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PERSPECTIVES

DATA SCIENCE IN INDIAN COUNTRY

By Maudesty Merino and Nick Salgado-Stanley

At the end of July 2022, some 150 individuals from across the country gathered at the University of Minnesota Twin Cities for “Data Science in Indian Country,” the Fifth Geoscience Alliance Conference since 2010. Founded by Dr. Nievita Bueno Watts of California State Polytechnic University, Humboldt (Cal Poly Humboldt), Prof. Anthony Berthelote of Salish Kootenai College, and Dr. Diana Dalbotten of the University of Minnesota’s St. Anthony Falls Laboratory, the Geoscience Alliance (GA) is a coalition of students, educators and staff, Indigenous community members, and others committed to broadening the participation of Native Americans, Alaska Natives, and people of Native Hawai’ian ancestry in the geosciences.

“We envision a future in which Native Americans are no longer underrepresented in the geosciences,” write the GA founders. “We look to a day where Native scientists take a leadership role in helping to steer our country toward a more sustainable and environmentally ethical relationship with the Earth.”

During the Fifth Geoscience Alliance Conference, participants discussed a number of key questions regarding data collection and analysis. They asked:

- *What safeguards are in place to protect and steward culturally sensitive data and knowledge?*



Wild rice growing in northern Minnesota. Image via Superior National Forest, (CC BY 2.0), via Wikimedia Commons.

- *What role does Traditional Ecological Knowledge (TEK) play in study design and data interpretation?*
- *How might environmental or cultural resources be imperiled by sharing data with non-Native entities?*

Two students engaged in these discussions were Maudesty Merino and Nick Salgado-Stanley of Cal Poly Humboldt. Both Maudesty and Nick brought their experiences in the St. Anthony Falls Laboratory's Research Experience for Undergraduates on Sustainable Land and Water

Resources (REU SLAWR) to the conference. Working with researchers from the University of Minnesota Duluth and in collaboration with the Fond du Lac Band of Lake Superior Chippewa, Maudesty and Nick contributed to a multi-year study on the effect of sulfur on Manoomin (Ojibwe) / Psin (Dakota) / Wild Rice.

In the following essays, Maudesty and Nick share their insights about their experiences.

—Clare Boerigter, St. Anthony Falls Lab Communications Manager

Researching in a Place away from Home

Maudesty Merino

Just before the summer of 2021, I was accepted into the Doris Duke Conservation Scholars Program, a two-year immersion program for scholars entering the field of conservation. The first summer was in preparation for an internship, helping us establish our skill sets and perspective in conservation science. Based on our experience of the first summer, our mentors helped us find an internship for the following summer. This led me to the Sustainable Land and Water Resources REU program in the summer of 2022, based at the University of Minnesota with the Kawe Gidaa-naanagadawendamin Manoomin “First we must consider the wild rice” Collaborative.

This is where I was introduced to new perspectives and opportunities to learn firsthand about Indigenist-led Research. Such research is based on the principles and philosophies of Indigenous peoples and is conducted by Indigenous people within their own communities (Boyd 2014). I felt out of place even as an Indigenist scientist, simply because I was conducting Indigenous research in a place away from home. I have gained many skills throughout my lifetime, learning from elders, teachers/professors, workshops, wellness

circles, conferences, and internships. There are differences in our Indigenous knowledge systems, as no place is ever the same. This has allowed my perception and approaches to collaborative ecological research to grow.

I began this project thinking about how I was going to see or learn something new and different. However, I recognize that I had not only learned the same lesson as many more before me who had also been guided to Psin/Manoomin, but a large part of this reciprocal relationship was to give back. “Plants answer questions by the way they live, by their responses to change; you just need to learn how to ask” (Kimmerer 2018, 158). I did not know how best to do that at first, and it took me the whole summer to recognize what had always been there. It felt only right that I continue to share my story and be that guide for future Indigenist leaders within all fields, reminding them of what it means to learn the language of the plants.

