

Toward productive complicity: Applying ‘traditional ecological knowledge’ in environmental science

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Abstract

Culture and tradition have long been the domains of social science, particularly social/cultural anthropology and various forms of heritage studies. However, many environmental scientists whose research addresses environmental management, conservation, and restoration are also interested in traditional ecological knowledge, indigenous and local knowledge, and local environmental knowledge (hereafter TEK), not least because policymakers and international institutions promote the incorporation of TEK in environmental work. In this article, we examine TEK usage in peer-reviewed articles by environmental scientists published in 2020. This snapshot of environmental science scholarship includes both critical discussions of how to incorporate TEK in research and management and efforts to do so for various scholarly and applied purposes. Drawing on anthropological discussions of culture, we identify two related patterns within this literature: a tendency toward essentialism and a tendency to minimize power relationships. We argue that scientists whose work reflects these trends might productively engage with knowledge from the scientific fields that study culture and tradition. We suggest productive complicity as a reflexive mode of partnering, and a set of questions that facilitate natural scientists adopting this approach: What and/or who is this TEK for? Who and what will benefit from this TEK deployment? How is compensation/credit shared? Does this work give back and/or forward to all those involved?

Keywords

culture, environmental science, essentialism, indigenous and local knowledge, local environmental knowledge, productive complicity, TEK

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Introduction

“Traditional ecological knowledge,” “indigenous and local knowledge” and “local environmental knowledge” (hereafter “TEK”) have become increasingly popular concepts in environmental research, conservation, restoration, and management (e.g. Berkes, 2018: 2, 23–27; Hill et al., 2020; Johnson et al., 2016; Molnár and Babai, 2021; Sidorova, 2020). Since the 1990s, when the UN passed legislation and held summits that promoted using TEK in environmental research, policy, and decision-making (Berkes, 2018: 23–27; Buell et al., 2020; Sidorova, 2020), increasing numbers of conservation biologists, ecologists, and environmental scientists (hereafter “environmental scientists”) have included TEK in their work, at times “playing the roles of anthropologist, political advisor, economist, and sociologist” (Drew, 2005: 1286). As a result, diverse environmental sciences have joined the ranks of anthropology, heritage studies, and other fields preoccupied with “tradition” and “culture” and the knowledge it comprises. In these branches of science, scholars (hereafter “anthropologists”) have debated the development, dissemination, reproduction and usage (or non-usage) of “tradition,” “culture,” and “traditional culture” for well over 100 years. Their knowledge production was at times problematic. For example, anthropologists created (and critiqued) representations of “culture” that gave the impression that non-western practices and knowledge’s were timeless and eternal (e.g. Fabian, 2014), or that the groups studied were more homogenous than they actually were (e.g. Ardener, 1972). As environmental scientists increasingly incorporate TEK in environmental research and management, they confront similar critiques. For example, Arctic scientists who use TEK in scientific reports and assessments have been criticized for overly homogenizing indigenous groups (Sidorova, 2020) as have orangutan conservationists in Borneo (Chua et al., 2020), while environmental science use of TEK more generally has been described as “freezing” or “distorting” this knowledge (Berkes, 2018: 27) and creating “distilled TEK artefacts” (Molnár and Babai, 2021).

Anthropology and environmental science are research endeavors directed toward different ends. Nevertheless, this article departs from the premise that environmental scientists, by engaging with the scientific fields that have been studying culture, may avoid errors that anthropologists have already made. To facilitate such learning, we use knowledge from anthropology and related social sciences to assess a sample of 112 peer-reviewed articles, published in 2020, in which environmental scientists (in some cases, working in research teams that include social scientists) use TEK. Our goal is not to suggest that environmental scientists should work with anthropologists (cf. Chua et al., 2020), adopt long-term, qualitative participatory research methods (cf. Molnár and Babai, 2021) or eschew engaging with TEK unless research is led by a TEK-holder (cf. Eckert et al., 2020). Rather, we wish to facilitate environmental scientists’ use of TEK by highlighting trends in contemporary work that can be problematic. In other words, we support environmental scientists’ attention to TEK and join those seeking to improve scientific practices and institutional structures in relation to it (e.g. Berkes, 2018: 42, 67, 261, 278, 291–292; Chua et al., 2020; Davies et al., 2020; DiPrete Brown et al., 2020; Eckert et al., 2020; Hall et al., 2021; Malmer et al., 2020; McElwee et al., 2020a, 2020b; Molnár and Babai, 2021; Weiskopf, 2020; Wheeler et al., 2020). For example, TEK is an integral component of IPBES, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (Hill et al., 2020; McElwee et al., 2020a, 2020b). Yet despite positive intentions and much work, scholars who have participated in IPBES’ global assessments express concerns that TEK is “flattened” in the attempt to produce synthetic knowledge (McElwee et al., 2020b). Social scientists describe IPBES’ usage of TEK as distortive (Löfmarck and Lidskog, 2017), placing TEK in a marginalised position vis-à-vis “scientific knowledge” (Turnhout, 2018; cf. McElwee et al., 2020a), and struggling to manage the expectations of different stakeholders (Obermeister, 2019). IPBES is not the only institution whose efforts to incorporate

TEK into ecological work is criticized; related points have been made about TEK's inclusion in the Arctic Council's environmental management and climate change impact assessments (Sidorova, 2020; Wheeler et al., 2020) and Canadian environmental co-management with indigenous groups (Buell et al., 2020; Schott et al., 2020).

These discussions are relevant beyond environmental science. In the Anthropocene, researchers from a variety of disciplines are drawn to the (anthropological) idea that "Traditional societies have much to teach us about experiencing and responding to epic social and environmental changes" (Thornton and Malhi, 2016: 202; see also Berkes, 2018: 81–108, 179–202). For example, environmental legal scholars increasingly take inspiration from indigenous or non-western legal traditions (e.g. Iorns Magallanes, 2019; Villavicencio Calzadilla and Kotzé, 2018). Given this trend, discussing how we as researchers engage with, deploy, and represent traditional knowledge is crucial.

