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## Traditional Ecological Knowledge as Scientific Literacy

**Abstract:**

Traditional Ecological Knowledge (TEK) predates Western Ecological Knowledge (WEK) as the methodology used in the conservation and management of natural resources within the United States. TEK approaches, however, commonly remain underutilized or altogether absent from conservation and management plans, and are often not taught or featured within natural resource curricula, even within nationally ranked environmental science universities within the U.S. The University of California, Davis's Wildlife, Fish, and Conservation Biology major serves as just such a case study, revealing how TEK approaches are excluded from science education, and thus science literacy. In general, perceived barriers to inclusion and incorporation revolve largely around questions of legitimacy of TEK as science, but extend also to challenges in integrating these ways of viewing the natural world in a manner that is respectful of ongoing tribal histories of mistreatment and discrimination within Western cultural frameworks. However, despite these obstacles that prevent a more holistic view of science, Indigenous scholars and TEK experts, as well as non-Indigenous scholars, recognize the importance of a partnership between TEK and WEK practitioners. This significance is recognized both for benefits conferred to science and natural resource conservation, as well as increased inclusivity of Native Peoples within academic spheres and respect for Native American tribes and Indigenous individuals as the original stewards of the natural world.

## Traditional Ecological Knowledge as Scientific Literacy

Traditional Ecological Knowledge (TEK) is knowledge closely tied to a place and ecosystem, and which is intimately shaped by the cultural experiences and ways of life of the holders of that knowledge. In the words of Winona LaDuke, an Ojibwe environmental activist and scholar, TEK is “the culturally and spiritually based way in which Indigenous people relate to their ecosystems. This knowledge is founded on spiritual-cultural instructions from ‘time immemorial’ and on generations of careful observation within an ecosystem of continuous residence” (127). Deborah McGregor, an Anishinaabe tribal member from Whitefish River First Nation and a professor at York University in Canada, speaks to the importance of foregrounding Indigenous definitions of TEK as they more accurately reflect how TEK is “action oriented” (394). McGregor points out that non-Indigenous scholars tend to limit definitions of TEK to that of a static “body of knowledge,” a definition which ignores the active relationship between Indigenous Peoples and the world around them as the living source of that knowledge (394). Despite TEK’s long-standing presence and the holistic approach it embodies, TEK faces ongoing challenges hindering its widespread acceptance as a branch of scientific literacy due to “conflicting” views on whether or not TEK should indeed be considered as scientific as that of more mainstream Western scientific processes (Ramos 358), also known as Western Ecological Knowledge, or WEK. Additional hurdles to TEK’s more widespread acceptance vary between groups and settings, such as between professional and academic spheres, but difficulties cited generally include translating TEK into the limited frameworks utilized by WEK due to being “rooted in different philosophies” (Ramos 359), as well as overcoming worries surrounding integration in a “culturally sensitive manner” (Ramos 358). Traditional Ecological Knowledge remains an underutilized source of scientific knowledge in natural resource conservation and

management practices, especially in academia within the U.S. Nevertheless, scholarship shows that TEK can increase the efficacy of Western Ecological Knowledge approaches by providing a more holistic knowledge that is rich in both natural history and scientific observations.

Issues surrounding the acceptance of TEK within the U.S. as a legitimate scientific literacy can find roots as far back as European immigration to North America. According to Robin Wall Kimmerer, an associate professor at the SUNY College of Environmental Science and Forestry and a member of the Citizen Potawatomi Nation:

When European settlers first set foot on this continent, they were awestruck by the bounty of the forest, its abundance of plant foods, fish, and game. They described the indigenous people as living off the “provender of the forest primeval”. . . The colonists were right about the abundance but mistaken about its source. Far from being a wilderness, the land was intensively managed by Native Americans to increase the availability of food. (“Native Knowledge” 4)

This initial discounting of Indigenous stewardship of the land and insistence that Native Americans lived off the “provender of the forest primeval” served to set the foundation for denial of Indigenous rights surrounding land access, ownership, and management, and access to plants and wildlife for both food and spiritual reasons. These struggles that coincide with Indigenous Peoples’ fight for recognition of tribal sovereignty persist today, as evidenced by continuing challenges to the validity of TEK as a sound knowledge. This challenge of legitimacy of TEK demonstrates the perseverance of these European immigrants’ original attitudes towards Indigenous Peoples within North America and indicates the extent of these biases as pervading even the sciences.

