Critical Investigations of Resilience: A Brief Introduction to Indigenous Environmental Studies & Sciences

Kyle Whyte

Abstract: Indigenous peoples are among the most active environmentalists in the world, working through advocacy, educational programs, and research. The emerging field of Indigenous Environmental Studies and Sciences (IESS) is distinctive, investigating social resilience to environmental change through the research lens of how moral relationships are organized in societies. Examples of IESS research across three moral relationships are discussed here: responsibility, spirituality, and justice. IESS develops insights on resilience that can support Indigenous peoples' struggles with environmental justice and political reconciliation; makes significant contributions to global discussions about the relationship between human behavior and the environment; and speaks directly to Indigenous liberation as well as justice issues impacting everyone.

KYLE WHYTE is the Timnick Chair in the Humanities, Associate Professor of Philosophy, and Associate Professor of Community Sustainability at Michigan State University. His research addresses moral and political issues concerning climate policy and Indigenous peoples, the ethics of cooperative relationships between Indigenous peoples and science organizations, and problems of Indigenous justice in public and academic discussions of food sovereignty, environmental justice, and the anthropocene. He is an enrolled member of the Citizen Potawatomi Nation.

One telling of *Anishinaabe/Neshnabé* (Ojibwe, Odawa, Potawatomi) history emphasizes how our peoples have always found ways to adapt to the dynamics of ecosystems.[1] Our ancient migration story describes our ancestors moving from the Atlantic Coastal region to the Great Lakes, learning how to adjust to the diverse ecosystems along the route, memorializing these places through stories, and keeping lessons learned for future generations. Knowledge Keeper and Grandmother Sherry Copenace describes one dimension of the concept of *bimaadiziwin* (the good life) as a society's or nation's capacity to respond best to the challenges it faces.[2] Academic environmental studies and sciences have recently developed the related idea of social *resilience*: a society's capacity to learn from and adapt to the dynamics of ecosystems in ways that avoid preventable harms, promote the flourishing of all human and nonhuman lives, and generate wisdom to sustain future generations.

doi:10.1162/DAED_a_00497

A well-known set of Anishinaabe stories tells about one of the stopping points of the migration: a land where food grows on water, and a place where the people encountered wild rice for the first time (*manoomin/mnomen*, translated as the good berry). Waterfowl showed the people that wild rice is edible and guided them to habitats of low-lying waters where wild rice grows best and different plants, animals, and insects flourish. The people studied wild rice habitats as webs of interdependent responsibilities. Ecologically, wild rice is responsible for feeding humans, birds, and animals; for providing protective cover for fish and birds; for supplying material for muskrat lodges; and for supporting clean water. Water is responsible for giving life to wild rice. The people then developed their own responsibilities to harvest in ways that leave enough wild rice for nonhumans and to work out diplomatic protocols for sharing or respecting the wild rice beds needed by other human communities, thereby securing justice for all beings. They delegated special responsibilities to women and certain clans to develop expert knowledge of water quality and wild rice habitats and to provide leadership to guide harvesting and habitat conservation.[3] The people created ceremonies that honor wild rice as a spiritual being because of its significance within ecological webs of interdependent responsibilities.

Anishinaabe storytelling on migration and wild rice tell us how the people adapted to new environments by developing moral relationships, including responsibility, spirituality, and justice, which are at the heart of how we understand resilience. The massive environmental changes imposed on Indigenous peoples by U.S. and Canadian colonization and settlement include deforestation, draining wetlands, damming, recreation, mining, commercial agriculture, shipping, petrochemical and industrial manufacturing, and burning fossil fuels. Settlement affects ecosystems, including hydrological systems and wetlands that support wild rice, that are crucial to Anishinaabe peoples for exercising moral relationships. From nineteenth-century testimonies, we know that some of our ancestors were particularly concerned that settlement was inflicting rapid and harmful environmental changes on our peoples, which offset the flourishing moral relationships that supported Anishinaabe resilience. The history of Canadian and U.S. colonialism can be read as the establishment of the conditions for their own resilience in North America at the expense of Indigenous peoples' resilience.

