
2020

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Recommended Citation

Hernandez, Jessica and Spencer, Michael S. (2020) "Weaving Indigenous Science into Ecological Sciences: Culturally Grounding Our Indigenous Scholarship," *Human Biology*: Vol. 92: Iss. 1, Article 1. Available at: <https://digitalcommons.wayne.edu/humbiol/vol92/iss1/1>

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Abstract

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Keywords

Indigenous science, indigenizing, ecology

Cover Page Footnote

As Indigenous scholars, researchers, and scientists, we thank you for helping us uplift Indigenous voices, perspectives, and science with this special issue. We also thank all of our peer reviewers for assisting us throughout the process and dedicating Weaving Indigenous Science into Ecological Sciences their time to ensure our articles met the criteria of Human Biology. A special thank you to R. Malhi and the Human Biology journal team for creating a space for Indigenous science and ecology. We also thank Katrina Claw and Krystal Tsosie for leading this initiative to produce two special issues focusing on Indigenous science. By culturally grounding our Indigenous scholarship, we can continue to revolutionize and indigenize.

Weaving Indigenous Science into Ecological Sciences: Culturally Grounding Our Indigenous Scholarship

Jessica Hernandez^{1*} and Michael S. Spencer^{2*}

Indigenous peoples are the original stewards of their native and ancestral lands, having maintained the balances of their ecosystems since time immemorial. However, as a result of colonization, imperialism, and the mass genocide of Indigenous peoples, environmental systems have been drastically changed. Since Western ideologies such as capitalism and Western science were introduced, Indigenous stewards and their knowledge systems have been invalidated and often ignored in environmental and ecological discourse. Their complex nature-culture nexus has been dismissed and suppressed, and European men have been given the credit for their discoveries and nuances in environmental and ecological discourse (Wildcat 2009). For instance, James Cook is considered the pioneer of oceanography and navigation, and Gifford Pinchot is considered the father of forestry. However, oral Indigenous history recounts how Indigenous people navigated the oceans before colonialism (e.g., Polynesians) and served as stewards of their forests (e.g., Amazonian tribes) (Anderson 2009; Walker 2012). Despite having generations of knowledge formation based on first-hand observations, Indigenous peoples have been left out of these conversations and discourses. In this special issue of *Human Biology*, titled “Indigenous Science and Ecology,” we weave

together five articles that demonstrate the nuances of Indigenous scholarship in the ecological and environmental sciences. These articles uplift Indigenous ancestral knowledge that has led these authors to contribute Indigenous perspectives within their respective fields. This special issue highlights how Indigenous peoples can indeed lead us to more holistic and effective ecological and environmental solutions in a changing climate. Given the drastic changes we continue to face as a result of climate change, it is imperative now more than ever to lift up Indigenous voices, perspectives, and knowledge systems. Climate change impacts Indigenous peoples’ culture-nature nexus, furthering the injustices they face (Maldonado et al. 2014). These injustices come from centuries of oppression, violence, and desecration they have endured under postcolonialism. Despite the genocide and forced assimilation tactics used in the past, and which continue to be used today, against Indigenous peoples, their teachings have been preserved in their communities through oral traditions and cultural practices (Lauer 2012). Their resiliency demonstrates how Indigenous peoples can be the focal point of any efforts to adapt to and mitigate climate change. Including Indigenous voices in climate change narratives and discourse can lead to holistic solutions, as our five articles contend.

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KEY WORDS: INDIGENOUS SCIENCE, INDIGENIZING, ECOLOGY.

While some of their teachings were in relation to their living conditions in the past, Indigenous cultures offer knowledge systems that can adapt to new climates, spaces, times, and environment, as demonstrated by the contributors to this special issue. These adaptations are seen through the eyes of Indigenous peoples who are also forcefully displaced as a result of climate change, ongoing militarization, and other results of settler colonialism (Laidlaw et al. 2015). This furthers our conclusion that Indigenous peoples' teachings can serve as solutions to the environmental crisis we are currently facing in a changing climate, due to their resilience and adaptive capacity (Aftandilian 2011). Our special issue demonstrates how Indigenous science can help heal our Mother Earth, and our five peer-reviewed articles do an outstanding job of displaying this through their authors' current research, analysis, and critical lens. These five articles weave Indigenous science into environmental and ecological discourse, amplifying Indigenous perspectives, voices, and ways of knowing.