In the following section, we describe TEK as a scholarly category. We then present our sample and methods. Next comes analysis of peer-reviewed environmental science publications from 2020 that engage with TEK. Using anthropological insights, we discuss two linked trends in this literature, ones that we have also experienced in collaborations with environmental scientists who use and discuss TEK: a *tendency toward essentialism* and a *tendency to minimize power relationships*. We propose *productive complicity* as a reflexive mode of engagement for scientists who work with TEK (or other aspects of "culture" in other fields). We conclude by suggesting four guiding questions for those conducting research on and/or with TEK for environmental scholarship, management, restoration, and conservation.

What is TEK?

Humanity exhibits multiple ways of understanding and relating to what some refer to as "nature." Throughout history and across diverse environments, groups of people have shown remarkably varied ways of associating with and making meaning of their surroundings. Over the past 200 years or so, "western scientific knowledge" has attained high status as a way of engaging with "nature," with boundaries drawn contrasting western scientific knowledge and practice with "non-" or "less" scientific approaches (Gieryn, 1999; see also Cajete, 2020; Davies et al., 2020).

Since the 1990s, increasing numbers of scholars, activists and policymakers have sought to improve knowledge about "nature" by acknowledging and incorporating TEK. TEK is a label for forms of place-based knowledge developed over time through methods other than those used in modern western science which "has served to sustain" specific groups "through generations of living within a distinct bioregion" (Cajete, 2020:2). While scholars have offered different definitions of TEK (e.g. Dove, 2000: 242; Weiskopf, 2020), in the literature we discuss below a popular definition derives from the work of marine ecologist Fikret Berkes, who describes TEK as "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationships of living beings (including humans) with one another and with their environment" (2018: 8). Philosopher Weiskopf (2020: 2) elaborates that:

- (1) TEK is an interweaving of beliefs and practices, hence something that is embodied not just in the mind but in action and material culture
- (2) it is adaptive, hence persists in virtue of making some substantial contribution towards group survival and flourishing;
- (3) it is passed down by the mechanisms that ensure the replication of other aspects of culture, rather than in any special-purpose fashion; and
- (4) it takes as its subject matter the organization of the living world in the widest possible sense.

In the publications we examine, TEK is often characterized as practical, “empirical rather than theoretical” (Joa and Schraml, 2020: 3); transmitted orally or outside of formal educational settings, and distinctive of particular social groups. TEK is considered to be different from western scientific knowledge (e.g. Sotero et al., 2020; Stenekes et al., 2020), although the extent to which this is the case is a matter for empirical investigation (e.g. Cebrián-Piqueras et al., 2020; see also Berkes, 2018: 13). Whether or not TEK and western science are translatable or commensurate is a topic for debate (e.g. McElwee et al., 2020a; Schott et al., 2020; Sidorova, 2020; Wehi et al., 2020; see also Weiskopf, 2020). Finally, the scholars whose work we discuss agree that TEK is valuable. What this entails varies: TEK may be a source of better ethics or worldviews (e.g. Mazzocchi, 2020; Zidny et al., 2021); a way to achieve sustainability (DiPrete Brown et al., 2020; Hosen et al., 2020); part of ecosystem services (Afentina and Wright, 2020); a source of knowledge about environments and/or environmental processes that researchers are unable to investigate using western scientific methods (e.g. Davies et al., 2020; Ferreira-Rodríguez et al., 2021; Peacock et al., 2020); a way to make environmental initiatives more palatable to local groups (Matuk et al., 2020; see also Chua et al., 2020); or a resource for ecotourism (Zerbe et al., 2020), development (Congretel and Pinton, 2020), health data (Samuel-Nakamura, 2020), or pharmaceutical knowledge (Gaddy, 2020; Schultz et al., 2020).

Methods

The literature using TEK is enormous. Typing “Traditional Ecological Knowledge” into Google Scholar produces approximately 2,770,000 results. Here we examine a snapshot of environmental scientists’ TEK usage, limiting our sample to English-language peer-reviewed articles and book chapters by environmental scientists (some working in research teams that include social scientists) published in 2020¹. This pragmatic choice misses TEK engagements published in other years or languages, but yields a portrait of present-day environmental science TEK use. To locate the publications, we consulted environmental-scientist colleagues about search engines, and then searched within Web of Science for peer-reviewed articles using the search terms “Traditional Ecological Knowledge,” “Indigenous and Local Knowledge” and “Local Environmental Knowledge.” We expanded these results with papers that met the search criteria but were located via other search engines or recommended to us, producing a sample of 112 publications.

We began analysis by reviewing the publications’ abstracts and introductions with two questions in mind: (1) to what extent, if any, do the discussions of TEK reflect issues related to “culture” and “tradition” debated in anthropology and/or our own experiences discussing TEK with environmental scientists who use it; and (2) to what extent, if any, do the authors seek to advise others on how to engage with TEK. Our mode of analysis was abductive: we moved between anthropological knowledge around the study of culture and the sample in order to interrogate the assumptions behind environmental science usage of TEK (see Alvesson and Sandberg, 2011; Sandberg and Alvesson, 2011). Within the 112 publications, we identified 27 articles (highlighted in Supplemental Appendix A) which advise on how to integrate TEK with environmental science. We view these articles as illuminating current research debates and criticisms concerning TEK usage in environmental science. The remaining 95 articles we take as representing “ordinary” TEK research use. Following this initial reading, our methodology was two-pronged. Singleton read the 95 articles applying TEK and categorized them according to issues raised by anthropologists. Gillette read the 27 “how-to” articles with an eye to patterns in the kind of advice they offered, using emic categories or “grounded theory.” She also scrutinized them for evidence of the two tendencies. The entire author team then collaborated to distil a list of potentially problematic usages into the two tendencies discussed below.

Over the past 20 years during which TEK has developed as a “discipline” (Berkes, 2018), many scholars have debated its significance and usage in environmental research, conservation, restoration, and management. Much of the 2020 literature is sensitive to criticisms raised in the past; the “how-to” publications in particular demonstrate that many environmental scientists work against the “quantitative,” “reductionist,” and “instrumentalist” approaches that motivated Berkes to publish *Sacred Ecology* (Berkes, 2018: xiv, 11). Still, the sample texts show, albeit to varying degree, two traits that we argue would be ameliorated by approaching TEK use as productive complicity.