In addition to this underlying bias against TEK, which is due to Western lack of understanding or acceptance of Indigenous epistemologies regarding the natural world, one of the primary causes cited for rejection of TEK as science is Indigenous use of spirituality within TEK. In the words of Dr. Seafha C. Ramos, Yurok tribal member, Rroulou'sik REU Coordinator for Wildlife, and Research Associate at Humboldt State University, "Indigenous Science and Indigenous conceptualizations of TEK are essentially theistic and spiritual; they are not so much bodies of knowledge as ways of perceiving, making sense of, and relating to the world" (362). TEK practices are often interwoven with everyday actions, making TEK synonymous with daily tasks and rituals and thus facilitating a cohesive knowledge which is present throughout Indigenous ways of living. In contrast, WEK creates and maintains space between the knowledge it encompasses, and the implementation of that knowledge. Ramos further states that "[t]he importance of spirituality as a component of TEK is exemplified in Ojibwe hunters' cultural protocols, which include giving thanks to and asking forgiveness and permission of a deer, as a spiritual being, to take its life" (362). Thus, it is proposed that including TEK as a branch of science would require those who follow WEK to broaden their definition of science to one which is inclusive of spiritual, and thus potentially religious, features (Ramos 362). Although the physical action is the same as a WEK game management operation involving recreational hunting, that of killing the deer for consumption, the diversion in mentality from 'typical' WEK hunting practices alone is enough to cause negative perceptions of TEK. Linking management and conservation practices with traditional rituals diverges from WEK views on the scientific process and the belief that separation must be maintained between personal lives and science. Thus, this inclusion of spiritual and thus 'non-scientific' aspects is considered by some WEK

practitioners to confound any potential scientific benefits, and thus invalidate TEK as science as it does not align with the knowledge sanctioned by universities as scientific.

In combination with concerns of science overlapping with spirituality, another aspect used to justify rejection of TEK is the lack of physical documenting processes and results. Instead of written records that are associated with WEK's scientific process, Ramos notes that "Traditional Ecological Knowledge often becomes part of the oral tradition of a specific Indigenous group and is generally transmitted in that manner, such as in descriptive names and stories where abstract principles are expressed metaphorically. Some scholars contend that anecdotal evidence and orally transmitted information over generations cannot be tested" (362). This link between the "oral tradition" of TEK and the fact that it is therefore considered "anecdotal evidence," serve to illustrate how negative attitudes towards TEK can influence perceptions of legitimacy, overshadowing any potential benefits afforded by a partnership between TEK and WEK approaches. Recognizing this reasoning also calls attention to how such attitudes are deeply biased against Indigenous ways of living and knowing, resulting from cultural differences rather than a lack of efficacy of TEK. Beth Rose Middleton Manning, Associate Professor and Chair for the Department of Native American Studies at the University of California, Davis and Yocha Dehe Endowed Chair in California Indian Studies, believes that resistance surrounding integration of TEK with WEK is because "there's a lack of trust, there's this rigid definition of what counts as evidence, there, I think, is really a deep-seated bias and racism." The "lack of trust" Middleton Manning notes is especially important given her position as a professor and department chair at the institution in question, as by neglecting to even acknowledge the existence of TEK within our natural resources curricula, the University of California, Davis, further perpetuates this "deep-seated bias and racism" while also contributing

to deficits in students' scientific literacy that could be avoided through integration. This "deep-seated bias and racism" in tandem with the rigidity of the scientific method maintain a pervasive influence throughout WEK and, along with worries surrounding the spiritual features of TEK, remain key contributors to the continued exclusion of TEK as science.

Despite the bias against and objections to the legitimacy of TEK, TEK and WEK follow similar processes often identified as scientific in origin. According to Ramos, "[s]imilarly to Western Science, knowledge production in Indigenous Science operates through a process of observation, theory, experimentation, and replication. Processes of science that include rational observation of natural events, development of technology, classification, and problem-solving are woven into all aspects of Indigenous cultures" (361). The intimate connection with the earth that is afforded to Indigenous Peoples through this knowledge system that is "woven into all aspects of Indigenous cultures" has allowed tribes to become finely attuned to all aspects of the ecosystem within which they live and travel. This extensive collection of knowledge thus enables tribes to make the most informed decisions based on thousands of years of experience and observation, decisions which in reality are the result of processes commonly recognized by WEK as scientific in nature. Therefore, it stands to reason that TEK is indeed scientific knowledge, which when ignored, can have drastic consequences. In an interaction between Inuit and WEK wildlife biologists in the Canadian Arctic, Inuit knowledge of caribou ecology and cultural harvesting practices was initially discounted during management program development (Kimmerer "Native Knowledge" 6). After these divergent management procedures were implemented, caribou herd sizes decreased noticeably, prompting the re-evaluation of the management program which subsequently resulted in the inclusion of Inuit TEK. By integrating

TEK with WEK approaches, a more extensive management and conservation system can be achieved, one which is better able to combat the ever changing natural world of present day.