Today, Anishinaabe peoples are leaders of environmental movements that advocate for the continuance and renewal of moral relationships of responsibility, spirituality, and justice. Anishinaabe grandmother Josephine Mandamin began the Mother Earth Water Walk to motivate people to take responsibility for clean water in the Great Lakes, honoring water's role as a sacred life-giver. A coalition of Potawatomi, Ojibwe, and Menominee peoples worked for years to stop the water pollution risks of the proposed Crandon zinc and copper mine in Northeast Wisconsin, a mine seeking to boost the settler economy at the expense of Indigenous peoples' health and ways of life, including fishing and wild ricing. Five Odawa and Ojibwe tribes in Michigan successfully resecured U.S. respect for the rights that their ancestors stipulated in the 1836 Treaty of Washington to protect future generations' capacity to exercise moral relationships with fish, plants, and animals living off-reservation. The Shoal Lake 40 Ojibwe Nation, through the leadership of community members such as Daryl Redsky, have worked to mitigate the impacts of Canadian settlers sacrificing its water quality and land base for the sake of extracting clean water for the city of Winnipeg. Anishinaabe nations, from the Citizen

Potawatomi Nation to the Sault Ste. Marie Tribe of Chippewa Indians, are frontrunners in experimenting with renewable energy, such as geothermal power, and green building standards. Diverse scholars, including Megan Bang, Leanne Simpson, Patty Loew, Melissa Nelson, and Deborah McGregor, have increased the awareness and practice of Anishinaabe pedagogical philosophies, environmental values, histories, and knowledge systems in the spheres of science, education, public policy, and media.

Globally, nearly four hundred million Indigenous peoples live on 22 percent of the world's land surface, interacting with 80 percent of the planet's biodiversity.[4] And they lead some of the most significant environmental movements, educational programs, and research that seek to protect humans' abilities to live respectfully within these diverse ecosystems. The Whanganui Iwi (Aotearoa), for example, succeeded in getting the New Zealand government to confer legal personhood on the Whanganui River, which is ancestrally, spiritually, nutritionally, and economically significant to the Iwi members. The College of Menominee Nation founded its own Sustainable Development Institute in 1994, based on the idea that sustainability has always been part of Menominee life, including values such as "respect for the land, water, and air; partnership with other creatures of earth; and a way of living and working that achieves a balance between use and replenishment of all resources."[5] Quechua peoples of the Andes region, specifically the Paru Paru, Chawaytiri, Sacaca, Pampallacta, Amaru, and Kuyo Grande communities, have created the Potato Park, a biodiversity conservation zone protecting over nine hundred varieties of native potato. The North American Standing Rock Sioux Tribe recently energized one of the largest Indigenous mass movements to stop the oil-transporting Dakota Access Pipeline, publicizing their *Mni Wiconi* (water is life) philosophy as the ground of their resistance. Indigenous scholars and activists, like lawyer and professor Sarah Deer, are calling attention to the continued abuses Indigenous peoples face, such as the exploitation of women and children through sex trafficking at oil and gas industry worker camps in the Bakken region of the United States at the hands of the extractive industries that also contribute to pollution and climate change. And the leaders of Indigenous environmental movements have sometimes paid the ultimate sacrifice. In 2016, Berta Cáceres, a leader in the Lenca people's movement to protect themselves from the risks of the Agua Zarca Dam, was murdered in Honduras.

Today, resilience is on everyone's mind. Vulnerability to climate change, extreme weather events, biodiversity loss, and food insecurity raise pressing concerns about the well-being of human and nonhuman lives. The World Health Organization estimates that between 2030 and 2050, an additional 250,000 annual human deaths will be caused by climate change.[6] Thousands of species are either extinct or are in danger of extinction from habitat destruction.[7] The Global Coral Reef Monitoring Network estimates that 19 percent of the world's coral reefs are already lost.[8] These are pressing challenges, but many human societies – like the Anishinaabe peoples – have long-standing sciences, collective practices (such as agriculture and ceremonies), arts, and philosophies that seek to maintain moral relationships with ever-changing environments that lessen harms and risks to humans and nonhumans alike.

Indigenous Environmental Studies and Sciences (IESS) is an emerging field that centers Indigenous historical heritages, living intellectual traditions, research approaches, education practices, and political advocacy to investigate how humans can live respectfully within dynamic ecosystems.[9] While environmental studies

and sciences involve diverse scholarly communities studying every imaginable topic, IESS, in particular, investigates how moral relationships – including responsibility, spirituality, and justice – within a society yield empirical and humanistic insights about resilience.

