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WATER FUTURES

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CONTENTS

INTRODUCTION

INTRODUCTION TO ISSUE EIGHTEEN

By Laurie Moberg, Managing Editor

On local and global scales, concerns about our water systems emerge from many directions. We read stories of contaminants compromising hydrologies and water ecologies, of farm runoff in the Midwest creating an expansive hypoxic zone in the Gulf of Mexico. We view shocking images of the effects of a decades-long drought diminishing the flow of the Colorado River. Hazardous drinking water conditions and deteriorating infrastructures like those in Flint, Michigan inspire distrust in resource management methods and make evident how inequalities and injustices are part of everyday entanglements with water. The present conditions of water—and our relationships to it—provoke an endless set of questions about what our future with water may look like.

This issue approaches the question of the future of water from a different angle by exploring practices that move us toward desirable futures with water. Rather than focusing on the challenges of amount or quality of water, we asked authors to be visionary, to imagine the future they want with water and the possibilities of making it a reality. Specifically, we offered a single organizing question for the issue: What knowledges, practices, and perspectives do we need in order to create the

Irrigation canal. Image by Ivan Bandura.

water futures we imagine and want? The articles in this issue present work that draws on history and art, community engagement and community-based practices, Indigenous epistemologies and analysis of satellite data. Collectively, the articles point us toward provocative and creative examples of the water futures people are already striving to create.

Elan Pochedley addresses this central question by demonstrating that as settler colonialism removed people from land, these practices compromised relationships between people and more-than-human others including waterways and mnomen. Pochedley explores water futures through the potentialities of restorative cartography, asserting that "the historic presences of the Potawatomi and mnomen, once mapped, provide an image of what has been and what could be once more."

Trinity Ek walks us through the history of Bassett Creek in north Minneapolis, demonstrating that to understand water futures, we must understand water histories. Focusing on the issues of environmental injustice that led the creek to be hidden underground, Ek suggests that considerations for the creek's future have the potential to disrupt rather than reproduce systems of inequality. Scot McFarlane similarly points to river histories as contested, complex, and critical tools as we confront environmental and social challenges now and into the future.

Other articles describe community practices that inspire commitment to shared water futures. Moira Villiard, in an interview about her "animated video collage" installation, *Madweyaashkaa: Waves Can Be Heard*, speaks to the power of public art as creating connections—to other people, but also to water, to nature more broadly, and to ancestors. Sayanangshu Modak illustrates the value of community-managed irrigation systems in India for future water policy. The issue also includes a review by David Morrison of the exhibit, *Why Canoes? Capacious Vessels and Indigenous Futures of Minnesota's Peoples and Places*, which centers the craft of canoe building among several groups of Indigenous peoples in Minnesota as part of shaping Indigenous futures and relationships to place.

To provide another perspective on exploring practices that move us toward desirable futures with water, we republish an article that analyzes how saltwater incursion is affecting coastal forests and argues that this evidence of climate change and sea-level rise leaves us with a choice for our futures: fight the seemingly insurmountable ecological changes or strategically adapt. And the two options may not be mutually exclusive.

Finally, we include a series of short responses to the issue's organizing question: What knowledges, practices, and perspectives do we need in order to create the water futures we imagine and want? While we share insights from researchers, community partners, community practitioners, and leaders in this issue, we also invite you to share your perspective. We hope to include reader stories in a future issue of *Open Rivers*.

The pieces in this issue demonstrate how people are creating water futures across disciplines, sectors, media, and geographies. They also compel us to consider not only the pressing water issues of the moment, but the histories that brought us to this point, and the possibilities of what our relationships with water should, could, and will be into the future. Enjoy.

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About the Author

Laurie Moberg is the managing editor for *Open Rivers: Rethinking Water, Place & Community* and the project manager for the Environmental Stewardship, Place, and Community Initiative at the University of Minnesota. She earned her Ph.D. in anthropology from the University of Minnesota in 2018. Her doctoral research investigates recurrent episodes of flooding on rivers in Thailand and queries how the ecological, social, and cosmological entanglements between people and the material world are reimagined and reconfigured in the aftermath of disasters. In her work at the University of Minnesota, Laurie brings her ethnographic sensibilities, attention to story, and interest in human-nonhuman relations to questions of water and absented narratives closer to home.

FEATURE (PEER REVIEW)

RESTORATIVE CARTOGRAPHY OF THE THEAKIKI REGION: MAPPING POTAWATOMI PRESENCES IN INDIANA

By Elan Pochedley

Editor's note: This feature article has been peer reviewed.

Introduction:
Virtually Mapping Potawatomi Presences and Connections

Wild rice and the 1833 Survey of Menominee's Reservation. Image by Elan Pochedley.

This article explores what decolonization can consist of—and be envisioned as—when we recognize how settler colonial governance, policies, industries, and structures have affected both Indigenous peoples and nonhuman relatives within their respective homelands. I assert that analyses of settler colonialism must address the environmental dislocations and degradations experienced by both humans and nonhumans. Further, I argue that decolonization must also account for the revitalization and health of those nonhuman relatives who have been displaced and harmed as a result of settlement. Philosopher Kyle Whyte (Citizen Potawatomi Nation) provides a definition of settler colonialism that is inclusive of the environments and ecological dynamics that have been disrupted or transformed by settlement:

> Settler colonialism refers to complex social processes in which at least one society seeks to move permanently onto the terrestrial, aquatic, and aerial places lived in by one or more other societies who derive economic vitality, cultural flourishing, and political self-determination from the relationships they have established with the plants, animals, physical entities, and ecosystems of those places.[1]

The digital mapping project I am working on in collaboration with the Cultural Heritage Center of the Citizen Potawatomi Nation (CPN) attempts to make visible—through the use of archival accounts, records, and ArcGIS mapping software—historic Potawatomi presences, ecological roles, environmental ethics, and narratives of geographic belonging. I wish to demonstrate how environmental disruptions experienced by Potawatomi people and native nonhuman relatives (commonly referred to as "natural resources") were and are entangled. I argue that these maps, and the narratives that shape how we understand the places represented within them, provide entry points for imagining returns to the territories from which our ancestors were forcibly removed. In this article, and through the interactive maps I've developed in collaboration with the CPN Cultural Heritage Center, I ask: What could such returns consist of? What lessons about ethics, about relationality to the earth, and about obligations to waters can we glean from bringing together disparate archival sources?

This article documents the methods used for conducting decolonial restorative cartography, utilizing archival sources in unconventional ways to illuminate Indigenous presences and networks of relationality. In envisioning decolonial methods for mapping, I draw on the concept of "Biskaabiiyang," meaning "a new emergence," as discussed by Leanne Simpson (Michi Saagiig Nishnaabeg):

> Within Nishnaabeg theoretical foundations, Biskaabiiyang does not literally mean returning to the past, but rather re-creating the cultural and political flourishment of the past to support the well-being of our contemporary citizens.... It also encompasses a visioning process where we create new and just realities in which our ways of being can flourish. Nonetheless, it is not just a visioning process. We must act to create those spaces—be they cognitive or spatial, temporal or spiritual.[2]

Settler state archives from the nineteenth through early twentieth centuries, including land patents, reservation maps, and natural resources surveys, document the presences of Neshnabék[3] ancestors and their nonhuman relatives in northern Indiana. The duality of these sources—recording the structural dispossession of Potawatomi as well as their presences and relational networks—makes them appropriate materials for applying Biskaabiiyang methods. Throughout this article, I draw on testimonies provided by Potawatomi leaders in the 1820s and 1830s, Neshnabék knowledge keepers' and scholars' understandings of environmental ethics and obligations to nonhuman relatives, and early pioneer histories and

journals detailing humans' historic relationships with nonhuman relatives in northern Indiana. These sources deepen our understanding of the maps by elucidating the political, social, and ecological networks that existed within these traditional Potawatomi territories.

As I've learned from visiting with relatives in Oklahoma and Michigan, as well as from Neshnabék writers and scholars, the sharing of stories is critical for teaching communal ethics and lessons, while also creating space for individual interpretation and meaning making. In *Dancing on Our Turtle's Back*, Simpson writes, "Our culture placed a profound importance on individuals figuring out their own path, or their own theoretical understanding of their life and their life's work based on individual interpretation of our philosophies, teachings, stories and values."[4] The stories included in this article are not traditional stories or creation stories; however, these place-based narratives present critical entry points for imagining the spatial lives, the seasonal migrations, and the relational networks of our Potawatomi ancestors.

By highlighting Neshnabék ancestral roots within our homelands, I am hopeful that the included maps, as well as the article itself, serve as means and mediums for modern Potawatomi people to connect once more to the waters, the lands, and the nonhuman relatives of present-day Indiana. By posing questions throughout this article, I seek to simultaneously guide readers to engage with the political and theoretical significance of these geographic and textual representations, while also providing them space to develop personal interpretations of the significance of these works for their own visioning processes and efforts toward decolonization.

By documenting the respective presences of Potawatomi people and wild rice beds, these virtual maps offer a starting point for spatially envisioning historic inter-species relational networks in northern Indiana. I hope this article encourages future, more expansive visions of representing and restoring ecological networks, and, in doing so, imagining decolonial returns—not only for ourselves, but also for the waters and our nonhuman relatives.

Ruptures in Relationality: The 1838 Forced Removal of the Potawatomi

The reservation of Chief Menominee, surrounding and inclusive of the chain of lakes then known as She-ba-ta-ba-uk ("Duck Lake"), was the central point of resistance for the Potawatomi threatened with removal from their homelands in present-day Indiana.[5] Local historian Daniel McDonald described the ecological features of the biodiverse region:

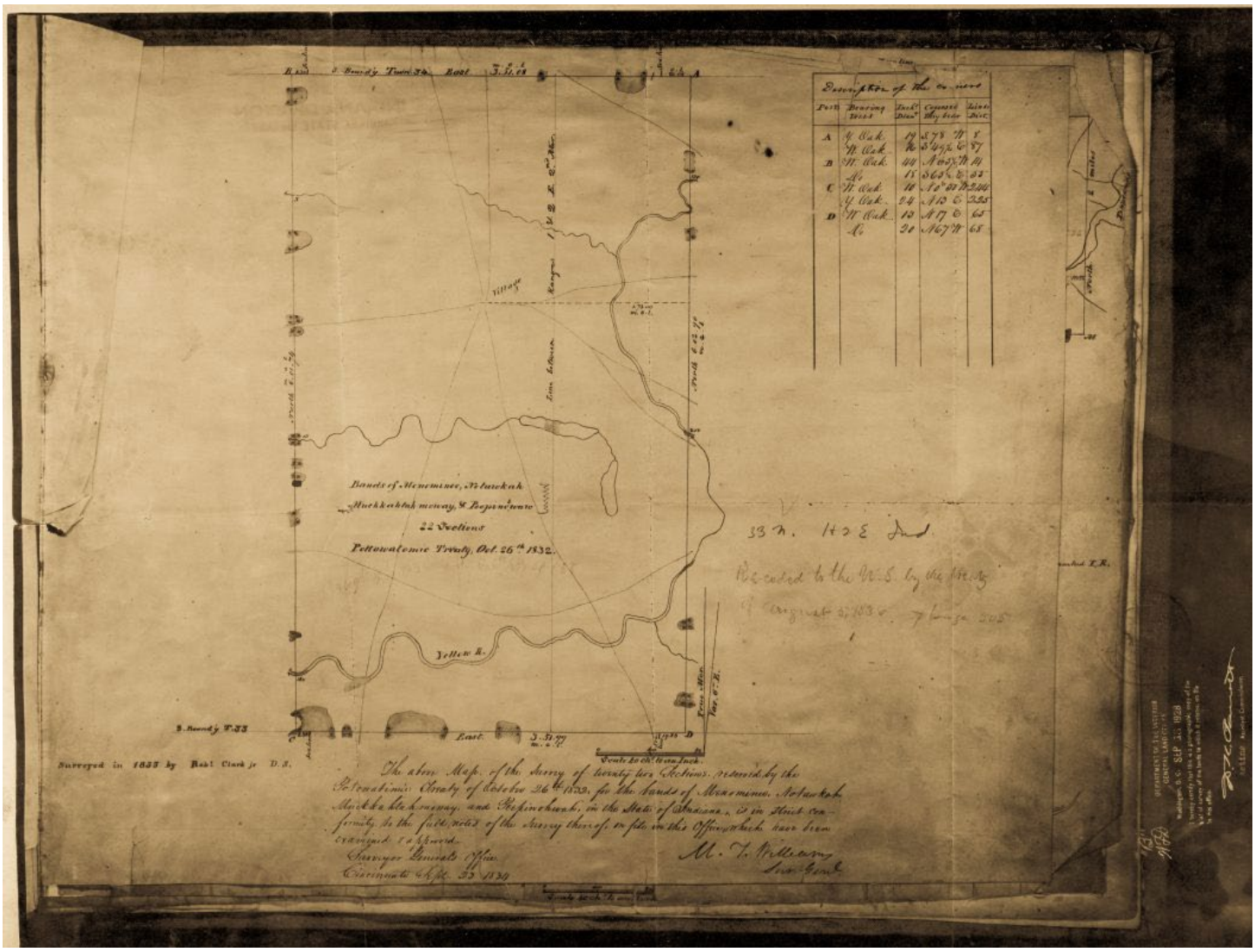
> Black bass, sun-fish, goggle eyes, perch and blue gills are plenty. There are still a few ducks to be found in the bayous and out of the way places during duck season, but since the white man came, they, like the Indians over on the north side of the Middle Twin lake, have had to move on and give place to "the survival of the fittest." Before the country was settled, ducks congregated there by the thousand, so much so that the Indians called it "Duck lake," in their language, She-ba-ta-ba-uk.[6]

William Sluyter, an early settler of the region, detailed the composition of Menominee's village of Potawatomi in the days leading up to their removal by force:

Lawrence Lake at She-ba-ta-ba-uk (Twin Lakes), Indiana. Image courtesy of Elan Pochedley.

> WILLIAM SLUYTER— "I lived near the Menominee village, which was just north of Twin lakes, in Marshall county, and was present at the time the Indians were congregated there, September 3 and 4, 1838, to be removed to the western reservation. The village was composed of log huts and wigwams of poles, covered with bark and matting, erected without any system. There were seventy-five or a hundred of these primitive dwellings. A graveyard in which their dead were buried was near by."[7]

From the 14,080-acre reservation of Chief Menominee, by the threat of bayonets and following the involuntary confinement of their principal chiefs, the Potawatomi began walking the path of their forced removal to Kansas on September 4, 1838, in what is now called the Trail of Death.[8] The waters and lands of Chief Menominee's Reservation, protected under the 1832 Treaty of Tippecanoe, had been encroached upon the preceding August by white settlers "who had squatted on the reservation expecting to enter the land as soon as the Indians went away."[9] Tensions between the Potawatomi and white settlers were at a peak after the latter moved onto the unceded territory of Menominee's Reservation, and were further compounded by the pressure applied



1833 Survey of Menominee's Reservation. Image courtesy of the Indiana State Library, Indiana Map Collection.

by the settler government on the Potawatomi to remove west of the Mississippi River under Indian Removal policy.[10] At the nexus of these forces, the removal of the Potawatomi was falsely construed as lawful and necessary by officials of the settler state, including Indian Agent Abel C. Pepper, U.S. Senator John Tipton, and Indiana Governor David Wallace.[11] At the request for settler militia intervention by Pepper and the white squatters, Governor Wallace determined that "the services of one hundred volunteers… armed and equipped" should be summoned for the removal of the Potawatomi to prevent the "shedding of blood."[12] The legal justification for removal was the 1836 Treaty of Yellow River, which purportedly transferred the reservation to the United States; however, it notably lacked Chief Menominee's x-mark. X-marks frequently stood in for the signatures of Indigenous leaders and parties at the conclusion of written treaty agreements. Scott Lyons (Leech Lake Band of Ojibwe) argues that we must view these x-marks critically while understanding them within the context they were inscribed: "The x-mark is a contaminated and coerced sign of consent made under conditions that are not of one's making."[13] Despite the pressure being exerted against the Potawatomi by settler government officials, Menominee refused to participate in the treaty-making process of an agreement that specifically aimed to dispossess him and his community of their homes. Menominee and other Potawatomi leaders petitioned U.S. Senator John Tipton in 1836, Secretary of War Lewis Cass in 1836, and President Martin Van Buren in 1837 to assert that they had never ceded the Yellow River Reservation.[14] Menominee gave the following speech at a council in 1838 explicitly stating

Chief Menominee Monument. Image courtesy of Elan Pochedley.

his opposition to the treaty and declaring his enduring commitment to ensure that the She-ba-ta-ba-uk Potawatomi freely remained in their homelands:

> The President does not know the truth. He, like me, has been imposed upon. He does not know that your treaty is a lie, and that I never signed it. He does not know that you made my young chiefs drunk and got their consent and pretended to get mine. He does not know that I have refused to sell my lands and still refuse. He would not by force drive me from my home, the graves of my tribe, and my children who have gone to the Great Spirit, nor allow you to tell me your braves will take me, tied like a dog, if he knew the truth. My brother the President is just, but he listens to the word of the young chiefs who have lied; and when he knows the truth he will leave me to my own. I have not sold my lands. I will not sell them. I have not signed any treaty, and will not sign any. I am not going to leave my lands, and I don't want to hear anything more about it.[15]

Despite Chief Menominee's persistent and steadfast efforts to avoid the removal of his people, he and the Potawatomi of his reservation were ultimately forced to leave their territory at gunpoint. The removal of the Potawatomi had extensive impacts on both the human and nonhuman kin that knew this area of the Great Lakes region as home, ushering in a shift of human-environmental relations and roles in northern Indiana. The Potawatomi, who practiced a seasonal round rooted in an ethic of sustainable harvesting, gathering, fishing, and hunting that deferred to the natural life cycles of native plant and animal relatives, were forced out of their homes by white settlers who sought to terraform the region into agricultural lands.

Evidence of Potawatomi presences, as well as bodily remains of Potawatomi ancestors, were covered and literally plowed over following their removal. The lakes of She-ba-ta-ba-uk were promptly renamed after settler farmers.[16] Further, Sluyter described the process of settlers exterminating the very traces of Potawatomi presences: "After they left, the wigwams were torn down and burned; eventually the old chapel, which was used as a guardhouse, was torn down, and the little graveyard was finally plowed over and obliterated, and no trace of the village, the chapel or the graveyard can now be found."[17]

Environmental tragedy followed the forced removal of the Potawatomi from northern Indiana. The Yellow River, a tributary of the Kankakee River, ran through Menominee's Reservation. Rivers, lakes, and wetlands were crucial to Potawatomi food systems and medicines, while also providing their primary mode of transportation via canoes. Within two decades of the 1838 Trail of Death, settlers began planning and executing the large-scale dredging, channelizing, and draining of the Kankakee River—historically documented as bountiful with wild rice[19]—in an effort to eliminate the swamplands known as the Grand Kankakee Marsh.[20] These projects of "reclaiming" agricultural lands from wetlands had profound effects on the plant and animal life that depended on the marsh. Author Andrea Neal has documented how the draining of the Grand Kankakee Marsh, pursued in order to create arable soil for farming, resulted in massive species loss: "Biologists estimate the draining of the Kankakee eliminated one-fifth of the migratory bird population in the United States."[21]

Even She-ba-ta-ba-uk, the home waters of Chief Menominee and his village, did not escape agriculture's ascent onto the once biodiverse territory of the Potawatomi. In 2005, researchers mapped hydric soils based on Natural Resources Conservation Service data in order to determine wetland loss within the Twin Lakes watershed. They concluded that only around 20 percent of the original wetlands of She-ba-ta-ba-uk remain in the present: "The greatest loss has occurred

in the northern counties of the state such as Marshall County.... Development of the land in these counties for agricultural purposes altered much of the natural hydrology, eliminating many of the wetlands."[22] These original wetlands—now depleted by approximately 80 percent—once provided an environment rich in biodiversity that the Potawatomi were dependent on, with the wetlands of this region supporting swamp loosestrife, cattails, soft stem bulrush, marsh fern, marsh cinquefoil, pickerel weed, arrow arum, sedges, red maple, silver maple, green ash, black ash, American elm, and swamp white oak, among other species.[23]

Mnomen, commonly known as wild rice, was documented in 1920 by the State of Indiana's Department of Conservation as still being abundant at She-ba-ta-ba-uk over eight decades after the 1838 removal: "the wild rice when well developed, is one of the most handsome of our native grasses.... It is fairly common at Twin Lakes, several miles to the north [of Lake Maxinkuckee]."[24] However, based on exhaustive online searches examining numerous primary sources, I have failed to locate any type of mnomen (i.e., Zizania aquatica, Zizania palustris, or Zizania palustris interior) within natural resource surveys of the Twin Lakes watershed since 1920.

According to our Great Migration story, in times long before Euro-American settlement, the Neshnabé knew that they had arrived home in the Great Lakes region once they reached the place where food grows on water. Yet, the removal of the Potawatomi and the subsequent eradication of wetlands by white Indiana settlers contributed to the decline of the mnomen that grows on water.[25] Mnomen—a critical spiritual relative and food source of the Neshnabé—once thrived in the shallow waters of wetlands, lakes, and rivers which have since been altered as a result of settler drainage projects. Just as agrarian settlers'

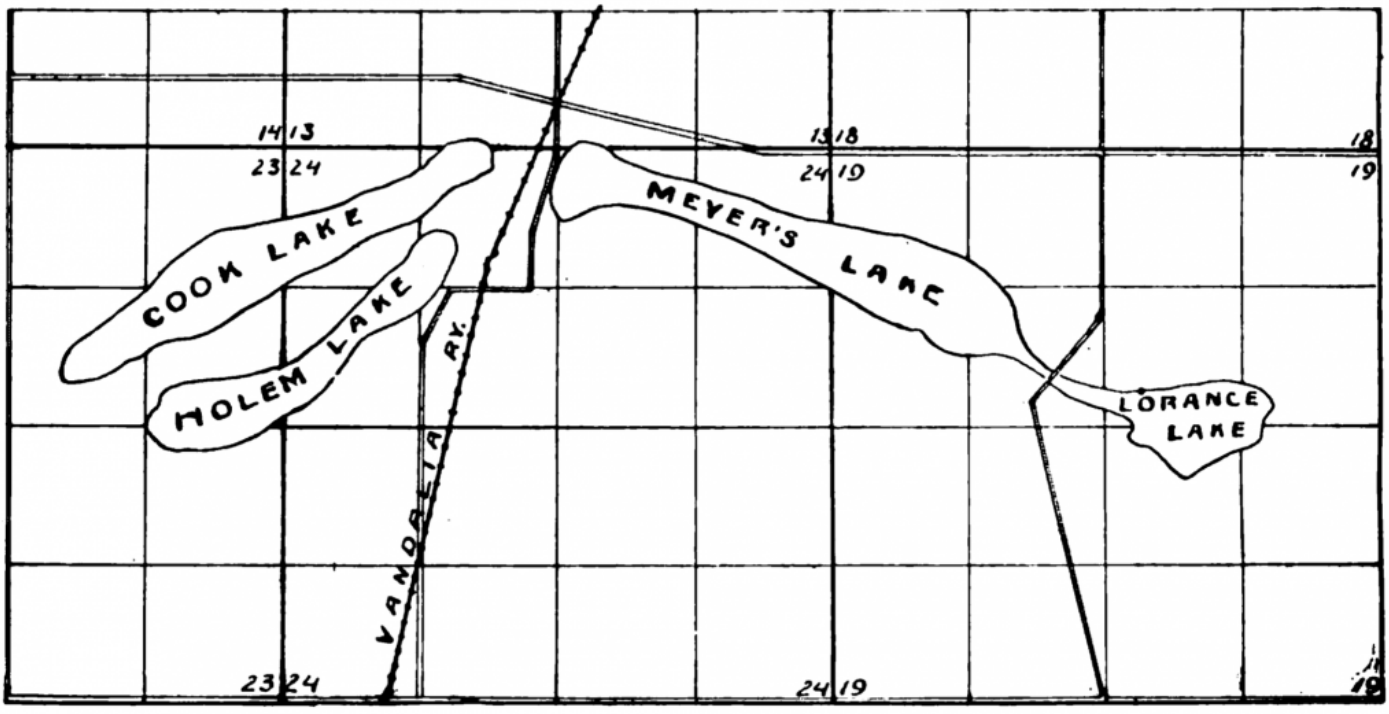


Fig. 59. Map of Twin Lakes, Marshall County, Ind.

Map of Twin Lakes, 1900.[18]

insatiable search for land forcibly uprooted She-ba-ta-ba-uk Potawatomi from their homelands, the displacement of water and the eradication of wetlands has negatively impacted and even decimated nonhuman relatives who relied on the natural environments of northern Indiana prior to being dislocated.

The displacement of natural waters, just like the displacement of the Potawatomi, was pursued by settler state agencies and white farmers to enact their collective vision of a white agrarian society premised on specific Euro-American methods of cultivating the land. In addition to examining how settler colonial logics affected both the Potawatomi and their nonhuman relatives within this article, I also ask: What types of futures could be made possible for local environments, watersheds, and Potawatomi people when we recognize our inter-species relationships as central roots of our identities, rather than relegating these bonds to the category of human-environmental interactions?

Lessons from Historic Mnomen (Wild Rice) Beds

Mnomen restored by the Nottawaseppi Huron Band of the Potawatomi (NHBP). Image courtesy of Elan Pochedley.

Mnomen is commonly known as wild rice but is translated into English by the Potawatomi as the "good seed."[26] In the story of the Neshnabék Great Migration—also shared by the Potawatomi's Ojibwe and Ottawa relatives—arriving to the place of mnomen tells us that we have reached our home. The late White Earth Ojibwe Historian Andy Favorite theorized: "Wild rice is part of our prophecy, our process of being human, our process of being Anishinaabe… we are here because of the wild rice. We are living a prophecy fulfilled."[27] The ontological significance of this relative is demonstrative of why Potawatomi protect their aquatic surroundings; bodies of water make mnomen possible by offering the good seeds homes, while mnomen itself signifies to the Neshnabé that they are where they are meant to be on this Earth.

The nation to which I belong, the Citizen Potawatomi Nation (CPN), no longer resides alongside mnomen as a result of the removal of Potawatomi people from the Great Lakes region; CPN is now based in central Oklahoma. The 1838 removal of Menominee's village and the Potawatomi of Indiana uprooted our ancestors from the rivers, lakes, and wetlands upon which they derived life in the place where food grows on water. Not only was removal a geographic displacement of our Potawatomi ancestors, it was a rupture in our interdependent relationships with our nonhuman relatives, including mnomen.

In a March 2020 interview, Dr. Kelli Mosteller (CPN), Director of the Citizen Potawatomi Nation Cultural Heritage Center, emphasized how our ancestors' knowledge of and dependence on inter-species kinship networks was violently severed as a result of removal:

> You are taking a woodland people—our homes are made out of wood, our storage vessels are made out of wood, our main mode of transportation is made out of wood—and you are moving us to the Central Plains of Kansas. You are taking a people whose main food staples are wild rice, and fish, and large hoofed animals, and berries, and you are putting us in the Central Plains, the Flint Hills of Kansas. You are taking a people whose clan animals and the medicines that they know how to cure their sick with grow in this place, and you're putting us in the Central Plains. Our oral traditions tell us that Creator made this place for us: that where the food grows on water is where

Citizen Potawatomi Nation (CPN) Cultural Heritage Center. Image courtesy of Elan Pochedley.

> we are meant to be as a people…. So how do you convey the trauma of the deaths that happened and the destruction, but also being completely uprooted from every natural element of your world that anchors you to who you are as a people is in this place, and you're being ripped away from that?[28]

While our nation has been removed from the homelands of our ancestors, first by force to Kansas, then by treaty agreement to Oklahoma, the memory of mnomen and its significance to our people has not been forgotten. Dr. Mosteller described how mnomen made life possible for the Potawatomi in the Great Lakes region through its ontological and nutritional significance to the Neshnabé:

> The wild rice is the symbol of a safe place… .'Cause you have to think about it: for our ancestors—yes the Great Lakes region gets a lot of snow today, but 200 years ago, 300 years ago, the snows were so much heavier that the wild rice was not only a place in the 7 Fires Prophecy that the Creator said, "This will be the place that you're meant to be," but it was the literal difference between food that had some nutrients to it and starving over those long winters when you're having to follow the herds and you've dried berries, you've dried fish, you've done everything. But that wild rice is something that if you had a good harvest, if you took care of it, and you did the hard work to prepare, wild rice could carry you a long way through the winter. You can take it with you. It's not prone to rot like berries and other things are…. Because it has a high nutrient value—whether or not our ancestors thought about it in that way—they knew that you could eat it and stay healthy throughout a long winter, even if the ability to procure your proteins failed…the wild rice was still there for us.[29]

I am incredibly grateful to have participated in a wild rice camp hosted by the Nottawaseppi Huron Band of the Potawatomi (NHBP) in early September 2019. In visiting directly with our mnomen and Potawatomi relatives, I gained experiential knowledge and a deep appreciation for what it means to care for and be in deference to the wild rice that sustained our ancestors for so many generations. Just as those who came before us depended on mnomen for sustenance,

CPN Cultural Heritage Center. Image courtesy of Elan Pochedley.

contemporary Potawatomi nations in Michigan are caring for this nonhuman relative in an effort to preserve it—and our bond with it—for future generations. This dynamic is reflective of the reciprocity timelessly characteristic of the Potawatomi's relationships to mnomen; as I learned at the camp, the wild rice that misses landing in your canoe and falls into the waters below seeds the plant, which will emerge in the years to follow.