It is important to note that Indigenous science cannot be defined by one sole definition, because it consists of all Indigenous knowledge systems—local, regional, and global. While some Indigenous knowledges share similarities with others, they differ based on the geographic location of each tribe, nation, or community. This is because Indigenous knowledge systems are place based and not socially acquired through Western systems (e.g. education) (Singer et al. 2015). Indigenous knowledge systems are acquired through cultural upbringing and Indigenous ways of teaching (e.g., storytelling, learning by doing). It is not entirely written in textbooks or expressed in research, because some components of Indigenous epistemologies are sacred and are kept only between family and tribal kinships. It is imperative that we as researchers and scientists respect this cultural protocol and not share any sacred Indigenous knowledge (Chou 2015). This is why some of our articles do not mention or share Indigenous sacred knowledge. Indigenous peoples have witnessed how sharing their sacred knowledge can result in its co-optation and dissemination without permission. A prominent example we witness today of Indigenous knowledge co-optation is the use of white sage by non-Indigenous peoples who have no relationship to this plant. White sage is known to cleanse and has been used in many

Indigenous ceremonies and cultural events, but it has been appropriated under the pretense that non-Indigenous peoples can also build this rapport and spirituality with it. As a result, white sage has become an endangered species due to extractive methods and commodification of this medicinal plant. This type of co-optation is one of the main reasons that Indigenous peoples are protective of their sacred knowledge.

Indigenous knowledge systems include both traditional ecological knowledge and Indigenous knowledges that have also incorporated nuances from our societal advancements (e.g. technology) (Rinkevich 2008). It is important to note that tribes and Indigenous communities have the autonomy to express their way of thinking, knowing, and being in the world with the term or concept of their choosing. As a result, in this special issue authors use terms for Indigenous science interchangeably, such as “tribal science,” “Indigenous knowledge,” “traditional ecological knowledge,” and “Indigenous ethnoscience,” to describe and label their knowledge. Each article uses terms based on the specific Indigenous community or communities they focus on.

As we continue to experience climate change, marginalized communities are impacted first and are the ones helped last. Climate change, coupled with the current pandemic we are experiencing, is displaying how already existing disparities among Indigenous communities further marginalize them (Fortuna et al. 2020). While COVID-19 cases are in the rise, Indigenous nations and communities are experiencing alarming rates of infection. For example, the Articulation of Indigenous Peoples of Brazil has calculated a 9.1% mortality rate among Indigenous peoples who have contracted COVID-19 (Ferrante and Fearnside 2020). Yet before the pandemic, Indigenous peoples from Brazil were already facing the devastating impacts of illegal mining and logging in their native and ancestral lands. The Navajo Nation has had far higher numbers of COVID-19 cases per capita than the state of New Mexico (Kakol et al. 2020). Just the year before, drought in the Navajo reservation caused more than 40% of their residents to not have running water (Moon 2019). These cases demonstrate how pandemics exacerbate the environmental impacts and disparities that already exist among Indigenous communities.

But what happens when natural disasters occur? In Oaxaca, an earthquake of 7.4 magnitude occurred on 23 June 2020 (Sieff 2020), which impacted the Indigenous pueblos of Ozolotepec Sierra Sur region. A lot of people lost their homes and as a result are now in jeopardy during the pandemic due to the more limited resources in their communities during these times. The pandemic is highlighting the injustices and disparities that Indigenous peoples and communities have continued to fight against. It demonstrates how settler governments are not providing them with aid or resources to ensure their well-being and build community resilience and capacity. Many of our authors come from these communities, and they walk us through the research they have done, research that is also culturally grounded in indigeneity, science, and resilience.

These impacts result in environmental injustices that are addressed through linear Western policies, laws, and regulations that do not incorporate important tribal and cultural values (Hernandez 2019). Yet Indigenous peoples continue to be in the front lines of environmental justice movements. Their communities are already confronting the impacts of climate change, such as sea level rise, ocean acidification impacts on shellfish, and shifting sea ice patterns (Reo et al. 2017). These changes affect natural resources, including keystone cultural species that sustain their livelihoods, traditions, and cultures. Thus, it is imperative that we continue to indigenize ecology and environmental science, so that these impacts that disproportionately impact Indigenous peoples are addressed. It is a matter of survival, and now more than ever our duty as Indigenous scientists, scholars, and researchers is to amplify these voices.

Indigenous Environmental and Climate Justice

Environmental justice has many definitions; as a social justice concept, it is tailored to fit each community's narrative in the environmental discourse. While "environmental justice" has now been co-opted by many, the term has roots in a community's advocacy and resilience. It cannot be framed solely within an academic setting, as the ivory tower excludes many communities of color

who are advocating and fighting for the inclusion of their voices, perspectives, and knowledge systems (Cantler et al. 2016). "Environmental justice" has been federally defined as equally distributing environmental burdens among all communities. Climate justice is a social movement that began as a result of ineffective solutions proposed to address climate change. It is deeply rooted in environmental justice perspectives, as climate change burdens and impacts communities of color the most, and not all people equally. It is no surprise that Indigenous peoples are the most vulnerable to climate change, yet despite this, they still have unequal representation in global, national, and local decision-making processes for environmental policies (Warlenius 2018).