Tendencies of TEK use

First, a *tendency toward essentialism* characterizes the sample. TEK may be presented as belonging to a discrete group of people, for example, “Inuit TEK,” “Rapa Nui TEK,” etc. (e.g. Friedlander and Gaymer, 2021; Henri et al., 2020; Kourantidou et al., 2020; cf. Nadasdy, 1999). Frequently, this group-specific TEK is meta-essentialised as generically comparable to other TEK. Second, and linked to essentialism, the publications have a *tendency to minimize* or pay inadequate attention to *power relationships*. TEK collaborations entail relationships with experts, usually scientists who seek to use TEK to achieve their research, conservation or environmental management goals (e.g. Davies et al., 2020; Hastings et al., 2020; Peacock et al., 2020). Such relationships have power dimensions that affect the research’s outcomes. Neither essentialism nor power relationships are inherently problematic, yet the two tendencies demand careful, conscious (or *reflexive*) handling.

Tendency toward essentialism

According to one definition, essentialism “is a metaphysical doctrine that holds that objects have essences—that is, intrinsic, identifying or characterizing properties that constitute their real, true nature” (Schwandt, 2001: 72). In relation to culture, essentialism often means that certain characteristics of a given culture are deemed definitive and indicative of any given instance of it. These characteristics can be almost anything. For example, French rugby fans may refer to the English team as “*les rosbifs*” (roast beefs). England supporters may refer to French people as “frogs.” In both cases, people are essentialising: highlighting perceived dietary preferences/habits as definitive of the other group. To state the obvious, not all English people eat roast beef and not all French eat frogs; these essentialisms obscure such dietary (and other) differences within each group. Often essentialism draws on narratives of the past, present, and future, for example in relation to particular practices. This is visible in conflicts over presentations of “primitive art” and the status of western museum objects “collected” through colonialism (Price, 1989). Within anthropology, critiques of essentialism often relate to the political (power-related) implications of specific essentialisms (such as representations of “indigenous groups”) as well as the tendency of essentialism to homogenise and disguise diversity within groups.

Essentialism is not only a practice that an outsider does to another group. Groups essentialise themselves and such essentialising has been part of many emancipatory calls for action (e.g. Tamale, 2020) and successful claims for involvement in environmental management by indigenous groups (e.g. Green, 2009, 2014). The indigenous rights movement has created discursive resources that have been called “strategic essentialisms” which groups have used in a variety of struggles for rights (e.g. Lonetree, 2012; Rubis and Theriault, 2020; Turner, 1992). Groups locked in conflict often essentialise strategically (Gaard, 2001; Lonetree, 2012; Nilsson Dahlström, 2018; Turner, 1992; Van Ginkel, 2004). Further, while anthropologists have often criticized one another’s scholarship as essentialising—making anthropology an “increasingly . . . guilty discipline, desiring to escape its complicity in pernicious othering” (Gable, 2014: 252)—essentialism need not in itself

be problematic. Constructing orderings is an inevitable part of how human beings interact with the world. Categorization and classification processes, which are inevitably essentialising, are required to deal with the infinite diversity of reality (Kendall and Wickham, 2001).

Essentialism is inherent to the TEK literature, in the sense that various aspects of people's ways of life, in this case related to "nature" or local ecosystems, are connected to a particular group of people. This is often a key methodological step in environmental scientists' engagement with TEK: a group of TEK-holders with TEK relevant to science is defined (e.g. Cebrián-Piqueras et al., 2020). Within our sample, degrees and kinds of essentialism varied considerably. Some researchers were extremely careful to discuss the detailed, ongoing and active process through which TEK was defined and agreed upon (e.g. Davies et al., 2020). Others were considerably less forthcoming about the process by which the knowledge of a small subgroup became definitive of the TEK of a greater whole (e.g. Cheng et al., 2020). Yet as other scholars have noted, in any given context people may disagree about who has TEK and who is allowed to speak for the whole (Chua et al., 2020; see also Berkes, 2018: 67).

In many of the sample cases, essentialism around TEK makes perfect sense. For example, in some articles researchers essentialise *fishers'* knowledge of marine environments as the TEK related to underwater ecologies that characterizes a whole group and is relevant to science (e.g. Barbosa-Filho et al., 2020; Bulengela et al., 2020). In other cases, the logic behind essentialism is unclear. For example, one publication describes a local indigenous community crafting items "non-native" to their own cultural repertoire in order to sell them to tourists (da Silva et al., 2020). This characterization raises two points. First, essentialism of one group may directly influence another. Second, if we accept that TEK is, as Berkes (2018) stresses, dynamic and adaptive knowledge in practice, then labelling the products of local crafting practices as "non-native" deserves interrogation.

In general, the texts do not discuss potential negative impacts of essentialism, which can connect to on-going violence and the operations of power within and among different groups. Anthropology is rich with examples that illustrate how essentialism can contribute to injustice and inequality. For example, essentialising Sámi as reindeer herders has made struggles for the rights of non-reindeer herding Sámi, whose needs are rather different, more difficult (Åhrén, 2008; Arora-Jonsson, 2019; Lantto, 2000, 2018; Mörkenstam, 1999, 2002). Essentialisms of the "Ecological Indian" (Krech, 1999; Nilsson Dahlström, 2018), meaning the idea that indigenous Americans are "natural conservationists," have been linked to antagonistic antiwhaling campaigns in Washington State (Coté, 2010; Van Ginkel, 2004). Likewise, essentialising Australian Aboriginal groups as country-dwelling hunter-gatherers harms many urban-dwelling Australian aborigines, whose "authenticity" is continually monitored (Maddison, 2013).

In some publications, we see a rhetorical jump from discussions of specific groups and their TEK to discussions of TEK-holders as a whole, a kind of *meta-essentialism* related to the (essentialised) category "TEK" (cf. Singleton, 2016). Meta-essentialism often happens even as researchers acknowledge that groups possessing TEK differ. To take one example, Sierra-Huelsz et al. write, "traditional ecological knowledge is embedded in a diverse array of ontologies, epistemologies and rationalities," a statement which highlights variation (2020:2). Yet in the very next sentence, the same authors meta-essentialise TEK-holders, stating, "Under these traditions, nature and society tend to be more intertwined concepts, and the human species considered as an element of nature." Taking a second example, McElwee et al. (2020a: 351, 353) discuss the difficulties of staying attentive to TEK as contextualized knowledge while also seeking to "scale up" and "synthesize," a dilemma that highlights how meta-essentialism undergirds arguments about why scientists and policymakers should pay attention to TEK, such as IPBES' claim that TEK supports biodiversity (ibid., 346).