IESS research centers on Indigenous peoples' historical heritages and living intellectual traditions as starting points for investigating the topic of resilience. Yet IESS investigations do not seek to mine Indigenous histories for lessons about the success of certain harvesting techniques or technologies, like fish traps. Nor are many IESS scholars concerned about establishing whether it is, in fact, true that Indigenous peoples lived sustainably. Rather, IESS centers on Indigenous heritages and traditions for the sake of understanding how the moral fabric of a society is related (or not) to its capacity to adjust to various ecosystems.

In diverse studies of Nuu-chah-nulth and related Northwest Coast peoples, Indigenous studies scholars Ronald Trosper, Marlene Atleo, and Richard Atleo focus on moral relationships of responsibility that connect humans to salmon, whales, and many other animals, plants, and habitats. Speaking on responsibility, Richard Atleo has described how, for the Nuu-chah-nulth, "The salmon does not give its life, but rather, in an act of transformation, is prepared to give and share its 'cloak' in endless cycles, provided the necessary protocols are observed, which indicate mutual recognition, mutual respect, mutual responsibility, and mutual accountability."[10] For Atleo, the relationship between humans and salmon, which can be critical to human nutrition, is a moral relationship of mutual responsibility. Salmon will carry out their responsibilities through reincarnation if humans carry out their responsibilities to the salmon, especially tending salmon habitats. The spiritual responsibility associated with salmon's reincarnation motivates humans to take care of salmon, or else the fish may not return to take care of humans.

Human/salmon responsibilities permeate the fabric of society, operating at many levels. In Trosper's historical studies, titleholders, or leaders of houses (the polities governing particular watersheds), were responsible for ensuring adequate abundance of salmon in their territories. To become accepted as a titleholder, one had to organize a feast, often called a potlatch ceremony. At the feast, titleholders not only paid respect ceremonially to salmon's value to humans, but they also gave away abundant wealth in the form of gifts, including bountiful salmon harvests, to the guests. While hereditary lineage was often one criterion for titleholder candidates, their candidacy was also judged publically and critically through the potlatch ceremonies. Titleholders' ability to give salmon as gifts proved their knowledge and skills at stewarding salmon habitats. During times of salmon shortage in particular areas, mutual responsibility meant houses with plenty helped suffering houses; houses receiving aid were responsible to reciprocate aid when needed. If a person trespassed in another house's territory and was killed, the punishing house was responsible for organizing a feast to stop trespassing and killing for the sake of future generations.

Nuu-chah-nulth peoples have longstanding traditions of making places sacred by endowing them with moral significance. Marlene Atleo has written that "Sacred sites are 'natural' places in which the spiritual work of *hahuulhi* (social fabric) roles intersect with the environment of the territory and have been carried out there for millennia, a place where the past, present and future crystallizes for a particular position and role."[11] She has described places where young women learn to cut salmon for the winter. In addition to acquiring the skills and scientific knowledge,

they tell stories at these places about salmon and the sacred responsibilities between salmon and humans across many generations. Learners come to see themselves as endowed with sacred responsibilities connecting them to past and future generations and the continued flourishing of their peoples. Making places sacred serves as a powerful motivator for people to continue to observe and take seriously their responsibilities to salmon and other humans and to maintain and pass on lessons.

The moral relationships of responsibility are not trivial. They facilitated peoples' capacity to adjust to the dynamics of ecosystems to avoid preventable harms. Ronald Trosper argues that responsibilities were organized to "buffer, self-organize, and learn in response to environmental issues."[12] Critically, this research teaches us more than just the idea that there are some responsibility-based practices that support resilience that occur now or occurred at some time in history. We learn to see the fabric of society as including responsible practices and the necessary moral qualities for carrying them out: trust, consent, and reciprocity. For example, leaders and knowledge keepers must pass vetting processes and ceremonies that vouch for their trustworthiness as stewards of salmon habitats. Ceremonies serve as public occasions to secure consent. Reciprocity, the moral quality of being accountable for returning what one has been given, is expected to help cope with shortages, restore social relationships damaged by trespass, and ensure, in a spiritual sense, the salmon's reincarnation. Salmon is just one species within a web of responsibilities knit together by trust, consent, and reciprocity. Salmon is not considered a "species," but as a people or nation who honor their responsibilities to humans.

