence the research process and ground the researcher within their place of study (e.g., geographic, socioeconomic, institutional, and cultural positionality; Table 1 and Box 1; 4).

Expanded positionality statements can generate reflection about a research effort in time and space and prompt individuals and groups of researchers to consider unexamined

assumptions, blind spots, and the potential to perpetuate harmful patterns (e.g., parachute science, colonial extraction; (3, 4, 32). For example, a settler ecologist reflecting on their blind spots associated with place-based knowledge systems might realize that what they thought was a “natural” process was managed by humans for generations, yielding different hypotheses and collaboration opportunities with Indigenous communities if there is interest and capacity. The exercise can also increase bias detection by the practitioner and readers alike and generally enhance critical thinking and transparency.

There is inherent value in practicing place-based reflexivity without externally communicating the statements (e.g., if personal or institutional barriers preclude this, 31); however, embedding expanded positionality statements within natural science journals (33), theses (e.g., Box 1), and coursework can support the broader training and normalization of this skill set throughout the natural science community [e.g., journal (31) requires positionality statements]. Providing instruction on how to explore personal and place-based reflexivity within undergraduate and graduate natural science programs can also enhance the reflexive skillsets of the next generation of natural scientists and ensure this practice becomes meaningfully embedded within the natural science research process as opposed to a box-ticking or performative exercise (Table 1).

2. Pathway 2: Strengthen Collaboration amongst Research Teams and Partners

Building collaborative relationships during research processes can generate comprehensive knowledge that leads to more inclusive and accurate policy outcomes (Box 2), enhances public trust of research, and fulfills community visions for the future (Box 3, 35, 36). We focus on two avenues to strengthen collaboration that are supported by case studies that embody community-informed and cocreated research (Boxes 2 and 3). As with pathway 1, scientists who seek to strengthen collaboration will need to reallocate their finite time, energy, and resources to adapt their research processes (see Pathway 3 for proposed systemic revisions to address these adaptations).

2.1. Build Collaborations across Disciplines and Worldviews. We encourage natural scientists to strengthen collaborative relationships amongst researchers and knowledge holders whose expertise or interest overlaps in space yet spans multiple disciplines and worldviews (e.g., Western, Indigenous, and local knowledge systems). A critical first step to building interdisciplinary and multiontological research capacity is investing time and energy in fostering mutual respect, trust, and reciprocal learning across individuals who hold distinct expertise and worldviews (see Table 1 for examples of trust and collaboration-building actions). Upon establishing a foundation of trust and knowledge sharing across researchers and knowledge holders, interdisciplinary collaborations can enhance collective understanding of how natural and human dimensions shape a place; thereby yielding richer, and more accurate, results that effectively communicate to a broader audience and advance the focus of study (4, 9, 37–39).

Not all research must be interdisciplinary, but working collaboratively can provide interesting and at times unexpected outcomes. For example, an interdisciplinary approach

Table 1. Questions, actions, and resources associated with implementing the three pathways and seven avenues described in this paper