When attending this wild rice camp and later visiting with NHBP members and personnel of the nation's Environmental Department, I was taught that the ecological restoration of wild rice is oriented toward also revitalizing Potawatomi ecological roles and environmental ethics by rebuilding relationships with this nonhuman relative. This is exemplified in the NHBP's documentary *Mnomen: The Good Seed Reawakens*, wherein Lee Sprague (Match-E-Be-Nash-She-Wish Band of Pottawatomi) tells the story of the Neshnabék Great Migration:

> Nanaboozhoo made that journey from the East Coast here to the Great Lakes and saw that flower. Then he started seeing everything else around here. That was the first thing that he noticed. So our peoples, Anishinabe peoples, have been living with wild rice since Nanaboozhoo found this homeland for us. As you go into the wild rice beds, that story becomes alive, our Migration Story. You see it happening right

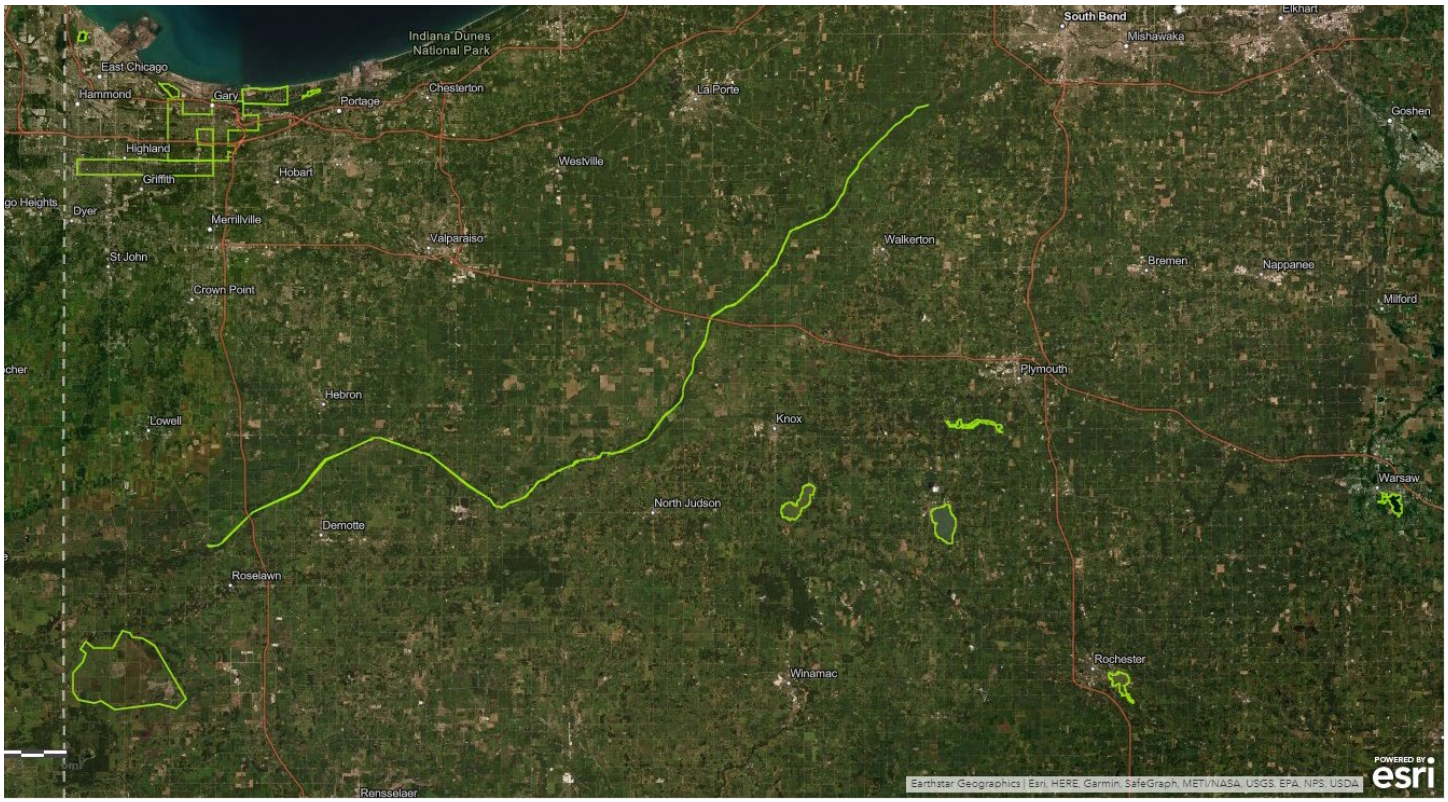
Mnomen restored by the NHBP. Image courtesy of Elan Pochedley.

> in front of you. You see what Nanaboozhoo saw, and it all makes sense.... I see mnomen as almost our seminal or our most sacred food. It's why we're here. So following that trail of Nanaboozhoo is like re-introducing ourselves and our people back to the wild rice and seeing what Nanaboozhoo first saw and then seeing all the other things that come with that. It's important, I believe, for our children to see the flower to understand that story, to understand the beauty of it, and that we need to take that responsibility and understand those stories and everything that comes with them.[30]

I understand the "everything that comes with them" to be a reference to the ethics and obligations to both human and nonhuman relatives that emanate from our stories, as well as teachings about what it means to be Neshnabé and in relation to all of our relatives, human and nonhuman.

Historic Mnomen Beds in Indiana

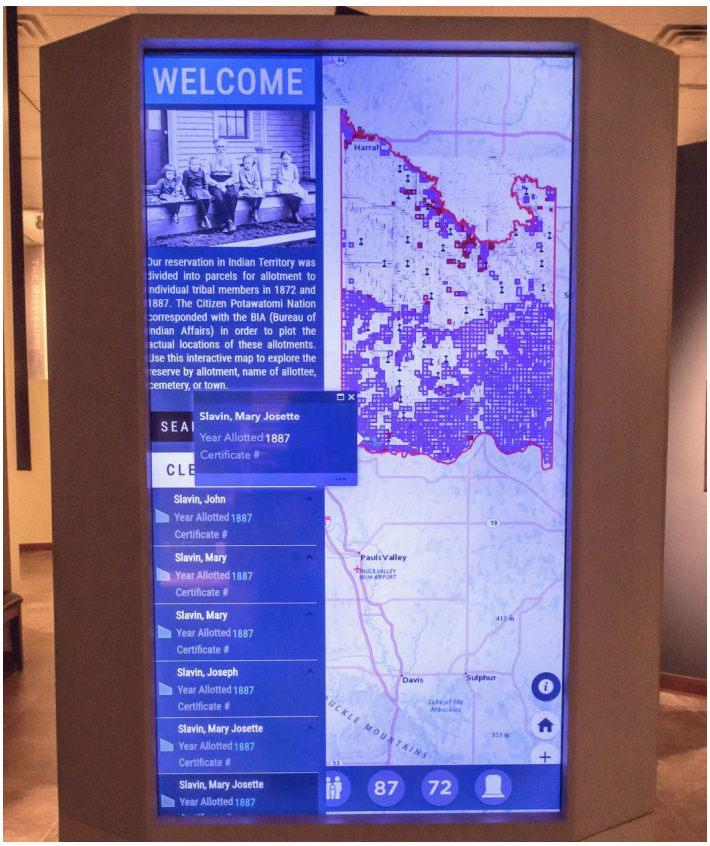
Mnomen beds in northern Indiana. View larger map here.



Mnomen beds in northern Indiana (detail). View larger map here.

Restoring Relationality through Restorative Cartography

I became committed to mapping historic Potawatomi territorial claims and mnomen beds as a process for—in the words of Leanne Simpson—attending to the "spatial" elements of a "visioning process" that centers the relational networks of our Potawatomi ancestors, as well as providing a potential blueprint for what future returns to relationality could consist of within Potawatomi homelands for their descendants. My entry into virtual mapping and the possibility of map-making as a powerful research tool came about through a unique set of circumstances. In the fall and winter of 2019, personnel of the NHBP's Environmental Department demonstrated to me the ways that digital mapping and aerially monitoring wild rice were deployed for the nation's Mnomen Restoration Program. This was my first introduction to digital mapping software, technologies, and techniques. While I was working at the CPN Cultural Heritage Center later in the spring, I passed an interactive map of family allotments within our reservation in Oklahoma daily. As I've learned from family members, the mapping of space is nothing new for the Citizen Potawatomi, with contemporary scholars such as Margaret Wickens Pearce representing our nation through her spatial endeavors. In conversations with intellectual leaders of different Potawatomi nations during the past few years, I found that the innumerable ways that our Potawatomi ancestors were attentive to the storying of space, to the centrality of movement, and to the knowledge of navigation were becoming clear. I soon began experimenting with ArcGIS mapping technologies in the summer of 2020, attempting to document both the historic presences of Potawatomi people and wild rice within their homelands of northern Indiana, in a moment when it was necessary to stay static due to the pandemic. As a result, it dawned on me that virtual maps of the Potawatomi's traditional territory in Indiana, prior to our ancestors' forced removal in 1838, could work toward revitalizing the removed Potawatomi's descendants' connections to the Great Lakes region and the ecosystems that our ancestors were dependent on. In focusing on the presence of historic wild rice beds and illustrating mnomen's proximity to the land patents and reservation sites of Potawatomi ancestors, I've visually reconstructed a critical component of the Potawatomi seasonal round through a speculative representation of historic mnomen beds and Potawatomi presences. In creating these maps, I've aspired to visually reconstruct portions of the inter-species relationality that was maintained and renewed by our Potawatomi ancestors, as well as to suggest what a decolonial return to relationality could consist of for modern Neshnabé, by looking to the movements of those who came before us.

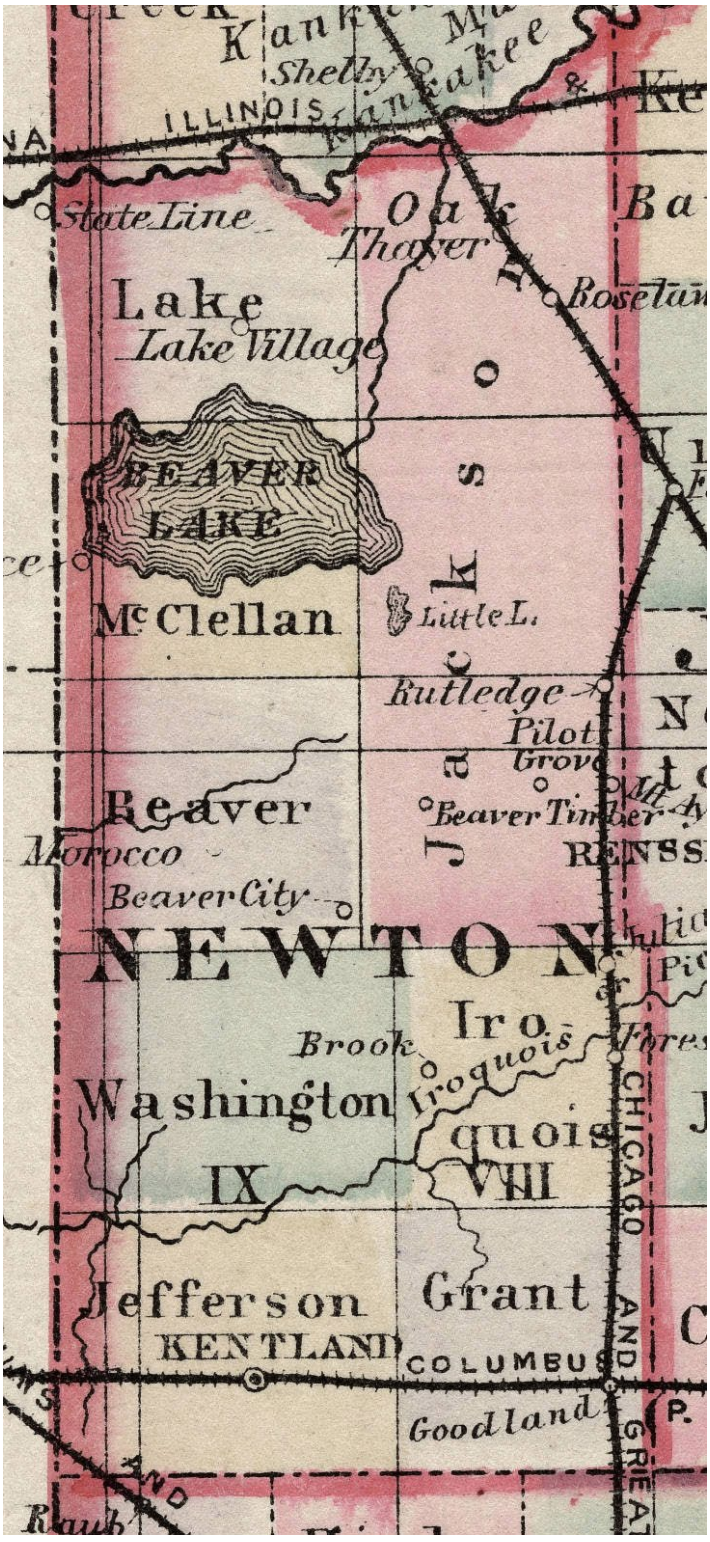


Allotment map at the CPN Cultural Heritage Center. Image courtesy of Elan Pochedley.

The Story of Beaver Lake

The story of historic Beaver Lake presents a powerful example of how waters, mnomen, and the Potawatomi were displaced by settler state actors who advanced white agrarian visions of Indiana. Once the largest natural lake interior to the boundaries of Indiana, Beaver Lake was known to have wild rice on its waters and wetlands. A survey conducted between 1834 and 1835 measured the spatial extent of the vast lake, detailing that "it covered an area of about 25 square miles, or about 16,000 acres of land.... In many places it was difficult to determine where the marsh ended and the lake began."[32] The massive lake was documented by pioneer historian Burt Burroughs as providing everything one would need to survive and thrive. He noted that the Beaver Lake region consisted of "thousands of acres of swampy stretches studded with musk-rat houses, and flanked by wild-rice and towering cat-tails and bulrushes," as well as including "heavily timbered" islands. Burroughs added, "As a breeding ground and natural retreat for wild game this ancient habitat has seldom been equaled and never surpassed anywhere in the Mississippi basin."[33] The watershed was also abundant with fish, until the search for agricultural lands arrived upon its shores.[34]

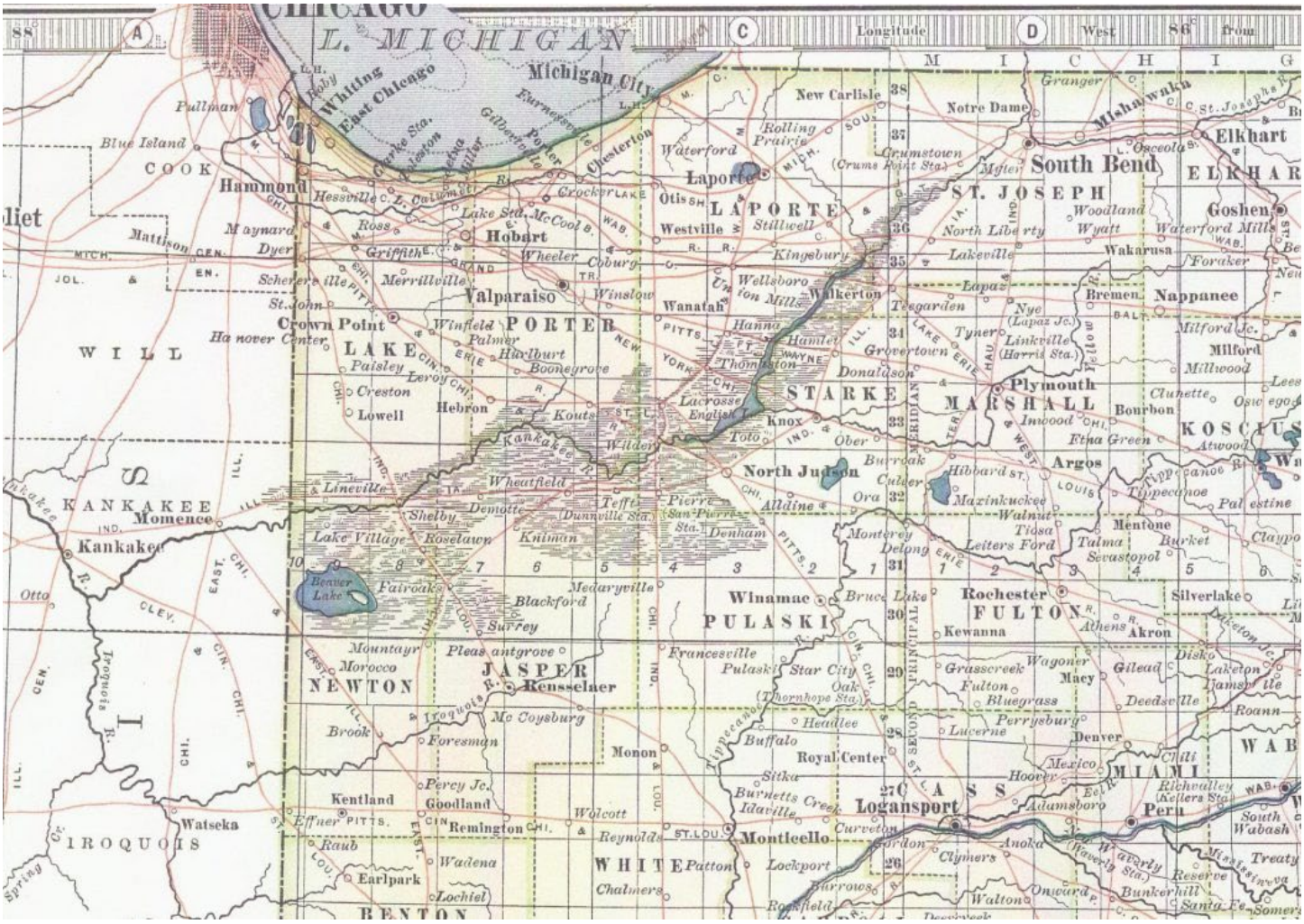
Despite the rich biodiversity that the lake and wetlands provided for humans and nonhumans alike, it was made the target of drainage projects. Beginning in the mid-nineteenth century, projects of ditching, draining, and channelizing bodies of water were pursued within Indiana as well as across the United States, in efforts to create arable agricultural lands. In 1912, U.S. Chief Hydrographer M.O. Leighton detailed his perspectives on the importance of draining—and thereby eliminating—wetlands for the national interest:



1886 Map by Frank A. Gray.[31]

> The whole function of man in reclaiming swamp lands is to supply that which nature has neglected.... Another national aspect of swamp drainage is that of home making. In their present condition the swamps of the country are a source of weakness in our national economy. They are now unproductive; they can be made sources of great national wealth. They are now practically vacant; they can be made to produce citizens. In other words, they can become the sustenance of the very element of which this country is made up. Seventy-four million acres of drained swamps can be made to support at least 7,000,000 people in agricultural pursuits. Is not this a national matter? Does it not enter into every element of production, trade, and finance? Does it not become an essential feature of national stability, national progress, and national defense?[36]

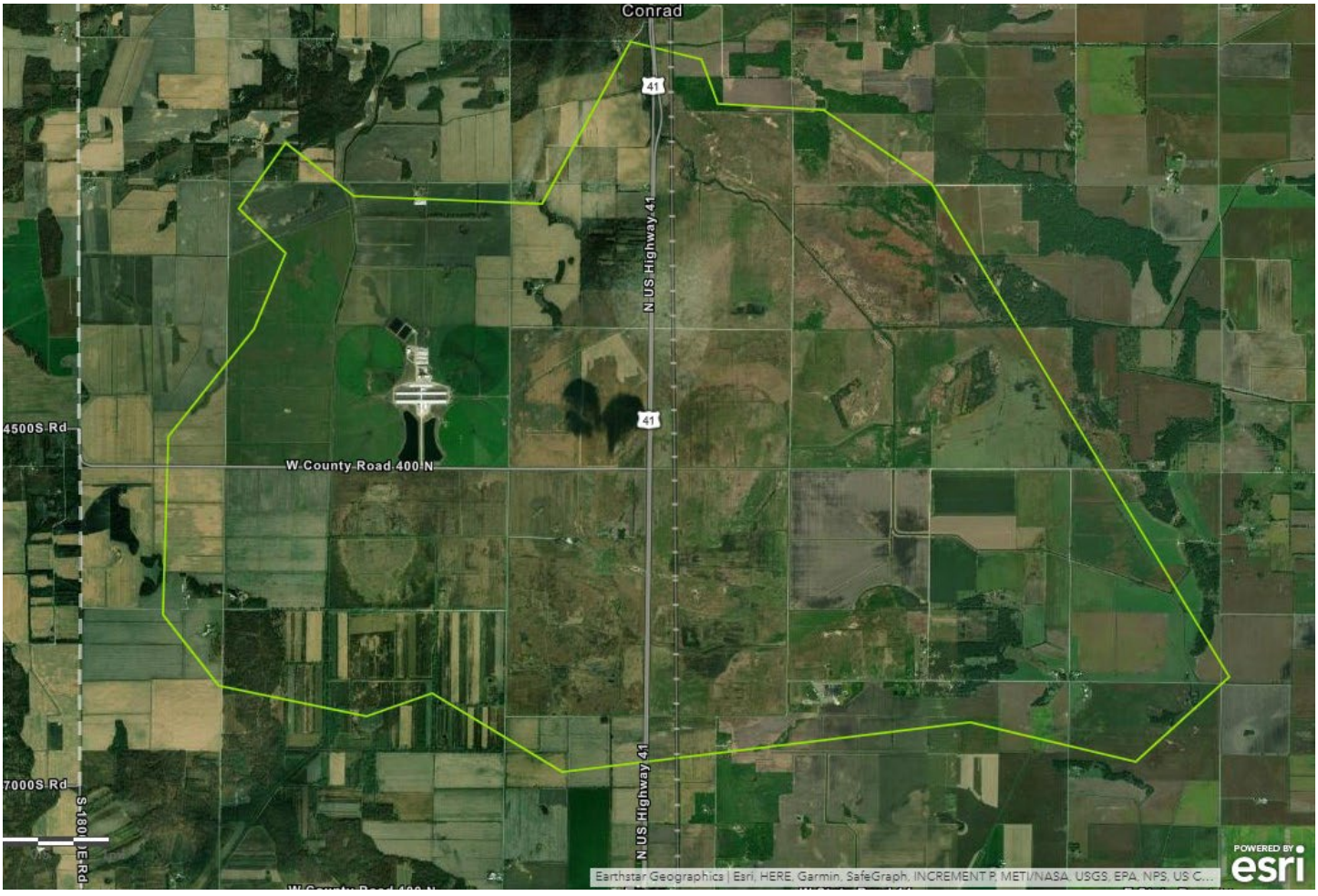
The state of Indiana's views on its own agricultural foundations were entirely commensurate with Leighton's speech, even in the early years of such "land reclamation" projects. In 1850, Indiana Governor Joseph Wright spoke to the State's General Assembly, asserting the economic, cultural, and—one could argue—ontological significance of agriculture to the increasing number of white citizens of the state. In encouraging the development of state and county agricultural societies, he asserted, "We are an agricultural people. Our climate, soil, and situation, make us so."[37]



1897 Map by Century Atlas Co.[35]

The government of Indiana was encouraged by the federal Swamp Land Act (1850) to ditch, drain, and channelize bodies of water including rivers, lakes, and wetlands, which, along with subsequent legislation, culminated in the U.S. government transferring title of "reclaimed" regions to the state under the agreement that they would be transformed into agricultural lands and sold to private citizens by the Indiana State Government.[38] Michael Dobberstein details how the Indiana State Legislature in 1851 and 1852 created the legal mechanisms for draining wetlands and selling the resulting agricultural lands: "Land was to be purchased through public auction, and the state pledged to drain the land with the proceeds. In 1851, the state's new constitution mandated that earnings from wetland sales would be allocated to funding public education, minus the cost of draining."[39]

The history of ditching, draining, and selling Beaver Lake resulted in a series of legal battles between land speculators and the Indiana Supreme Court, causing debate within the Indiana legislature and the state's courts, and ultimately requiring U.S. congressional intervention to settle ownership disputes.[40] While Dobberstein asserts that the "federal government never considered Beaver Lake 'swamp and overflowed lands,' as defined by the language of the 1850 Swamp Land Act," the lake was in fact drained with state money and its bed subsequently sold in an era of expanding settlement wherein such environmental interventions had become common.[41] John Ade described the progression of "land reclamation" projects affecting the Beaver Lake region:



Historic Beaver Lake. View larger map here.

> About 1853 the first effort was made to drain the lake by cutting a ditch from the northwest part of the lake to the Kankakee river. The contract to make this ditch was taken by Austin M. Puett, grandfather of William Darroch. This first ditch carried off enough water to cause the shore line to recede about a hundred yards—in other words, it reclaimed a very narrow strip all around the lake. As this ditch was enlarged and tributaries opened, the old bed of standing water gradually disappeared and Beaver Lake is now dry land at most seasons of the year. The name remains but the "lake" itself is now only a memory of the past.[42]

In mapping the perimeter of Beaver Lake upon modern aerial imaging of the region, I have illustrated the scale and enduring impacts of these drainage efforts. In 1925, Burroughs wrote about the devastating ecological consequences experienced by nonhuman relatives during the draining of Beaver Lake:

> For days the sandy spaces roundabout the sloughs were alive with the roly-poly forms of these goslings, some dead, others dying, while the remainder toiled persistently though painfully landward, under a burning sun, in search of water… With the passing of the waters of the lake the hosts of buffalo, cat-fish and pickerel contained therein were left marooned in shallow pools or stranded helplessly in the black muck of the lake's bottom. There were buffalo and pickerel of enormous size, patriarchs of these primeval waters, whose carcasses littered the bottom of the lake so thickly that one could step from one to another in any direction, like upon so many stepping stones.[43]

Beaver Lake was well known to the Potawatomi, who relied on the abundance of life the lake and wetlands provided for their sustenance. "Berry Whicker, Henry Campbell and other Ohio land hunters" who joined Potawatomi on a trip to Beaver Lake in 1824 recorded that it was "a beautiful body of water, very clear and rather shallow, a delightful place for the Indians to hunt, fish and bathe. It was one of the principal camping grounds of the Potawatomi Indians."[44] With wild rice and Potawatomi presences being documented in pioneer histories of the region, the Neshnabé may very well have harvested mnomen from the waters and wetlands that once were Beaver Lake. With approximately half of the historic lakebed currently undergoing prairie restoration by The Nature Conservancy, could historic inter-species relational networks inclusive of the Potawatomi be revitalized in this region?[45]

The Story of Lake Manitou

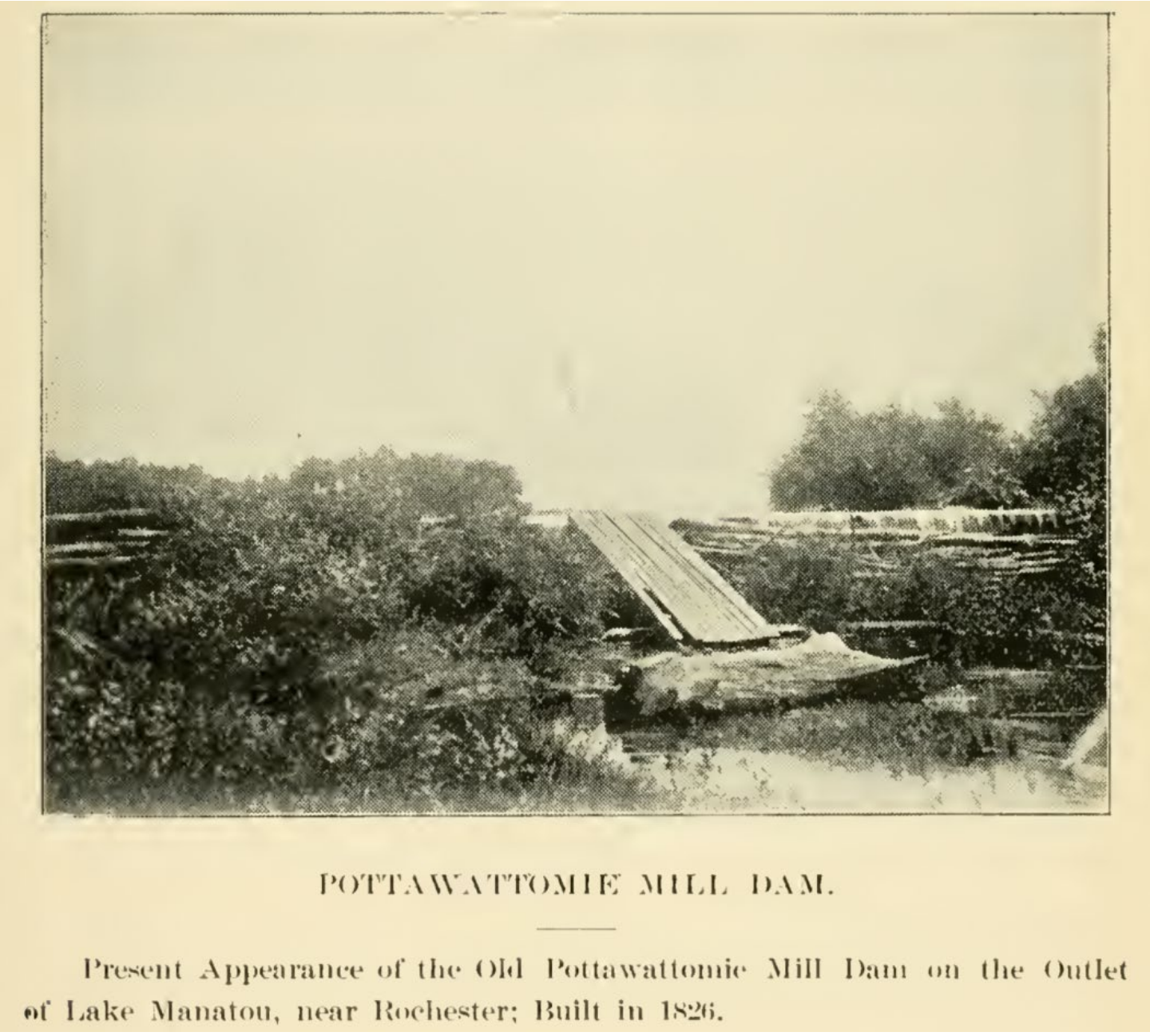
Lake Manitou provides a key site that demonstrates Potawatomi environmental ethics during a period when both Potawatomi and their nonhuman relatives were threatened with displacement by settlers. Mnomen was documented at the lake in 1875 by Indiana State Geologist E.T. Cox.[46] The water body was originally five distinct lakes that were flooded as a result of a government dam being built near the lake's outlet.[47] Under the 1826 Treaty of Mississinewa, a mill for processing corn would be constructed by the United States for the benefit of the Potawatomi.[48] Samuel Milroy was assigned by then Indian Agent John Tipton to build the mill, with the task completed in 1827.[49] The dam was built to generate hydropower that would power the mill. With the federal government's mission of assimilating the Potawatomi and other Native peoples into primarily geographically contained farmers during this period, it should come as no surprise that the government supported the construction of a mill and dam to facilitate the processing of corn, therefore encouraging its very cultivation.