In spite of the continuities between TEK and WEK, natural resource college curricula commonly fail to include education or even dialogue surrounding TEK, further compounding attitudes of exclusion and devaluation. Take, for example, the University of California, Davis as a case study. Within the university's Wildlife, Fish, and Conservation Biology (WFCB) major, review of WFCB courses required for undergraduates reveals that mention of TEK is made merely in passing, if at all, and no explicit references to TEK are found on course syllabi such as "Conservation Biology" (Karp) and "Field Methods in Wildlife, Fish, and Conservation Biology" (Blenk et al.), two classes which all WFCB majors are required to take. This lack of inclusion within the University of California, Davis' WFCB educational requirements speaks to this widespread devaluing of the role Indigenous Peoples have had and continue to have with the natural world, further compounded by the college's influential standing as one of the top institutions for ecology and environmental biology globally. Even institutions like the University of California, Berkeley, which offers an "Introduction to Culture and Natural Resource Management" course that highlights this tumultuous relationship between Native Peoples and colonial cultures, features language which displays bias against TEK as a scientific knowledge (Spreyer). The course syllabus clearly attributes a greater credibility to WEK through its distinction "traditional ecological knowledge and western fire science" in reference to a lecture focusing on fire management within northern California (Spreyer). This widespread lack of equal acknowledgement across the UC system serves as a symptom of the pervasiveness and extent of the challenges TEK faces preventing inclusion as scientific literacy. Furthermore, Middleton Manning says that integration of TEK within the University of California, Davis's education is

particularly important because the land upon which this institution sits is tribal land that was “taken, and made [into] a university.” Not only have Native Peoples been displaced from their traditional homelands and ways of life, but these acts of erasure are continually perpetuated within the university’s educational structure. Middleton Manning concludes that due to this fact “we need to be ... aware of that, and ... cultivating respect for Indigenous People and Indigenous Knowledge should be part of the curriculum throughout the university.” Although the University of California, Davis remains an acclaimed institution within the natural resource fields, further growth and integration of TEK with WEK is needed not only to help better prepare graduates for future work and research in the natural sciences, but also to help improve relations between the university system and tribal governments.

Despite the prevalence of underutilizations such as those seen in the University of California, Davis curricula, some colleges such as the State University of New York College of Environmental Science and Forestry (SUNY-ESF) have moved towards offering classes or seminars that focus more fully on TEK education (*Environmental and Forest Biology*). Here students are able to take an “Indigenous Issues and the Environment” class taught by Kimmerer herself, a course which addresses Native American approaches to natural resource management and conservation (*Environmental and Forest Biology*). SUNY-ESF has also further supported acknowledgement of Indigenous presence and knowledge by [formally recognizing](#) the college’s existence upon Onondaga Nation lands, as well as recognizing the responsibility for a shared partnership in the management of that land as they “stand on the shoulders of Indigenous environmental knowledge and wisdom” (“SUNY College” 00:19). By acknowledging this inherent relationship between Indigenous Peoples and the college--which indeed literally “stand[s] on the shoulders of Indigenous environmental knowledge and wisdom”--students are

taught by example that “Traditional ecological knowledge has value not only for the wealth of biological information it contains but for the cultural framework of respect, reciprocity, and responsibility in which it is embedded...” (Kimmerer “Weaving Traditional Ecological Knowledge” 432). Within WEK, such heightened focus is often placed upon discovery of scientific advancements that participants often lose sight of this “cultural framework of respect, reciprocity, and responsibility” which is inherent within TEK. Through the incorporation of TEK within WEK practices, and the continuous efforts at implicitly and explicitly acknowledging the credibility of TEK, expansion to a more holistic curriculum and inclusive community can be achieved.

Furthermore, incorporation of TEK into college curricula has the potential to directly benefit Indigenous students and scholars as well by facilitating inclusion of Native Peoples within academia. Specifically, integration can help reduce Indigenous Peoples’ perceptions of WEK curricula and academia as an “alien culture” which is “unwelcoming, exclusionary, and hostile to traditional ways of knowing” (Kimmerer “Weaving Traditional Ecological Knowledge” 435). By expanding college curricula and education to include TEK and thus more accurately “resonate with [Indigenous Peoples’] cultural values,” the exclusion of Native Peoples from participating within these educational spheres and within scientific communities and narratives can more effectively be avoided (Kimmerer “Weaving Traditional Ecological Knowledge” 435). Thus, incorporation of TEK into college curricula has the potential to not only increase the quality of science available for natural resource management, but it will also contribute to improving relationships between academic institutions and Native Peoples. Widespread integration within educational institutions would result in not only expanding students’ technical knowledge of conservation and management practices, but also teaching

students vital lessons surrounding the implementation of that knowledge and ways of relating to the world that are as diverse as the knowledges themselves, all while serving to promote inclusion of an otherwise widely underrepresented group of scholars and students.