Several articles stress certain types of ecological understanding, spirituality and consciousness as definitive of indigenous peoples (e.g. DiPrete Brown et al., 2020; Mazzocchi, 2020; see also Berkes, 2018), although there are exceptions (Cold et al., 2020). In many cases this meta-essentialism is accompanied by a broader criticism of modernity (e.g. Bulengela et al., 2020) and arguments about re-establishing “traditional roles as stewards of the land” (Popp et al., 2020: 296). Here meta-essentialism disguises the specificity of TEK, homogenizes groups that are in fact quite different, creates an opposition between TEK and other forms of knowledge that may not reflect particular realities, and, in some cases, overplays the sustainability of TEK (see also Chua et al., 2020; Congretel and Pinton, 2020; Sidorova, 2020).

Meta-essentialism of indigenous groups, what could be called “the ecological indigene,” bear a resemblance to historical representations of the “noble savage” which have been integral to colonial depictions of the colonized other (cf. Nilsson Dahlström, 2018; Price, 1989; see also Berkes, 2018: 249–259). Such ideas are problematic. The “ecological indigene” is a stereotype that many indigenous groups are forced to react to yet did not themselves create or control (Nilsson Dahlström, 2018). It is also one of the ways that indigeneity is commodified (Westberg, 2021). As other scholars note, not all indigenous people have a “conservation ethic” (Berkes, 2018: 274), and indigenous people’s goals may not match environmental scientists’ goals (Berkes, 2018: 257–259). In other words, the “ecological indigene” signifies a group whose TEK is good/useful TEK *from scientists’ perspectives*.

This essentialism raises questions about which TEK is valuable and the rights that TEK-holders whose TEK does not gel with scientific aims or norms can claim. As we have noted, TEK is often connected to sustainability, including by institutions such as IPBES (Hill et al., 2020). What does this suggest about “unsustainable” TEK? Is TEK that does not support western scientific visions of sustainability valueless? “Ecological indigenes” and to some extent the notion of TEK itself raise questions about whose knowledge counts and who is a legitimate producer of knowledge, on what grounds and with what aims. Related to this point, we observe a divergence between our sample and the social science literature: in the former, TEK and western science are integrated or used in parallel in a manner that the authors find productive (cf. Eckert et al., 2020; Sidorova, 2020), while in the latter, accounts of conflicts receive significant attention (e.g. Held, 2020; Nadasdy, 2011). Whether, to what extent, and toward what ends environmental scientists who use TEK also publicize case studies of conflicts deserves further scrutiny.

Another problematic feature of essentialism is how it disguises individual creativity. Berkes’ definition of TEK speaks of “a cumulative body of knowledge, practice, and belief” (2018:8). Potentially, this contrasts societies of collective innovation with societies that produce rugged individualists. Several articles in our sample stress the ancient character of the knowledge that TEK-holders possess. Many refer to TEK as transferred over “generations” (e.g. Cajete, 2020; Cold et al., 2020; Crema et al., 2020; Galappaththi et al., 2020; Hosen et al., 2020; Hutton and Allen, 2020; Mazzocchi, 2020; Shokirov and Backhaus, 2020; Thorn et al., 2020). Talking about TEK this way subsumes individual genius and creativity into the group, much in the manner that “primitive art” is credited to entire cultures rather than individual artists (Price, 1989). Such essentialisms deny credit to innovative individuals and (sub)groups, who occasionally can appear almost inert, timeless and passive in the sample (e.g. Campbell et al., 2020; Mattalia et al., 2020a). At the same time, care is also needed when focusing on the role of individuals, as crediting individuals with knowledge or innovation may obscure the collective nature of current and historic scientific and technical progress.

An example illustrates some of these challenges. In an article on Romanian livestock guardian dogs, the commonalities of herders over different historical epochs are stressed—an essentialism. While the article draws primary material from the TEK of a specific group of herders, historical

data from the nineteenth century and the present in the form of photos and quotations indicate continuations and commonalities (Ivaşcu and Biro, 2020). In stressing the historical continuity of practice, there is a risk that the authors underrepresent the distinctiveness and creativity of adaptation among particular herders. It may also feed into current and future societal conflict (the article itself mentions a conflict with hunters).

Within the sample, essentialism and meta-essentialism sometimes produce a bifurcated representation of TEK-holders, who are depicted as creative and adaptable within their environment on the one hand, but simultaneously threatened by or vulnerable to modern trends on the other (Pearson et al., 2021; Rubis and Theriault, 2020; cf. Koot, 2015). In some cases, publications convey the impression that people and their lifestyles require protection from modern threats (e.g. Ambu et al., 2020; Aziz et al., 2020; Uchida and Kamura, 2020; Varga et al., 2020; cf. Fontefrancesco and Pieroni, 2020). No doubt this is sometimes accurate; there is a limit to resilience (Folke, 2006). To take an obvious example, climate change in some areas is occurring at a speed and intensity that TEK-holders (and others) find it difficult to cope. Still, essentialising TEK as threatened by a vague “modernity” contradicts an understanding of TEK as adaptive learning and knowledge in practice, a process of creation, not a body of knowledge (Berkes, 2018; Congretel and Pinton, 2020). Knowledge migrates over geographic distances and adapts to new pressures, and people are able to communicate beyond epistemic divides (Agrawal, 1995).

We reiterate: essentialism is not necessarily problematic. Any effort to include TEK in conservation, restoration, environmental management and/or research necessarily entails some essentialism. Some sample texts avoid and combat stereotypical and problematic essentialisms like the “ecological Indian” by rendering visible the knowledge of “atypical” TEK groups, such as “non-indigenous,” “Western,” majority-group, property-owning citizens (e.g. Ciftcioglu, 2020; Ferreira-Rodríguez et al., 2021; Joa and Schraml, 2020). In others, researchers take care to identify specific individuals with whom they worked, thus acknowledging individual creativity (e.g. Bogardus et al., 2020). In some cases, authors describe the measures that they took to be sensitive to differences in TEK “ownership” and deployment within the group (e.g. Davies et al., 2020; Henri et al., 2020). A few researchers are clear their work with TEK-holders (and its attendant essentialisms, although they do not use this concept) had political implications and was linked to a broader configuration of power within which the TEK-holders were fighting for control over resources (e.g. Buell et al., 2020). It is to this topic, power relations, that we now turn.