While Euro-American conceptualizations of agriculture and property were premised on the individualized "improvement" and ownership of lands held in severalty, the Potawatomi's harvesting, fishing, and hunting activities emphasized mobility and adaptation. The annual fluctuations of the Earth and the Potawatomi's nonhuman relatives dictated the seasonal timing of our ancestors' subsistence networks. During

Lake Manitou. View larger map here.

negotiations of the 1821 Treaty of Chicago, renowned leader and orator Metea[50] attested to the Potawatomi's dependence on the Earth upon which they lived: "I am an Indian…and live by hunting and fishing, but my country is already too small; and I do not know how to bring up my children, if I give it all away."[51] The sustainable harvesting of fish was undeniably central to the replenishing of Potawatomi food sources in northern Indiana.

While the construction of a mill to process corn and a dam to create hydropower may initially appear as a boon to the Potawatomi, their construction was at odds with Neshnabék environmental ethics that deferred to the balanced relationships of the natural world, only intervening in ways



Pottawattomie Mill Dam by Daniel McDonald, 1899.[56]

that would not harm the long-term sustainability of the nonhuman relatives that our ancestors depended on for survival. Milroy reflected on the dam's construction in 1827: "So far as came to my knowledge, the Indians had no fear of being on the Lake; their fishing and night-hunting for deer, was common on it. The objection made by them to the erection of the mills, was that the dam at the outlet would injure their fishing."[52] The Potawatomi saw the construction of the dam as impacting their ability to successfully live off the natural resources of the Earth. For the Potawatomi, maintaining the health of the fish by being respectful of their lifecycles, seasonal migrations, and ecological interactions was directly intertwined with the Potawatomi's ability to continually rely on these nonhuman relatives for their dietary needs.

Local histories refer to the ubiquity of fish at Lake Manitou. John Troutman recounted how in the days of early settlement, "All the streams and lakes were alive with the best varieties of edible fish… this natural and bountiful supply of game and fish was a Godsend to the pioneer settlers of this country."[53] In 1883, A.L. Kingman documented the extent of the fish population at the lake:

> In early days the supply of cheap and delicious food procured from Manitou Lake was surprising, and it still yields all the fish required by the citizens of Rochester and the surrounding country. The varieties found are bass, pike, sun-fish and buffalo fish, the same as in the other lakes of the county… Fish have at times been so plentiful that the millwheel on the race leading from Manitou has frequently been clogged up by them.[54]

While these pioneer histories of Lake Manitou emphasize the abundance of fish, the dam caused the population decline of the pike. This decline, however, was narrated as being reflective of the fish's lack of intelligence, rather than the lack of intelligence of those (i.e., Tipton and Milroy) who had decided to intervene in the natural ecological dynamics of the watershed. Pioneer settler Alfred Sibert directly blamed the pike of Lake Manitou for their own elimination: "Large pike were plentiful in the lake forty years ago, but the pike is a fool fish and its foolishness has lead [*sic*] to its extermination… In addition to swarming up stream in the spring time, the pike is strongly disposed to go down stream in the fall, and as there is no means of getting back into the lake over the dam, Manitou pike are now but a memory."[55] Settlers and government officials failed to recognize the pike's seasonal migration patterns and subsequently failed to make alterations to the dam that respected and deferred to their cycles of movement. In having warned Milroy that the dam would negatively impact their fishing, the Potawatomi demonstrated ecological knowledge of the pike that was critical for maintaining the integrity of ecosystems in which these nonhuman relatives could thrive and continue to provide for the Potawatomi. The displacement of the pike and the displacement of the Potawatomi demonstrate how settler colonial governance and technology severed inter-species relational networks premised on ecological knowledge, sustainable dependencies, and mutual respect in northern Indiana.

For descendants of the removed Potawatomi, knowledge of inter-species dependencies and symbiotic relationships within our homelands is being actively sought out and revitalized. In central Oklahoma, galleries at my nation's Cultural Heritage Center describe our Neshnabék ancestors' origins, migrations, and connections to Turtle Island (i.e., North America). When entering the galleries of the Heritage Center, visitors are surrounded by a principal teaching that guided and continues to guide the Potawatomi of the past, present, and future: the Seven Fires Prophecy. In association with the Third Fire, which describes the Neshnabé arriving to the place where the food grows on water, is a beautiful, backlit drawing of three pike:

CPN Cultural Heritage Center. Image courtesy of Elan Pochedley.

During an interview with the Heritage Center's director, Dr. Mosteller, I asked her about the association between the pike and wild rice. She responded by detailing pike's dependence on mnomen, relationally linking it to the Potawatomi's own reliance on wild rice:

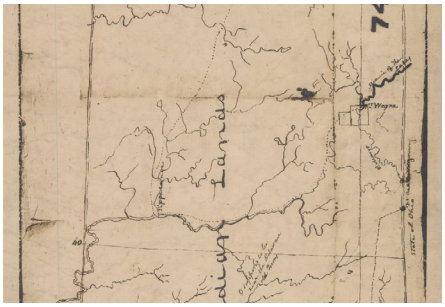
> It actually acts as the nursery for the pike. So in the early spring season, they go in, lay their eggs in the reeds—like sort of down on the root ball—and they come and go. It keeps their eggs from being eaten by other fish or beavers or things like that. And so that's the part from our nature/science writing research that we were really drawn by. But then we're also reading, in various places like [Alanson] Skinner and places like that, why our ancestors had an understanding of as to why the pike were there. And it was very much: This is a safe place. The wild rice is the symbol of a safe place. So it is the literal protective barrier for the pike and their eggs, but it is this symbolic protective place for us: that food will always be there.[57]

Wild rice and pike were both documented as historically residing at Lake Manitou, making it highly plausible that such ecological niches and relationships existed there, supporting the lives of our Potawatomi ancestors. What decolonial possibilities could emerge by virtually re-assembling the ecological networks and inter-dependencies shared by mnomen, gnozhe (pike), and the Neshnabé? With wild rice signifying and providing homes for the pike as well as our Potawatomi ancestors, how can virtual returns inspire map viewers to imagine the restoration of expansive ecological systems that are inclusive of the descendants of the removed Potawatomi?

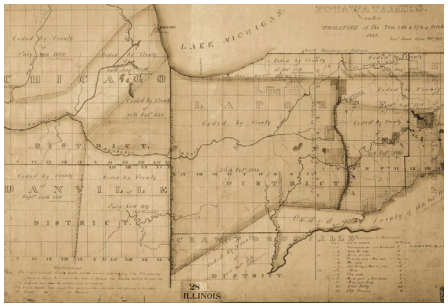
Potawatomi Reservations, Land Patents, and Mnomen Beds

The historic presences of the Potawatomi and mnomen, once mapped, provide an image of what has been and what could be once more. Nineteenth-century maps of Potawatomi reservations and property patents approved by respective U.S. presidents allowed me to locate Potawatomi claims to space that were—at least for a brief period—recognized by the federal government. In providing specific locations of reservations and individual land patents, these records are incredibly valuable. They facilitate our ability to tie Potawatomi presences to the historic mnomen beds described and represented above. Critically, they empower contemporary Neshnabék people to geographically trace the political lives of our ancestors as they navigated constructions of property imported to Turtle Island by Euro-Americans, while also enabling us to speculate on the seasonal migrations and inter-species relational networks of our ancestors through the mapping of mnomen beds.

Reservations and individual patents were detailed in a number of treaties made with the Potawatomi of northern Indiana. So far, I have been able to locate maps and records associated with the following treaties: Treaty of Chicago (1821); Treaty of Mississinewa (1826); Treaty of St. Joseph (1828); and Treaty of Tippecanoe (1832). With the assistance of the Indiana State Library, I have located maps of Potawatomi homelands in northern Indiana. The following gallery allows the reader to visit these cartographic representations of Potawatomi reservations recognized and guaranteed under the 1832 Treaty of Tippecanoe.



1818



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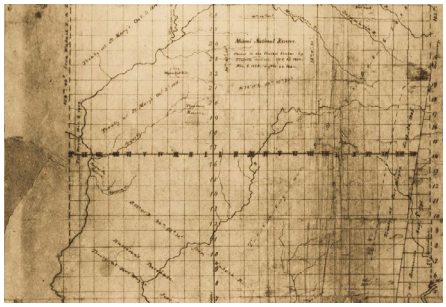
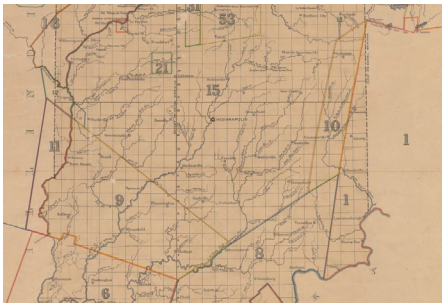
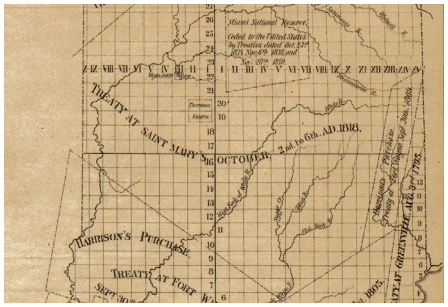


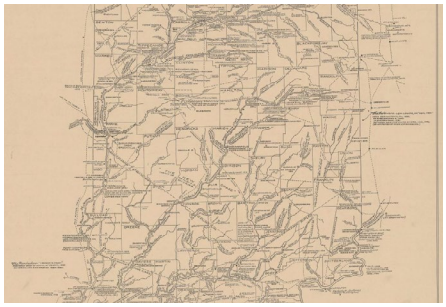
1840



1872



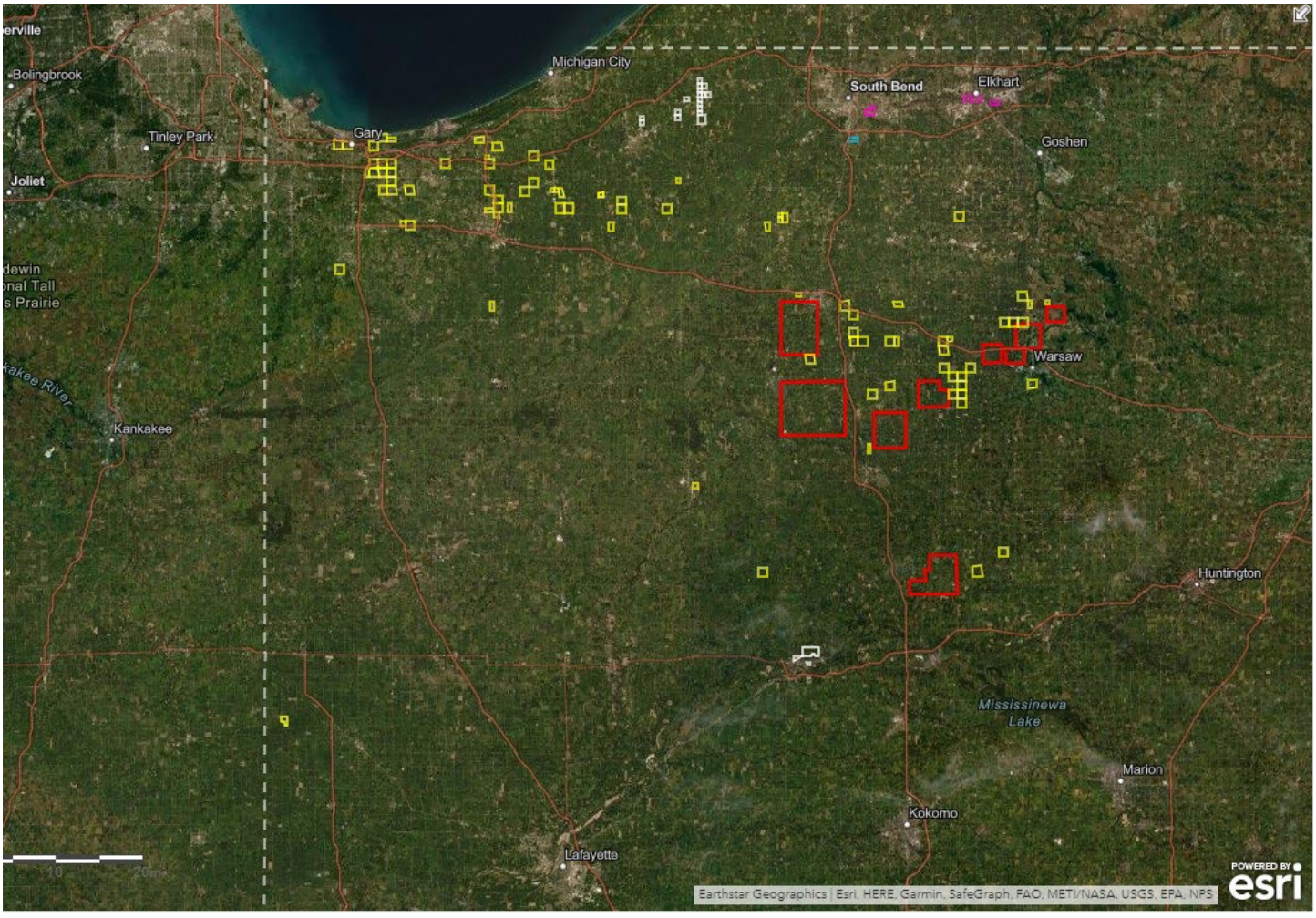
1882



1933

Years of Maps: (1) 1818; (2) 1835; (3) 1840; (4) 1872; (5) 1882; (6) 1933, Gallery of Reservation Maps. Images courtesy of Indiana State Library, Indiana Map Collection.

Individual land patents provide names of Potawatomi who had property titles secured under treaty agreements while, critically, providing the geographic locations of their parcels of land. By cross-referencing individual land patents' descriptions of townships, ranges, sections, and aliquots with the Public Land Survey System (available as a "map image layer" through ArcGIS software), I have been able to—surprisingly precisely—document Potawatomi people's recorded claims in northern Indiana. The irony of the utility of these archives and settler state systems which abstracted Turtle Island is not lost on me: the survey system that facilitated the sale of lands stolen from our Potawatomi ancestors by white settlers is also the very mechanism through which we can track the political, legal, and geographic claims of our relatives.



Map of Potawatomi Reservations & Land Patents in Indiana by Treaty. View larger map here.

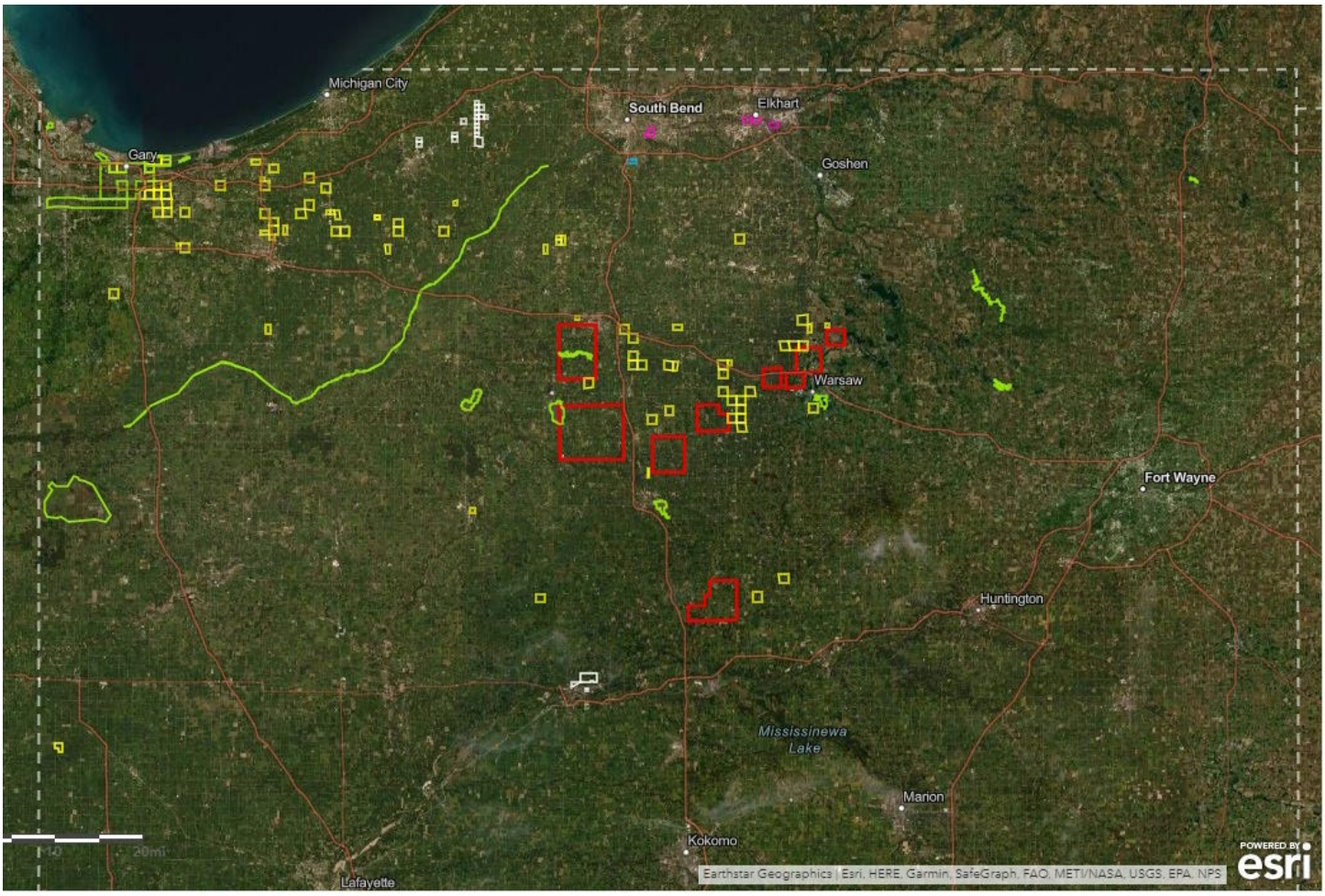
By interacting within the map, by selecting individual boxes that represent the spatial extent of respective land patents, one can access the associated treaty, language in the treaty referencing the land patent, the digitized patent record hosted by the Bureau of Land Management, and the spatial reference used for mapping each individual patent.

The historic mnomen map, when brought together with the mapped reservations and land patents, provides a visual medium for conveying the Potawatomi seasonal round in enhanced detail from the generalities usually found in earlier histories of the Potawatomi. Historian David Edmunds described the seasonal round: "Potawatomi life followed the rhythm of the seasons. During the summer the Indians formed large villages, usually along streams or rivers, where Potawatomi women planted small fields of beans, peas, squashes, pumpkins, melons, and tobacco.... Wild rice was harvested [during the Mnomneké-gizes] when it was available, as were many types of nuts, roots, and berries."[58] Kyle Whyte emphasizes the centrality of renewal to the seasonal round, as well as the place of Neshnabék ecological roles within this system:

> "Renewal" is a complex ecological process. As Anishinaabe/Neshnabe people, we have long traditions of relating to particular relatives, whether water, whitefish, wild rice, sandhill crane, blueberries or sturgeon. We call them relatives, in part, to refer to our seasonal round system of governance in which humans have multiple responsibilities throughout the year to monitor, steward, harvest, process and recycle refuse involving all of these relatives and how they relate to one another.... In our seasonal round system, a part of what makes it work is what humans do; but another part involves the ecological conditions that interact reciprocally with what humans do.[59]

The layering of the reservation and land patent map with the historic mnomen beds map creates an entry point to begin envisioning other ways of mapping space from a Neshnabék perspective; locating potential sources of relationality between humans and nonhumans, and the networks that emerge and can be deduced from considerations of geographic proximity, as well as the interplay of mobility of the Neshnabé and the seasonal emergence of wild rice. By bringing the reservation and land patent map together with the historic mnomen beds, I've constructed a cartographic representation of speculative relationality and inter-species dependencies between mnomen and our Potawatomi ancestors, reflective of the seasonal round.

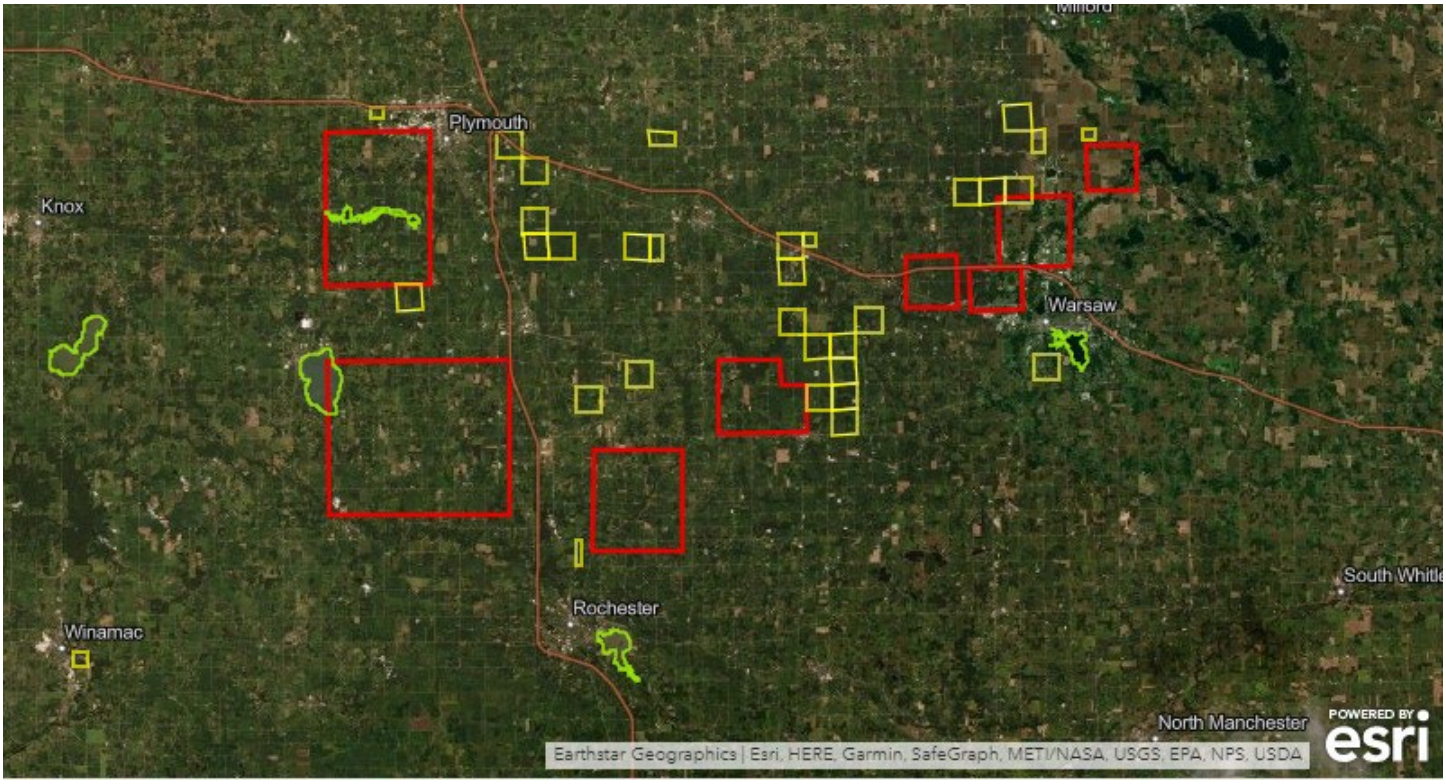
This layered map demonstrates the ubiquity of wild rice beds within, adjacent to, and in locations generally accessible to the Potawatomi who were both nutritionally and ontologically dependent on harvesting the good seed to sustain and renew their place in the world. The majority of locations of wild rice were identified during an exhaustive summer-long search through digitized surveys that had been conducted by the State of Indiana's Department of Geology and Natural Resources, Department of Conservation, and additional primary sources which I undertook in 2020. The locations had all been identified during the 1800s and early 1900s, stretching as far back into the historical record as I could reach virtually. Through keyword searches of "wild rice," "water oats," "Indian rice," and "Zizania (followed by aquatica, palustris, or palustris interior)" within surveys and reports uploaded primarily on Google Books, I was able to create a spatial rendering of the historic, potentially present, and optimistically future homes of mnomen.



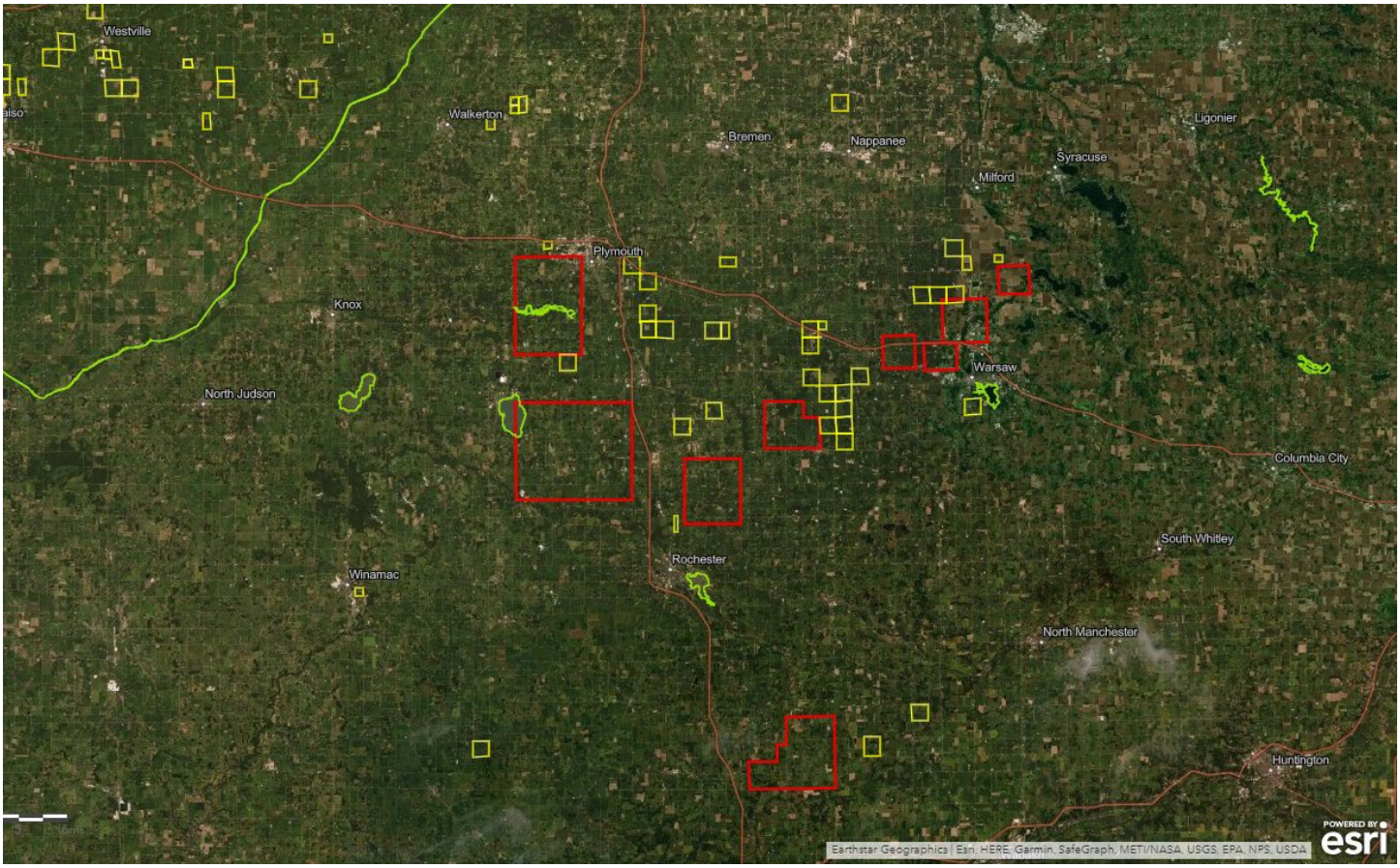
Map of Historic Mnomen Beds, Potawatomi Reservations, & Land Patents in Indiana. View larger map here.