Indigenous perspectives are necessary voices when discussing potential change or measurement within a landscape, as are all stakeholders along with continuous inclusion throughout the

implementation process. During my second summer internship, I attended a Tribal Adaptation Menu Workshop on the lands of the Fond Du Lac Band of Lake Superior Chippewa. There we focused on the Indigenous-led research and conservation of Psin/Manoomin, as well as their process of conducting research, including the seven Ojibwe values: Nibwaakkaawin (wisdom), Zaagi'idiwin (love), Minaadendamowin (respect), Zoongide'ewin (bravery), Gwayakwaadiziwin (honesty), Dabaadedendiziwin (humility), and Debwewin (truth). These new perspectives helped me change some aspects of my perception while also strengthening others, showing me an additional pathway to understanding and recognizing how the land has changed over time.

There are many protectors of Psin/Manoomin; their survivance today is all thanks to the Dakota and Ojibwe families picking up the bulk of these responsibilities. Although commonly known as Ojibwe peoples, they actually refer to themselves as Anishinaabe and their language as Ojibwe. The great migration prophecy of the Anishinaabe tells of their journey to the land where the “food grows on the water,” leading to a new equilibrium of stewardship for Psin (wild rice) by the Dakota and Manoomin (wild rice) by the Anishinaabe (Great Lakes Wild Rice Initiative, 2020). The spiritual, emotional, physical, and mental wellness of the Indigenous peoples are strongly connected with Manoomin or Psin; they even named the August moon as their Ricing Moon, the Manoominike-giizis (Ojibwe.net). The Anishinaabe and Dakota story of healing begins with Manoomin/Psin, just as Manoomin/Psin's story of survivance is carried on through their stories; it is a story of reciprocity and resilience.

Healing the land also heals the people by instilling altruistic values and deepening our roots with the land as stewards. The Dakotas' story of survivance has much to do with their core values and their return to Psin, the knowledge having been passed down to help guide them: Wóokiya (generosity and helping), Wóksape (wisdom),

Wówaunšidaŋ (caring and compassion), Wóohoda (respect), Wówahbadaŋ (humility), Wócekiya (prayer), and Wówicaka (honesty and truth) ([Our Seven Dakota Values – Native American Heritage Month](#)). These altruistic values instilled within the Dakota and Anishinaabe have raised them to be protectors or activists on Psin/Manoomins' behalf. As an Indigenist researcher, I feel it is important to consider not only the people, but also the beings or species themselves, as they hold stakes in the land. Psin/Manoomin is respected as an animate being by the Dakota and Anishinaabe, having formed a reciprocal relationship that would ensure each others' survival (David et al. 2019).

Gelinas wrote, “When we work in relationship with stakeholders, we can achieve things that no one of us could accomplish on our own” (2016, 157). This highlights those parts of our experiences that may be hidden from others, while also encouraging “the satisfaction and comfort of being part of and contributing to a community of people.” These concepts can lead to new beginnings or changes within our society, helping us to diversify the various communities of research. There will always be multiple pathways to knowledge and change, helping to ignite our survivance, perpetuate acts of reconciliation, and brighten the light of revitalization, while also fighting for repatriation. Positive ecological collaboration is a process of unity and understanding of each other and using our differences as strengths and inspiration for new and inclusive solutions. One example of a positive ecological collaboration is the Kawe Gidaa-naanagadawendaamin Manoomin or “first we must consider the wild rice” Collaborative. The Collaborative has partnered traditional ricers and scientists, all who have been protecting Psin/Manoomin long before, laying out the groundwork for future researchers like myself. Psin/Manoomin (wild rice) has its own protocol under the Kawe Gida-naanagadawendamin Manoomin collaborative, inspiration drawn from all of the Indigenous communities. One of

the protocols' guiding principles is the level of respect and understanding one must have for Psin/Manoomin as it builds cultural competency (UMN Manoomin project protocol).