Pathway	Avenue	Questions	Actions	Resources
Deepen reflection	Consider historical and social-ecological context	What is the social-ecological history of this place as it relates to my research?	Learn about and communicate the social-ecological context and history associated with places of study and their peoples	Local gray literature, websites, museums
		What dimensions and processes have shaped this place through time? (e.g., geology, climate, people)	Introduce yourself to local contacts to start building relationships. Visit learning centers and museums and important places and features surrounding places of study	
	Expand land acknowledgments	What is my/our responsibility to the people of this place? (e.g., personal relationship with colonialism, extraction, development, settlement)	Learn about Indigenous and long-term local relationships with places of study, attend events, research websites, and learn language terms and concepts where appropriate	(15–18)
		How do the relationships Indigenous and/or local peoples hold in this place relate to my research?	Craft and communicate expanded land acknowledgments during public events (e.g., conferences, talks)	
	Expand positionality statements	How do I/we or other researchers relate to this place and its peoples?	Learn about the local research landscape and history (e.g., local research institutions, history of research-community partnerships, other researchers working in the area).	(11)
		How does my/our relationship to this place and peoples affect the research process?	Include reflexivity training within undergraduate and graduate school programs	
Strengthen collaboration	Build collaboration across disciplines and worldviews	How do our perspectives and expertise about this place differ?	Form research teams that blend specialists and bridge-building researchers	(19, 20)
		How can different perspectives be brought together to create a more holistic picture?	Learn the local language and communications approaches that effectively engage community audiences	
	Build relationships beyond academic research partners	What questions may be of value to the people of this place? What are key issues affecting the place and people, and can research help address some of these?	Discuss research opportunities and offer to present results to and in community settings (e.g., town halls, public talks, social media)	(21–23)
		What knowledge exists that research can build upon?	Ask and learn from community members about their needs	
		What local research or other institutions could be partners?	Embed researchers within community and partner cultures and embed partners within research cultures	
		What are local protocols for requesting permission to do research and/or for developing research partnerships (e.g., in Indigenous territories, foreign countries, with local community groups)?	Create opportunities for community members to be part of the research (e.g., hire local research assistants and create training opportunities for local youth)	
		Can all or some of the research be at the service of community partners, rather than be research-institution driven?	Build sufficient time and resources into grants to allow for relationship-building and compensation of partners involved (e.g., honoraria, stipends, research assistants)	
		How can the research process become more reciprocal? What benefits might the research process or team contribute to the place of study and people?		

Table 1. (Continued)

Pathway	Avenue	Questions	Actions	Resources
Transform systems	Restructure training, evaluation, and funding systems across career stages	What is the history of the research system, including the funding entity, in relation to the place of study?	Adjust curricula to include place-based content (historical and contemporary)	Latin American Fisheries Fellowship Program
		What local organizations and communities exist that may inspire and engage students and young researchers?	Provide opportunities for students and young researchers to meet with and work within local organizations and communities to learn about places and provide an introduction for future collaboration	Fulbright COMEXUS program
		To what extent is knowledge about a place reflected in learning and training systems? What widely known information about the history of a place is absent from local learning and training systems?	Advocate for funding and evaluation systems to support additional work associated with building relationships to places and peoples, communicating work to broader audiences, working in complex interdisciplinary teams, etc.,	Canada's IDRC Doctoral research awards
		How are transient and deeply rooted researchers evaluated and supported within evaluation and funding systems?	Enable researchers from a place to be based in their home community (e.g., advocate for institutions to allow professors and students to do online teaching and learning, participate in meetings virtually)	(24)
	Cultivate research capacity outside academic institutions	How can researchers be repatriated (or retained) within their communities and countries?	Expand criteria for recognizing diverse research outputs (e.g., reward alternative forms of communication such as reports to communities in tenure, promotion, and funding applications)	
		How can ownership and uptake of the identity of "researcher" and "expert" be expanded across diverse contexts (i.e., held by community members who lead research endeavors outside of academic contexts)?	Obtain funding to hire and train researchers in community	(14, 25–28)
		What are mechanisms that would allow diverse knowledge and projects to be recognized such that communities are leading their own research?	Increase funding and engagement mechanisms to support community-led research (e.g., expand who can hold research funds)	
			Appropriately cite local and Indigenous knowledge in research deliverables Support community-led research organizations Build place-based research centers supported by interdisciplinary and diverse partners	

to studying a coastal system could involve considering the myriad physical (e.g., oceanographic, climatic, geological), ecological (e.g., trophic interactions), and social processes (e.g., human activities, perceptions, policy, or legal frameworks) that interact to shape present and future processes and resilience to drivers of change (39, 40). Such an approach is increasingly valued in fields of sustainability and climate change research, where complex and synergistic interactions require interdisciplinary collaboration (41). The present study's lead author was involved in an interdisciplinary collaboration that brought together place-based and non-place-based natural scientists (e.g., ecologists and astrophysicists) to design and implement research aimed at addressing transboundary environmental issues in the Salish Sea. Benefits of this collaboration included a stronger sense of place and place-based accountability within the research team and an expanded awareness and application of diverse tools and processes that improved research design and communicability.