Moral qualities of responsibility facilitate resilience. High levels of trust, consent, and reciprocity allow us to rely on each other transparently and productively when faced with environmental changes. Food and water shortages, for example, can spark conflicts within and across societies, especially as people challenge the trustworthiness and legitimacy of leaders, scientists, and those vested with authority. Spiritual relationships with nonhumans, the cultivation of places as sacred (or not), and social rules that commit people to help one another and repair fraught relationships motivate us to see ourselves as bound to a "covenant of reciprocity."[13] Environmental scientist Robin Kimmerer defines this covenant as the complex mutual responsibility – connecting human and nonhuman beings – to be conscientious gift givers and gracious gift receivers.

The environmental dimensions of resilience are just as much issues of genuine moral responsibility – trust, consent, reciprocity, and more – as they are issues of biology and ecology. Morality and resilience are key topics in environmental studies and science fields, including adaptive management, religion and ecology, and environmental ethics. IESS furnishes curricula, research, and programs that arise from and center the historical heritages and living intellectual traditions of numerous Indigenous peoples. These heritages and traditions, which continue to be tied to Indigenous peoples' current practices and identities, treat moral relationships as complex systems working to promote adaptive capacity, not stagnancy.

The term *spirituality* is often reserved for beliefs that are not grounded in evidence. Many scientists are suspicious of the role of spirituality or religion in a "rigorous" empirical study of an environmental topic such as resilience. Some IESS scientists, however, explicitly assert that scientific research must always be spiritual. For many Indigenous peoples, spirituality refers to moral relationships, especially accountability, that are tied to the pursuit of sci-

entific knowledge. In IESS, the connection between spirituality and science reveals how empirical inquiry provides information about resilience; and how spiritually oriented processes of empirical inquiry promote accountability within societies and respect for our interdependence with nonhumans and the environment.

Yupiaq scientist Oscar Kawagley discusses how the field of ecology is "closest to Yupiaq science," however, ecology often ignores "spirit" and hence "ignores the interaction and needs of societies and cultures within ecosystems." Kawagley has written that, "[Indigenous] scientific knowledge is not segregated from other aspects of daily life and it is not subdivided into different fields of science." He has claimed that, "to design a fish trap . . . one must know how the river behaves, how the salmon behave, and how the split-willow of which the trap is made behaves (i.e. one must understand physics, biology, and engineering)." Spirituality fosters accountability between humans and the environment, what Kawagley has described as the "incorporation of spirit in the Yupiaq worldview [which] resulted in an awareness of the interdependence of humanity with the environment, a reverence for and a sense of responsibility for protecting the environment."[14] This way of thinking about science privileges empirical inquiry that is designed to achieve goals beyond the production of information. Science must be part of moral relationships, increasing human accountability to nonhumans and the environment. Science must also be interdisciplinary and include diverse sources of knowledge. And investigating systems of interdependence must be rooted in and applicable to the practical activities of everyday environmental stewardship and subsistence, like designing a fish trap!

A powerful example of Indigenous science as a process of coupled spiritual and empirical inquiry can be found in the Great Lakes, where research about sturgeon biology and habitat is designed to recover abundant sturgeon populations. For the Odawa, Ojibwe, Potawatomi, and Menominee, sturgeon populations provided nourishment as people emerged from winter with nearly exhausted food supplies. The sturgeon habitat was so important that some peoples had sturgeon clans, which were responsible for protecting the environmental conditions necessary to support the fish's anadromous life cycle. Some of these clans continue to honor their responsibilities today, and the sturgeon is still referred to as a "grandparent" by some Anishinaabe because sturgeon can outlive humans and possess incredible wisdom. These anadromous fish remember the exact streams in which they were born, returning to them for spawning. Tragically, sturgeon populations have plummeted due to the U.S. colonial impacts of overfishing, dam construction, industrial pollution, and recreation activities such as sportfishing. In Michigan, for example, by the early 2000s, well under one hundred fish per year came to spawn in the Manistee rivershed.[15]

Historic studies show that Indigenous peoples across the U.S. and Canadian sides of the Great Lakes sustained abundant sturgeon yields. Seasonal knowledge of sturgeon fisheries includes watching for "pink [wild] rose buds to come out or the [wild] plum trees bloom," which signaled the onset of spawning, a prime time for fishing.[16] Ancient place names, such as Sturgeon Lake, Sturgeon River, and Sturgeon Falls, indicate historic or still current sturgeon abundance. Indigenous peoples who seek to rekindle sturgeon populations, however, have goals that exceed the recovery of historic knowledge of sturgeon. They are dedicated to returning the fish to abundance and using the process to renew humans' own sense of accountability for the relationships of ecological interdependence they are part of but often ignore.