We as Indigenous peoples have struggled to align with the scientific ecological methodologies, though it does not change that “generations of data collection and validation through time builds up to well-tested theories” (Kimmerer 2018, 159) of traditional ecological knowledge. Indigenous perspectives tend to lean more on the side of relational interactions of living beings originally from Turtle Island, rather than seeing nonhuman others as objects to be controlled. This is one of the primary differences in practicing Scientific Ecological Knowledge (SEK) or Traditional Ecological Knowledge (TEK). SEK has some similarities with TEK, including their observational and subjective qualities that imply a process of curiosity and inquiry (Stokes 2022). This bridging of social capital through the sharing of knowledge systems can bring great strength and diversity to the modernized scientific community. Social capital has two aspects that help us socially bond with people who are like us and bridge the gap with those different from us (Gelinias 2016, 157). The information that is shared within the Indigenous communities is spatially specific, having “developed in a multiplicity of cultures that have passed down a knowledge of place through thousands of years of experience to subsequent generations” (Tribal Adaptation Menu Team 2019, 8). Indigenous perspectives are extremely important to incorporate when looking into potential research sites, as “many of the ecological crises humanity is facing are due to the pervasiveness of the western perspective in decision-making around the globe”(9). The knowledge changes everywhere you go; these knowledge systems tend to lean on the side of plurality or multiple ways of knowing (Stokes 2022).

The Anishinaabeg are a symbol of cultural survival and perspective; they have often called

“for observation, deliberation, recognition, and adaptation,” not western perspectives of “exploration, domination, exploitation, and extraction” (Tribal Adaptation Menu Team 2019, 9). This can bring a very different perspective to conducting research, as we recognize what happens when we no longer value their wisdom and suddenly “our teachers and relatives quickly become ‘resources’ stripped of their true identities and sold on the open market to the highest bidder” (10). Indigenous peoples strive to come together in a good way, so when researching, we must be sure to use “the approach of respect and reciprocity” helping to open doors “to local perspectives and stories in ways that discussion questions, which tend to be direct and focused, will not” (11). I personally resonate with the teachings from my Aunty and what it means to dance for the people, to share our good medicine by allowing ourselves to keep a good mindset and do things in a good way. I have worked to incorporate these values into my mental model and allow it to positively change my mindset, especially when conducting research.

Psin/Manoomin is a relative to the Anishinaabeg as many other “plants, animals, and other manidoog (spirits) are our relatives and original teachers” (Tribal Adaptation Menu Team 2019, 10). I wanted to ensure that I acknowledged and reciprocated the respect that was necessary in order to gain a slight understanding of the importance Psin/Manoomin holds for the people. This includes specific parameters placed around communities caring for Psin/Manoomin, respecting their vulnerable stages such as floating leaf stage and choosing to not disturb our relatives. The floating leaf stage is the most sensitive stage of Psin/Manoomin’s life cycle, their abundant survivance is variably dependent on “weather, water and/or nutrient levels, and presence of pests” (GLIFWC 2018, 29). It leads to a different way of understanding and finding solutions for ecological restoration that also takes into consideration the environment as a whole and how all things interconnect. This includes understanding

and respecting the wisdom being shared, and recognizing the different forms of survivance—or presence—worldview.