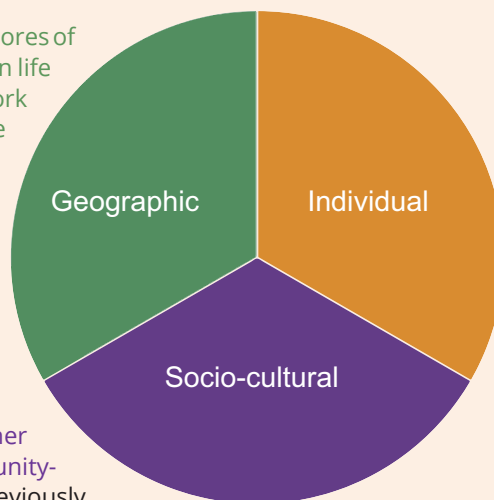
Research that ethically brings together multiple world-views has similarly led to breakthroughs and transformations, such as redefining biodiversity patterns based on the consilience of Indigenous languages, cultural geography, and genetics (42, 43), respecting multiple ontologies and relationality in fisheries management (33), directing policy toward more holistic and sustainable fisheries management (44), and enhancing just outcomes for Indigenous communities (6). Building collaborative relationships within research systems can stand apart from the need to collaboratively produce research, as simply increasing the flow of information, trust, and awareness across disciplines and worldviews can inspire different ways of thinking about and relating to place.

2.2. Build Relationships beyond Academic Research Partners. We emphasize relationship-building with peoples who are directly affected by research processes, responsible for applying results, and have deep connections to places

Box 1.

The following expanded positionality statement, derived from FB's published PhD dissertation, reflects upon the effect of place-based relationships, emotional ties, and personal identity on research development (34). The text colors correspond to dimensions of individual, sociocultural, and geographic positionality that blend across a color spectrum.

"My underlying motivation for this thesis stems from growing up on the shores of the Salish Sea and caring deeply about protecting the marine and human life connected with my home waters. My connection to place drew me to work with non-profit organizations on marine projects in Átl'ka7tsem/Howe Sound prior to and during my degree [geographic]. Átl'ka7tsem is one of three Skwxwú7mesh Úxwumixw (Squamish Nation) place names for Howe Sound, a fjord in the Salish Sea, and references the journey by canoe from the head of the fjord out toward the Strait of Georgia. My work experience immersed me in Átl'ka7tsem/Howe Sound's social, political, cultural, and ecological systems and enabled me to nurture relationships and absorb abundant place-based knowledge that were central to my co-creation of Chapter 4. My identity as an 'insider' to the regional Átl'ka7tsem and Salish Sea communities granted me access to spaces and conversations that would have taken an 'outside' researcher a long time to access. It also motivated my implementation of a community-based participatory approach [socio-cultural], despite this being a previously unexplored research method in my lab at the University of British Columbia.



That said, while my roots grant me the identity of an 'insider' to the regional Átl'ka7tsem and Salish Sea community, I am an outsider to many communities within these regions, specifically Indigenous ones [socio-cultural]. I am a white, upper-class woman of European settler descent, and I recognize that I have benefitted from the extractive human systems that have generated the climate, biodiversity, and social inequity crises. As such, I am still (un)learning the extent to which my worldview perpetuates colonial and privileged assumptions and harm [individual]. I have tried actively to practice reflexivity about my identity, be critically aware of my worldview throughout my research process, and take responsibility for crafting my research in a way that minimizes the perpetuation of extractive harm. Collectively, these emotional, place-based, and positional components of my identity shape the lens through which I create knowledge and cannot be separated from my research questions, methods, interpretations, or desired outcomes."