Tendency to minimize power relationships

In the “how-to” literature, many authors state that “power asymmetries” negatively affect researchers’ engagements with TEK (e.g. Eckert et al., 2020; Hill et al., 2020; Kourantidou et al., 2020; Malmer et al., 2020; Matuk et al., 2020; McElwee et al., 2020a, 2020b; Schott et al., 2020; Villagómez-Reséndiz, 2020; Wheeler et al., 2020). The aspect of power relations that receives most attention is how to produce knowledge that includes both western science and TEK, with many arguing that scientists must do more than integrate TEK into a western science framework (Buell et al., 2020; Cajete, 2020; Chua et al., 2020; Eckert et al., 2020; Hall et al., 2021; Hastings et al., 2020; Henri et al., 2020; Hill et al., 2020; Malmer et al., 2020; Matuk et al., 2020; Villagómez-Reséndiz, 2020; Wheeler et al., 2020; see also Molnár and Babai, 2021). Several how-to articles suggest that power asymmetries can be managed methodologically (e.g. Davies et al., 2020; Ferreira-Rodríguez et al., 2021; Malmer et al., 2020; McElwee et al., 2020a, 2020b; Peacock et al., 2020; Samuel-Nakamura, 2020; see also Molnár and Babai, 2021). We agree that the methods used to integrate western science and TEK significantly affect the knowledge produced, but “power

asymmetries” cannot be fully addressed by methods. As Matuk et al. (2020) argue, attitudes, ethics, and reflection, what anthropologists call *reflexivity* (see next section), also matter.

A *tendency to minimize* (or pay inadequate attention to) *power relationships* plays out in multiple registers in the sample. The first relates to internal power dynamics in the TEK-holding group. It is quite common that particular essentialised groups, for example, “elders” (Bowles et al., 2020), “senior knowledge custodians” (Davies et al., 2020:6), “hunters” (Peacock et al., 2020), etc., are given status as TEK experts. This is not necessarily problematic; indeed, it is a feature of purposive and snowball sampling employed in qualitative social science. However, members of TEK-holding groups may or may not agree about who is and is not a TEK-holder and/or authorized to share TEK. Many texts in the sample provide few details about who was involved in the selection of TEK experts and the extent to which other community members were given the chance to deliberate this choice (e.g. Ferreira-Rodríguez et al., 2021; Friedlander and Gaymer, 2021; Kourantidou et al., 2020; Matuk et al., 2020; Peacock et al., 2020; Schott et al., 2020) ². Furthermore, even researchers who are explicit about whom they worked with can minimize their partners’ internal politics. For example, Davies et al. (2020) contains a broad and sensitive description of their TEK-holding collaborators, the Anindilyakwa people of the Groote Eylandt Archipelago, Australia. Yet in outlining their methods, the authors do not explore or problematize the extant power structures within Anindilyakwa communities. How the initiative affected and was affected by these power structures is unknown. Instead, the chosen experts “come to be seen not as individual personalities but as representatives of an amorphous, homogeneous, authentic community” (Conklin and Graham, 2009:704).

Minimizing power relationships in this mode relates to another aspect of how power informs TEK-based research: scientist-TEK-holder collaboration may reshape local power relations. Indeed, implicit to several papers is the idea that scientific findings will aid societal development (Mattalia et al., 2020b; Mustafa et al., 2020; Pasta et al., 2020). Yet the results of such shifts may be positive or negative, for the group as a whole, specific individual members, and/or subgroups. One potential result of scientist-indigene relationships is described in Conklin and Graham’s study of the Kayapó: “In acquiring the linguistic skills, cultural savvy, and political connections required to deal with outsiders, bicultural mediators may become alienated from their local communities” (1995: 704; cf. Burman, 2018). Additionally, if prestige or value comes to be attached to “expert knowledge” then competition may emerge between those seeking authority within a community, for example if certain actions (dis)favor particular authority figures (Gaard, 2001). The sample ignores such possibilities. For example, one publication seeks to access the TEK of traditional healers in Greater Mpigi, Uganda (Schultz et al., 2020). The researchers are commendably committed to “giving back” to respondents yet neglect to consider the political and social impacts of implicitly endorsing particular medical authorities in complex healthcare settings (cf. Whyte, 1997).

A case from the sample where the authors explicitly discuss transforming power relations is Schott et al. (2020). In this collaborative project, scientists worked with a local Arctic community to gather data on fish genetics. The authors explain that weather conditions make it difficult for researchers to gather data beyond the summer months, and the descent of environmental scientists during a condensed time-period can overwhelm locals. In their research, the scientists trained some locals to gather data for genomic analysis, including sterile techniques and fisheries sampling methods. In an effort to respond to local interests, they also trained some youth how to provide country food for themselves and others. The authors state that the project affected power relations: the community “are starting to ask important questions” about fisheries management, and know how to do scientific sampling (224). The implication is that this is empowering, yet exactly how

and who is empowered are unclear, as are the consequences for those who did not participate in the training.

As our discussion of “elders” and “hunters” suggests, essentialism can play into a tendency to minimize power relations. In some publications, scientists apparently neglect to consider the political hierarchies or struggles they are supporting or suppressing (but cf. for example Buell et al., 2020; Davies et al., 2020; Eckert et al., 2020; Hausner et al., 2020; Henri et al., 2020). A striking example is Mustafa et al. (2020), in which the authors appear to accept essentialisms integral to particular nationalist readings of history. In the article, researchers analyze the differences in TEK held by ethnic Albanians and Serbs in Kosovo, essentialising two groups of elderly people as representative of wider national cultures. The categories “Albanian” and “Serb” are treated as if they were inherently separate, without apparent consideration of the implications of such a “split” version of history in this highly-charged political context. Could there not be a shared Kosovan ethnobotany that both groups may be part of? In another essentialism, the article also seeks to evaluate “herbophilia” Serbian culture (18). Such language feeds into political struggles in the Balkans.