The Little River Band of Odawa Indians in Michigan has engaged in extensive sturgeon recovery. Jimmie Mitchell, a program founder, has described sturgeon recovery as providing a "connection between spirit-world and our own.... The spirit that is connected to our belief system guides the Anishinaabek to our respective responsibilities [to the environment]."[17] Tribal biologist Marty Holtgren describes how the scientific research was designed by a community-based committee of elders, scientists, and tribal members. For Holtgren, the Cultural Context Committee facilitated a voice that "was an amalgamation of cultural, biological, political, and social elements, all being important and often indistinguishable." Their meetings were punctuated by ceremonies and feasts. Holtgren has discussed how the tribe worked to develop a process to "restore the harmony and connectivity between [Lake Sturgeon] and the Anishinaabek and bring them both back to the river."[18] Here, the goal of scientifically investigating sturgeon biology and habitat for the sake of population recovery includes restoring human accountability to sturgeon and rekindling the philosophies of ancient moral relationships that link humans and sturgeon in an interdependent ecosystem. The involvement of non-scientists on the committee exemplifies accountable science: the idea that empirical inquiry should be designed so that communities can trust and consent to the research design, the implementation of its methods, and its outcomes.

Bringing people back to the river built awareness of and human accountability for the major environmental factors degrading sturgeon habitats, especially dams and pollution. Important components of the science of sturgeon recovery included learning about historic relationships of accountability between humans and sturgeon and renewing that accountability today. The Little River Band, Menominee, White Earth Ojibwe, Rainy River First Nation, and other Tribes working to restore sturgeon in the Great Lakes have designed public ceremonies and community feasts to commemorate the ways sturgeon plays a key role in highly interdependent, local ecosystems. Little River's sturgeon-release ceremony invites the public to attend when juvenile sturgeon are released into the river each fall, exposing many non-Natives to Indigenous histories, culture, and traditional knowledge of sturgeon, as well as sturgeon biology and life cycles and environmental challenges. The Menominee sturgeon feast each spring is also public, bringing Menominee and non-Menominee together for educational and cultural immersion in sturgeon-related history, values, and practices, including dance. Some Odawa and Menominee attendees see the ceremony and feasts, which attract hundreds of people, as a chance to commemorate accountability to the fish, to create intercultural conversations about sturgeon science, to heal relationships with settlers through a public discussion of environmental degradation, and to engender responsibilities in future generations. At the Odawa ceremony, many children of all heritages personally release a juvenile sturgeon into the river. Of course, these events are significant parts of Indigenous sturgeon recovery projects that frame provocative empirical inquiry into sturgeon; Little River's and Menominee's research on anadromous sturgeon add to knowledge about sturgeon biology, genetics, life cycles, and habitats.[19]

Both Little River and Menominee sturgeon programs seek to rekindle moral relationships between humans and sturgeon, and thus couple science and spirituality. The programs are interdisciplinary, aimed at understanding complex human interdependence with sturgeon, and committed to bringing sturgeon back to sustenance levels. The ceremonies and feasts bring people together to strengthen moral qualities, in

this case accountability, but also trust, consent, and reciprocity. They seek not only to rebuild the social fabric of Indigenous peoples, but also to repair the fraught relationships with settler and other non-Indigenous populations in the region. IESS activist and scholar Winona LaDuke, writing on the restoration of sturgeon at White Earth, has expressed hope that "Maybe the fish will help a diverse set of people work together to make something right. . . . The fish help us remember all of those relations, and in their own way, help us recover ourselves."[20]

IESS' focus on responsibility and spirituality yields lessons about another moral relationship relevant to resilience: justice. Scholarship on environmental justice shows that groups such as Indigenous peoples around the world and U.S. people of color bear high burdens of environmentally related harms, such as lower health outcomes and losses of cultural integrity. IESS research often takes an additional step to demonstrate that environmental injustice can be understood as threatening the moral relationships that empower all societies' resilience. Consider how Haudenosaunee peoples and their allies have developed a portfolio of IESS research studying the relationship among pollution, health, self-determination, and cultural vitality in the Saint Lawrence River watershed. They designed this research to respond to widespread industrial pollution burdening Mohawk communities on both the U.S. and Canadian sides, including toxicants like polychlorinated biphenyls.