of study (e.g., Indigenous peoples, long-term residents, individuals with cultural/ancestral ties). While researchers often personally identify with one or more of these groups, many research systems (e.g., academia, research centers, funding and outreach agencies, government), particularly those in the Global North, fail to incentivize researcher engagement with partners outside of academia (45). Yet, sustaining collaborative engagement has proven central to generating and disseminating knowledge that informs plans and policies to fulfill visions for the future and achieve better social-ecological outcomes [Box 2; 19, 46]. In practice, collaborative engagement can range from self-orienting about community needs, hosting town halls to discuss research opportunities, disseminating results via social media, public talks, or using other accessible communication tools, and embedding researchers within community cultures to grow trust and mutual understanding (Table 1, 21). Collaborative engagement with partners is a particularly powerful tool to enhance the accuracy and trust in research findings and can help decolonize science by enhancing knowledge access (32, 35, 36). Researchers will have varying capacity to engage with partners, thus we emphasize that any small step taken to enhance external engagement can help transform research paradigms (Table 1).

In our experience, co-creation of projects with local partners who have deep connections to places is one of the most meaningful and transformative ways to embed histories, context, and relationship-building into research when researchers are external to the place of study. Moreover, it can lead to better outcomes. Many natural science fields do not currently practice or train research co-creation, despite it being a relatively common practice within social sciences (12). Thus, calling for a greater awareness and uptake of research co-creation within the natural sciences represents a strategic opportunity to enhance relational and place-based outcomes of research processes without reinventing the wheel. Co-creation involves diverse research partners working together to co-design (47), coproduce (48), and codisseminate research (49). Research co-creation is increasingly advocated for, and attempted in, sustainability research because it ensures legitimacy and enhances research usability while empowering all partners (47, 48). Research co-creation necessitates building trusting relationships, learning each other's perspectives, and being accountable, thereby resulting in research that is meaningful to people and places, and hence more likely to lead to positive and transformative outcomes (Box 3). We encourage natural scientists who want to expand their co-creation practices to consider empirically

Box 2.

The following case study from the Northern Gulf of California, Mexico, describes how community-informed research was vital for conservation management strategies.

In the Northern Gulf of California (Mexico), negative estuaries, complex macrotidal saltmarshes where salinity is higher in the head than in the mouth, dominate the landscape. One of the present study's authors (HML) began a research program in 2005 with the aim of developing knowledge that would lead to conservation actions, as part of a new team within CEDO Intercultural, a binational US–Mexico conservation, research, and education-focused NGO. Initially, the research program focused on ecological processes and objectives, such as restoring plant communities and fish habitats. Soon, however, the research team realized that the wetlands were valued locally because of their nursery and refuge role for local artisanal fisheries, which are of great cultural and economic importance for local inhabitants.

These community-informed social–ecological values associated with estuary function transformed the research and conservation program efforts to ensure that fisheries and sustainable harvesting objectives were met alongside the restoration of ecological function. CEDO had been working for 40 y in the Northern Gulf of California and had built relationships and trust with the local communities. As members of the research team became embedded in the local community, this trust deepened. Working with local stakeholders and recognizing their priorities throughout the research process led to the establishment of two new RAMSAR sites. Overall, recognizing and responding to the needs and perspectives of local stakeholders who worked within wetlands, such as a women's oyster growing cooperative and blue crab fishers, enhanced the effective implementation of comanagement strategies, education campaigns, and conservation tools such as the RAMSAR Convention on Wetlands of International Importance.

grounded guidelines (Table 1; 50). Research co-creation still implies that a researcher is separate from the partner community and, as such, is a first step toward redesigning the system such that local or Indigenous knowledge is leading the research (Section 3.2.).