As other scholars have noted, any TEK-based collaboration is affected by political struggles both internal and external to the collaborating groups (e.g. Chua et al., 2020; Sidorova, 2020). Nevertheless, some of the environmental scientists doing TEK research idealize their work as largely non-political and purely scientific. For example, several studies depict their activities as simply gathering data points, for example, proverbs (e.g. Garteizgogeoasca et al., 2020), human-animal interactions (e.g. Melovski et al., 2020), or local species names (e.g. Mattalia et al., 2020a). If TEK is credited to ancestors (cf. Afentina and Wright, 2020), scientists may feel this recording is apolitical. However, by adopting this characterization (an essentialism), the scientist joins an ongoing political conversation about how and *which* ancestors are remembered or forgotten and why (cf. Thompson, 1979: 80). Likewise, recording local species names, proverbs, or human-animal interactions provides resources for local sovereignty movements and a tacit endorsement of particular people’s voices as TEK-holders³. This may be unproblematic or even desirable from respondent and/or researcher perspectives, but it affects power relations. Put another way, even research aspiring to neutrality and objectivity has a political footprint and thus sociological implications.

Bowles et al. (2020) provides a case related to the apolitical aspirations of science. In their collaboration to understand harvest-induced genetic changes in walleye populations, the researchers cooperated with indigenous Cree people living near Mistassini Lake in northern Quebec and involved indigenous researchers. The article ends with co-authored reflections on the collaborative process. The scientists are clearly sensitive to power relations. However, they also state superficially that “past colonialism” is a reason TEK collaborations are needed (1141). This excludes the possibility that *contemporary* colonialism might affect the study (see also Wheeler et al., 2020). Indeed, ongoing colonialism is implicated in many of the issues environmental scientists seek to address (cf. Norgaard et al., 2018).

Another way in which power relations are sometimes minimized relates to the fact that environmental scientist-TEK initiatives do not necessarily bring anything of worth to the TEK-holders. Some of the how-to literature is sensitive to this fact (e.g. Buell et al., 2020; Hall et al., 2021; Hastings et al., 2020; Schott et al., 2020; Sidorova, 2020), but other parts of the sample are not (e.g. Brackhane et al., 2019; Caballero-Serrano et al., 2019; Ferreira-Rodríguez et al., 2021; Florko et al., 2020; Garteizgogeoasca et al., 2020; Hosen et al., 2020; Irigoyen et al., 2021; Jewell et al., 2020; Khan et al., 2020; Ludwinsky et al., 2020; Patankar et al., 2020; Sinthumule and Mashau, 2020; Uchida and Kamura, 2020; Zhang et al., 2020). As others have noted, environmental scientists and locals may in fact have divergent priorities for a given environment (Chua et al., 2020; see also Berkes, 2018: 259–264).⁴ Linked to this, within the sample (and science in general) is an

assumption that rendering knowledge visible (often by publishing) is inherently good. In the words of social scientists Rubis and Thibault, “As activists and scholars, we have been conditioned to think of institutional “visibility” as a form of empowerment for socio-politically “invisible” populations and therefore also a necessary part of accountable research” (2019: 4). However, there are many political situations where people may wish to play down their distinctiveness, and environmental scientist-TEK-holder collaborations can lead to management initiatives that work against local groups’ or subgroups’ desires or interests. Further, scientists of all stripes accrue money and prestige through their work often far beyond local horizons (Burman, 2018)⁵. Locals, on the other hand, may see the world becoming aware of them and their landscape as the beginning of the end. “Visibility is a dilemma,” note Rubis and Theriault (2020: 14).

Another way in which scientist-TEK engagement is implicated in power relations occurs when TEK-holders and scientists believe that they are speaking about the same things, when their ways of seeing the world are actually quite different (Blaser, 2009; see also Marshall, 2019; Weiskopf, 2020). Probably the most obvious way that such differences manifest is when TEK and western science categories do not map onto one another (e.g. Davies et al., 2020). Another is when researchers describe diverging priorities between environmental scientists and TEK-holders, for example, about which species are valuable in a given environment (e.g. Buell et al., 2020). The implications of these differences can be enormous (cf. Love, 2021). For example, anthropologist Paul Nadasdy describes the breakdown of a collaboration between wildlife biologists and Yukon First Nation people to manage a wolf population (2011). The two groups cooperated at first, but the collaboration disintegrated when the project’s methods of keeping wolf numbers in check turned to wolf sterilisation rather than killing. Killing was understandable and ritually manageable within Yukon First Nation conceptualizations of the relationship between human-persons and wolf-persons. By contrast, sterilisation inherently disturbed this relationship by treating wolves as things to be owned, rather than persons to be dealt with in the appropriate way, thus threatening the community’s ability to live up to its obligations to wolf-people. The management initiative concealed divergence between wildlife managers and First Nation people and ended in the exercise of power: the wildlife biologists went forward with sterilisation and the illusion of agreement disintegrated. This kind of difference goes beyond the issue of whose knowledge counts, an issue to which many environmental scientists working with TEK are sensitive (e.g. Hall et al., 2021; Schott et al., 2020; see also Molnár and Babai, 2021). Rather, it raises the question of whose reality is allowed to be real (see Burman, 2017).

Toward productive complicity

The two tendencies that we identify in the sample—which manifest to greater or lesser degree in any individual text, in ways that may or not be problematic—are also found in anthropological scholarship. Anthropologists have spent decades debating essentialism and the workings of power in relation to culture and their own knowledge production. We do not expect environmental scientists to immerse themselves in this literature (not in the least because environmental science is directed toward other purposes than anthropology). We do, however, think there are useful lessons to be learned from it.

Some of this knowledge is presented in the how-to literature. For example, the point that *TEK is processual and relational* is recognized by many scholars (e.g. Congretel and Pinton, 2020; Davies et al., 2020; Hill et al., 2020; Sidorova, 2020; Weiskopf, 2020; see also Molnár and Babai, 2021). However, fewer environmental scientists take the next step and connect this insight to their own essentialisms. Any particular instance of demarcating TEK (be it a group or a locale) makes its dynamism and its relations to other knowledge’s and practices harder to see—which is one

reason why we describe the tendencies toward essentialism and minimizing power relations as linked.