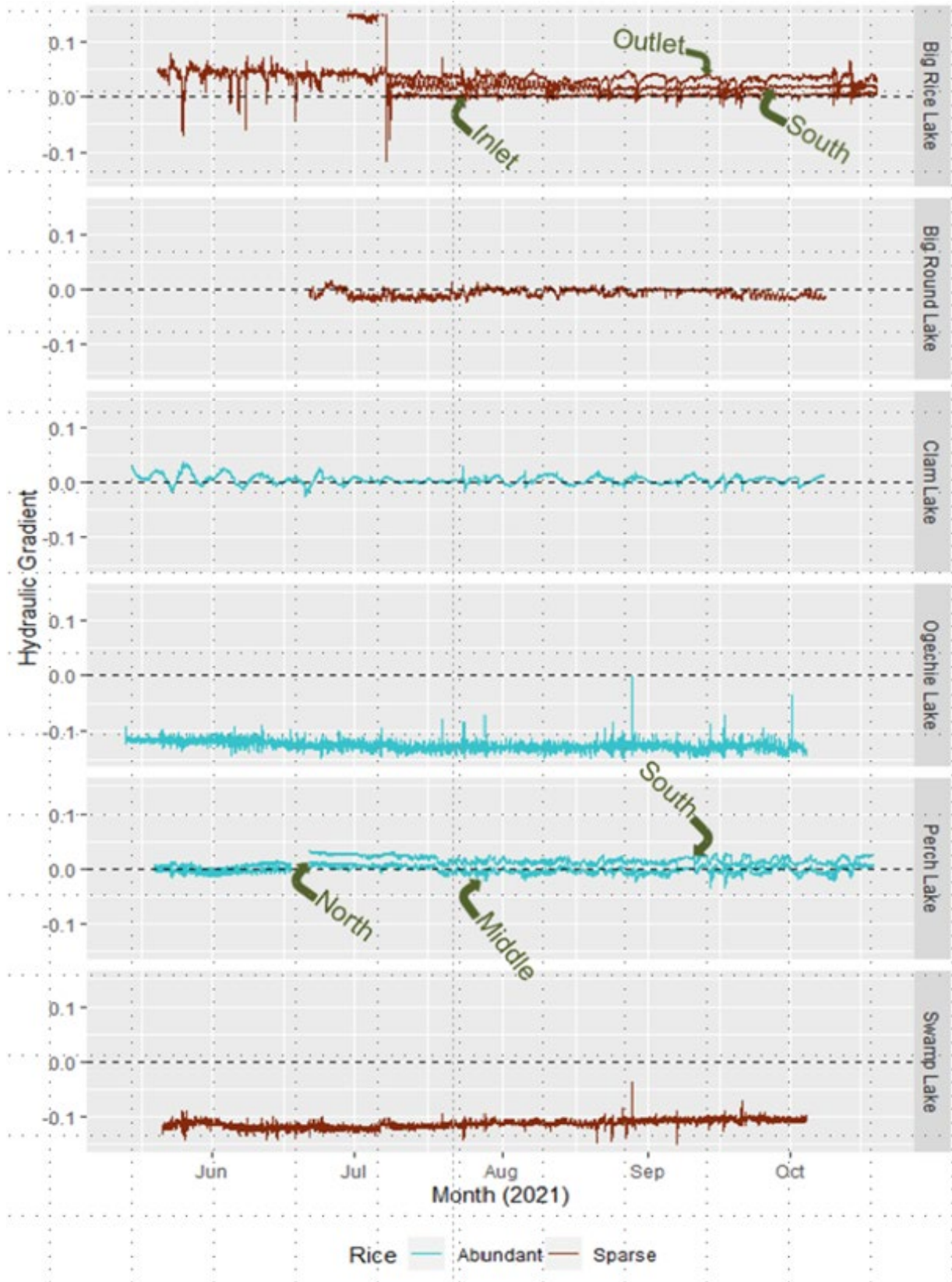
Survivance, Reconciliation, Revitalization, and Rematriation are all important aspects that should always be considered when Mother Earth is involved. When we begin to revitalize our way of life and share our knowledge with the communities, both young and old will slowly begin to feel the good medicine that's been looking over them always. Continuing through the motions of reconciliation for our individual mental well-being, we are best understood together, our good medicine is stronger together. This mindset of greed and need brings pain and suffering upon us. Though once we are “assembled by those who have a covenant of reciprocity and respect, the bricks of science build a hospital, a school, a water purification plant, a wildlife refuge, and organic farm, and generate knowledge on behalf of our more-than-human-relatives” (Kimmerer 2013, 56). Survivance is a part of all of us; survivance is the battle scars and intergenerational trauma that have been passed down from our ancestors.

The survivance of Psii/Manoomin is highly interconnected with the Indigenous peoples and the revitalization and reconciliation of both their life history strategies. This journey through ecological colonization has led the people directly into the decolonization of those very same practices. Decolonization has many forms as it is a, “process of disruption, resistance, disentanglement, renewal, and creation out of the ashes of colonialism” (Strutt 2021, 21). There are multiple changes throughout Psii/Manoomin's life cycle, including germination, submergent, floating leaf, emergent, flower, and the seedling. Psii/Manoomins' survivance is interconnected with conditions created by the wetlands and Indigenous peoples (David et al. 2019). In order to revitalize their way of life, they cherished Psii/Manoomin practices and passed them down through the generations. Once people began to change their minds about reconciliation, they began to reciprocate a more positive relationship.

The rights of Psii/Manoomin are directly connected to their health, meaning a key factor in strengthening their survivance tactics for Psii/Manoomin involves the understanding of how they are interrelated.