These geographic representations are far from perfect. They represent the total possible spatial extent of mnomen beds across the entirety or large stretches of lakes, rivers, and wetlands, many of which have been significantly altered or completely drained since mnomen was documented. The map flattens the years in which mnomen beds were observed and recorded. I am surely missing lakes, rivers, and wetlands where wild rice was documented, due to not yet locating those sources. The spatial representations illustrated—and relational connections suggested—in this map are undoubtedly limited by a Euro-American property ideology that was utilized to confine the Potawatomi within reservations and individual land parcels, as well as the surveying techniques employed to capture both Potawatomi and mnomen in abstracted space. Our homelands are exponentially greater in size than these reservations and land patents convey. Yet, the bringing together of reservations, land patents, and mnomen beds within Potawatomi homelands encourages the viewer to imagine a decolonial future of this territory informed by the presences and relational networks of the past.

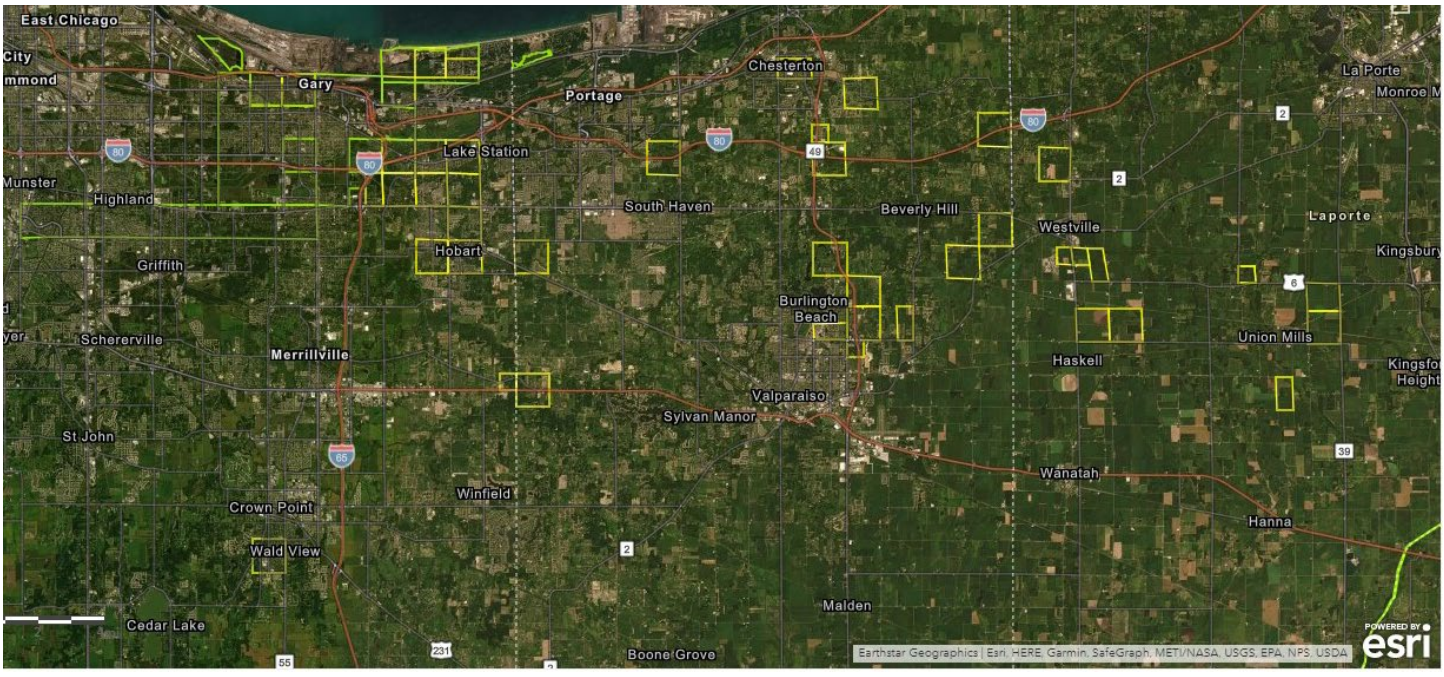
While I do not expect these cartographic depictions to do justice to the complexities of relational networks and subsequent dislocations, I see them as access points: points of speculation that allow us to decenter what geographer Sarah Hunt (Kwakwaka'wakw Nation) refers to as the "Colonialscapes" that cover Indigenous peoples' relationships to each other and with nonhuman relatives: "Just as landscapes appear to create a complete view of a particular space,



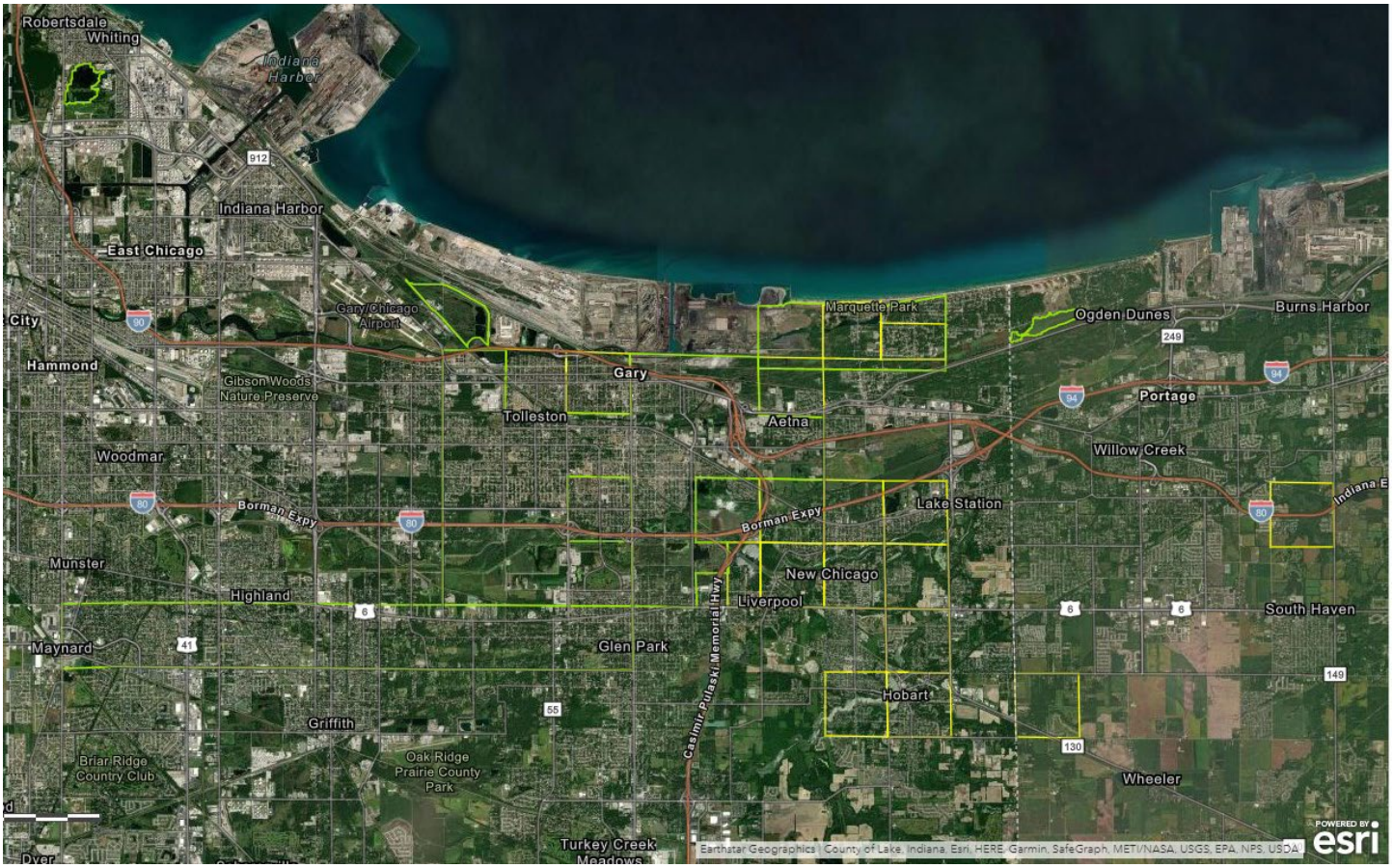
Map of Historic Mnomen Beds, Potawatomi Reservations, and Land Patents along the Tippecanoe River. View larger map here.



Map of Historic Mnomen Beds, Potawatomi Reservations, and Land Patents (including the Kankakee River and Elkhart River).
View larger map here.



Map of Historic Mnomen Beds and Potawatomi Land Patents in the Calumet Region.
View larger map here.

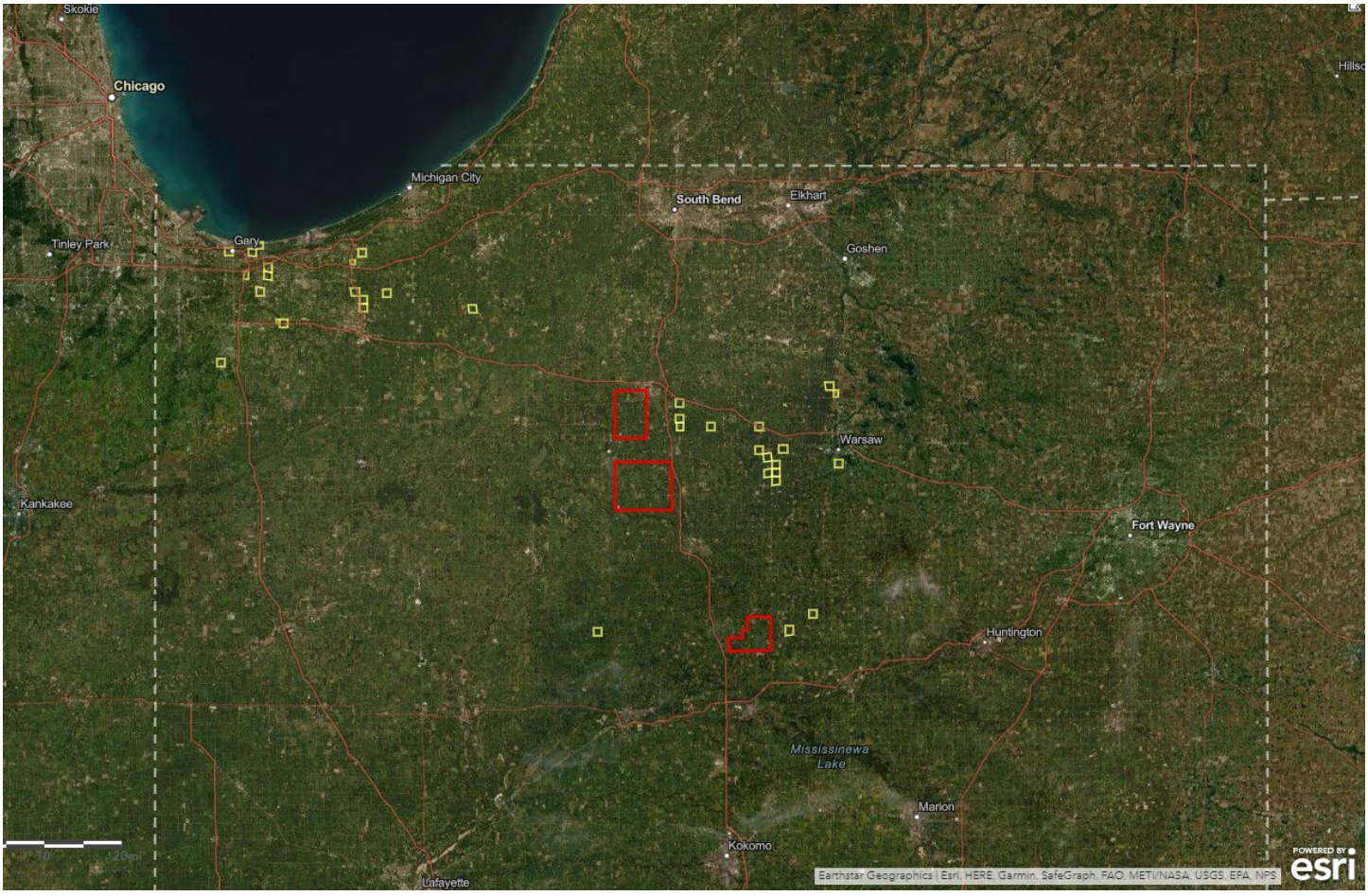


Map of Historic Mnomen Beds and Potawatomi Land Patents in the Calumet Region (Detail). View larger map here.

colonialscapes create the appearance that a colonial spatio-legal perspective…is somehow 'true'. Colonialscapes thus cover over other spatial relations and representations, as the colonial view blankets over these prior and deeper spatial orders."[60] I constructed these maps to offer a beginning point for envisioning and enacting a decolonial return to the waters, lands, and nonhuman relatives of our homelands across generations. Leanne Simpson describes the temporal structure of the Seven Generations Teaching practiced by Neshnabék peoples: "Nishnaabeg custom required decision makers to consider the impact of their decisions on all the plant and animal nations, in addition to the next seven generations of Nishnaabeg."[61] Our accountability to future generations in the present, just as our ancestors' accountability to us in the past, must be understood as being far more expansive than any anthropocentric interpretation would suggest. If our Potawatomi ancestors knew that they had arrived home when they reached the place where food grows on water, shouldn't the restoration of mnomen—virtually or physically—be central to a visioning process for a future wherein our descendants are connected to the sacred plant that signifies our ontological connection and existential belonging to Turtle Island? These maps open avenues for imagining what routes our Potawatomi ancestors navigated to harvest mnomen, celebrate the ricing season, and visit with their relatives. These maps, derived from data included in the records of a settler colonial government, open possibilities for envisioning the restoration of relational bonds between Potawatomi and mnomen in the present and future, glancing back at our ancestors' roots to the sacred plant that sustained their very existence.

Conclusion: Towards A Decolonial Method of Ecological Restoration

The growth of Chief Menominee's village coincided with the ever-increasing threat of removal in the late 1830s. When Baptist missionary Isaac McCoy visited Menominee's village north of the chain of lakes on June 11, 1821, he noted the entire community "lived in four little bark huts."[62] However, by early September of 1838, the village had grown to roughly a hundred homes of Potawatomi who had moved to the village in order to resist removal to Kansas or had been brought to the village by the armed volunteer settler militia.[63] The very place of resistance, Menominee's Yellow River Reservation—while unceded territory—was also the place where Potawatomi were brought and confined in the days prior to their removal. It is not a coincidence that the removal of the Potawatomi began from the location where Chief Menominee and the Potawatomi at She-ba-ta-ba-uk (Twin Lakes) refused to leave; where our ancestors were collectively congregated, yet confined, within the spatial limits of the reservation. Through bringing together five distinct archives of nineteenth-century maps, land patents, government records, journal entries, and muster rolls, I have painted a picture of the territorial



Reservations and Land Patents of the Potawatomi Removed on the 1838 Trail of Death. View larger map here.

extent of the Potawatomi who were brought by force to She-ba-ta-ba-uk or who gathered there to resist removal. By ascertaining the names of the Potawatomi explicitly recorded as being on the forced removal of 1838—as documented in a corn roll conducted on September 1, 1838, William Polke's journal kept during the removal, and muster rolls made for the journey from Indiana to Kansas—I created a map that demonstrates the specific territorial connections and property claims of the Potawatomi uprooted by gunpoint from their Indiana homelands.

Over the past two years, I have come across stories detailing how Potawatomi nations in southwestern Michigan—the Match-E-Be-Nash-She-Wish Band of Pottawatomi,[64] the Nottawaseppi Huron Band of the Potawatomi,[65] and the Pokagon Band of Potawatomi[66]—are involved in ecological restoration initiatives throughout traditional Potawatomi homelands and what is commonly referred to as "ceded territories." These Potawatomi nations either strategically avoided removal or subsequently returned to their homelands. Their initiatives range from restoring wetlands, rehabilitating sturgeon populations, re-establishing the natural floodplains of channelized rivers and tributaries, and restoring mnomen beds. These nations are in the process of restoring aspects of watersheds to their natural states that existed prior to being altered as a result of Euro-American settlement, industrial development, resource exploitation, and pollution.[67] The Pokagon Band of Potawatomi has even been working on an ecological restoration project beyond the state boundaries of Michigan, restoring native habitat on 1,147 acres originally part of the Grand Kankakee Marsh in North Liberty, Indiana.[68] Their respective projects are emblematic of ecological restoration initiatives that are led by and inclusive of Indigenous nations who retain obligations to the waters, lands, and nonhuman relatives of their traditional territories and homelands.

Watch video here: Indiana NRCS Restoring Indiana's Wetlands: Pokagon Band.

Numerous rivers, lakes, and creeks within the jurisdictional boundaries of the state of Indiana have been the focus of recent ecological restoration initiatives by local, regional, state, and federal environmental agencies, as well as alliances, coalitions, commissions, conservancies, councils, and departments pursuing various ends. These include watershed restoration, dam removal, natural habitat restoration, shoreline revegetation, invasive species management, reforestation, environmental cleanup, controlled/prescribed burns, and even freshwater mussel translocation. These efforts, when planned and executed in sustainable and ecologically sound ways, are vital for the health and protection of watershed biodiversity. However, these projects—excluding the Pokagon Band of Potawatomi's restoration efforts within the Kankakee River watershed—have largely failed to respect the descendants of the removed and displaced Potawatomi as the enduring environmental stewards of their homelands.

Our Potawatomi ancestors were environmental stewards of Indiana, along with the Wea and Piankashaw (Miami), Lenape (Delaware), and Shawnee.[69] Not only were our relationships with the aquatic worlds of northern Indiana transformed as a result of settlement and subsequent dislocations, the lands and soils too have been affected by the removal of the Indigenous stewards of this region. Artist George Winter noted, on an 1844 trip to Kee-waw-nay Lake where a Potawatomi village once existed, "The scene her[e], now presented a wilder and more rugged appearance – the unrestrained growth of thrifty woodland, than when occupied by the Indians – whose annual firing it – had kept it in an apparently well trained condition, keeping down the undergrowth."[70] It should come as no surprise that the Potawatomi in Indiana historically conducted prescribed burns, wild rice seeding, and other forms of ecological regeneration as an

Indigenous people who derived their livelihoods from their local environments.

The following restoration projects are for watersheds that run through or adjacent to land patents and reservations of the Potawatomi who were forcibly removed from Indiana in 1838:

Water Bodies & Potawatomi Connections:	Projects:
Coffee Creek Runs: 1. Through Mie-saw-bee's Land Patent	1. Invasive Species Management 2. Prescribed Burns 3. Reforestation 4. Vegetative Buffer Restoration 5. Water Restoration
Deep River Runs: 1. Through Paq-q-shuk's Father's, Aub-e-naub-bee's, Land Patent 2. Through Pee-pees-kah's Land Patent 3. Through Quash-mau's Land Patent 4. Through Wee-saw's Land Patent 5. East of Old Wee-saw's Land Patent 6. West of Paq-q-shuk's Father's, Aub-e-naub-bee's, Other Land Patent	1. Dam Modification (Proposed)
Eel River Runs: 1. Through Mis-sink-qu-quah's Land Patent 2. Directly East, Southeast, and South of Paq-q-shuk's Father's, Aub-e-naub-bee's, Land Patent	1. Dam Removal 2. Decreased Nutrient & Chemical Runoff from Agriculture 3. Freshwater Clubshell Mussel Translocation
Fancher Lake Located: 1. Completely within Mis-sink-qu-quah's Land Patent	1. Native Aquatic Habitat Restoration 2. Native Prairie Habitat Restoration 3. Removed Exotic Species 4. Stabilized Shoreline 5. Vegetative Buffer Restoration
Grand Calumet River Runs: 1. Through Ash-kum's Land Patent 2. Northwest and North of Miss-no-qui's Land Patent	1. Capping and Removal of Contaminated Sediment 2. Invasive Species Management (Proposed) 3. Native Plant and Habitat Restoration 4. Prescribed Burns (Proposed)
Indian Creek Runs: 1. Through Mon-i-taw-quah & Swa-gaw's Land Patent	1. Reforestation
Lake Maxinkuckee Located: 1. Partially within Aub-e-naub-bee and Mau-ke-kose's Reservation	1. Sediment Studies 2. Shoreline Revegetation 3. Wetland Restoration

Water Bodies & Potawatomi Connections:	Projects:
Long Lake Located: 1. West and Southwest of Wee-saw's Land Patent	1. Invasive Species Management
Tippecanoe River Runs: 1. Through Miss-no-qui's Land Patent 2. Through Paq-q-shuk's Father's, Aub-e-naub-bee's, Land Patent	1. General Watershed Restoration 2. Protection and Enhancement of Aquatic Habitat for Fish and Wildlife 3. Riverbank Stabilization 4. Water Flow Management to Protect Endangered and Threatened Freshwater Mussels

For references to specific ecological restoration projects: [71]

As these restoration initiatives continue and new ones emerge within the Potawatomi homelands of present-day Indiana, affecting the watersheds from which our ancestors directly derived life, what could a decolonial return consist of through the inclusion of Potawatomi people and nations in stewardship decisions? Outside of a paradigm of Western legal rights and property laws, how could justice for the descendants of the removed Potawatomi—as well as the waters, lands, and nonhuman relatives who were displaced due to Euro-American settlement—be realized? Can we imagine justice beyond solely anthropocentric concern, a justice oriented toward restoring inter-species relationality and accountability? How could ecological restoration projects provide an opening for contemporary Potawatomi to return to the homelands of their ancestors who were forced by threat of violence to abandon the waters and lands where their foods and medicines grew, where their ancestors were buried, and where they knew they were home through the presence of mnomen?

These maps are virtual entry points for members of the Citizen Potawatomi Nation to reconnect with the aquatic worlds and terrestrial landscapes of their ancestors. These cartographic representations are intended to be invitations for imagining geographic, ontological, cultural, and ecological returns for those Potawatomi who no longer live within the Great Lakes region, as well as for those Potawatomi whose lives are dictated by settler state-constructed borders that too frequently limit access to our homelands. I hope, in the maps being accessible through this article and my nation's Cultural Heritage Center, that they also digitally connect members of other Potawatomi nations to the territories of their ancestors who share roots in northern Indiana. I dream that they will inspire virtual and physical returns to where the mnomen grew, grows, and can grow once more on water—to those geographic places that signify to modern Potawatomi that we've arrived home, just as our ancestors had generations before.

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About the Author

Elan Pochedley is a PhD candidate in the Department of Anthropology at the University of Minnesota, where he has earned dual graduate minors in American Indian & Indigenous Studies (AIIS) and Heritage Studies & Public History (HSPH). His doctoral research investigates Potawatomi and Ojibwe nations’ efforts to restore wild rice, rehabilitate eagles and sturgeon, protect and restore bodies of water, and contest infrastructure projects that threaten the health and livelihoods of their nonhuman and human relatives. His dissertation documents how sovereign Neshnabék nations navigate emerging technologies, legal approaches, and U.S.-sponsored ecological restoration projects while maintaining specific ethical commitments. He currently serves as the Research Fellow in Geography and Cartography at the Citizen Potawatomi Nation’s Cultural Heritage Center. Research for this article,

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FEATURE

ON *MADWEYAASHKAA: WAVES CAN BE HEARD* WITH MOIRA VILLIARD

By Moira Villiard and Laurie Moberg

In February 2021, artist Moira Villiard debuted her installation, *Madweyaashkaa: Waves Can Be Heard* as the fourth installment of the *Illuminate the Lock* series at the closed Upper St. Anthony Lock and Dam in Minneapolis, Minnesota. On three chilly February evenings, 2,500 people walked through the snow on top of Upper St. Anthony Lock and Dam to watch what Villiard calls an "animated video collage" projected on the 49-by-400-foot concrete walls of the no-longer-functioning lock.

Part of the All My Relations Arts *Bring Her Home: Sacred Womxn of Resistance* exhibition,

Illustration of Nokomis (Grandmother) appearing over a fire. Image courtesy of Nedahness Greene.

the installation includes images of the Grandmother moon (Nokomis) and the jingle dress dance created by Moira Villiard (Fond du Lac Band of Ojibwe direct descendant), a soundscape composed by Lyz Jaakola (Fond du Lac Band of Ojibwe), and narrative by Dakota/Ojibway First Nation elder Millie Richard. Together, the provocative and breathtaking 10-minute looping projection speaks to the experiences of isolation in the midst of a global pandemic, the resilience of Indigenous women, and reconnecting to ourselves, culture, ancestors, and nature.

After the installation closed, Laurie Moberg of *Open Rivers* [OR] spoke with artist Moira Villiard [MV] about her work and about the experience and meaning of *Madeweyaashkaa: Waves Can Be Heard*. The interview has been edited for length and clarity.

[OR] Thank you for joining me today, Moira. I was moved by your installation *Madweyaashkaa: Waves Can Be Heard* as part of the *Illuminate the Lock* series and I'm pleased to be able to talk with you today. To start our conversation, would you be willing to tell me a little bit about yourself and what brought you to public art?

[MV] Yeah. I always like to say that my life is a series of intentional accidents. As a kid I didn't really have a lot of plans for my future; I didn't grow up in a family that would say "go to college and make a life for yourself." Pretty much every decision I made after high school was thinking "I'm just going to put myself in a space and see what happens." I put myself in spaces where I

Spectators line up at the edge of the lock to watch the animated projection at sunset. Image courtesy of Nedahness Greene.

felt like opportunity was going to present itself in some way if I just hung around long enough.

I went to college and that was really where I started connecting with all sorts of different people and then getting inspired to do more artwork. Initially what inspired my art was people—being around people and doing portraiture. I just love human beings. I had a very isolated upbringing (for many reasons—social, geographic, financial, etc.), so that's where the people obsession comes from—because I didn't have a lot of people growing up. As soon as I got into environments where there were people, I decided I was going to make art about people.

I had my first art show when I was 18 or 19. That was another chance happening. There was another artist in my science class, and we used to sit in the back of the classroom and doodle. Eventually, he asked if I wanted to do an art show with him at the American Indian Center that had just opened in Duluth.

For that show, I dropped off all the artwork that I'd done in my solitary life, unframed. I literally

A view from the top of the wall where Madweyaashkaa was projected, opposite the audience who looks onward at the animation. The deep blue color of the projection radiates throughout the whole lock. Image courtesy of Moira Villiard.

In a photo taken on the night of testing the projectors, Minneapolis glows in the distance as the Mishomis (Grandfather) animation appears on one of the lock site's smaller walls. Image courtesy of Moira Villiard.

brought about 100 pieces of art to the gallery the day before the show. I didn't know what went into an art show or anything like that. Being a new program, they covered the costs of framing a lot of that work. From there, I had a body of framed, ready-to-hang work, and I started to go to other gallery spaces.

I made a goal back then that I was going to do at least one art show or arts-related public thing every month for the rest of my life. And I stuck by that. On my resumé there's over 150 things, like exhibitions I either curated or I was a part of with my art, my private painting practice.

Then I started doing live painting at shows. That was just a fun idea I had: I like being around people, so I thought I'd invite people to start adding to my paintings as I set up at events or set up at coffee shops. People would come and put their stuff on mine.