Once WEK practitioners and institutions have recognized the need for integration, work can begin on forming partnerships with TEK practitioners. However, for WEK professionals and academic institutions seeking to collaborate with TEK specialists, knowing where to start and who to talk to can be daunting. Middleton Manning suggests that interested individuals request permission to attend Indigenous conferences and convenings, particularly those with an environmental focus, and that they reach out to faculty in Native American Studies departments on campus who would be able to in turn make introductions to TEK specialists. Professionals, especially those already working with state and federal agencies such as the U.S. Fish and Wildlife Service, can reach out to tribal liaisons for help facilitating partnerships with tribes. For academic institutions in particular, Middleton Manning stresses the importance of allocating funding to TEK-based field courses and internships to allow for “more equitable partnerships” during university-tribal relationship building. During these field courses, internships, and even class settings, focus should be on “foreground[ing] Indigenous voices” in order to further collaboration between the institution and TEK practitioners (Middleton Manning). In order to be successful with any approach, efforts must include “recognition of Indigenous People as experts” which includes monetary compensation for education and consultations, equal knowledge “exchange on the land” both between WEK and TEK specialists, and clear ongoing communication of costs and benefits that is respectful and ideally in-person, and must which involve an open mind from all participants and be implemented early on in any project in order to create an effective partnership (Middleton Manning). Although making changes to current

mindsets and curricula may be difficult, it is a concrete action that can be taken to begin the journey towards inclusion of TEK in conservation and management programs.

Although the path to begin forming partnerships between TEK and WEK experts may appear straightforward, care must be taken to ensure that these relationships are formed and maintained in a culturally sensitive manner. M. Kat Anderson, an Ethnoecologist with a joint appointment in Natural Resources Conservation Service and the University of California, Davis, cautions that “[t]he use of native knowledge detached from its source and rich context (termed ‘cultural appropriation’ by anthropologists) can be meaningless and exploitative, like taking a sacred symbol and placing it on a T-shirt” (354). Thus, the attempted integration would result in more harm than good for both parties involved if “cultural appropriation” were to occur. In order to prevent this exploitation during partnerships and knowledge integration efforts, Anderson recommends that “restoration and related activities proceed with a concerted commitment to the conservation of [I]ndigenous cultures” (354), such as by assisting with “the reacquisition of lands within reservation boundaries that have passed out of Indian trust status” (355). Through these efforts aimed at helping to protect Indigenous Peoples, WEK practitioners can not only foster a more aware knowledge exchange, but they can also help provide material benefits and compensation for this knowledge exchange. Therefore, incorporation of these practices overall, as well as further consultation with tribal liaisons and facilitators, can ensure that these partnerships are not only successful, but are conducted in a culturally aware and respectful manner in order to continue this growing utilization of TEK with WEK approaches.

As with any knowledge integration and meshing of ideologies, there are many challenges that must be overcome before both sides, especially Indigenous Peoples, can be heard and feel trusting of their university partner(s); these challenges are ongoing and continually developing

throughout partnerships. For integration of TEK with WEK approaches within North America, special attention must be paid to challenges that are a result of the ongoing tumultuous history and treatment of Native Americans by non-native (European) immigrants; immigrants who control the majority of resources in U.S. society today. Despite these challenges, acceptance and utilization of TEK is becoming more prevalent within professional and academic spheres within the U.S., although progress is still needed at institutions such as the University of California, Davis before this partnership can be fully realized. Through these efforts, the efficacy of conservation and management practices within the natural resource sciences can be further improved, thus in turn benefiting the natural world we seek to protect, while also serving to honor and respect Indigenous Peoples as experts and as integral partners in achieving these conservation and management goals. Despite the availability of information on the benefits of integrating TEK with WEK approaches, further research is needed in regards to integration of TEK within educational programs in the U.S. Specifically, we need further case studies highlighting integration efforts by universities, organizations, and individuals, especially those focused on identifying barriers preventing integration, and how to effectively overcome these barriers and thus improve the scientific literacy of natural resource students within these programs.

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