That *TEKs* (we emphasize they are plural) *are heterogeneous* is a second insight from anthropology, which is acknowledged by environmental scientists involved with TEK (Berkes, 2018). However, it bears repeating that contemporary “traditional communities” are the products of long histories of (often imperialist and colonial) contact with the wider (capitalist) world (Love, 2021; cf. Wolf, 1982]), and what is observable today is the product of that contact. These histories are political, and what people remember may be a source of conflict. There may be reasons people choose to conceal TEK (see Rubis and Theriault, 2020). This may cause people to seemingly appear or disappear in the historical record (see Ybarra, 2018). Furthermore, as others have written, traditional does not necessarily mean “ecological” in the sense of environmentally friendly or sustainable, and the goals of environmental scientists and locals may conflict and spill out into wider social settings. Finally, recognizing the heterogeneity of TEKs also helps us recognize the heterogeneity of western science and its practitioners (see also Berkes, 2018: 13). Differences exist in the scientific community, and “sacred ecologies” (Berkes, 2018), “place-making” (Sen and Nagendra, 2019) and “restorative cultures” (Aronson et al., 2020) may be anywhere, including environmental science and conservation biology.

The how-to literature demonstrates that environmental scientists are increasingly aware (and wish to promote awareness) that *TEK is inherently political* and any TEK usage has implications for power relations. This is one reason why so many scientists insist that TEK collaborations reflect local priorities (e.g. Buell et al., 2020; Chua et al., 2020; Hall et al., 2021; Hastings et al., 2020; Henri et al., 2020; Kourantidou et al., 2020; Malmer et al., 2020; McElwee et al., 2020a; Schott et al., 2020; Wheeler et al., 2020; see also Molnár and Babai, 2021). Researchers play an active role in creating the spaces where “tradition” has value (cf. Conklin and Graham, 2009), and intentionally or unintentionally take part in picking and choosing what is and is not “TEK,” including for people from groups to which they do not belong (see McElwee et al., 2020a:1673; Molnár and Babai, 2021: 684; see also Nadasdy, 1999, 2005). This has an effect which may be positive or negative, depending on one’s standpoint.

Participants in TEK collaborations can have different objectives. For example, scientists may be interested in TEK as a source of useful data for conservation and as an input to burgeoning research careers, while indigenous groups may be interested in collaboration to establish or safeguard their rights and build political strength. At times, these goals will conflict with one another. Scientists must confront such differences. To take one example, political ecology scholarship has shown how mainstream conservation is implicated in the appropriation of land and impoverishment of local communities in various parts of the world (e.g. Neumann, 2002). This may be desirable from a conservation perspective and as such environmental scientists may endorse initiatives that have these outcomes, but they should be conscious of political consequences.

Reflexivity—self-conscious assessment of the repercussions of a particular act from a multitude of normative perspectives and awareness of our activities’ place in broader contexts, not least in relation to dispossessed and marginalized groups (Rubis and Theriault, 2020)—must become more central to environmental scientists’ TEK engagements. This includes reflexivity when seeking to validate different knowledge systems (Aronson et al., 2020), which also has political implications⁶. Berkes suggests that acceptance of TEK as an autonomous and valid knowledge system requires a major paradigm shift (2018: 261). Many environmental scientists who deploy TEK advocate for parallel knowledge systems, the multiple evidence base approach (Tengö et al., 2014), and the like (e.g. Davies et al., 2020; Ferreira-Rodríguez et al., 2021; Hall et al., 2021; Malmer et al., 2020; McElwee et al., 2020a). However, detailed discussions of what this actually entails—how

researchers and policymakers can understand, accept, and apply different knowledge systems *on their own terms*—are lacking.

To facilitate more reflexive, politically-sensitive TEK usage, and move away from the notion that scientist-TEK-holder power differentials can be managed methodologically (see also Matuk et al., 2020), we propose that environmental scientists conceptualize their engagements with TEK-holders as *productive complicity*. We take the term from Hellman's study of pilgrimage in Indonesia (Hellman, 2019), where he, drawing on the scholarship of anthropologist George Marcus, offers the concept to explain the sacred as co-produced by guide and pilgrims. Participants on the journey (anthropologist included) intersubjectively constructed a sacred experience by participating in acts of "productive complicity" that identified the ancestor's presence in a series of "strange" yet ordinary happenings, such as sightings of civet cats, spouting water in a cave, and rumbling sounds in a cloudless sky. While Hellman develops "productive complicity" in relation to religious experience, the concept can be usefully applied to a wide range of situations. For example, a successful guided tour at a heritage site rests on the "productive complicity" of guide and visitors in the creation of historical meaning. Political rallies are an intersubjective production of reality through the "productive complicity" of political leaders and their followers. Environmental scientists working with TEK could think about their endeavors in a similar way: scientists and communities coming together to affirm temporary but useful essentialisms ("traditional knowledge," "ecological indigenes") that can contribute to achieving one or ideally both sides' objectives. By viewing their TEK usage as intentional acts of productive complicity, environmental scientists heighten their awareness of TEK's inherent essentialism and complicity in power relations. This in turn facilitates strategically channeling TEK usage toward the emancipation of marginalized communities and the pursuit of equitable environmental outcomes for humans and nonhumans (see also Chua et al., 2020; McElwee et al., 2020a; cf. Eckert et al., 2020).

We see a resemblance between productive complicity as a mode of partnering and others' suggestions for improving TEK research, such as coproduction and the multiple evidence base approach (Hill et al., 2020; Malmer et al., 2020; Matuk et al., 2020; Villagómez-Reséndiz, 2020; Wheeler et al., 2020), coexistence (Buell et al., 2020), parallel knowledge (Davies et al., 2020), two-eyed seeing (Hall et al., 2021), knowledge coordination (Weiskopf, 2020), constructive engagement (Shackeroff and Campbell, 2007), indigenous-led research (Eckert et al., 2020) and adopting a problem-focused approach (Cebrián-Piqueras et al., 2020; Chua et al., 2020; Hastings et al., 2020; McElwee et al., 2020b; Samuel-Nakamura, 2020). Where productive complicity differs from these approaches is by focusing attention on the dynamic, political and temporally-situated nature of any TEK collaboration. Coexistence, parallel knowledge, and two-eyed seeing, for example, might suggest two eternal, separate bodies of knowledge. Constructive engagement or a problem-focused approach come closer to productive complicity, yet do less to convey the fundamentally political nature of these engagements. The ambivalent word "complicity" draws attention to the wider impacts of particular essentialisms, where for example framing the ecological indigene in one way in one place may impact on the lives and struggles of others, elsewhere, for better or worse (cf. Maddison, 2013). Put another way, while the hoped for "win-win" of TEK-research that proves beneficial for conservation/environmental management, research and all participants remains an important aspiration, scientists must confront the likelihood that attaining a win-win in practice may be both rare and/or fleeting.