Building collaborations across disciplines and worldviews is not without challenges, especially relating to the nonlinear processes of building trust, relationships, and mutual understanding. For example, some setbacks the authors of this paper have experienced include timing mismatches between academic and community deliverables, research institutions not being set up to provide compensation or credit to nonacademic partners, mistakes and repair processes while learning community protocols, and lack of support for additional work, and responsibilities associated with relationship building and research dissemination (e.g., funding, supervisory support, institutional recognition). Additional challenges can arise when previous research processes have disingenuously engaged

with community partners, who in turn feel reluctant to engage with new researchers due to broken trust (51). Thus, we encourage researchers to remember that engaging in collaboration and trust-building across disciplines, worldviews, and partners is a nonlinear process that expands beyond the time and scope of each individual project.

Enhanced collaboration, engagement, and co-creation with partners inside and outside of research institutions increases the complexity of research processes. We recognize that not all natural scientists or disciplines are equally amenable to implementing this pathway due to resource limitations, institutional or disciplinary barriers, and career-stage, among other factors. For example, students and early-career researchers may be more primed to incorporate these principles into their research program development, especially if they enrolled in interdisciplinary post-secondary education programs that developed collaborative, interdisciplinary, or reflexive skill sets. However, they have often had less time than more established

Box 3.

The following case study describes research co-creation amongst Indigenous and academic partners in British Columbia, Canada.

An example of a research co-creation process was inquiry into the need for, and effectiveness of, Dungeness crab (*Cancer magister*) closures on the central coast of the place now known as British Columbia, Canada (52, 53). Four Indigenous communities (Heiltsuk, Kitasoo/Xai'Xais, Nuxalk, and Wuikinuxv First Nations), that together comprise the Central Coast Indigenous Resource Alliance, invited researchers from the University of Victoria to partner with them to investigate the status of Dungeness crab populations. The collective expertise and wisdom within that place, and within ecological and social sciences, allowed the team to bring together Indigenous knowledge, ecological science and modeling, and social science methods (52, 53). After decades of observations of decline by Indigenous fishers, the findings—along with years of discussions at management tables—resulted in closures of select bays important for constitutionally protected Indigenous crab fisheries. These closures would not have occurred without the high-resolution data produced through this collaborative research process. Overall, understanding the social contexts in which knowledge is produced through collaborating with diverse partners is central to positioning research to achieve meaningful outcomes beyond academic audiences.

researchers to grow trust and build relationships with diverse partners or collaborators. Moreover, the lower job security at this stage compared to tenured positions may preclude taking risks or reallocating time toward activities that are currently under-incentivized within many academic reward systems (e.g., research dissemination to communities). For these reasons, we emphasize that systemic and institutional transformations must accompany these calls for individual and collective action to enhance relationship-building with places of study. This is the focus of Pathway 3.

3. Pathway 3: Transform Systems of Knowledge Creation to Foster Place-Based Roots

Deepening connection and strengthening collaboration both require natural scientists to invest time and energy into learning about and building relationships with social-ecological contexts. This extra work is critical, yet currently under-incentivized within many research systems (38). Thus, this third pathway targets broader systemic transformations that can enable, reward, and support natural scientists to build place-based roots and relationships. We focus on two avenues that apply across career stages and to research systems throughout the world.

3.1. Restructure Training, Evaluation, and Funding Systems across Career Stages. The training provided to many natural scientists can be greatly improved to establish a foundation of knowledge and skill sets required to develop deep relationships with place and implement the suggestions outlined in Pathways 1 and 2 above. Revising training and research opportunities across undergraduate and graduate programs is a critical place to focus resources and transformation. One opportunity to foster deeper roots to place within training systems involves embedding student learning and research experiences within non-governmental organizations, government agencies, or community groups (Table 1; 21, 22). Embedded experiences can strengthen intellectual and emotional understandings of place, thus influencing research generation and impacts, and enhance awareness of research and employment opportunities outside of academic institutions. Cultivating this knowledge and experience in students can minimize “ivory tower” tendencies in research that disconnect it from practical needs (Section 3.2., 54). Training programs, curricula, or workshops could also be developed across career stages to learn and grow relationships with the history and social-ecological context of places of study (Table 1). Educating natural science students about diverse science communication approaches and social science practices and literature, including reflexivity and co-production, is also critical to deepening connection and strengthening collaboration. Finally, it is critical for natural science supervisors and instructors to support students who are interested in implementing the adapted research processes articulated in Pathways 1 and 2, even when the pathways fall outside of their established research programs. This support can include emotionally supporting students so they feel confident exploring and taking risks, connecting students with other faculty who can provide

training and resources outside the primary supervisor’s expertise, and working with students to seek and secure funding.