The lack of representation of Indigenous peoples results in environmental policy preferences favoring the wealthy and white communities and disfavoring communities of color. As we continue to undergo climate change, unequal distribution of risks and responsibilities continues to burden Indigenous communities (Klutz and Walter 2018). Because of the mitigation and adaptation practices implemented by Indigenous communities, they are better able to adapt and address the impacts of climate change on their communities. Because they rely heavily on natural resources for cultural resilience and survival, when natural resources are impacted as a result of climate change, Indigenous peoples are also impacted. Climate change is resulting in ecological debt, but it is Indigenous peoples who are paying the highest price for this debt (Barrett 2013; Running 2015).

We continue to bear witness to the fight for environmental and climate justice led by Indigenous peoples around the world. However, we also continue to witness how Indigenous science continues to be dismissed in the name of Western science. In Hawaii, Kānaka Maoli (Native Hawaiians) are leading a resistance movement to protect their sacred mountain, Maunakea, from the construction of a 30-meter telescope (Witze 2015; Brown 2016). In Canada, the Wet'suwet'en Nation is advocating against the construction of a pipeline that ignores tribal sovereignty and will lead to more environmental degradation and pollution (Petersen 2020). In Australia, we witnessed how ignoring the First Nations and their Indigenous science led to a massive fire that destroyed many

ecosystems and resulted in one billion animals dying. This catastrophe could have been prevented or better managed through prescribed burning—a First Nation tradition in Australia and various Indigenous communities across the globe. All of these current cases all have one commonality: the suppression and dismissal of Indigenous science that is essential to healing our Mother Earth.

Indigenizing Environmental and Ecological Sciences

Indigenizing is a concept that has gained more attention in our current scholarly and pedagogical realm. However, for the purposes of this special issue, we refer to “indigenizing” as addressing colonial layers that continue to invalidate Indigenous science. “Indigenizing” also incorporates Indigenous-led research, projects, and community work that respect and amplify Indigenous voices in their respective studies. It moves away from having mere Indigenous inclusion and instead advocates for Indigenous-led initiatives, research, and projects. In this special issue, we shift our focus from Indigenous inclusion to Indigenous-led projects, as it is time for Indigenous peoples to have a seat not just at the table but at the head of the table. As mentioned before, climate change and environmental injustices disproportionately impact Indigenous peoples. Despite all the climate change and environmental initiatives, policies, and regulations, not much has changed among Indigenous communities. It is time to change our perspective of wanting Indigenous inclusion to creating Indigenous-led initiatives, projects, and research. As a result, all four peer-reviewed articles in this special issue are first-authored by an Indigenous scholar, scientist, and/or researcher. While we understand that to conduct certain research, projects, and initiatives requires collaborative work with non-Indigenous scientists and scholars, our mission for this special issue is to uplift and amplify Indigenous voices first.

Our first article in this special issue, by Noelani Puniwai, demonstrates how using cultural chants, stories, and genealogies passed down orally for centuries among Kānaka Maoli can aid conservation management decisions pertaining to sharks (*manō*). Puniwai is an Indigenous professor at the

University of Hawai‘i at Mānoa who believes in the integration of *pono* science (ethical scientific practices), the foundational wisdom of our *kūpuna* (elder generations), and our experiential daily practice of *aloha ʻāina* (love of the land) to awaken responsible action for the future of Hawai‘i. Our second article, by Tommy Rock and Jani C. Ingram, discusses an important environmental justice case that has been ignored in the Navajo reservation: the detrimental effects of uranium mining. Rock grew up in a small community on the Navajo Reservation, where he saw firsthand the effects of uranium mining on his relatives. As mentioned above, the Navajo Nation has been hit very hard by the pandemic. We hope this article brings more light to the environmental injustices they have faced and continue to face. Our third article, by Kimberly L. Paul and Laura B. Caplins, discusses how oral stories from the people of the Amskapi Piikani Nation (Blackfeet) can help address environmental justice surrounding the potential of toxic dumping within Blackfeet lands. Paul is a member of the Blackfeet Nation and completed her thesis focusing on this environmental justice case. Our fourth article, by Jessica Hernandez and Kristina A. Vogt, demonstrates how we can indigenize restoration in urban parks, centering their case study at Daybreak Star Indian Cultural Center, in Seattle’s Discovery Park. It weaves together Indigenous science and environmental sciences to create more holistic land restoration frameworks. Hernandez is a Zapotec and Ch’orti’ Maya scholar whose work has centered on climate, food, and environmental justice. Our fifth article, by Michael S. Spencer, Taurmini Fentress, Ammara Touch, and Jessica Hernandez, provides an Indigenous Pacific Islander perspective to environmental justice issues. The authors link ongoing atrocities in the Pacific to imperialism, white supremacy, and capitalism resulting in loss of land, culture, and, most important, the relationship that exists between people and their environments.

Xquixhe pe laatu’ and Mahalo: Thank You

As Indigenous scholars, researchers, and scientists, we thank you for helping us uplift Indigenous voices, perspectives, and science with this special issue. We also thank all of our peer reviewers for assisting us throughout the process and dedicating

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Received 15 May 2020; accepted for publication 1 June 2020.

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