I started doing public art with an organization called Zeitgeist. They reached out saying, "We've got a street that's going to be blocked off during the summer. Do you want to facilitate some sort of large-scale mural on the street? We can pay you and pay for the paint." I turned to Facebook and asked people what they wanted to see in the art world around [Duluth]. We're an artsy city, but we don't have a lot of people or stories that are really well represented in public art. People wanted a mural around water because it's important to everybody here in Duluth. We're a port city and water is also culturally significant. Over 100 people came to help me paint a temporary mural on the street. It was a big fish with all these different vignettes of how water is important.

I used that as my one public art example for a Forecast Public Art grant which led to doing crosswalk murals with [Zeitgeist]. I think people were sad that the crosswalk murals and the street art were temporary, so people asked me to paint their walls so it would be permanent. I'd learned to paint murals kind of on the fly, getting a paid gig and learning as I went. I've learned to do everything I do just by having a paid opportunity and people who are willing to let me figure it out. I was also doing freelance graphic design in between large-scale public art work as well.

Then fast forward to this past year: All My Relations Arts reached out and said, "Do you want to try to do animation on this big wall?" And I said, "Okay, why not?"

[OR] And your installation for *Illuminate the Lock—Madweyaashkaa: Waves Can Be Heard*—is part of the *Bring Her Home: Sacred Womxn of Resistance* exhibition put together by All My Relations Arts, right?

[MV] Yeah. I'd been working in digital art for the *Bring Her Home* exhibit series since it started, but I didn't do digital art for this year. Instead, they asked me to be part of the collection of events and have my own, different opportunity.

The *Bring Her Home* set of exhibits has been recurring for three or four years. Originally it was drawing attention to the issue of murdered and missing Indigenous women (MMIW); it has been sort of building since then, adding additional themes. The exhibit narrative continues to revolve around murdered and missing Indigenous women, and has grown to include other components of Indigenous women's representation. This year the theme was Sacred Womxn of Resilience. They're trying to have more of a resiliency theme because it's important to draw attention to the issues but then you don't want the narrative of the community to be only this sad representation. It has opened up a bit, uplifting Indigenous women's voices.

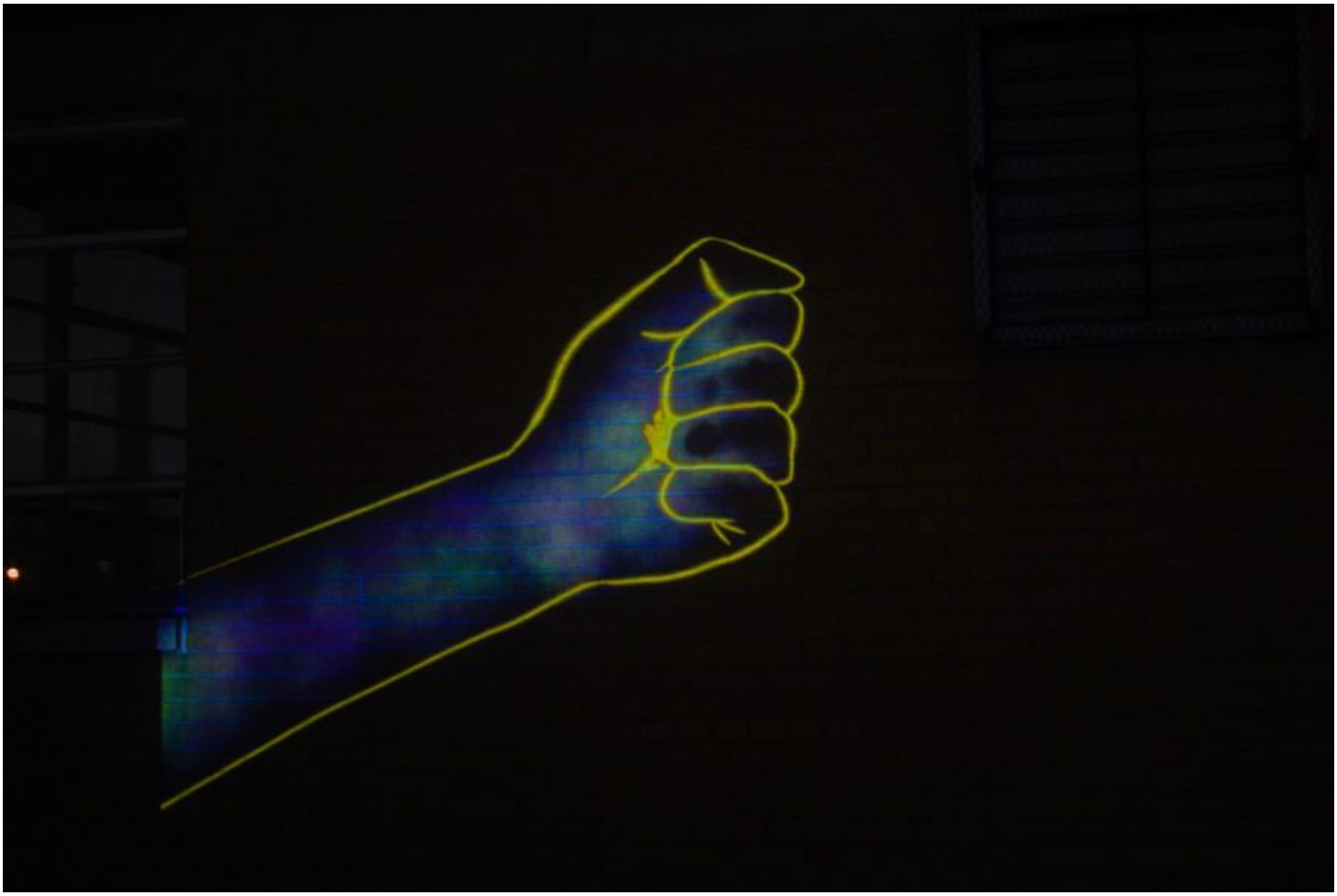
[OR] MMIW is an important set of issues, but I also see the point All My Relations Arts' is making—of wanting to be sure to share more than just a single narrative.

[MV] Yeah. We had a conversation about this after *Illuminate the Lock* because there's a lot of pressure, especially for artists of Indigenous

heritage when they do get these public platforms, to wrap a lot of things into it because there's not a lot of representation in the art world of Native artists, of their stories. I had this big platform, but I can't do everything; I can't wrap up everything that the community wants in this one opportunity, but hopefully it opens the doors for more stories to take place.

There's always that danger—because there's not a lot of representation—that anything you do, is going to be taken as the overall narrative. That is always the biggest challenge for me in doing anything that's very public, understanding that there are expectations, and even extra expectations when you're dealing with Indigenous content.

I always have to remind myself in these processes that I'm just one facet of Indigenous identity. I am not a voice for all people and all experiences, and I try to be really clear in my work about that. With *Illuminate the Lock*, there was a balance of personal and public. I have my own personal inspiration, but it's in a public space, and dealing with a very public subject. Bringing that to light and then putting it in a space that's public, that is not necessarily a Native-specific space. There was a need for balance, too, to consider what



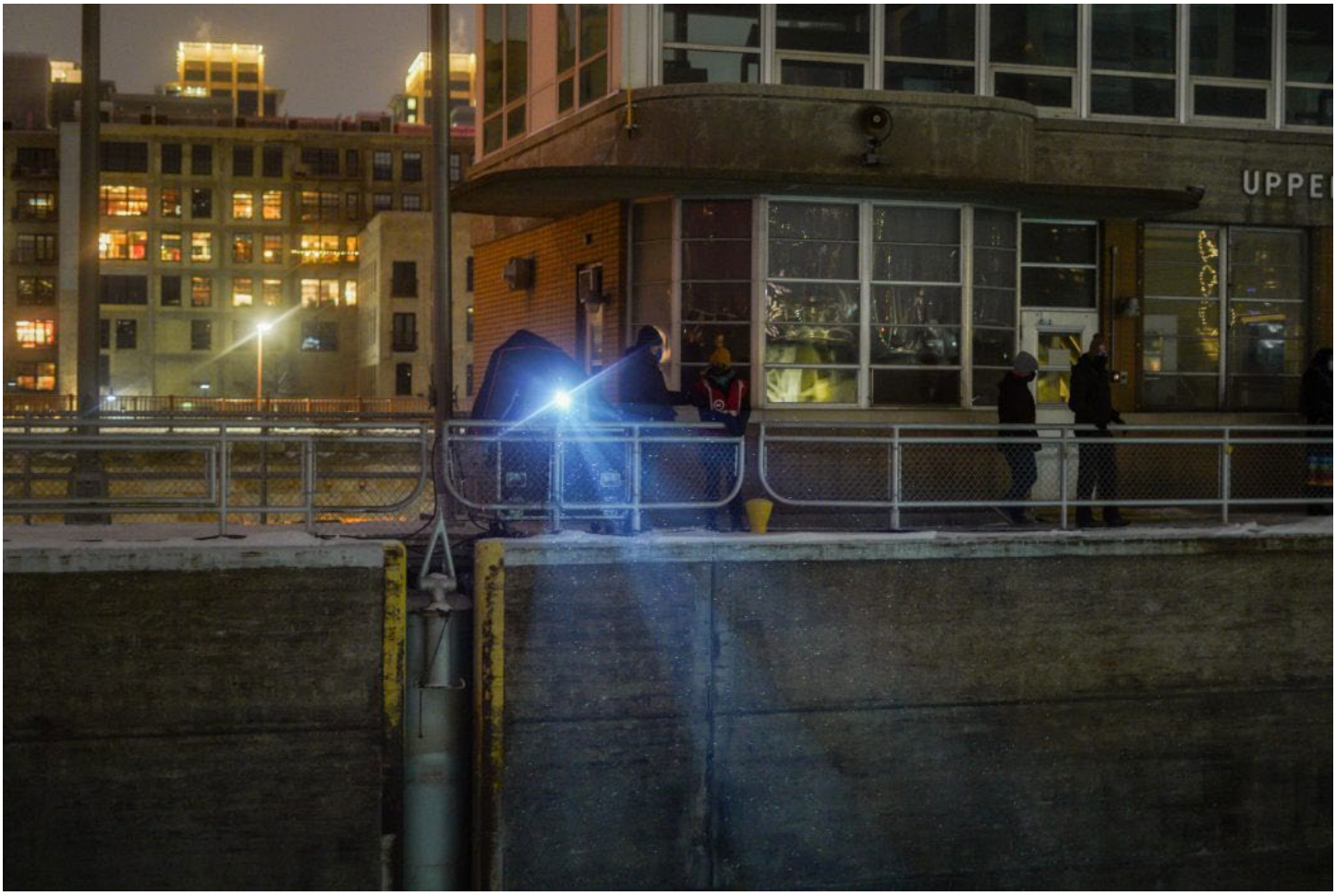
A scene from the first mini projection loop in which a hand offers asemaa (tobacco) in prayer. Image courtesy of Nedahness Greene.

non-native viewers are going to get out of it, as well as Native viewers.

I questioned, "how do I work with this content in a way that's not putting culture on display?" That was my main goal. If there's material that non-native viewers are not going to understand, I don't need to explain it; those parts are for the Native viewers. There are also overall themes that worked well, like connection to the water, respecting nature, and the overall experience of the pandemic. Everybody's feeling disconnected right now, not just Native people. With this installation, there is this constant tug and pull; I want to say one thing to this group, and another thing to this group, and then they overlap as well. And I have my own stuff to throw in and that is going to be just for me and people who know me well. Public art is such a balance of audience.

[OR] You can't be expected to anticipate every audience response; you can anticipate parts of it, but it is a lot of pressure to be able to think through how the installation might create ripples in ways that encourage curiosity or in ways that might be not as welcome. Tell me a little about your process overall for this exhibit and how you put this all together.

[MV] Dealing with that balance of audience is where I think collaboration comes into play. It's not just my voice out there. Whenever I get a bigger opportunity like this or like my murals, I try to pull in as many people as budgets will allow. It's not just a personal work. My philosophy is



Using two large, high-luminosity projectors, the animation was projected over the edge of the lock and monitored from a makeshift tech room. Image courtesy of Nedahness Greene.

that this is a public space and this is for whoever's living there and whoever calls that space home in different ways. I'm kind of a guest offering a little bit of perspective. It's always more helpful when I can include more than just my perspective.

For my process, everything is spur of the moment. I think people sometimes are a little bit surprised by that. There's a lot that's intentional in the philosophy of what I do, but then it's intentional accidents; I have intentions in the big picture, but the details happen the way they want to.

For this project, I knew I wanted narration by Millie Richard. I've been to different ceremonies that she's led and I've seen her work with urban Native women specifically. She's able as an elder to still have this contemporary lens on issues that women are facing, and a lot of people come to her ceremonies, sometimes as their first return to ceremony after a long time. I've been really inspired by how she works with people and I thought it would be really cool for urban Native women out in the Twin Cities, in this bigger urban space, to have access to her voice and her teachings. So I asked her to speak for that specific audience.

I offered Millie tobacco because she's an elder and I wanted to make sure I did this process in a good way. She did her meditations on the prompt of resilience and disconnection tied to the project. I didn't really give her much more of a prompt than that. I just asked her to do what she does naturally and so she spoke. She sent me about 40 minutes of audio. I had the tough job of cutting everything she said down to 10 minutes.

An animated illustration of Nokomis. Image courtesy of Nedahness Greene.

Then I reached out to Lyz Jaakola for the music. I know she's done a lot of hand drum music and MMIW events. She's a very prominent female voice for Native women. I used the same process with her: I gave her the prompt, my ideas, and I sent her Millie's audio as the content that we were going to have and asked her to make a song about it.

Lyz went around and talked to people in the community and asked, "What's a respectful way to make music around this? Is it okay to compose something?" There are songs that exist, but she didn't want to take a song and have it be culture on display. So she composed a song.

Once I had the song and Millie's audio and my loose sense of how I felt the work coming together, I reached out to my friend JayGee. I went to college with him. There were times where we would hear something clicking in the distance, and he would make a beat, start hitting the table. He heard music and melody and everything. I hired him to do the sound effects and make it flow, to make things sound like they're meant to be.

The whole process was those three components of collaboration.

For the artwork I made, I had a very rough four-panel storyboard of images that came to mind. At the beginning I also reached out on Facebook and asked people what they would like to see. From that, I had a list of things that people suggested for the animations.

Guests in attendance interacted with the smaller, shape-shifting animations on smaller walls at both edges of the lock. Image courtesy of Nedahness Greene.

Artist Moira Villiard stands in front of the mini projections. Image courtesy of Nedahness Greene.

Then, in response to Millie, in response to the music, and in response to all the material that we put together soundwise, I did the rest of the animations and filled in between those four storyboard points. Then I did a lot of looping and repetition because animation frame-by-frame is really hard. I experiment; I'm not a professional animator. I know that the methods that I used were not industry standard; I was just drawing on my iPad on a $10 program. I could animate five- to ten-second loops frame-by-frame on Procreate [a digital drawing app], and I can loop those pieces together using a video editor. I put the pieces together in a video editor like a collage, basically. I know basic video editing to make stuff move across the screen, so I just worked with keyframes and transitions doing basic editing. I treated the video editor itself as a canvas, meaning my traditional painting and artist's background influenced this work. It isn't industry standard, but that is the fun part; it is an illusion.

[OR] You're demonstrating that there isn't one right way to do it. To my untrained eye, I saw it as an intentional style. I thought it was remarkable; I could tell that there were moments of looping, of bringing back previous themes, and I liked that. I thought that sort of repetition was cyclical and tied into the message of the piece. I also really like the way you frame this as an animated video collage.

What about the content in particular speaks to you? What drew you to this message? What does it mean to you?

[MV] There are so many full circle components in the messaging in it. In all the mediums that I work in, I find the most meaning in my work after it's finished, which is why I trust the process to be what it's supposed to be. I was telling everyone I worked with that this is going to be what it's supposed to be; whoever is going to see it, it's going to be meant for them in that moment and they'll take away what they needed to take away in that moment. I try not to control those things too much throughout but then I always find a lot of meaning, at the end, almost like I am an audience member myself.

Some of the messaging that was significant to me; I've been dealing with situations in my life that peripherally or directly tie into some of the MMIW issues. One of the influences for this piece was a conversation I had during the first year of participating in the *Bring Her Home* exhibition. I was learning more about the issues of MMIW and thinking about the nuance of the word missing, and how people go missing in more than just the physical sense. There is missing through disconnection of culture, and displacement from homeland, and also going missing in terms of addiction that takes people away even though they're physically still here. People disappear through trafficking, too. There are all these different ways that you can look at murdered and missing Indigenous women beyond just the physical sense of it.

That was a huge influence, applying that definition to the personal experiences with people in my life.

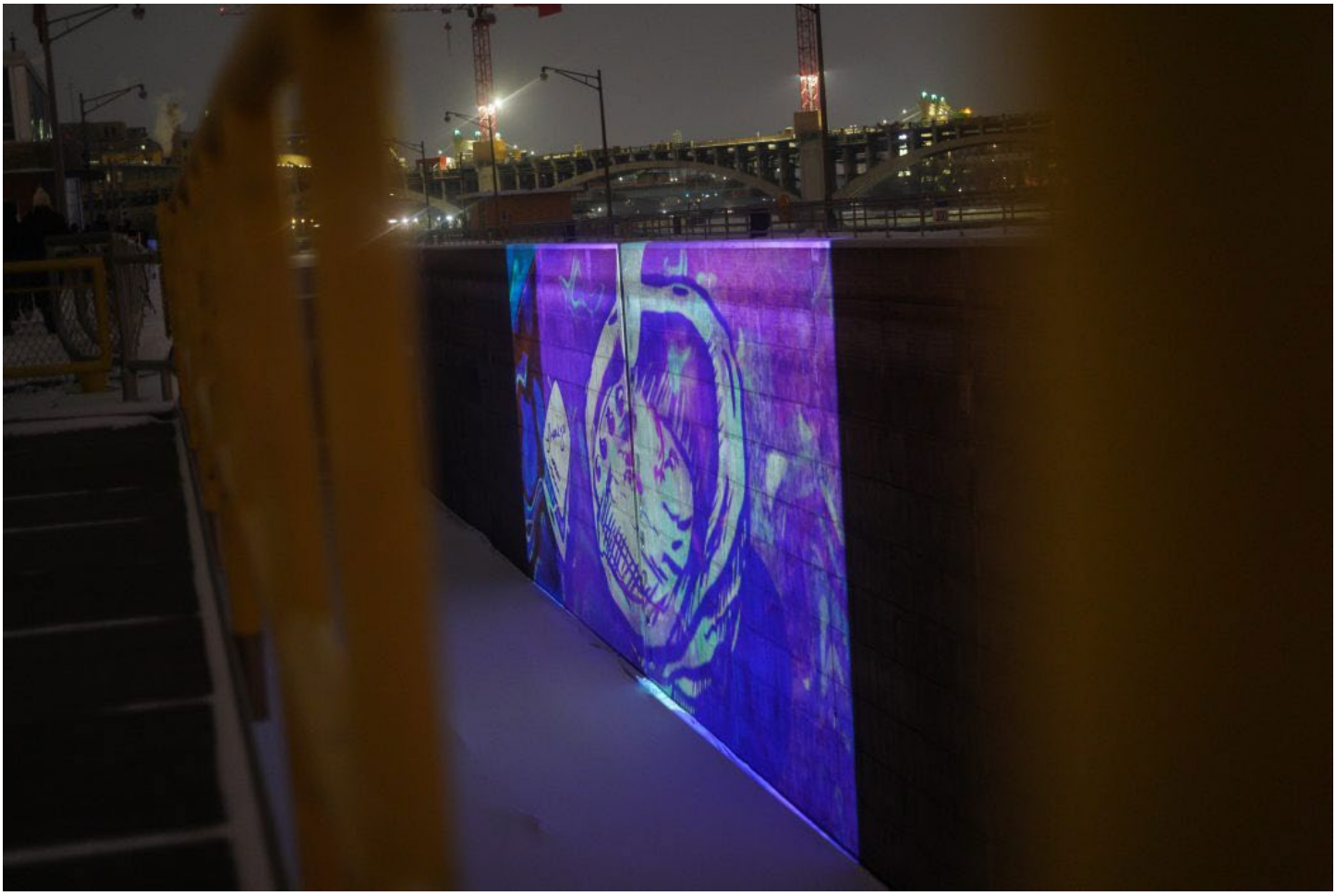
But I also didn't want the narrative to make people really sad. The ceremonies with Millie are about connecting.

For me personally, a full moon ceremony has been kind of a full circle thing. Growing up I was always obsessed and fascinated with the moon. I didn't particularly have any reason that I knew of at the time, but I used to draw the moon all the time. Then in adulthood, I attended a full moon ceremony and I've learned that there's all these connections between Indigenous women ancestrally and with the moon. It answered the question of why I had this inherent feeling that there was something there. I had this realization recently that if you were to tell little Moira that one of her moon doodles would go up on this 50-foot wall, at this giant scale, I would have been as excited then as I was this year. That one of those illustrations would transition into this scale

Grandmother Moon and Grandfather Sun make an appearance in the animation, paired with narration by Millie Richard urging the audience to connect with their ancestors and their roots. Image courtesy of Nedahness Greene.

was really cool for me. So connecting with culture through the moon was a meaningful piece of this work for me.

There were also little things. When we went to do the site visit at the lock, there was a loon that was swimming in the lock. The park rangers are super excited and everyone was taking pictures because there is never wildlife in the lock itself. For me it was kind of synchronistic. I'd been thinking about basically the first time I'd been to the Twin Cities for something other than a school field trip. It was with Jonathan Thunder and another artist. We got hired to do this art project down there together. I was super excited because being a small-town kid having an art show in Duluth was like the big city for me, so thinking I'd be doing anything in the Twin Cities was also kind of crazy. I remember going to Jonathan, full of excitement. I didn't know where I wanted to go, but I wanted to see the city. He grew up around there. He took me down to the lock and dam area and we walked across the bridge. I remember we watched the water in the lock rise and I asked Jonathan what happened with the fish when the lock does its thing. He said he didn't know, and I said I thought they became little ghost fish; they just turned into little spirits then and there. My brain likes to make up stories like that sometimes. The idea of these fish became part of my work. In a lot of my artwork I draw these little fish and they were inspired by that day by the river with Jonathan and thinking about little ghost fish and what they could represent in my art as the spirits of living things that are impacted by human intervention and human quest for energy. That's



The closing scene brings viewers full circle back to the first scene in the animation—a shell lit with sage used for smudging rests on a wooden table. Image courtesy of Nedahness Greene.

what those little fish represent for me. Then fast forward and I get this gig at the lock and dam and Jonathan Thunder is my mentor. And it's all right at the site where my signature fish were born.

Then we see this loon fishing in the spot where I had wondered what happened to the fish. Obviously, the fish are there because there's a loon miraculously fishing. That day I decided to put a loon in my art as a tribute; it all fit together so perfectly with Millie's narrative of life, of finding life in the middle of a concrete jungle. That loon became the embodiment of the project for me as this life that you'd expect to find way out in the wilderness where there's lots of plant life and an environment it can flourish in, but somehow it's finding a way to flourish right here in the middle of these two concrete walls. It was the epitome of the project, like a symbol of the audience that I was hoping to reach with this, deep down: people who are just getting by and maybe they're not feeling as connected to this place the way it is, but they're making their lives here and they're doing what they can during a pandemic.

[OR] It is really powerful to hear about your reflections on your first visit to the lock, to this watery place. The title of the piece, *Madweyaashkaa: Waves Can Be Heard*, relates to water, too. How did you decide on this title?

[MV] Madweyaashkaa, the waves can be heard, or the waves are making sounds, or water is making sound. Those are different interpretations for it. I don't speak Anishinaabemowin fluently but there's so much you can say in the language that you can't in English. English is a language of things–it's categories and things–whereas Anishinaabe is different. I'm reading *Braiding Sweetgrass*, which is great, and [Robin Wall Kimmerer] has a stat in there that in the Potowatami language—and I think this is true probably for most Indigenous languages—that something like 70 percent of the words are verbs, and the other 30 percent are nouns. In English it's the opposite: almost everything is a noun and then we have fewer verbs and they aren't very helpful sometimes. So, I knew I wanted to find a phrase or word in Anishinaabe. I don't usually title stuff until the very end of the project because I don't find the meaning so much until the very end, but with this project I had to title a little bit sooner because we had to promote it. Usually, I write a list of words or influences, things that are inspiring me. They might be connected to the imagery, or they might be very distant threads of thought. I started plugging some of the words into the Anishinaabe language dictionary online. I came across madweyaashkaa in looking for things that related to tides or waves because I think it's interesting that the moon is also connected to tides. Western science has proven that, but there's always been an understanding in Indigenous cultures of that connection between the moon and the water and womanhood in general. I wanted to find a word that said something about tides, basically.

I saw that phrase—madweyaashkaa—and I wanted to make sure I was understanding it in the correct way. So I reached out on Facebook and asked Ojibwe language speakers, and people confirmed that I was understanding the word correctly. People said it was a really cool word and mentioned that it's all about that sound of water nearby. I thought that was really appropriate for the context of the space and the sound component that was there. I just let whatever divine intervention needs to happen to make my art happen. I couldn't have set up the sound that was going to be there at night or the lighting or anything like that. For the three hours every night [of the installation] the sky was always different because it was sunset so there was a background happening. And the waves can be heard in that space and so they added this component on top of the sound effects that was just the environment making the sound.

A child eagerly played with the animated maang (loon) swimming up and down the wall in one of two mini projector sites. Image courtesy of Moira Villiard.

I was thinking that if the moon is guiding these tides and the moon is connected to women and our bodies are made of water, then the moon is kind of this figure that pulls us, too. If there are tides and water inside of us, then this is about listening not only to those external waves but to the internal waves creating our life decisions and guiding our connection to our surroundings and everything.

[OR] Given the layers to this title and the work as a whole, what kind of impact did you hope that the installation would have on people?

[MV] For Native folks, not everybody has access to elders and their wisdom. I think it's really good in this digital age for elders who are willing to reach out and share wisdom through new mediums to reach young people. I think that was a really positive part of it, just having Millie who is so excited to get to urban Native folks; so many Native people are in cities. Making that connection, creating access was important. It was also important not doing it in a way that puts culture on display, at the same time not putting disclaimers. So there's symbolism in there like with the moon and the fire that I felt like if you know, you know, and if you don't, maybe you will eventually or maybe you'll find your own meaning in it. Then you'll think back and maybe make that connection.

My hope is that for whoever went to see the installation, it provided them whatever they needed in that time, and that it keeps providing, keeps making people think long past the moment of seeing it. Maybe it will be one of those funny little intentional accidents or synchronistic moments like those that were part of making it, carrying a theme through other people's lives.

[OR] That's a very generous framing. What kinds of responses did you get for the installation?

[MV] I heard one murmuring of critique indirectly, and I hope maybe I'm addressing it a little bit in this interview. I am one form of personal experience and I can't put everybody's experience into this one thing. I also have mixed heritage; I can't pretend I'm not white and I can't pretend I'm not Native, I'm both. Navigating this can sometimes be awkward, but I'm also not alone in it; none of us are alone in our identities.

Other than that, I got really good responses from both Native and non-native folks that it spoke to people in the ways that I'd hoped, which is always really nice to hear.

I have a very strong inner toddler. I think especially for folks who've been through a lot of trauma, there's a very prominent inner child that's always there, and that I always feel like I have to take care of. So I like for my work to be very accessible to kids; I want to make sure that kids watching it can get the sense that they can do it, too. I was really happy at the kids' responses. I had side projections [near where people were walking] and a little kid was chasing the loon on the wall and that literally brought me to tears. It was all I needed. I just needed to see kids feeling that magic. Imagery is so strong when you're a kid and the light and colors are so strong. There's just so much visual stimulation and to be a part of a kid's visual memory was really meaningful to me. To see that kids at the installation were laughing and having fun, being a part of that moment, just being able to witness it, is all I needed for response. It was so magical.

[OR] I appreciate your sense that art should be accessible to kids. There were a lot of kids there when I attended.

[MV] The cool part for me was that I didn't see any kids running around; they were watching. If you can get a kid's attention and hold it through a whole piece of art? That is awesome.

[OR] *Madweyaashkaa* was up for three nights on the lock wall. What do you plan on doing next with the installation? Is it feasible to show it elsewhere?