As part of my 2022 SLAWR internship, I analyzed data from 2021 of the groundwater and surface water fluctuations according to research sites with Psii/Manoomin abundance and sparsity. The hydraulic gradient graphs I created are comparable to the graphs in the Kawe Gidanaanagadawendamin Manoomin Collaborative's “Site Comparison Report for 2018–2020.” Our tribal partners have provided the research locations and have chosen where to place their stream gauges and piezometers, according to Psii/Manoomin abundance and sparsity. The tribal partners include: 1864 Treaty Authority (4 sites), Fond Du Lac Band of Lake Superior Chippewa (2 sites), Great Lakes Indian Fish and Wildlife Commission (1 site) Lac Du Flambeau Band of Lake Superior Chippewa (3 sites), Mille Lacs Band of Ojibwe (2 sites), and St. Croix Chippewa Indians of Wisconsin (2 sites). The hydraulic gradient looks at the differences of the hydraulic head or water levels along the same path of water flow, where the differences in points are being accounted for. Psii/Manoomin has a beautiful sense of understanding with groundwater and surface water; they have evolved to benefit from the varying fluctuations of water levels (David et al. 2019).

The graph above was created from the 2021 dataset. While it did not reveal any major changes or correlations, there are still patterns to be recognized. Upwelling means that water levels are rising, while downwelling means they are going down. This can be important for many different reasons, including the influx and assimilation of nutrients during reoccurring flood events, as “emergent macrophytes acquire the nutrients required for growth directly from wetland sediments and incorporate them into living biomass” (Arneson 2020, 6). The nutrients being absorbed by the plants may be deteriorating the plants'



Hydraulic gradient on Minnesota and Wisconsin lakes. Data gathered by the Kawe Gidaa-nanaagadawendamin Manoomin Collaborative and analyzed by the author and her mentor Gigi Voss. Image courtesy of the author.

ability to flourish. “The sensitivity of individual waterbodies to sulfate pollution effects on wild rice toxicity can thus be predicted from the analysis of the carbon and iron concentrations in the solid of a wetland” (Pollman et al. 2017). Both Ogechie and Swamp Lakes have downwelling hydraulic gradients, meaning the water levels have gone down. However, Ogechie is a known ricing site of abundance with a lot of Psin/Manoomin to compare with other known sparse sites. The pattern of one abundant site and one sparse site having the same characterization of upwelling or downwelling continues the known method of Psin/Manoomin needing a variance of shifting water levels (Great Lakes Wild Rice Initiative 2020). The stream gauge measures the flow of surface water while piezometers focus on the ground water levels. Each site also carries two types of pressure transducers. The Solinst barologger records the air pressure in fifteen minute increments; it is placed above the water and inside the pvc pipe. The Solinst levelogger also records every fifteen minutes, though it is placed underwater and measures temperature and pressure. Understanding the movement of water is helpful in many situations; for this situation it is allowing us to compare the gradients with Psin/Manoomin abundance and sparsity. Big Round Lake and Perch Lake have multiple stream gauges and piezometers, showing the spatially specific shift of upwelling and downwelling. This helps increase our spatial understanding of these specific areas and how the land’s geography may be shifting the dispersion of water.

Many different factors continue to nurture and care for Psin/Manoomin, though as dams begin to fail they also negatively affect the necessary parameters for Psin/Manoomin; the fluctuating water levels help keep the Ginoozhegoons (pickerelweed) from invading (Great Lakes Wild Rice Initiative 2020). Truth be told, the temporal scale is off for this short three-year analysis and we would need more time to truly determine what is working and not working. However, tribal entities have been more successful in

supporting Psin/Manoomin and understanding what they need to flourish. Flooding helps uproot perennials and invasive plants, but flooding at the wrong time of year may be affecting the sensitive floating leaf stage of Psin/Manoomin. Each area of Manoomin is different and therefore requires more spatially specific data and information (David et al. 2019). Every tribal partner is different in their implementation of research methods; more often than not different solutions are necessary for different problems. Especially as there are many different factors that influence Psin/Manoomin, learning their language begins with understanding their lifeway preference (Kimmerer 2018, 158) like greater water clarity, with a higher submerged aquatic vegetation (SAV) cover, and a sandy substrate for sediment composition (Arneson 2020). A longer temporal scale of research may help clarify the actual pattern upheld by Psin/Manoomin.