Hiring and evaluation processes are a second dimension of research systems that can be transformed to incentivize the development of deep relationships with places of study. In many current research systems, researchers are expected to move across multiple institutions and countries in search of educational or job opportunities (55). A broad transformative change is needed to recognize and reward early-career researchers who choose to develop roots in a single place on par with those who elect to move across institutions or locations (Box 4). For example, early-career researchers could be encouraged to take risks and dedicate energy strengthening collaboration if they knew that hiring institutions valued collaboration within and outside of academic systems, science communication and dissemination activities, and community engagement alongside traditional metrics of research success, such as academic citations (24). While we recognize the benefits of moving across multiple institutions and countries (e.g., knowledge and language acquisition, cultural exchange, diversification), we seek to build academic training systems that value both mobile and deeply rooted systems of knowing.

Restructuring funding programs is a third and critical dimension of systemic transformation to foster place-based roots within research systems. We identify two initial opportunities to restructure the funding landscape. First, funding agencies must diversify the types of supported activities, including but not limited to community events, honoraria and stipends to partners, and research dissemination products that access non-academic audiences and support community or partner needs (e.g., reports, documentaries, newsletters). This would require funders to recognize the value and process of long-term engagement with communities and non-academic deliverables. Funders who engage in trust-based funding practices play a critical role in advancing this pathway (60). Trust-based funding is increasingly being practiced between philanthropic, non-governmental, and community organizations, but is less commonly practiced by academic and research funding programs. Second, similar to hiring evaluation processes, funding programs should evaluate and reward researcher achievements across diverse metrics of success, including science communication, mentorship, community engagement, and collaboration (24). Collectively, these funding system changes can both support and incentivize natural scientists to implement the complex and resource-intensive transformations advocated for within this paper.

3.2. Cultivate Site-Based Research Capacity. A more fundamental and longer-term shift is needed to cultivate research capacities and engagement within communities. In addition to applying the training and funding transformations called for in Section 3.1. beyond academic and large research institutions, this shift toward valuing and supporting community-based researchers and research processes requires a cultural shift that embraces epistemological pluralism (32). Such a shift contributes to the decolonization of expertise (i.e., recognizing local and Indigenous knowledge) and enables local researchers to dictate research directions and carry out their own research beyond the scientific agenda of external academic partners (32). This shift can provide institutional support that enables

Box 4.

Institutional and national incentive systems to enhance place-based roots for Latin American researchers.

Fundamental differences between research systems of the Global North and South impact the ability of students from the Global South to maintain place-based roots. There is a general trend for students from the Global South to pursue degrees elsewhere due to disproportionate resourcing. Students who seek to return to their country-of-origin often face two fundamental barriers. First, the limited funding available to support researchers from the Global South is often restricted to studying sites within the countries providing the funding, usually in the Global North. Second, repatriation is often challenged by a lack of professional opportunities in countries of the Global South and access to community networks in the country-of-origin, despite high-level training (56–58). Mechanisms implemented by Latin American countries to address these barriers include requiring students to reside in their home countries for varying lengths of time as a condition upon degree completion (e.g., Chile, Costa Rica) and implementing national policy to support within-country research retention (e.g., Argentina). Students from the Global South will sometimes stay in the Global North while they engage in research back home (e.g., Mexican scientists in the US and Canada), constituting a “scientific diaspora” that develops strong ties and connections to places abroad, while supporting scientific capacity and development in the researcher’s home country (59). Additional opportunities to transform training and education systems for researchers from the Global South include funding and fellowship programs that support researcher retention, repatriation, and partnerships between Global South and North institutions that enable the flow of resources and ideas without requiring researchers themselves to uproot (Table 1).

researchers to be based in their communities rather than at remote institutions, for instance, through Extension programs, thus facilitating research by and for the researcher’s community (61).