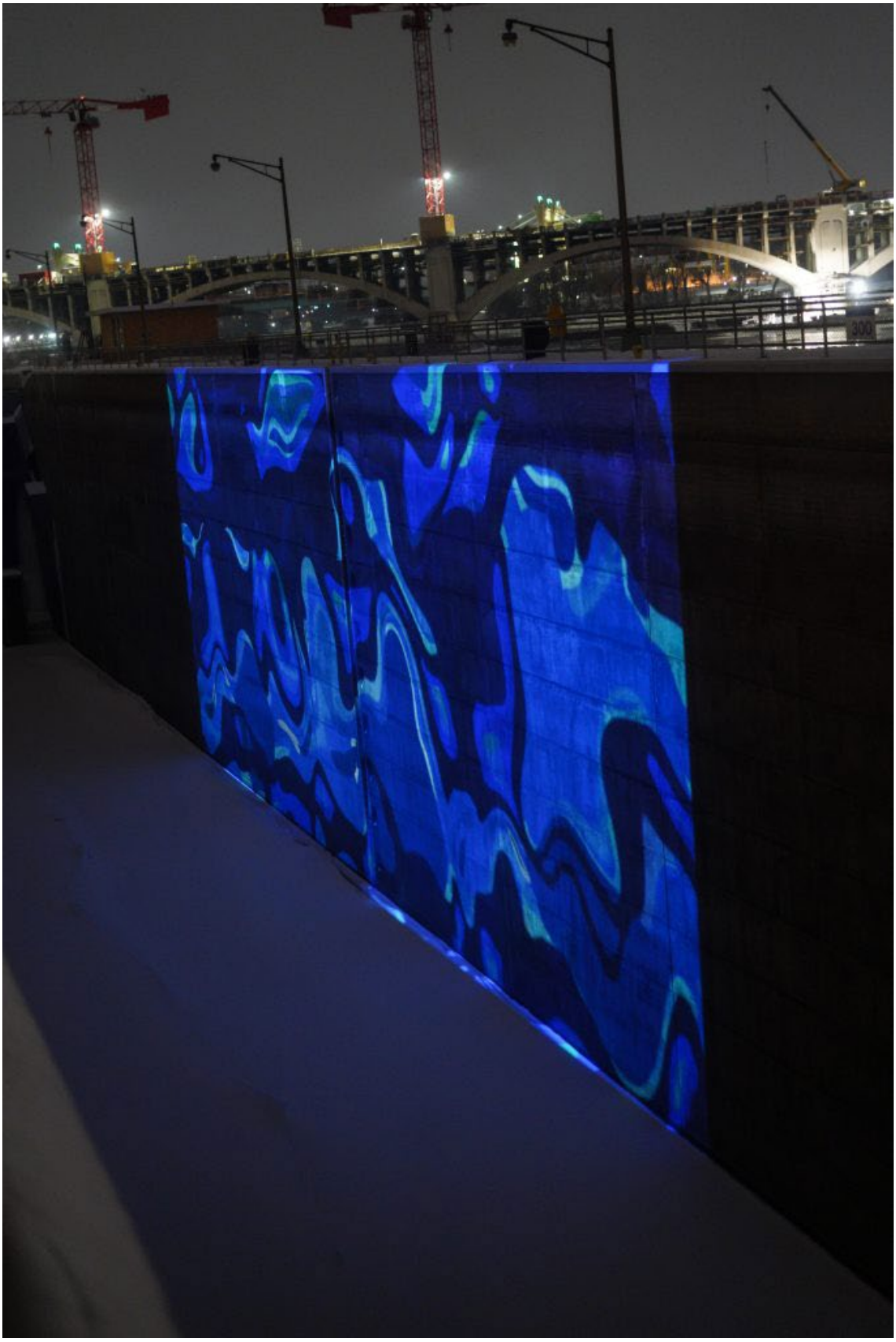
[MV] We're working on it. I want to bring it to Duluth. I've been talking with the city because they have a projection initiative that they're working on. They reached out to me so I'm hoping to get it in Duluth for sure. There are other cities, like Granite Falls and Sandstone and a lot of different cities, that are interested and have a wall that would work. My hope, though, is to really make sure it's accessible to tribal folks first and foremost. I think it will travel. No matter where you go in Minnesota, there's always some form of water, and there's always that same narrative of human presence that could be juxtaposed to the natural environment. It fits in a lot of places.

I'm excited to have it travel because a lot of people couldn't come down to the Twin Cities or didn't register in time. Registration filled. I couldn't have predicted that.

[OR] I'm glad to hear that the installation will travel! What's next for you? Will you do an animated video collage again?

[MV] Oh yeah. I've had so many people reaching out about this kind of thing. We've gotta work on getting the youth more interested in doing digital

Child watching the animation through fence holes at the edge of the lock. Image courtesy of Nedahness Greene.



Music composed by JayGee builds in intensity during the undulating water animation before the opening scene. Image courtesy of Nedahness Greene.

art stuff because there's so many people looking for Native animators and Native digital artists, and there are so few of us here in Minnesota. I'm trying to do a lot more mentorship work. I'm not the best at it but I'm hopefully accessible for Native kids, getting them interested and getting them to know that there are a lot of jobs that I'm turning down. It would be great if I had a list longer than the two other busiest Native American designers.

Right now, I'm waiting on grant approval for a couple other projects in a similar vein. I think this is the start of something. But the other issue I have is I have some nerve issues in my arm, so I can't really do long drawing sessions. I used to be able to work like crazy, doing so much physical creation of artwork. And then I really messed up my hand doing that seven years ago. I've had surgeries and all sorts of stuff to fix my hand, but I still can't do long sessions.

It would be really nice to have a team of folks to help draw, to give them opportunities and creative rein and have some assistance and apprentices.

I got into public art, actually, because of my arm. I started doing these community painted murals, having other people be my paintbrush. I can design this stuff and I can sketch it out really quickly with chalk, and then everybody becomes my paintbrush.

Families enter the site of the projection to find a good place to view it. Image courtesy of Nedahness Greene.

[OR] Your work often seems to be speaking toward questions of equity and justice. *Madweyaashkaa,* of course, because it was part of the *Bring Her Home* set of exhibits that in part speak to issues of MMIW, but also you were a part of mural work in Duluth around remembrances for George Floyd and Breonna Taylor last summer. What inspires you to want to be doing work that is oriented toward social justice?

[MV] The more I get into my practice, the more I realize that my medium is people and space and creating spaces for people to engage in arts experiences. There's a difference between instructing people at a site, on the one hand, and genuinely opening up the space for people to have their voices out on a platform on the other. With the George Floyd murals, I was really hesitant. I'm not a Black artist; I have a lot of connections to Black artists because in Duluth a lot of them were really a part of my early art career. I was hesitant to step up and do too much, but I felt a connection through the youth.
There was a day when people were at the Clayton Jackson McGhie Plaza, and at the time it was one of the only pieces of public art reflecting a story in the Black community in Duluth. I think back to my own experience not seeing Native representation anywhere, and how it might feel for today's Black youth in Duluth seeing the only visible artistic representation of Black people in the story of a lynching. That's not to say the story shouldn't be told and articulated through art, but how is Duluth honoring the Black children of today? The Native children? How does community use art to bring to light the injustices that community has perpetuated, as well as honor the life that exists today so that children can see themselves as somehow important in the fabric of community itself? That, in and of itself, is a much bigger conversation we need to have as artists around "what's missing?"—one that I don't think I have time to fully articulate gracefully in this interview. But ultimately, there was a youth who spray-painted that memorial during the protests. I can't speak on behalf of that youth specifically; I just know that after it happened, I was thinking about what our role as adult activists and artists in the community was in showing up and opening space for youth to feel connected, to feel their anger, to mourn, and to mobilize?

As all of this was happening, I decided to reach out to the activists I know, and Clayton Jackson McGhie Memorial folks, and offer plywood and paint from other projects. I didn't need to lead or have my art out there; I just offered to facilitate a community painting session. They agreed and set up the filming of the "I Can't Breathe" documentary with the DanSan Creatives. We set up a tent and we blocked off the whole street. We worked with the city to make this space that was specifically for BIPOC people to have a platform. We didn't censor anyone, just made that space. It was for the community and that's sort of the magic of doing public art like that; there's this silent sort of communication that happens, there's a vibe that happens when you're painting with other people about something you care about. We had 100 people of color who painted those murals and nobody wrote stuff that might be deemed super extra controversial. I didn't tell anyone not to; they just chose not to because they recognized this as a healing space for all of us. It was so beautiful. Everybody took ownership of those pieces of art without "owning" them in the physical sense.

After those pieces of art went up at the Clayton Jackson McGhie Memorial, people kept adding to the murals, and suddenly people were bringing flowers, and then there was this big altar that was set up around those pieces of work.

For me, the social justice component is really just making sure people have that space to try different forms of activism. It just takes the capacity to break down those resource barriers and to open up space and not tell people what to do, and for the youth to get that sort of experience and see what works for them.

An animated jingle dress dancer moves gracefully across the wall and fades into the glow of a Minneapolis streetlight. Image courtesy of Nedahness Greene.

It's back to that philosophy of whatever it's supposed to be, it'll be, it'll have a home somewhere. The public art world is really opening my eyes. It's so much about people and what they need. I guess it's cheesy to say it has been an honor, but it has been an honor to be able to open up the floor for folks to be public. All my murals have so far had that component of other people adding to it, even during the pandemic.

A big dragonfly mural—the largest permanent mural I've done—was done during the pandemic. Originally we were going to have a bunch of kids' painting sessions. We ended up having one socially distant kids' painting session and then I made a coloring page. I posted it online and sent it to all the parents I knew and asked them to have their kids color it in exchange for a gift card. Their designs were put up on this mural, so every dragonfly on the mural was designed by a little kid somewhere. The kids are the ones that have to grow up with it. I look at these cities and they are the youths' cities at the end of the day.

[OR] Thank you, Moira, for sharing so much about your practice, your values, and your commitments in public art. It was great to talk with you and to hear more about *Madweyaashkaa: Waves Can Be Heard*. I look forward to hearing about where the installation goes next and I hope some of our readers might have a chance to see it live at some point in the future.

To learn more about Moira Villiard and her work, please visit her website: https://www.artbymoira.com/.

You can also learn more about *Madweyaashkaa: Waves Can Be Heard* at http://northern.lights.mn/projects/madweyaashkaa-waves-can-be-heard/.

Read Suenary Philavanh's full essay on the project at http://northern.lights.mn/2021/02/resilient-searching-for-connections-through-waves/.

Madweyaashkaa: Waves Can Be Heard was made possible through a partnership of All My Relations Arts, a program of Native American Community Development Institute (NACDI), Northern Lights.mn, Mississippi Park Connection, and Mississippi National River and Recreation Area and supported through a grant from the St. Anthony Falls Heritage Board.

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About the Authors

Moira Villiard is a dynamic visual artist proficient in a variety of artistic genres including portraiture, illustration, graphic and digital design and as a muralist. She is also a community organizer, curator, and passionate arts educator concentrating her efforts round issues of equity and justice including: arts access, creative placemaking, environmental sustainability, collaboration with youth, and acknowledgement of Indigenous land, culture, and history.

Moira (pronounced "Mee-Ree") grew up on the Fond du Lac Reservation in Cloquet, MN and

identifies as a Fond du Lac direct descendant of both settler and Indigenous heritage—Anishinaabe paternally and Delaware Lenape maternally. For three years she worked as the Arts & Cultural Programming Coordinator for the American Indian Community Housing Organization (AICHO). She currently works as a freelance consultant, designer, speaker, and grant writer. She was broadly recognized in 2019 when she received the 2019 Duluth NAACP "Take a Stand for the Revolution" award, 2019 Emerging City Champions fellowship, Forecast Public Art 2019 Early-Career Project Grant, 2019 YWCA Women of Distinction award, and The Duluth News Tribune 20 under 40 award.

Her work has been featured in numerous shows in Duluth and around Minnesota, including her recent solo show, "Rights of the Child" at Zeitgeist, and group shows "Beyond Borders" at MacRostie Arts Center and "We the People" at the Minnesota Museum of American Art. She received her Bachelor's Degree in Communicating Arts (Global Studies Minor) from the University of Wisconsin-Superior in 2016.

Laurie Moberg is the managing editor for *Open Rivers: Rethinking Water, Place & Community* and the project manager for the Environmental Stewardship, Place, and Community Initiative at the University of Minnesota. She earned her Ph.D. in anthropology from the University of Minnesota in 2018. Her doctoral research investigates recurrent episodes of flooding on rivers in Thailand and queries how the ecological, social, and cosmological entanglements between people and the material world are reimagined and reconfigured in the aftermath of disasters. In her work at the University of Minnesota, Laurie brings her ethnographic sensibilities, attention to story, and interest in human-nonhuman relations to questions of water and absented narratives closer to home.

FEATURE

HIDDEN WATERWAYS: BASSETT CREEK

By Trinity Ek

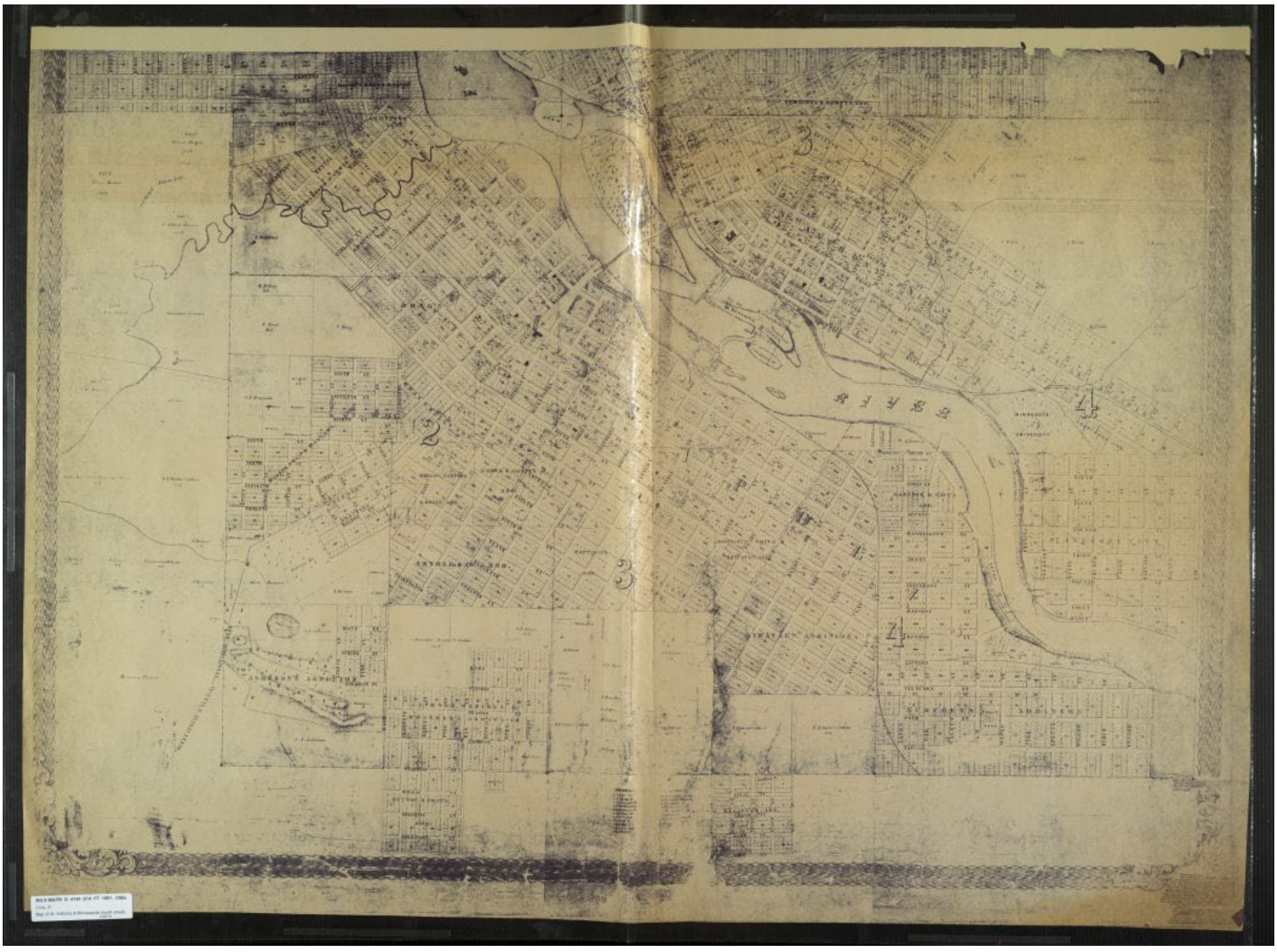
Bassett Creek, a meandering waterway separating North Minneapolis from the rest of the city, was ignored, piped, and hidden from the landscape over the course of the nineteenth and twentieth centuries. The creek's main stem begins downstream of Medicine Lake. The North Branch and the Sweeney Lake Branch join it in the 1.7-mile long tunnel that runs through Minneapolis (Bassett Creek Watershed Management Commission, n.d.). Unlike many of the other water features in Minneapolis such as the Chain of Lakes and Minnehaha Creek, Bassett Creek was not seen as an amenity.

Today, Minneapolis, like many cities across the nation, is reembracing its natural environment.

Where Bassett Creek meets the Mississippi River. Image courtesy of Patrick Nunnally.

Polluted rivers are becoming beloved waterfronts and abandoned industrial sites are being remade into commercial corridors with beautiful green spaces. For example, the reopening of the Stone Arch Bridge, formerly carrying railroad tracks, as a pedestrian and cyclist bridge signified the reorientation of Minneapolis to the Mississippi River. It became a site of recreation and engagement with "nature" rather than a site that primarily fueled capitalist endeavors of the past such as sawmills, flour mills, and breweries. As these former environmental hazards transform into amenities, it is necessary to ask who is at the table making these decisions, who these amenities are for, and who benefits and loses.

Throughout history, unnavigable waterways and natural wetlands have been piped, filled, and drained to accommodate urban living. When hidden, the original waterway is often forgotten, but continues to influence the landscape and the communities that live within it. Detrimental effects for the community appear in the form of bad soils, polluted waters, and flooding. Additionally, these waterways are often turned into neighborhood dump sites. Patterns of inequity and environmental injustice align with these historic hidden waterways. The people who live in these places are typically communities of color or of lower socioeconomic status. These spaces with hidden urban waterways are defined by the intersection of race, place, and hydrology.



A meandering Bassett Creek outlined on an 1861 plat map by R. & F. Cook.

Today, hidden urban waterways pose a major redevelopment opportunity for cities. Jason King's (n.d.) work explores select "lost rivers, buried creeks & disappeared streams," how we continue to see them in today's urban landscapes, and how we might reconnect with them. The potential for reconnection to the landscape is an opportunity for previously neglected urban spaces to attract new residents and development, which in turn increases a city's tax base. Bassett Creek is one waterway that displays how in landscapes where race, place, and hydrology intersect, there is potential for infrastructural development that may combat or exacerbate inequities.

The History of Bassett Creek

Ecological Changes

As Minneapolis grew in the 1860s and 1870s, a major railroad corridor ran along Bassett Creek and became central to the warehouse district. John R. Borchert notes that the creek demarcated "the north side of Minneapolis from the rest of the city" (1983, 11). Further, due to its regular flooding in the spring, it proved difficult to cross and build around. A series of streets and bridges were built over the creek to connect North Minneapolis with the rest of the city (67).

In addition to Bassett Creek as a barrier between North Minneapolis and the rest of the city, it was also an environmental hazard. The noise and air pollution from sawmills near Bassett Creek caused residents to move away from the

1892 plat maps stitched together which reflect straightening efforts. Maps published by C. M. Foote & Co.

area in the 1860s and 1870s. The creek itself was characterized as a problem by elected officials and city engineers. Mayor Albert Ames in a letter from 1876 called it "that mammoth sewer called Bassett's Creek," and in that same year, city engineer Thomas Rosser also described it as the "sewer known as Bassett's Creek" (Smith 2011). During this time, the creek was less a waterway and more the neighborhood's place to dump anything and everything, including "ashes, dead animals, garbage, glass bottles, car tires, bedsprings, tin cans and other rubbish" (Friends of Bassett Creek, n.d.). It was recommended by the *Minneapolis Tribune* in 1882 to turn "the creek into a sewer, the outlet of which should be below the falls" (Smith 2011). This perception and reality of the creek as an environmental hazard would persist for decades to come.

The creek subsequently was reshaped and hidden in an effort to create a more amenable, developable landscape. It was straightened as seen in the difference between the 1861 and 1892 plat maps. A proposal also recommended "build[ing] a wall on each side seven feet high" in order to control the flooding from the creek (Smith 2011). While the walls may not have been built, the creek and its wetlands were increasingly filled with sewage and eventually with 10 to 15 feet of construction fill (Friends of Bassett Creek, n.d.). By the 1930s, the original creek was lost with the numerous changes that occurred from the late 1800s to the early 1900s.

Social Impacts

In 1937, the urban renewal public housing project, Sumner Field, was built along the straightened creek. The project provided low-income housing. The residents were predominantly Black from 1960 to 1980 and by 1990, it was heavily populated by Southeast Asian refugees (Crump 2002, 587). As a result of the creek being filled in for the development of Sumner Field, the land was unstable and the soils were poorly packed. It led to severe issues with the foundations of buildings and contributed to the flooding of basements (587). These health, environmental, and physical harms of water and sewage contamination were relegated to Black residents and residents of color. In addition to harms to the community, the buried and piped creek led straight to the Mississippi River, meaning that all the pollutants from residential and urban living directly impacted the river and its ecosystem.

Further, there was a considerably high volume of runoff due to freeway and other development in the area, exacerbating these issues. The wetlands were once able to absorb and filter high levels of runoff from rain events when they were clear of sewage, debris, and fill. However, they no longer could serve that purpose due to all the alterations to the landscape. The waste combined with the construction fill prohibited the wetlands around the creek from serving nature's intended functions (EPA, n.d.). Among those functions are improving water quality, providing wildlife habitat, and protecting against floods.

Around this same time, at the turn of the twentieth century, the practice of redlining, which was the systematic denial of financial services such as mortgages and business loans to people of color, especially Black populations, appeared across the country's urban spaces—Minneapolis included (Mills 2020a). Redlining's insidious legacy is a factor that contributed to the environmental degradation and hazard associated with Bassett Creek. It worsened disinvestment and economic stagnation in these neighborhoods, negatively impacting their value and disproportionately harming Black and Southeast Asian communities. Work done by the Mapping Prejudice Project shows how the spread of racial covenants throughout South Minneapolis shifted

the city's Black population to North Minneapolis from 1910 to 1940 (Mills 2020b, 2020c).

The demolition of Sumner Field began in 1998, 60 years after Sumner Field was built. With the slow pace of construction for new housing in Minneapolis paired with the quick demolition of hundreds of low-income units, many residents were left with few options for relocation. In 1999, a group of Black ministers protested the demolition of the remaining 300 units of public housing at Sumner Field (Crump 2002, 591). Mayor Sharon Belton Sayles agreed to delay the demolition of 70 units in response to protestors. However, that still did not meet the need for affordable housing for the displaced residents. Today, affordable housing in this region remains a concern of residents (Hankerson et al. 2020).

Throughout the nineteenth and twentieth century, the series of developments, changes, and alterations to the creek and its surrounding landscape resulted in lasting impacts for people and place. The view of Bassett Creek as a burden and hazard led to its burial. And yet, even though it was hidden from the landscape, it continued to appear in the form of floods and unstable land. The hidden creek's convergence with racially motivated planning in this landscape meant that the harms associated with reshaping and filling the creek unfairly impacted low-income populations and communities of color.

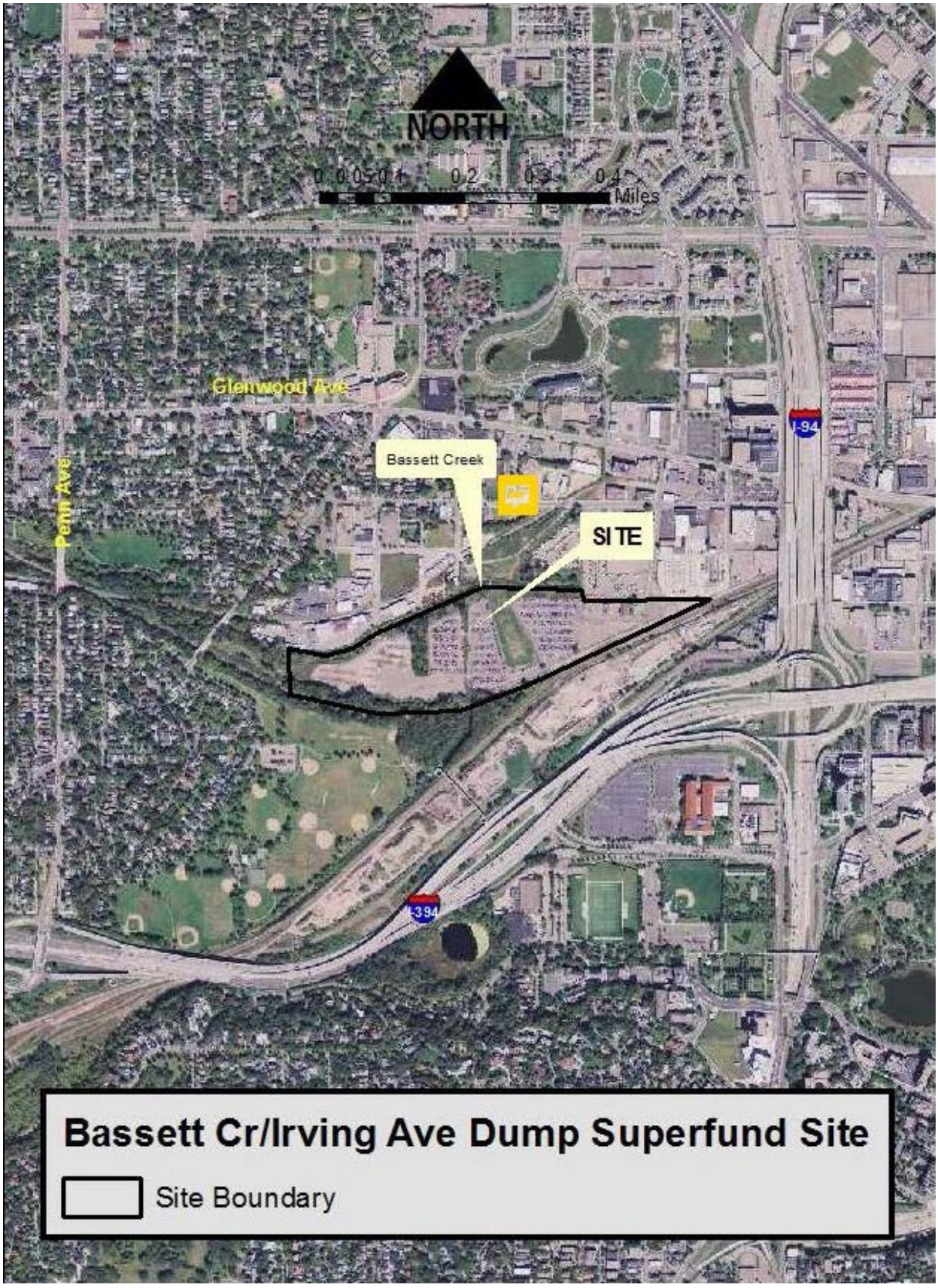
Google Maps satellite image of Heritage Park and surrounding area.

Bassett Creek Today

Today, Heritage Park stands where Sumner Field once was. It is described by the Heritage Park Neighborhood Association as "a stable, affordable and sustainable urban neighborhood on the western doorstep of the Minneapolis' downtown area" (Bayerl, n.d.) The neighborhood has been retrofitted with a new, state-of-the-art stormwater system that seeks to showcase an earlier version of Bassett Creek and its associated wetlands.

According to the Minnesota Pollution Control Agency (MPCA 2016), the project uses "a combination of engineered and natural systems" in park and open space amenities to filter water and rainfall at several levels. The creek has been daylighted in select areas that can be seen from satellite imagery on Google Maps. What once was an environmental nuisance is now seen as an amenity.

Stormwater management pond in Heritage Park facing the grate that leads to the Mississippi River. Image courtesy of Trinity Ek.



The Bassett Creek/Irving Avenue Dump Superfund Site is on the Minnesota Permanent List of Priorities due to its elevated concentrations of lead, polynuclear aromatic hydrocarbons (PAHs), and volatile organic compounds (VOCs). Map published by MPCA (2013).

South of the Heritage Park development is the 230-acre Bassett Creek Valley project area. It is largely industrial and encompasses portions of the Harrison and Bryn-Mawr neighborhoods. Minnesota Compass data reveals that Harrison's population is 47.3 percent white (n.d.[b]) and Bryn-Mawr's is 89.3 percent white (n.d.[a]). The project area was established in 1998 by the Minneapolis City Council. It also includes the Bassett Creek/Irving Ave Dump Superfund Site, which is located along the creek itself. Due to decades of poor treatment, the soils, surface water, and groundwater are polluted by "lead, polynuclear aromatic hydrocarbons (PAHs), and volatile organic compounds (VOCs)" (MPCA 2013, 1). The site is currently mostly an impound lot with industrial facilities surrounding it.

Land uses such as the impound lot continue to separate the creek from the residents who live near it. Once the creek leaves Theodore Wirth and Bassett's Creek Park, it is separated from residential areas by railroads, abandoned mills, and industrial sites. While trails exist along the creek in these parks, they are relatively few and far between compared to the parkways and walking paths present around Minnehaha Creek and the Mississippi River. Bassett Creek is still largely hidden in the landscape.

Bassett Creek near the abandoned Fruen Mill. Image courtesy of Trinity Ek.