Why is this research different? How have these Indigenous perspectives improved and expanded the process of conducting research? The beginning of this research involved the building of a relationship with this living being, staying consistent with all the stakeholders and learning the plants’ language (Kimmerer 2018). The tribal stakeholders are able to help with almost every aspect of the project, so they should be included throughout the process. This includes access to more lands, historically sacred places for ecological survivance and adaptability of Psin/Manoomin. It includes providing researchers with the opportunity to change the approach and push for creative thinking, “the ways we enact relational accountability” (Wilson and Hughes 2019, 7). It includes learning and incorporating Indigenist-led research philosophies when researching on their land, which means that researchers “include a relational and emergent understanding of reality and Knowledge, and requires a particular way of behaving in the world” (7). These ideas are woven throughout the collaboratives’ research protocol, pushing them to find new methods for conducting research, such

as respectfully staying out of the waters during the sensitive floating leaf stage. The voices that were previously pushed to the side have finally been given the support necessary to make change and have a voice in water quality standards, reporting, and policy intervention. Species have been evolving to attract pollinators for ages now, so why is a human following Psin/Manoomin any different? Are we not all controlled, if not mesmerized, by the very beings or “resources” that sustain us, helping us in all aspects of our lifeways—physically, spiritually, mentally, and emotionally.

I came into this internship thinking I would learn a lot about the process for collaborating positively. I have gained more questions than answers—more dreams than results. However, the one thing I’ve noticed in common between the Indigenous communities and these different spatially specific species is that by creating this connection with the land, it becomes sacred to the community. Understanding and researching for Indigenous communities means recognizing that “Indigenist knowledge is not made up of discrete or arbitrary relationships but rather represents a system of relationships that encompasses worldviews and cultures that arise from their place” (Wilson and Hughes 2019). These complex systems of knowledge and interconnecting relationships, within both the natural world and modern society, have become highly intricate with different perspectives weaving themselves into a metaphorical basket. Through this journey of weaving a basket, I am also writing, dreaming,

and praying to the creator and my ancestors above me for guidance and protection. It becomes more than just the physical dependency of each other, but rather the understanding and willingness to commit. The increase in traditional teachings is meant to help us all recognize who we are and how we’ve come to be, to have gratitude for our adaptability in times of crisis. The connections that are built within these Indigenous communities are dynamic and meant to push the limitations of our colonized mindsets instilled within us from a young age.

There were many different organizations that guided and supported me throughout my journey of becoming a Indigenist Researcher, including but not limited to: The Round House Council, The Maidu Summit Consortium, The Susanville Indian Rancheria, The Fifth Direction Program, The Doris Duke Conservation Scholars Program, The Louis Stokes Alliance for Minority participation, The Indian Natural Resources Science and Engineering Program, The Indian Tribal Education and Personnel Program and Club, The American Indian Science and Engineering Program, The Sustainable Land and Water Resources Internship, Great Lakes Indian Fish and Wildlife Commission, The University of Minnesota, and the Kawe Gida-naanagadawendaamin Manoomin Collaborative. All of these programs have brought me to a good place, with encouraging leaders who have guided me along my lifeway to “the place where the food grows on the water.”

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Data Science Across Borders

Nick Salgado-Stanley

As an undergraduate pursuing degrees in wildlife conservation and economics at Cal Poly Humboldt, I was drawn to professionals who understood the importance of data and its applications to the natural world. In particular, I was excited to be part of a community of scholars who were committed to preserving Indigenous sovereignty through academic research and collaboration.

Entering a space of Indigenous knowledge and respect as a non-native student was a new experience for me. Initially, I was hesitant to speak up and questioned my place in an environment rich in cultures unlike my own. However, positive affirmations from mentors, peers, and strangers alike allowed me to see that having multiple backgrounds in one space is imperative to create inclusive solutions to a diverse world.



Fond du Lac Water Resources Director Nancy Schuldt (left) and REU researcher Amber Simon (right) take water samples at Big Lake for E. Coli and other water-borne diseases. Image courtesy of Nick Salgado-Stanley.