Mohawk scholars, activists, and scientists have documented the history of pollution in the region.[21] The United States and Canada permitted giant industrial facilities of General Motors, the Aluminum Company of America, Domtar, and Reynolds Metals to operate in close proximity to the Mohawk communities. The nations and industries neglected to be responsible for cleaning up immediately after some of these facilities closed. Some areas within the Saint Lawrence River watershed near Mohawk communities have been among the most polluted in North America. The pollution is no accident. Winona LaDuke has argued that the United States and Canada set the Mohawks up for these circumstances by coercing them into ceding much of their lands.[22] In addition to land dispossession, Canada and the United States forced many Mohawks into boarding schools that attempted to divest them of their cultures, languages, and potential to pass on skill sets.

The pollution of fish is a particular concern. Indigenous studies scholar Elizabeth Hoover has written that, in Akwesasne, "the relationship between fish – whose duty it is to cleanse the water and offer themselves as food – and humans – whose role it is to respectfully harvest these fish – has been interrupted by environmental contamination."[23] Those most at risk from pollutants include women of childbearing age, pregnant and nursing women, and children under fifteen, especially given the bioaccumulation of some toxicants in breast milk. Indigenous environmental scientists Alice Tarbell and Mary Arquette estimate that 50 percent of the economy used to be based on fishing before the pollution started. Beyond fish, they tell how the contamination of medicinal plants leaves traditional health care providers unable to recommend natural remedies that some elders in Mohawk communities rely on.[24]

For the Haudenosaunee, the harms of pollution strike at the heart of the moral relationships that make up the fabric of their societies. Indigenous environmental scientist Henry Lickers has said that when pollution makes it hard to continue fishing, "people forget, in their own culture, what you call the knot that you tie in a net. And so, a whole section of your language and culture is lost because no one is tying

those nets anymore. . . . That whole social infrastructure that was around the fabrication of that net disappeared."[25] For Lickers, the "whole social infrastructure" and "language and culture" refer to the convergence of responsibilities and spiritual relationships connecting people to each other, to fish, to biota, and to the ecosystem. These relationships sustained trust, consent, reciprocity, and accountability within the community and made it possible for people to live respectfully within dynamic ecosystems. Tarbell and Arquette describe Mohawk people as in mourning due to the loss of their capacity to exercise their moral relationships.[26]

The Haudenosaunee have developed a comprehensive strategy for responding to pollution through the environmental divisions of the Mohawk Council of Akwesasne and the St. Regis Mohawk Tribe, the Akwesasne Task Force on the Environment, the Mother's Milk Project, the Traditional Mohawk Nation Council of Chiefs, and the leadership of Mohawk scientists in the Saint Lawrence River Institute. Their IESS portfolio is diverse. At one level, they have produced peer-reviewed research on the environmental and human impacts of pollution, often collaborating with universities, such as the University at Albany, in ways that ensure scientific expertise and education stay in the Mohawk communities after particular projects end. They also work at the level of ethics, human rights, and justice.[27]

In terms of the scientific research, Arquette and her collaborators at Akwesasne have emphasized how studying moral relationships is crucial for understanding the impacts of pollution. Challenging the notion – common in some environmental science circles – that if there is no exposure, then there are no adverse health effects, they have shown how, when moral relationships between humans, fish, and plants break down, "alternative diets are consumed that are often high in fat and calories and low in vitamins and nutrients," which produces additional negative health outcomes that affect Mohawks acutely, including diabetes.[28] The study of environmental health is not only about degrees of exposure, but also about peoples' moral relationships.

Mohawk advocate Katsi Cook, through the Mother's Milk Project, has worked to make environmental health science accessible to affected communities so that people can respond to pollution by observing moral relationships with fish, medicinal plants, and other beings. Cook sees the Mohawk responses to pollution through the lens of moral relationships. She said "the beauty of the response of the mothers . . . is that they saw everything in a bigger picture. Many of us bless the seeds, pray to corn, and continue a one-on-one relationship with the earth."[29] Regarding innovative solutions, Tarbell and Arquette have discussed aquaculture, for example, not as a permanent solution, but "one that allows the skills associated with fishing to continue" and provides a "healthy protein."[30] The same concern for moral relationships has also inspired Mohawk leadership in the fight against climate change. The publically available climate change plan of the St. Regis Mohawk Tribe, organized according to the Mohawk Thanksgiving Address, uniquely focuses on moral relationships, including sections on the "Three Sisters," "The Four Winds," and "Grand Mother Moon."