Within the sample, we see several scientist-TEK engagements that move toward productive complicity (for a list of positive examples, see Supplemental Appendix B). The environmental scientists conducting ecological restorations in collaboration with local groups strike us as particularly good examples of this mode of partnering (Hall et al., 2021; Hastings et al., 2020). To take one example, in Hastings et al., a group of environmental scientists on Oahu worked

with a community-based nonprofit farm to design and implement a restoration project (2020). The community-based farm participants identified strengthening community connections to forest and each other and strengthening community access to native plants for cultural and medicinal uses as core goals, while the scientists' goals related to ecosystem services, water quality retention, and retaining soil on the landscape. An additional goal, pertinent to all actors, was low costs. In order to meet everyone's needs, the scientists adopted a functional trait approach to the restoration. They selected species assemblages that were native, and reflected the community's priorities, but did not correspond to any existing "natural" (or reference) ecosystem. In other words, the environmental scientists accepted that restoring the area to a historically-occurring "natural" precedent did not have to be prioritised. Rather, scientists and community members, in an act of productive complicity, co-constructed a "restoration" that was "traditional" and new, yielding outcomes that were good for the ecosystem and cultural preferences.

Conclusion

Environmental scientists who work with TEK assert the value of lay people's knowledge to science and acknowledge that non-scientists have successfully designed and maintained sustainable socio-ecological systems for long periods. This review confirms that TEK is a "hot topic" for environmental scientists (Molnár and Babai, 2021) and that many environmental scientists strive to engage with TEK in ways that are productive, responsible, and sensitive to power asymmetries. We seek to facilitate these efforts by discussing potentially problematic tendencies toward essentialism and minimizing power relations in 2020 TEK publications by environmental scientists. Knowledge from anthropology shows that essentialism and implicatedness in power relations are *inevitable* and *unavoidable* within TEK-based research. This reality requires environmental scientists to be reflexive about their TEK usage. We offer the concept "productive complicity" as a way to understand TEK-based collaboration (or indeed any dialogue between different bodies of knowledge, including natural and social scientific collaborations⁷). *Productive complicity* requires that we directly confront the contextual, temporal and political dimensions of any and all research collaboration. It is an approach useful to scientists of all stripes who conduct research on essentialised and meta-essentialised traditions.

In the spirit of productive complicity, we end this paper with four questions that we as anthropologists ask ourselves when working with the bearers of tradition and culture. They can be considered part of adopting a reflexive stance. Environmental scientists striving for productive complicity can ponder these questions when considering doing research with TEK-holders.

1. *What and/or who is this TEK for?* All parties involved in a research or management initiative should consider their own motivations and interests and those of the people with whom they are working. This includes consideration of how the various parties and bodies of knowledge came to be defined and essentialised.
2. *What will this knowledge result in/what will this knowledge be used for?* Working with TEK may produce different effects for different participants, at any stage of the research design, implementation and dissemination. Whether and which particular groups/individuals will benefit or suffer is an issue that demands scrupulous attention. TEK plays into essentialisms integral to wider societal conflicts, and we as researchers must reflect and make choices based on this.
3. *How is compensation/credit shared?* Defining knowledge as a generic cultural good obscures individual creativity. Likewise, emphasizing the individual denies the contribution of wider communities to producing knowledge. In TEK-environmental scientist

collaborations, it is the innovative responses of people faced with dynamic environmental situations that are to be harnessed. Consideration should be made to who is acknowledged (or rewarded) for any given research output collectively and individually.

4. *Am I giving back and giving forward to the people I work with and depend upon?* As Ybarra (2014) argues, when extracting knowledge from groups of people it is not enough to simply “pay back” by sharing results and behaving appropriately within the community (cf. Held, 2020). One should also pay forward, and reflect upon one’s role as an ally or at least a colleague in ongoing and future struggles. Research ends, but struggles continue. Anyone working with TEK-holders is implicated in these past and future struggles and should be fully conscious of this.

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Supplemental material

Supplemental material for this article is available online.

Notes

1. The vagaries of online publishing mean that some publications are listed as 2018, 2019 and 2021 rather than 2020.
2. As one reviewer pointed out, much contemporary anthropological work also lacks this type of detail. We agree and emphasize the importance of discussing the selection of research participants in all scholarly fields, not just environmental science.
3. Barley’s book *Not a Hazardous Sport* provides a fascinating example of this from anthropology. Barley engaged with Torajan craftsmen to build a traditional rice barn in the then Museum of Mankind, London. The builders (his respondents) then came into conflict over who held the authority to lead the work and to interpret its cultural meaning Barley (1988:179-206).
4. Of course, conflicts are not always between scientists and TEK-holders. Buell et al. (2020) is an example where TEK-holders and scientists collaborate to produce an environmental risk analysis that contested one produced by the local government.
5. Writing on the unequal exchange involved in ethnographic research, Burman argues that “anthropologists derive a substantial part of their power from the knowledge extracted from the people they study” (2018:57). This knowledge is transformed into data out of which anthropological commodities

are manufactured as “monetizable deliverables” (Luka et al., 2016) in the form of articles and books, based on which anthropologists in turn build their academic careers within “regimes of performance” (Morrissey, 2015) and neoliberal metrics of academic production. These commodities tend to be not only geographically and institutionally out of reach to research participants but also economically so. Moreover, they tend to be manufactured in such a way that they exclude a large portion of humanity, not least for being written in an inaccessible academic idiom.

6. We are grateful to the reviewers for suggesting we emphasize this point.
7. For example, we believe that environmental science can provide methodological innovations and techniques around aspects of human-nature relationships that have atrophied in contemporary environmental social-scientific scholarship. Rappaport’s environmental anthropology classic *Pigs for the Ancestors*, originally published in 1964, contains self-collected data on agriculture and food production, analyzing the interrelation between social and ecological systems for the Tsembaga in Papua New Guinea (Rappaport, 1984). Many contemporary anthropologists lack the skills required for such work, which limits their research frontiers. Working with environmental scientists could address this. Perceptively, Rappaport wrote lamenting the “wastefulness” of anthropology in abandoning older paradigms, methods and knowledge wholesale, rather than addressing the paradigm’s problems (ibid.:xv).

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