At the gathering, provoking ideas were questioned, and cultural questions were answered. Most importantly, though, mental walls were broken down; through roundtable discussions that allowed people of different backgrounds to shed light on controversial issues, people grew comfortable enough to discuss the misconceptions and stereotypes that typically surround Native American affairs.

Specifically, we had discussions in intimate groups where everyone was encouraged to share experiences and thoughts. Educating many different generations on how to respectfully treat their elders, people of different ethnicities, and even how to pronounce different nations across the continent all help to eradicate ignorance from STEM spheres.

One perspective I considered throughout the Fifth Geoscience Alliance Conference was how Chicano individuals' concerns are reflected in academia regarding data sovereignty. Speaking from experience as a Latino in STEM, I believe that data sovereignty is very important to many Chicano issues, and is especially relevant for those in the San Joaquin Valley in California. Here, many Chicano farm workers suffer from human rights violations.

The San Joaquin Valley supplies a quarter of the United States' food, yet its workers have long been viewed as second-class citizens. United Farm Workers, a labor union recently backed by California Senator Alex Padilla, is advocating for the equal treatment of farm workers, regardless of citizenship status or national origin. A large part of the fight is in accessing figures to estimate exactly how many farm workers in the state are protected under the Deferred Action for Childhood Arrivals Act, or DACA, and immigration legislation passed by Congress and signed into law by President Biden (White House 2023).

According to the U.S. Census Bureau, only 12 percent of reported farm workers across California are Hispanic (USDA n.d.); however,

organizations like United Farm Workers believe the figure to be far higher because of the number of unreported immigrants who come to the States seeking work and legal protection (Harvey 2017). The data on workers who have sought asylum or attempted to obtain visas is kept private by the Department of Homeland Security in many states, including California. Individuals not counted by the U.S. Census are unable to collect social security, local tax refunds, and other benefits, which historically have been solely for U.S. citizens.

Similarly, data sharing has long been controversial for Native nations in both the United States and Canada. When data on natural resources and people is collected by state or federal agencies and not shared with tribes, cooperation is nearly impossible. One example is the contention surrounding the Line 3 pipeline being developed through the reservation of the Fond Du Lac Band of Lake Superior Chippewa outside of Duluth, Minnesota. In the last decade, after years of secrecy, the Minnesota Department of Natural Resources and Fond Du Lac officials finally began consulting in order to protect native species and cultural resources and respect the 1854 Treaty that ensures the Band's rights to fish, hunt, and live according to traditional standards (Minnesota Humanities Center n.d.). Small steps are being taken toward a respectful relationship between Indigenous tribes and the U.S. government as progressive leaders take power and follow through on promises related to land back movements and Native sovereignty (Fonseca 2022).

One common theme between the Chicano farm workers of California and the Fond Du Lac Band members of Minnesota is a disconnect between the people and those in power. There are certain incentives for the latter to keep their cards close. Less documentation of immigrants entering the West means less government spending on social security benefits and an ever-increasing population of fearful workers who are historically overworked and underpaid. In the Midwest,

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the Bureau of Indian Affairs offices and officials receive some of the smallest portions of government spending (USCCR 2003).

Yet, when the rights of every person residing in this country, regardless of nationality, are respected, momentous achievements follow. The Fond Du Lac Band recently opened Mashkiki Waakaa'igan Pharmacy, the first fully funded tribal pharmacy in downtown Minneapolis (Huggins and Mueller 2022). In California, the

United Farm Workers union has recently completed a 28-day march across the Golden State to demand equal treatment of undocumented workers by California legislators. Despite the many struggles that remain across the country, strength persists among the impoverished. Likewise, the Fifth Geoscience Alliance Conference created a sense of solidarity among all present. Unity existed in rooms full of diverse participants at the University of Minnesota for a very important gathering.



From left to right: Parker Arntsen-Beaudin, Nick Salgado-Stanley, Cheyenne Koran, Maudesty Merino, joining a special dinner on renewable energy at the Fifth Geoscience Alliance Conference in Minneapolis, Minnesota. Image courtesy of Nick Salgado-Stanley.

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