Injustice is a form of domination that works to undermine Indigenous peoples' capacity to have moral relationships with nonhumans and the environment, which are crucial to their resilience. The pollution in the Saint Lawrence River watershed exemplifies U.S. and Canadian injustice against the Haudenosaunee peoples. And the Akwesasne Task Force has argued that fighting pollution is about

Mohawk self-determination, whether by supporting environmental health or creating new economic options that are safe and sustainable. Injustice occurs when one society seeks to upend the moral relationships that constitute another society's resilience, in this case, Canada and the United States establishing the conditions for their own resilience at the expense of the Mohawk peoples. Establishing justice, however, as the Mohawk leaders and institutions demonstrate, involves the continuance and renewal of moral relationships that support their capacity to live respectfully with a changing environment.

IESS centers on Indigenous historical heritages, living intellectual traditions, research approaches, education practices, and political advocacy to investigate how humans can live respectfully within diverse ecosystems. IESS makes critical contributions to environmental research by showing the value of moral relationships as lenses through which to learn about sustainable social norms (such as the potlatch ceremony), scientific research on fish habitats (such as sturgeon recovery science), or the social dimensions of environmental health (such as the decline of fishing at Akwesasne and diabetes). On the flipside, IESS frames efforts to empower people to form moral relationships as a type of resilience. IESS supports Indigenous peoples' capacity to achieve sustainability and environmental justice and provides global insights into key challenges pertaining to resilience, including lowering carbon footprints, achieving gender justice, conserving biodiversity, strengthening peoples' senses of responsibility, and remediating polluted places.

Perhaps most important for the well-being of Indigenous peoples everywhere, IESS makes strong statements about what Indigenous reconciliation with settler and colonial nations will require. While apologies and forgiveness have symbolic value, Indigenous peoples are demanding reclamation of Indigenous lands and waters, and recognition of Indigenous sovereignty and self-determination on those lands and waters. IESS sheds light on how reclamation and sovereignty entail the capacity of Indigenous peoples to rebuild and continue complex moral relationships that can promote economic, cultural, and social resilience for the sake of future generations' well-being.

ENDNOTES

[1] Anishinaabe will be used as shorthand for the diversity of spellings, including but not limited to Neshnabé. Future references to words in this language will include a secondary spelling option.

[2] Author conversation with Sherry Copenace, July 7, 2017.

[3] While many Anishinaabe persons identify in the English language as women and discuss women's responsibilities, it is also the case that Anishinaabe language and culture do not admit of nor aspire to a binary gender system. Readers should mind the complexity framing Anishinaabe utterances of the English language words "women" and "girls."

[4] Claudia Sobrevila, *The Role of Indigenous Peoples in Biodiversity Conservation: The Natural but Often Forgotten Partners* (Washington, D.C.: The World Bank, 2008), xii.

[5] Diana Morris, "Letter from the President," College of Menominee Nation, http://www.menominee.edu/About_CMN.aspx?id=1233 (accessed December 24, 2017).

[6] World Health Organization, Climate Change and Health Fact Sheet, July 2017, http://www.who.int/mediacentre/factsheets/fs266/en/.

[7] Ronald Sandler, *The Ethics of Species: An Introduction* (Cambridge: Cambridge University Press, 2012).

[8] Clive Wilkinson, ed., *Status of Coral Reefs Around the World: 2008* (Townsville, Australia: Global Coral Reef Monitoring Network, 2008), 5.

[9] For an introduction to this topic, see Brigitte Evering and Dan Longboat, "An Introduction to Indigenous Environmental Studies," in *Contemporary Studies in Environmental and Indigenous Pedagogies* (New York: Springer, 2013); Eve Tuck, Marcia McKenzie, and Kate McCoy, "Land Education: Indigenous, Post-colonial, and Decolonizing Perspectives on Place and Environmental Education Research," *Environmental Education Research* 20 (1) (2014): 1–23; and Warren Cariou and Isabelle St-Amand, "Introduction to Environmental Ethics through Changing Landscapes: Indigenous Activism and Literary Arts," *Canadian Review of Comparative Literature* 44 (1) (2017): 7–24.