Recognizing that research funding and infrastructure are often centered in academic and research institutions (typically in the Global North), the change we propose includes decentralizing the academic unit and funding programs to create site-specific centers that train and hire local experts who, in turn, can set research agendas, partner with locally relevant organizations, and produce knowledge that matters to place (see Table 1 for examples). This systemic change can empower local knowledge holders, produce information that is useful for local livelihoods, and provide opportunities to share this knowledge across broader networks. While care must be taken to ensure these decentralized knowledge hubs maintain agency and equal power, such arrangements build capacity within communities and provide a role model for youth to envision research as a career path. When research capacities are built within communities, there is no longer an “other” who has to be brought in to meet research needs.

4. Conclusion

Centering relationships to places of study through deepening reflection and communication about social–ecological contexts, strengthening collaboration, and advancing systemic transformations is critical to reduce the perpetuation of harmful research practices and generate research that fulfills community and societal needs. While our suggested pathways require additional effort by researchers, we emphasize that the outcomes generated will lead to more meaningful and impactful research. By working iteratively across the individual (Pathway 1), collective (Pathway 2), and systemic scales (Pathway 3), we hope actions will become easier and benefits more broadly distributed (Fig. 1). We do not expect individual researchers to work simultaneously across every pathway and avenue. Rather, we contend that the strongest impact will be generated if the collective natural

science research community concurrently advances and tracks changes across each pathway. For example, natural scientists who are completely new to these concepts may gravitate toward individual reflection and learning exercises, whereas those with more familiarity or who work in systems with greater flexibility may champion systemic transformations that open doors for more widespread collaboration, reflection, and transformation. The relevance and change-making potential of the specific avenues we articulate within each pathway will evolve with time based on each research system’s social–ecological context, evolving community and partner needs, and the ever-changing role of scientific research in society.

Last, we emphasize that any level of effort taken by individuals, groups, and across systems will lead to better and more impactful research. Expanded land acknowledgments can provoke deeper reflection and learning about the present-day effects of historical processes, and expanded positionality statements can facilitate more transparent interpretation and evaluation of research results and processes. Strengthened collaboration across researchers, partners, and communities can produce more ethical and applied outcomes and transformational insights. Shifted incentive structures and power dynamics within research systems can create space for more deeply rooted, relationship-rich, and place-based ways of knowing to thrive. Perhaps most importantly, by deepening our relationships with place and our knowledge of social–ecological contexts, we build more empathy and connections to place and people, both intellectually and emotionally. This can only strengthen the quality and impact of our research, and that is our vision for the future.

POSITIONALITY STATEMENT. We, the authors, are a group of interdisciplinary marine scientists with diverse personal and professional backgrounds. Collectively, our expertise spans archaeology, ecology, policy, oceanography, fisheries, and conservation science, and career stages, geographies, and institutional sectors (academia, government, not-for-profit organizations, Indigenous organizations). We comprise a subset of a cohort formed by COMPASS Science Communication as part of the Leaders for Sea Change program, which aimed to strengthen the

change-making potential of scientists who study climate change along the West Coast of North America. The origin of our cohort shapes the content and examples we provide, which are largely biased toward North American marine social-ecological contexts and North, South, and Central American institutional contexts. This geographic bias may limit the relevance of our suggestions. Our cohort origin also shapes the perspectives we include, which span myriad complex and diverse relationships with colonialism, geography, and identity. There are still gaps in participation that influence the overall recommendations. Finally, our cohort origin shapes the motivation for this piece, which explicitly aims to transform and improve research systems through incremental and place-based pathways. We recognize the limitations of our perspective and aim for this work to contribute toward a growing conversation about shifting research paradigms toward more relational framings.

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