It takes a trek over unpaved trails and through railroad tracks to reach the creek near Fruen Mill. Here, the creek runs next to the abandoned Fruen Mill which it once powered (Painter 2015). The railroad tracks, cement blocks, and the mill itself show an older version of the creek. Further, because Bassett Creek is not maintained like other waterways in the city, debris such as snack wrappers, bottles, and even car batteries are present on inaccessible stretches of the creek.

The Bassett Creek Valley Master Plan "advocates redevelopment of this outmoded industrial landscape into more than three thousand housing units, 2.5 million square feet of commercial space and the establishment of nearly 40 acres of new open space" (City of Minneapolis, n.d., 1). It was prepared by Hoisington Koegler Group, Inc. (HKG) in 2007 for the Redevelopment Oversight Committee (ROC). It also puts specific emphasis on changing the idea of Bassett Creek as a barrier and instead thinking of it as "the symbolic knitting thread of the Valley's urban fabric" (1). The City of Minneapolis explains that the ROC is composed of residents from both neighborhoods, business owners in the Valley, a City Council member, and mayoral representatives. Ryan Companies is the master development partner.

As with other redevelopment projects across the nation, gentrification is a major concern of residents. In the plan, HKG explains the redevelopment proposals will increase "the Valley's real estate value from roughly 50 million dollars today to well over 1 billion dollars" (Hoisington Koegler Group, Inc. 2007, 1). This dramatic increase in real estate value alone predicts the rising costs of living and rent commonly associated with gentrification, a sentiment many residents explained in *Beneath the Surface* by the Center for Urban and Regional Affairs (CURA 2018, 10). However, unlike other instances of gentrification, large numbers of residents are not being displaced, as there was not a large amount of existing housing stock. Another concern involves the change in population and demographics. When asked about the signs of gentrification residents were seeing, "they all cited the increased presence of young white families and new economic investment that did not match the historic character of the area" (11). This demographic change also has led to a tension between Harrison residents who stated there is a need for more affordable housing and Bryn-Mawr residents who want to see more high-end shops and green space (11).

The change in the landscape can already be seen. Before the COVID-19 pandemic, developers had already begun buying up land and replacing houses with condos. The Harrison Neighborhood Association (n.d.) is tracking this neighborhood development on their website and through ArcGIS Story Maps.

Going Forward

As plans move forward and this landscape is altered both physically and socially, conflict will arise as it already has. The orientation of the community toward the creek instead of away from it signifies how neighborhoods and cities are prioritizing natural features to take advantage of ecosystem services. In this case, these beneficial ecosystem services include managing stormwater and runoff as well as creating a means to increase both real estate value and potentially the tax base. During this change, it is necessary to consider who these changes are for—the residents who already live here or the new and future ones?

The history of the place as a site of systemic inequality must also be considered so the practice of harm does not repeat itself in the form of gentrification. The ideal goal is to create a place where both current and future residents can have their needs met and have access to opportunities

to grow and thrive. When rectifying the fraught history of these landscapes, Ujijji Davis (2018) emphasizes it is necessary to "elevate marginalized residents into key players in the turnover of their neighborhoods" to avoid gentrification. Not only listening, but implementing the desires and needs of the existing residents will lead to a more livable and welcoming community.

The concern surrounding gentrification echoes sentiments about the Upper Harbor Terminal further north on the Mississippi River. Similar to Bassett Creek, the Upper Harbor Terminal was also once an environmental hazard (The CREATE Initiative 2020; O'Connor Toberman 2020). It is now in the process of being redeveloped with focuses on new park space, housing, office space, and an amphitheater. The proposed redevelopment of the former barge terminal has sparked heated debate and controversy, especially surrounding the amphitheater, about who the development is for and who it will benefit. Many Northside residents welcome access to the river that other parts of the city have long benefited from, but not the private ownership of lands that may attract a demographic that would alter the feel and community of the Northside and eventually push out lower-income residents.

The intersection of race, place, and hydrology continues to define the landscapes surrounding hidden waterways today. Waterways that are being remembered and resurfaced offer landscapes full of potential—potential to break harmful cycles or perpetuate them. As Bassett Creek is increasingly seen as an amenity and an ecosystem service, there will be a heightened desire to restore, and where possible, daylight it. Changing the landscape not only physically alters places, but the people and communities within them as well. These processes foster a reciprocal relationship between the places people live in and the people themselves.

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Trinity Ek is an Honors student at the University of Minnesota, Twin Cities pursuing a B.S. in Urban Studies. She is passionate about the environment, community building, land use, and sustainability. Her past and current projects, such as Lost Waterways and Women of the Mississippi River, focus on waterways, land, and justice.

PERSPECTIVES

CREATING OUR WATER FUTURES

By Teresa Opheim, Douglas Snyder, Kate A. Brauman, and Valerie Were

This issue of Open Rivers *invites us all to envision the kind of future we hope to have with water. It encourages us to see the possibilities. By imagining the relationships we want with water, imagining the water conditions we want to see in our future, we begin to see both the challenges and potentials in our present and the steps necessary to move us to these desired and desirable water conditions.*

As a way to start the conversation about water futures, we asked community partners, researchers, faculty, and students, people connected to policy work and people creating change in the field, in their communities, and

Climate Land Leaders are learning that soil health is needed for healthy waters. Image courtesy of Sharing Our Roots.

in the classroom, to share their response to the following question: What knowledges, practices, and perspectives do we need in order to create the water futures we imagine and want? Here we share four responses to this question that all speak to the ways our values are entangled with water and to the value of water itself. We hope this collection will spur an ongoing conversation to which you, our readers, may contribute. We welcome anyone who is interested in responding to this question to share your perspective via our google form (z.umn.edu/waterfutures). Periodically, we will include a collection of responses in subsequent issues of Open Rivers. *By drawing together a variety of ways of imagining more equitable, sustainable, hopeful water futures, we begin to create these futures together.*

-Laurie Moberg, Managing Editor

Teresa Opheim, Love the Soil, Protect the Waters

After farmers harvested corn and soybeans last fall, most left their fields bare. Soil will blow away and erode into our waterways until planting again later this spring.

But not at the Sharing Our Roots Farm near Northfield. This 100-acre farm is covered with grasses and trees. Life in the soil is increasing. Carbon is being drawn out of the atmosphere and into the ground where it belongs. And the soil is becoming sponge-like, slowing the movement of water and keeping it in place.

Sharing Our Roots Farm is a member of the Climate Land Leaders, a group of farmland owners who are working collaboratively and creatively for the land and water, and for those who grow our food. Landowners have tremendous power and responsibility to steward our land. As Climate Land Leader Helen Gunderson says, "Land is a limited resource, and people who own it are in a unique position to make a difference."

The Climate Land Leaders know that we will improve our waters and make our land more climate-resilient by implementing some basic principles:

- Cover the soil.
- Keep living roots in the ground year round.
- Minimize soil disturbance.
- Increase the diversity of crops and livestock.

The Climate Land Leaders are learning so much! They now know that climate change is resulting in increasingly volatile weather, including more intense rainfalls. They also are discovering that re-greening the land is a climate change solution because it helps restore the water cycle. Perennial landscapes can help moderate temperatures; land stripped of vegetation cannot.

The Sharing Our Roots Farm is a vision of the land regeneration we could achieve across the Midwest. The Farm's land stewards and all the Climate Land Leaders are strengthening their own commitment to place and sense of awe about nature. Building the soil means improving the water and addressing with compassion and commitment our climate crisis.

Sharing Our Roots acquired 100 acres of degraded cropland in October 2016 and has since been transitioning it to a resilient, regenerative system. Images courtesy of Sharing Our Roots.

Douglas Snyder

Stated simply, the perspective I would want everyone to have is that water is indeed precious and provides innumerable benefits to us. We must work to ensure that these benefits are brought front and center, rather than remain hidden or underappreciated, by all of us who benefit from clean water when experiencing nature, when living our urban lives, and when undertaking our economic activities. If everyone understood this and incorporated it into their decision-making, their purchasing decisions, and their work life, water would have a better chance of being valued and protected, and not endangered though ignorant actions or unintended consequences.

I would have people understand that water decisions are ubiquitous. When you purchase a new pair of pants, your food, or products for managing your yard, you are making a decision that impacts water. How was the fabric grown or created? Were pesticides used? How it was manufactured? How far did it travel? How much and what kind of energy was needed? The answers to all of these questions have water consequences, and the issue today is that we do not take those consequences into account. Rather, they are viewed as externalities. Very soon, I think we will not have the luxury to see the interconnectedness of things as externalities. We need to acknowledge the connections between our decisions and their impact on water.

I am optimistic that this is beginning to happen. In my work-world of stormwater management, rainwater was for many years viewed as waste—something that needed to be moved off the urban landscape as quickly as possible. Unfortunately, it also carried nutrients and pollutants with it, unintentionally causing problems for the lakes, streams, and rivers collecting it. Now we are seeing rainwater, snowmelt and other forms of precipitation being viewed as a resource that can be collected, cleaned, and used in place of potable water for numerous commercial, home, and landscape needs. It's a start. By no means have we solved how to deal with all the connected processes and externalities of the current system.

Water provides life to us, and is in many ways a living thing itself. It should be respected and honored as such. Only then will we make decisions that keep water clean and available to our environment and ourselves.

Kate A. Brauman

To build a future in which limited water supplies are used equitably, productively, and resiliently, we need to understand not just what people are directly using water for, but what the purpose of that water use is. A green lawn in an arid region could be a status symbol or a place to play, a memory of home or a statement of what home could mean. Keeping the lawn green will always require a certain amount of water, but those real purposes, the deeper needs, might be met in other, less water-intensive ways. Once we shift our thinking and management to focus on achieving end goals, not just on providing water for specific activities, there is a wide world of water alternatives that go way beyond increasing efficiency or raising prices. Instead of fighting about reallocating the same supply among more users, we could make the pie bigger by finding ways to achieve our goals in entirely different ways. Doing this requires talking to people, really understanding their values and needs and goals. Fun new technology is, well, fun, and we will need technical solutions. But even new technology can't be deployed effectively until we understand what water users are trying to achieve.

Green lawn highlights outdoor sculpture at the Villa Panza in Varese, Italy. Image courtesy of Kate A. Brauman.

Valerie Were

We need more refined knowledge on how water security is experienced across the globe. Our imprint on the natural water cycle, which many in the United States begin learning about in elementary school, is profound and affects water security. The United Nation's proposed definition for water security is "The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability" (UN Water 2013). Can anyone say they are completely water secure? Dr. Indrani Pal, a Research Scientist and colleague at the NOAA Cooperative Science Center for Earth System

This aerial photo, released by the California Department of Water Resources, shows the damaged spillway with eroded hillside in Oroville, California during the dam crisis in 2017 during which the dam threatened collapse. This crisis remains emblematic of greater issues of water security globally and in California. Image by William Croyle, California Department of Water Resources.

Sciences and Remote Sensing Technologies, and I were discussing this issue recently. She said that although the northeastern United States is projected to receive more precipitation due to climate change, much of it will likely be unavailable because of changes in how water flows.

A group of us wanted to address the urgent need to find better ways to predict water availability. We are developing a tool that predicts the availability of renewable freshwater resources in California's rivers using a combination of computer modeling and prediction, data visualization, and social sciences. The tool is unique in that we use actual river water data rather than basing predictions on components of the water cycle. The tool will also take into account the socio-economic factors that influence how much water is available at a given location at a given time. Advances in computer modeling make it possible to deal with missing data, which is often a limiting factor in understanding water. Learn more about our work here: https://www.hydrodetectus.com/ and stay tuned for more!

We need to advance our knowledge around the value of water. We often think of value purely in economic terms but there are other ways to value water beyond assigning a dollar amount. Water has cultural value, it has aesthetic value, and those perspectives need to be included in conversations about valuation. That means inviting a variety of participants to conversations about water. The process takes time, commitment, and recognition that the current project cycles we use run counter to a meaningful engagement process. A big part of the engagement is making sure justice, equity, diversity, and inclusion are part of the process.

Perhaps I am just late to the game, but there also needs to be more focus on chronic issues. Sea level rise, for example, will have a profound impact on coastal communities. We still struggle to communicate that risk. We need deeper conversations about the realities of the displacement that sea level rise will bring. Climate migration is already happening in other parts of the world and the United States will be no different.

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TEACHING AND PRACTICE

TEACHING THE HISTORY OF AMERICAN RIVERS

By Scot McFarlane

Like *Open Rivers*, I have long tried to answer the question of the value of river history and how can it be put to work to achieve environmental justice. While we each have a home or favorite river that captivates us, there is a broader, if unspoken, understanding of rivers and the role they play in shaping our history. Last fall I organized a conference that attempted to address this challenge. Called *All Water Has a Memory: Rivers and American History*, the conference featured presenters from academia, nature writing, and environmental and community activism who shared their history and experience of individual rivers in three sessions: Slavery and Freedom, Indigenous Resistance, and The Environmental Movement. I hoped that we could all learn something about each of these topics individually and show how river history's perspective offers a uniquely effective approach to restorative justice for people and places. This conference, now available as online videos, is part of a larger project to teach river history in

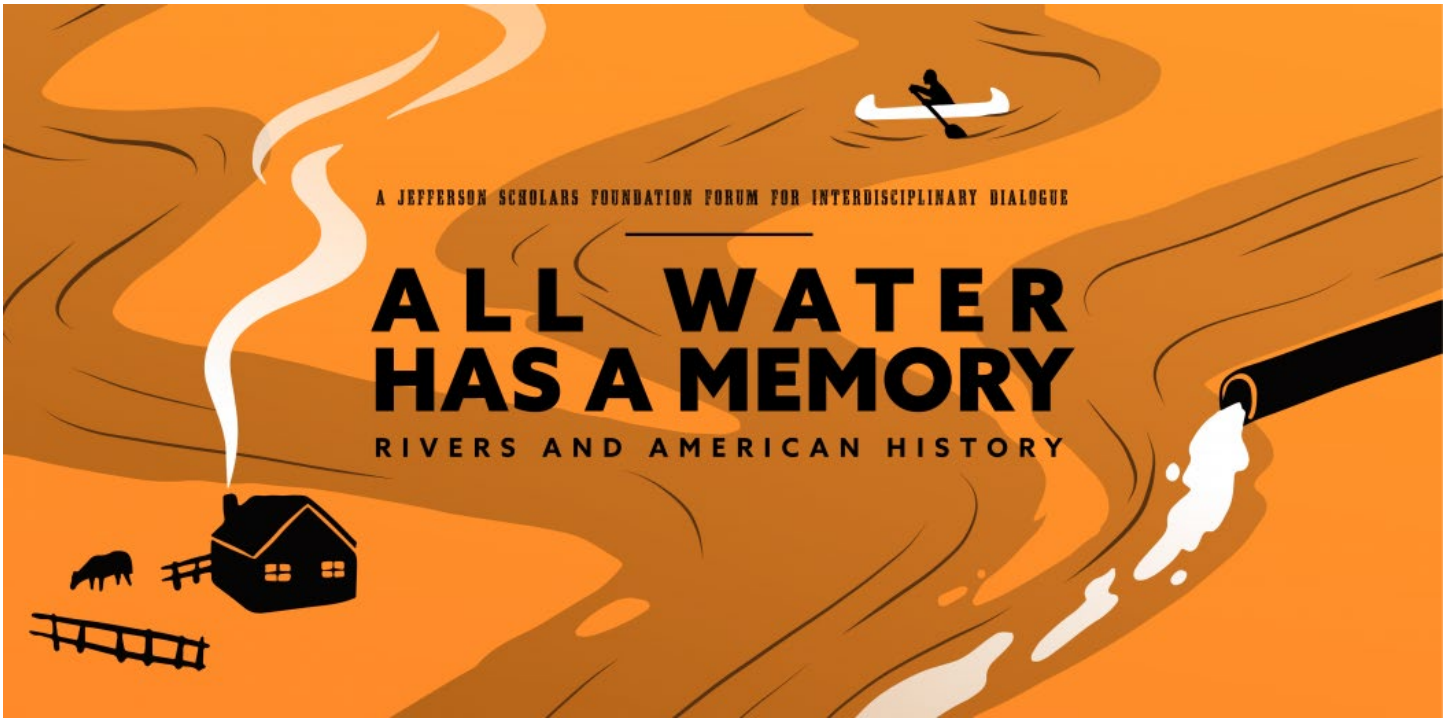
Illustration of major rivers for 'Confluence: The History of North American Rivers' courtesy of Robert Szucs, www.grasshoppergeography.com.

classrooms and communities across the country that goes beyond a strictly scientific perspective on rivers and helps individuals understand how waterways have shaped our societies and relationship with the natural world.

The Slavery and Freedom session featured Adrienne Troy Frazier, J. T. Roane, and Tony Perry discussing the Combahee, James, and Potomac Rivers. In the Indigenous Resistance session Dustin Mack, Zachary Bennett, and Ashley Smith focused on the Mississippi and Kennebec Rivers. The final session on the Environmental Movement featured Janisse Ray, Fred Tutman, and Chris Manganiello presenting on the Altamaha, Patuxent, and Savannah Rivers. To have as much continuity as possible between the three different panels, I asked the same guiding questions for all of the speakers to consider in their presentations and discussion. They were: What can river history tell us about this particular theme in American history? And, how might river history contribute to both a stronger environmental movement and environmental justice?

See the Slavery and Freedom session here.

A thousand people registered and several hundred attended each session, with a roughly even mix of people from conservation, academia, and the specific places being discussed. Without the necessity of having a virtual conference it would have been impossible to bring so many people together for an unproven concept. The large turnout suggests that there is an audience for this type of event and these conversations about the complex histories of rivers. Many of the audience members, especially those from the environmental community, attended with a sense of urgency following last summer's protests against racism and inequality, which made it clear that supporting movements like Black Lives Matter required action rather than public relations statements. The attendees looked to the intersection of people and place for ways to make their work more



Conference poster for 'All Water Has a Memory: Rivers and American History' courtesy of Edyta Lewicka.

inclusive and committed to justice. The speakers challenged many of the audience members' preconceptions. For example, the idea of giving legal personhood to rivers has generated a lot of excitement among environmental activists. Yet in the Slavery and Freedom session, J. T. Roane and Tony Perry pushed back against this enthusiasm: if American history suggests that many people have been long denied their own rights to protection, then why not solve that problem first?

See the Indigenous Resistance session here.

Together the three sessions highlighted another contradiction about American rivers. On the one hand, many people can look at an image of any of these rivers and their blood pressure instantly drops. On the other hand, the terrible violence of enslavement, massacres, and toxic pollution takes place on these rivers. These histories suggest a great ambivalence: the rivers served as a source of resistance but could not end slavery or colonialism. Rivers represent both tragedy and hope, and it remains for individuals, communities, and organizations to use narratives of individual and ecological resilience to sustain themselves and take action. The history of struggle shows that such emotions as despair are inevitable but also fleeting in the face of crisis. As the anthropogenic causes of climate change have become widely understood over the past two decades, people are becoming more open to river history's possibilities. If the engineering of the floodplain, development, and even rainfall that all contribute to causing a river to flood have been shaped by human beings, then the solution must take into account each river's history. Environmental justice is explicitly political because of the ways in which communities have been unequally affected by environmental degradation; river history makes clear how we are all connected to our waterways and also that environmental change and decisions about how to manage these waterways are always political.

See the Environmental Movement session here.

With the exception of two individuals, all the speakers for the *All Water Has a Memory* conference focused on different rivers, and yet they often arrived at the same conclusions. Following their individual presentations on a specific river, panelists participated in discussions at the end of each session. These dialogues highlighted how new ideas could be generated through the framework of river history and these understandings will lead to a search for more knowledge. I approached the conference discussion much as I would a classroom. I provided some guiding questions and then I gave the speakers as much space as possible. The fact that the presenters came from a range of backgrounds in academia, community organizing, or environmental activism and converged on the power of water to shape the possibilities for social and environmental justice exceeded my hopes for the conference. Finally, audience members also grappled with how to apply river history to their own work in the policy and conservation world. Several people asked questions such as whether frameworks beyond the existing language of watersheds would be needed to consider the parallels of water networks and human networks. Though the video recordings of each session do not allow for further questioning and engagement with the speakers, the discussions make clear the utility of river history for promoting diverse perspectives on our relationship with the natural world and for highlighting best practices to support both people and places.

Rivers can shape our cultures, economies, and perspectives, but rarely do we have an opportunity to center our relationship with them. One of the major goals of my work creating the river history site *Confluence*, of which this conference is a part, is finding ways to teach river history in the classroom. In K-12 settings, often the only time students may learn about or visit a river would be in the context of a biology or environmental studies class rather than through the humanities. If we don't teach students to understand the connections between people

and place, then it will be much more difficult for them to contribute to environmental justice or conceive of climate change as a scientific *and* political problem. Eventually I plan to work with organizations to create river history curriculums that align with state standards. In the meantime, however, students continue to study the history of slavery or Native American history and the presentations from *All Water Has a Memory* will be a great way for them to learn about that history regardless of its emphasis on rivers. All of the sessions have been uploaded to *Confluence* where people continue to watch them, and hopefully, teach these histories too.

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GEOGRAPHIES

COMMUNITY-MANAGED TRADITIONAL MEANS OF IRRIGATION IN THE SEMI-ARID ARAVALI LANDSCAPE

By Sayanangshu Modak

Earthen channels winding like serpents across a hilly landscape are not a common sight everywhere. They appear quite misplaced in a terrain that is highly undulating and rugged, covered with dry deciduous forests and dotted with rocky outcrops. Such a terrain is hardly conducive for agriculture, and irrigation seems unfeasible in villages located in the back of beyond. Yet the sheer will and determination of humans to challenge the impossible and put forth remarkable and ingenious works should never be underestimated.

Children washing fruit in a dhora. Image courtesy of the author.

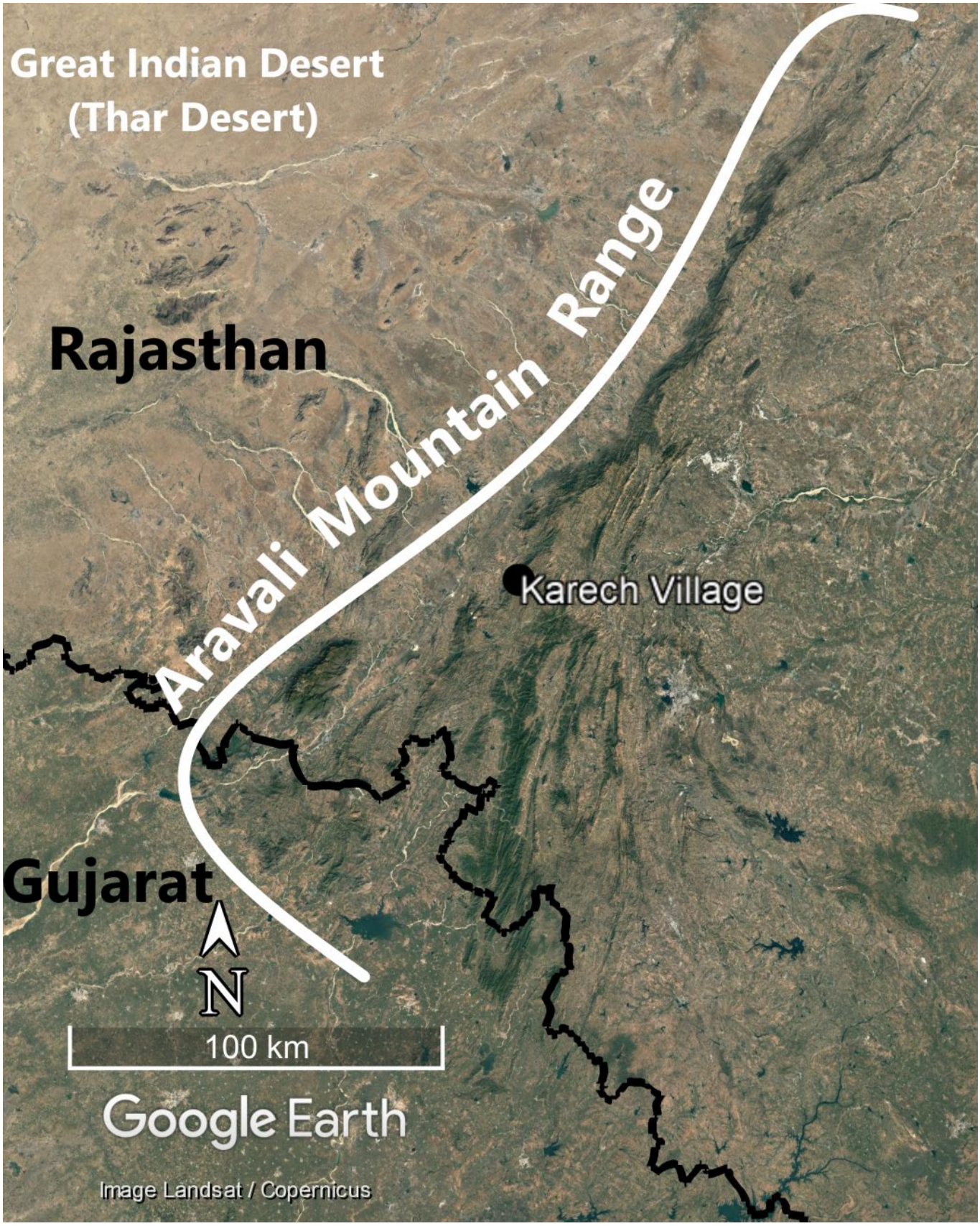
The collective action over water commons is equally impressive, helping transform a hostile landscape into one where agriculture becomes foundational to rural livelihoods. This could be achieved by diverting water from the river through earthen channels. Locally known as *dhoras* in the Aravali landscape of northwestern India, these channels are a living memoir of acts of innovation, facilitating the transport of water across this difficult terrain with the help of gravity. Therefore, it should not be an exaggeration when one connotes the possibility of them resembling the veins and arteries of agricultural productivity in this region, providing a bountiful harvest despite the difficult conditions. The case studies that follow are provided to demonstrate and emphasize the utility of collective, community efforts to build and manage *dhoras* and identify them as a cornerstone of decentralised governance of water resources.

Spotlight on *Dhoras*

Using a range of Participatory Rural Appraisal (PRA) tools including resource and social mapping, focus group discussions, and semi-structured interviews, I carried out a field-based research study to understand the use of *dhoras* and the management practices associated with it. As a part of my professional involvement in Foundation for Ecological Security (FES)—an Indian nongovernmental organization (NGO) committed to strengthening collective rights over common pool resources in diverse social, economic, and ecological setting (FES 2015, 2017), I had the opportunity to stay with the local community and observe their way of life from close quarters. This study was conducted between 2016 and 2018 as part of a larger study to understand the role of local communities as water stewards and to carry out a scoping exercise for advancing the Alliance for Water Stewardship (AWS) Standard in Karech where FES has been engaged for the past two decades. This data and evidence demonstrates that the earthen channels are not just physical infrastructures that have been fueling the productivity of small-scale farming, but are also social infrastructures providing affordance for social connections and collective action.

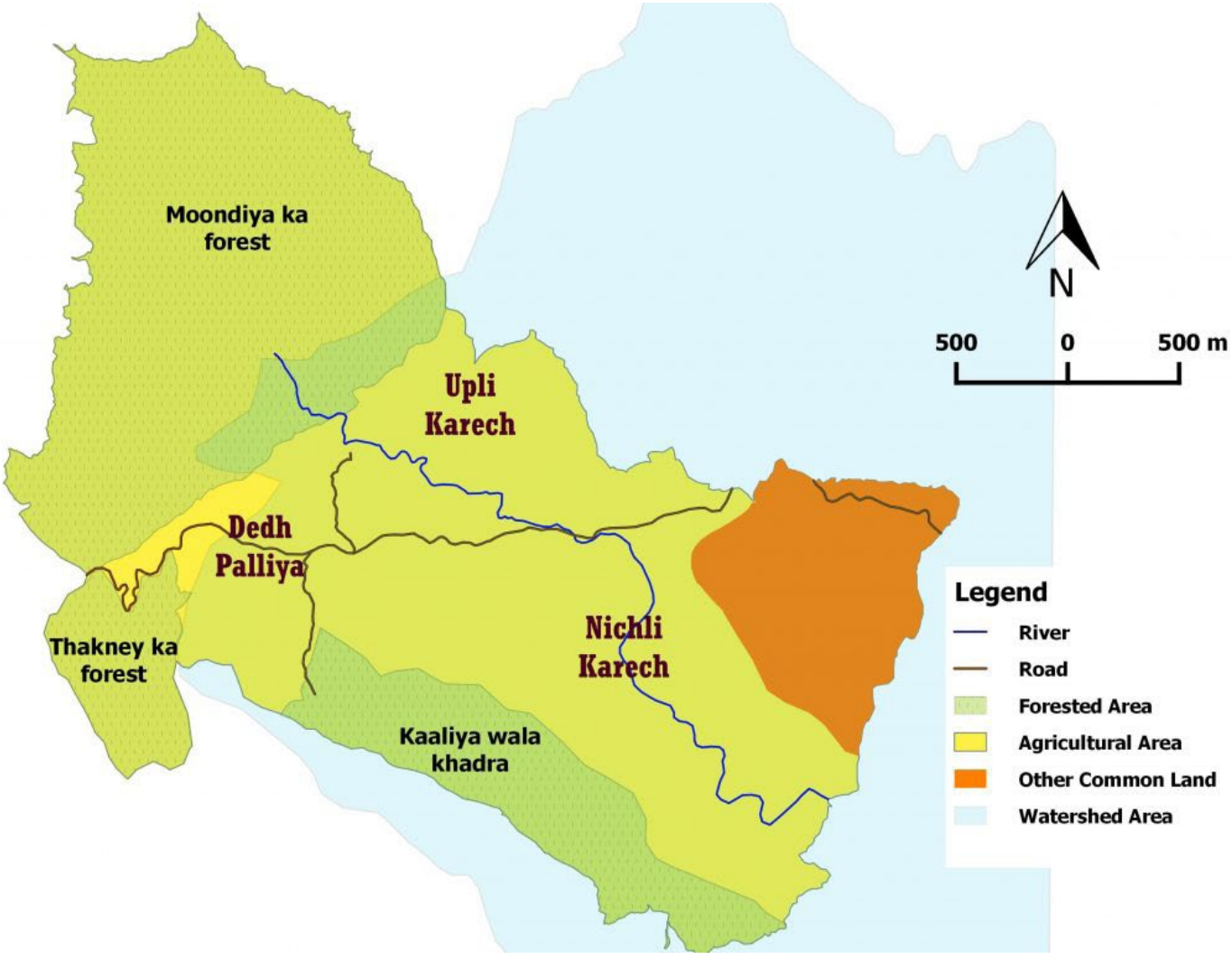
Karech, a far-flung and rather nondescript village, presents one such opportunity to witness this traditional means of irrigation and acknowledge the community's contribution in managing and maintaining the time-tested arrangements of water sharing and distribution. Nestled in the old fold Aravali mountain range of northwestern India and located at the periphery of the Great Indian Desert (Thar Desert), Karech has a rich legacy of collective action for restoring the degraded commons in the village. Consisting of three hamlets—Upli Karech, Nichli Karech and Dedh Paliya—the Indigenous, tribal community organized itself by forming a *samiti* in 2002, a village-level institution and has since initiated a process for conserving the commons that includes the three forest patches (Rathore 2019).