[10] Richard E. Atleo, "Discourses in and About the Clayoquot Sound: A First Nations Perspective," in *A Political Space: Reading the Global through Clayoquot Sound*, ed. Warren Magnusson and Karena Shaw (Kingston, Canada: McGill University Press, 2002).

[11] Marlene Renate Atleo, "The Ancient Nuu-Chah-Nulth Strategy of Hahuulthi: Education for Indigenous Cultural Survivance," *International Journal of Environmental, Cultural, Economic and Social Sustainability* 2 (1) (2006).

[12] Atleo, "Discourses in and About the Clayoquot Sound"; Atleo, "The Ancient Nuu-Chah-Nulth Strategy of Hahuulthi"; and Ronald L. Trosper, *Resilience, Reciprocity and Ecological Economics: Northwest Coast Sustainability* (New York: Routledge, 2009).

[13] Oscar Kawagley, Delena Norris-Tull, and Roger Norris-Tull, "The Indigenous Worldview of Yupiaq Culture: Its Scientific Nature and Relevance to the Practice and Teaching of Science," *Journal of Research in Science Teaching* 35 (2) (1998): 133–144, esp. 138–139.

[14] Angayuqaq Oscar Kawagley, *A Yupiaq Worldview: A Pathway to Ecology and Spirit* (Long Grove, Ill.: Waveland Press, 2006).

[15] Marty Holtgren, "Bringing Us Back to the River," in *The Great Lake Sturgeon*, ed. Nancy Auer and Dave Dempsey (East Lansing: Michigan State University Press, 2013), 133–147.

[16] Christopher James Hannibal-Paci, *"His Knowledge and My Knowledge": Cree and Ojibwe Traditional Environmental Knowledge and Sturgeon Co-Management in Manitoba* (Ph.D. diss., University of Manitoba, 2000).

[17] Jimmie Mitchell, "N'me," in *The Great Lake Sturgeon*, ed. Nancy Auer and Dave Dempsey (East Lansing: Michigan State University Press, 2013), 22. *Anishinaabek* is the plural of Anishinaabe.

[18] Holtgren, "Bringing Us Back to the River."

[19] See, for example, Jonathan D. Pyatskowit, Charles C. Krueger, Harold L. Kincaid, and Bernie May, "Inheritance of Microsatellite Loci in the Polyploid Lake Sturgeon (Acipenser fulvescens)," *Genome* 4 (2) (2001); and Holtgren, "Bringing Us Back to the River."

[20] Winona LaDuke, "Return of the Sturgeon: Namewag Bi-Azhegiiwewaad," *News from Indian Country*, August 31, 1999.

[21] Alice Tarbell and Mary Arquette, "Akwesasne: A Native American Community's Resistance to Cultural and Environmental Damage," in *Reclaiming the Environmental Debate: The Politics of Health in a Toxic Culture*, ed. Richard Hofrichter (Cambridge, Mass.: The MIT Press, 2000).

[22] Winona LaDuke, "Akwesasne: Mohawk Mothers' Milk and PCBs," *All Our Relations: Native Struggles for Land and Life* (Cambridge, Mass.: South End Press, 1999), 11–26, esp. 13.

[23] Elizabeth Hoover, "Cultural and Health Implications of Fish Advisories in a Native American Community," *Ecological Processes* 2 (1) (2013): 1–12.

[24] Tarbelle and Arquette, "Akwesasne."

[25] Henry Lickers quoted in ibid, 5.

[26] Tarbell and Arquette, "Akwesasne."

[27] See, for example, Haudenosaunee Environmental Task Force, *Words that Come Before All Else: Environmental Philosophies of the Haudenosaunee* (Ontario, Canada: North American Travelling College, 1992) on human moral relationships with the environment; and Haudenosaunee Environmental Task Force, *Haudenosaunee Environmental Restoration: An Indigenous Strategy for Human Sustainability* (Cambridge: Indigenous Development International, 1995).

[28] Mary Arquette, Maxine Cole, Katsi Cook, et al., "Holistic Risk-Based Environmental Decision-Making: A Native Perspective," *Environmental Health Perspectives* 110 (2) (2002): 261.

[29] LaDuke, *All Our Relations*, 20.

[30] Tarbell and Arquette, "Akwesasne."