All the *dhoras* in Karech are located within the hamlet Nichli Karech. There are five *dhoras* in the hamlet and one Diversion Based Irrigation system (DBI). A pre-existing *dhora* was converted into a DBI network in 2013 with aid from FES. Even though this is a concrete channel and allows for more efficient conveyance of water, it still follows the same pathway as that of the earthen *dhora* which had existed for many years. The importance of these structures can be adequately established by documenting the sheer number of farmers using them within the village for fulfilling their subsistence needs. The total area irrigated through these structures was 39.54 hectares in 2017, which was about 80 percent of the total irrigated area in Nichli Karech at that time, with as many as 72 farmers benefiting from them. Some of these *dhoras* are quite long and



Location of Karech Village with respect to the Aravali Mountain Range, Gujarat, and Rajasthan. Map prepared by the author.

traverse large tracts of land, dissecting rivulets and undulations all along. Others can be short with lesser irrigation coverage, owned and maintained by a single household. The arrangements needed to maintain these *dhoras* and regulate the water use and distribution are also quite varied. Having evolved over time, they are molded and structured according to the needs of the users and reflect their experiences and aspirations.



Watershed map of Karech. Prepared by the author.

A dhora cuts across a natural drainage in Karech. Torrential rains and consequent high flow in the channels often destroy these structures and they have to be constructed again. Image courtesy of the author.

The evolution of rules

Mahadev Ka Dhora of Nichli Karech hamlet is a case in point; it has the most elaborate and well-structured rules needed to maintain its two-kilometer long earthen channel. All the rules are unwritten and have developed based on need; they remain amenable to change as per the requirement of the time. It is the longest *dhora* cutting across forested areas and streams. There are some stretches where it flows on a raised platform made with stones and boulders. These stretches are prone to disruption as flowing water or rolling stones regularly disturb the structure and break it down. Therefore, meticulous care is needed to construct it and to carry out the repair work. All the users assemble to carry out the repair work at the beginning of the *Rabi* cropping season (October–March) and a penalty of 250 Indian rupees (INR) is imposed when a member fails to show up to contribute. The process of repair and restoration begins with all the members assembling at the site of origin. They keep walking until they reach the first few farms, at which point the individual owners of those farms leave the group and the rest of the group continue with the repair work. This way, the group progressively diminishes with only those farmers owning land at the last leg of the channel continuing to the very end.

Mahadev Ka Dhora also exemplifies the spirit of equity in sharing the limited supply of water. This was made evident through my in-depth interaction through semi-structured interviews with water users and elaborate mapping of farming and irrigation practices. This entailed creating a detailed map to locate each parcel of farmland drawing water from the *dhora* and identify their ownership. This map was further used as an aid while conducting the semi-structured interview with member(s) of the family that owned the irrigated farmlands. On the whole, the scarcity of water in the village and its cruciality during

A representative diagram of irrigation practices. Image courtesy of the author.

the *Rabi* cropping season dictates the irrigation practice among users of *Mahadev Ka Dhora*. As a well-accepted principle, the irrigation cycle during the *Rabi* cropping season begins with the tail-end users getting the first share of water. Irrigation cycles per season are the number of times water must be provided to the crop. Irrigation cycles differ based on the type of crops and their variety. For example, the two main *Rabi* crops in Karech—wheat and chick-pea—require five to six and two to three irrigation cycles respectively.

The tail-to-head arrangement came into existence from a shared understanding of being more considerate toward the tail-end users who had their fields at a disadvantageous location. The system has continued for many years. This mutual feeling of sharing and caring also extends to the way the irrigation cycles are arranged. Along the *Mahadev Ka Dhora*, there are five primary parcels of land and each parcel comprises smaller patches which may be owned by a single household or by different households. The duration of one rotation cycle is decided on the basis of both the size of the primary parcel and its relative position with respect to the others along the *dhora*. For example, the first parcel of 1 hectare is jointly owned by three farmers who can avail themselves of water for only 3 days. However, the second patch, despite being only marginally greater than the first one—consisting of 1.3 hectares—gets water for 6 days owing to its relatively disadvantageous location as compared to the first one. Similarly, by virtue of both the size and the location along the *dhora*, 12 days of irrigation are permitted to the owners of the fourth patch for irrigating 5.5 hectares of agricultural land. Furthermore, within these primary patches, the duration of irrigation for each patch is decided based on need and through mutual consent of all the owners. This rule is also quite fluid, and an extra day of irrigation can be taken whenever a farmer feels the need for it. However, the farmer must seek the permission of all the other users.

An emphasis on collective action

Other *dhoras* also exhibit certain unique traits of governance based on the need of the users. However, often the absence of a collective feeling and the heterogeneous social composition of users make matters complicated. *Panchayat Ka Nala* of *Nichli Karech* provides a good example for highlighting this case. This *dhora* is collectively owned by 17 users who irrigate a little over 7 hectares of land. One of the users belongs to the *Gameti* tribe, while the other users are *Garasiyas*. The rules for rotation are not strictly adhered to and the *Garasiyas* often allege that the *Gameti* user takes water out of turn. This hinders the development of a collective for managing the structure. Moreover, it is only after the third or fourth rotation, when the water availability dwindles, that the users begin paying attention to the three-day rotation period and strictly enforce it. All this leads to an unequal apportionment of the resource, and some of the tail-end users are left with no water after the third or fourth cycles of irrigation when they are expecting five or six cycles for the health of their crops.

It is a common practice by all the users of *dhoras* to come together and assess the water availability at the beginning of the season for deciding the choice of crops. The users of *Anganwadi Ka Dhora* also decide the choice of the crop, as well as the duration of each irrigation cycle, by taking stock of water availability. For example, during a year of surplus rainfall, each irrigation cycle can comprise two days whereas, during a year of low rainfall, this increases to four days because there is very little residual moisture in the field following the season of rain-fed agriculture or *Kharif*. The choice of crop is also quite homogeneous, and all the farmers collectively decide it before the beginning of the *Rabi* season. This collective

initiative paves the way for removing the need to maintain an irrigation cycle that is bound by a fixed number of days. An important aspect of this form of governance is that the feeling of collective engagement is quite strong, and it often overrides the individualistic need to maintain a fixed irrigation cycle. The fulfilment of irrigational requirement is the only limiting factor in such a case and if tail-end farmers continue to get water, which is most often the case, harmony is maintained. Further interaction with water users of *Anganwadi Ka Dhora* through semi-structured interviews revealed that the next person up the *dhora* stays vigilant and watchful while the one before uses water, to ensure that no water is wasted.

Irrigation is often done during the night-time to eliminate the possibility of evaporation losses. In some cases, it is also done as a prerequisite for fulfilling the water needs during a fixed cycle of irrigation. In contrast, users of *School Wala Dhora*, which is the first *dhora* to emerge out of the stream, prefer not doing night-time irrigation until the third or fourth cycle of irrigation. This norm has emerged from the prolonged experience of facing a water surplus, and night-time irrigation would lead to waterlogging in the fields.

Community members participating in the construction of a boribund in Karech. Image courtesy of the author.

Improvisations

There are opportunities for increasing the irrigation coverage through innovations and improvisations over traditional systems like *Haran Bandhana*. In this traditional system, the water is obstructed within a stream by constructing a *Haran*. The water that gets collected is then diverted for irrigation through *dhoras*. Haran is a structure made of soil and stones mixed with Palash (Buteamonosperma) leaves to check the shallow water flow. This traditional structure is made of loose materials so there is always a lot of water seepage and the structure is also prone to breaking down due to the impact of high-water flows.

This problem had a very simple and cost-effective strategy. FES suggested and promoted the construction of *boribunds* to check the water seepage. *Boribunds* are structures that are made of *boris* (plastic bags filled with sand and soil) piled on top of one another. The benefits of constructing a *boribund* are immediate and have been strongly felt by all water users. By 2017, the third year of this intervention in Karech, most of the users attributed an extra cycle of irrigation to the construction of *boribunds*. Moreover, a lot of time and effort that was previously devoted to repairing the *Haran* and keeping it standing could now be saved. The pocket of water that gets collected within the stream also acts as a steady source of water for livestock, thereby effectively expanding the reach of benefits.

Conclusion

Irrigation through *dhoras* is integral to the indigenous agricultural systems in the hilly tracts of South Rajasthan. This age-old and time-tested form of irrigation needs to be given its due share of acknowledgement for not just being resilient, but also cost-effective. The continued use and management of *dhoras* are a testimony to decentralized governance of water commons in far-flung villages and build a strong case for the adoption in the larger policy framework. Research on the contemporary use of *dhoras* and practices of community-engaged management in the village of Karech provide supporting data to suggest that communities dependent on shared water resources can evolve codes of behavior that are agreeable to all users, frame rules to check individualistic behavior, and promote mutual cooperation for using the scarce resource equitably. Such roles played by local communities are often undermined in the dominant discourses of water governance, which are tilted toward greater centralization and operate within the binaries of state and individual property regimes.

Certainly, it cannot be claimed that the system of governance is infallible and does not require improvements. In fact, perhaps, the biggest strength of such a decentralized system at local levels is that it is dynamic and adaptive, responding quickly to emerging situations and enabling a mutually agreeable outcome for all users. Instances like those in Karech can be found throughout the semi-arid regions of South Asia where local institutions have played an enabling role in fostering cooperation over conflict. Such forms of water tradition and cultures need to be used as evidence and pushed up the policy ladder to strengthen these systems and allow for experiential learning at the local levels. It is imperative that we support such arrangements as we move into uncertain times with the onset of climate change. The accumulated wisdom of the community needs to be harnessed and adopted for establishing good water stewardship for a better tomorrow.

Acknowledgements

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About the Author

Sayanangshu Modak is a junior fellow at the Kolkata Centre of Observer Research Foundation (ORF). His research experience spans the semi-arid western part of India as well as the flood-prone fluvial landscapes of eastern India, thereby straddling the hydrological extremes and the issues thereof. His current research focus is at the interface of science and policy for the effective governance of river basins. Sayanangshu has previously worked as a project manager in the Foundation for Ecological Security (FES) and holds a B.Sc. (Hons.) in geography from Presidency University, Kolkata and an M.Sc. in Water Policy and Governance from the Tata Institute of Social Sciences, Mumbai.

IN REVIEW

WHY CANOES? AN EXHIBIT AT THE UNIVERSITY OF MINNESOTA'S NORTHROP GALLERY

By David Morrison

Minnesotans love boats, and canoes are a particular favorite. The state has the highest per capita rate of recreational boat ownership in the nation, according to the Department of Natural Resources.[1] Consequently, the current exhibit, *Why Canoes? Capacious Vessels and Indigenous Futures of Minnesota's Peoples and Places*, at the Northrop Gallery should find an

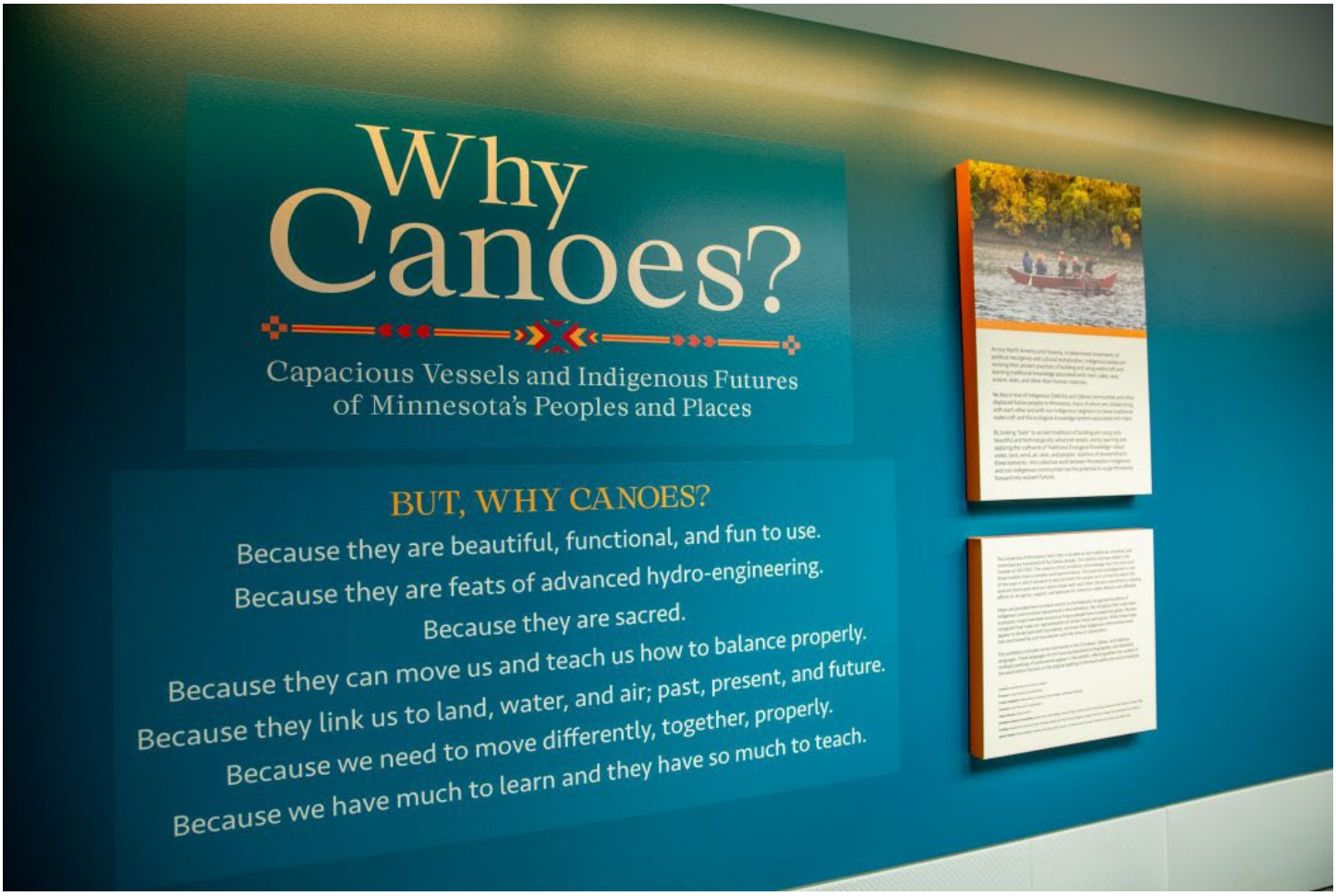
From the exhibit, a birchbark canoe, paddle, and creation stories from the Asabiikone-zaa'igan (The Bois Forte Band of Chippewa). Image by Laura Mazuch, UMN Printing Services.

interested audience. The exhibit reflects the desire of three Indigenous peoples—Dakota, Anishinaabe, and Micronesian—to revitalize their canoe-building traditions, and to pass them on to the next generation.

Why Canoes? is a small and beautiful exhibit. Full-sized canoes are unfortunately not on display, but detailed models of the boats of the three groups are featured, as are full-sized, newly carved paddles in the traditional Dakota, Anishinaabe, and Micronesian (Polowat) styles. Paintings by Indigenous artist Angela Richards grace the entrance to the gallery, and many maps and photos throughout offer historical and cultural context as well as documentation of present-day canoe building efforts.

Minnesota is, as we know, a well-watered landscape where geology and climate have produced an abundance of permanent lakes and streams. It was formerly what Professor Vicente Diaz, of the exhibit's advisory committee, likes to call the kind of terrain "where to travel at all was to travel by water."[2]

Why Canoes? illustrates how the birchbark canoe—*wiigwaasi jiimaan*—of the Anishinaabe was developed in response to that environment. It is a sophisticated piece of engineering created from available materials: spruce roots, pine pitch, cedar, and birchbark. For centuries before Teddy Roosevelt wrote, "Do what you can, with what you've got, where you are," Indigenous people in Minnesota were doing just that, and doing it beautifully.[3] The birchbark canoe, light in

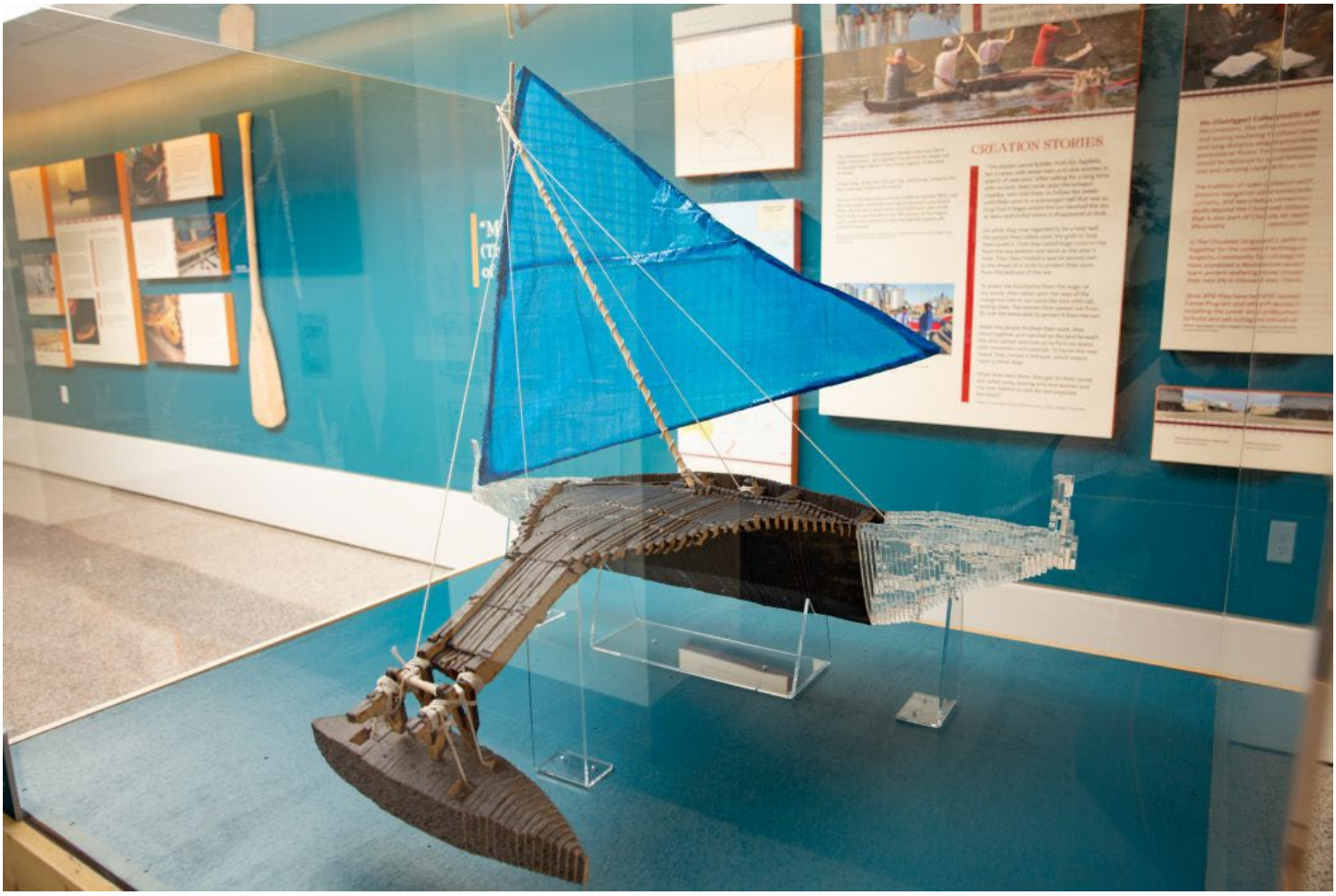


Why Canoes? Capacious Vessels and Indigenous Futures of Minnesota's Peoples and Places. Image by Laura Mazuch, UMN Printing Services.

weight, capacious, and easy to propel, was a great quality-of-life enhancement, useful for wild rice harvest, fishing, hunting, and movement between seasonal camps. The exhibit makes the case for the canoe's central importance to the Indigenous people's ways of doing and being—their cultural identity, and relationship to the environment in which they live.

Watch the video "Why Canoes?" A New Exhibit at the University of Minnesota.

Although not a large exhibit, ***Why Canoes?*** has quite a lot of content, and may offer the visitor new information and insights on familiar topics, as it did for me. I was previously unaware of the Dakota tradition of making dugout canoes. I had been in dugouts made by the Indigenous Guna Yala people on the coast of Panama, but I had not imagined that technology also existing here in my own back yard. The exhibit tells of the dugout's antecedents here in the land that the Dakota call Mni Sota Makoce, including a nearly thousand-year-old dugout canoe pulled from Lake Minnetonka. We learn that this canoe and other dugouts found submerged in local lakes prompted Mat Pendleton of the Bdewakantunwan Community at Lower Sioux, where he is Recreation Director, to revive the Dakota tradition of the ***chanwata***, "wooden boat." Pendleton sees the revival of this tradition as offering the youth of the Dakota Indigenous community the tools and support system, in his words, "to walk with a good heart and a good mind" as they learn about who they are as Dakota.



A model of the Micronesian wa, an outrigger canoe. Image by Laura Mazuch, UMN Printing Services.

For some visitors the exhibit may serve as an introduction to the Micronesian community of Milan, Minnesota, where over half the population stems from Chuuk State in the Federated States of Micronesia. It should be no real surprise that the renowned outrigger canoe heritage of Oceania remains culturally important to them. The "Milanesians," as they call themselves, have been working since 2016 in the Native Canoe Program to revitalize the tradition here by building and sailing outrigger canoes. Collaborating with other Indigenous groups including the Upper and Lower Sioux Communities, the Milanesians have helped to build not only their own Micronesian outriggers, but also Dakota dugout canoes. The exhibit includes construction photos of both kinds of boats as well as photos of the finished boats being paddled on local waters.

Several other programs and initiatives related to Indigenous peoples' canoes, culture, and ecological knowledge are showcased in the exhibit in text and images. Among them are Navigating Indigenous Futures, Dakota Wata UMN Regional Sustainable Development Program, and the student organization Canoe Rising.

Why Canoes? is a fascinating exhibit exploring the background and meaning of what for Minnesota has become an icon—the image of the canoe important enough to the state's identity to appear on our license plates since 1978. *Why Canoes?* beautifully offers insights—through the lens of Indigenous peoples' experience—into the centuries-old story and present-day significance of small boats here in the Land of 10,000 Lakes. A video preview of the exhibit can be seen online

A model of a Dakota chanwata, a wooden dugout canoe. Image by Laura Mazuch, UMN Printing Services.

at http://northrop.umn.edu/events/why-canoes, and a more in-depth discussion at the University of Minnesota's Institute for Advanced Study at https://ias.umn.edu/events/why-canoes.

The Why Canoes? Capacious Vessels and Indigenous Future of Minnesota's Peoples and Places *exhibit is currently open at the Northrop Gallery at the University of Minnesota through Fall 2021. An online,* virtual tour *is also available.*

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About the Author

David Morrison is a graphic designer and visual artist. For years, he has kept his old aluminum canoe on the banks of the river that the Dakota call Hogan Wanke Kin. Countless hours paddling among its islands have made that landscape the main focus of his artwork for several decades. With an abiding interest in native plant communities, he has converted his small, urban yard into pollinator-friendly gardens—to the apparent satisfaction of local buterflies and bees. A University of Minnesota alumnus, he enjoys increasing his understanding of the geology, ecology, history, and culture of the spot on earth where he resides in Mni Sota Makoce.

PRIMARY SOURCES

GHOST FORESTS

By Emily Ury

Sea level rise is killing trees along the Atlantic coast, creating 'ghost forests' that are visible from space

Trekking out to my research sites near North Carolina's Alligator River National Wildlife Refuge, I slog through knee-deep water on a section of trail that is completely submerged. Permanent flooding has become commonplace on this low-lying peninsula, nestled behind North Carolina's Outer Banks. The trees growing in the water are small and stunted. Many are dead.

Throughout coastal North Carolina, evidence of forest die-off is everywhere. Nearly every roadside ditch I pass while driving around the region is lined with dead or dying trees.

As an ecologist studying wetland response to sea level rise, I know this flooding is evidence that climate change is altering landscapes along the Atlantic coast. It's emblematic of environmental changes that also threaten wildlife, ecosystems, and local farms and forestry businesses.

Like all living organisms, trees die. But what is happening here is not normal. Large patches of trees are dying simultaneously, and saplings aren't growing to take their place. And it's not just a local issue: Seawater is raising salt levels in coastal woodlands along the entire Atlantic Coastal Plain, from Maine to Florida. Huge swaths of contiguous forest are dying. They're now known in the scientific community as "ghost forests."

Ghost forest panorama in coastal North Carolina. Image by Emily Ury, CC BY-ND.

The insidious role of salt

Sea level rise driven by climate change is making wetlands wetter in many parts of the world. It's also making them saltier.

In 2016 I began working in a forested North Carolina wetland to study the effect of salt on its plants and soils. Every couple of months, I suit up in heavy rubber waders and a mesh shirt for protection from biting insects, and haul over 100 pounds of salt and other equipment out along the flooded trail to my research site. We are salting an area about the size of a tennis court, seeking to mimic the effects of sea level rise.

After two years of effort, the salt didn't seem to be affecting the plants or soil processes that we were monitoring. I realized that instead of waiting around for our experimental salt to slowly kill these trees, the question I needed to answer was how many trees had already died, and how

Deer photographed by a remote camera in a climate change-altered forest in North Carolina. Image by Emily Ury, CC BY-ND.

much more wetland area was vulnerable. To find answers, I had to go to sites where the trees were already dead.

Rising seas are inundating North Carolina's coast, and saltwater is seeping into wetland soils. Salts move through groundwater during phases when freshwater is depleted, such as during droughts. Saltwater also moves through canals and ditches, penetrating inland with help from wind and high tides. Dead trees with pale trunks, devoid of leaves and limbs, are a telltale sign of high salt levels in the soil. A 2019 report called them "wooden tombstones."

Researcher Emily Ury measuring soil salinity in a ghost forest. Image by Emily Bernhardt, CC BY-ND.

As the trees die, more salt-tolerant shrubs and grasses move in to take their place. In a newly published study that I coauthored with Emily Bernhardt and Justin Wright at Duke University and Xi Yang at the University of Virginia, we show that in North Carolina this shift has been dramatic.

The state's coastal region has suffered a rapid and widespread loss of forest, with cascading impacts on wildlife, including the endangered red wolf and red-cockaded woodpecker. Wetland forests sequester and store large quantities of carbon, so forest die-offs also contribute to further climate change.

Assessing ghost forests from space

To understand where and how quickly these forests are changing, I needed a bird's-eye perspective. This perspective comes from satellites like NASA's Earth Observing System, which are important sources of scientific and environmental data.

Since 1972, Landsat satellites, jointly operated by NASA and the U.S. Geological Survey, have captured continuous images of Earth's land surface that reveal both natural and human-induced change. We used Landsat images to quantify changes in coastal vegetation since 1984 and referenced high-resolution Google Earth images

A 2016 Landsat8 image of the Albemarle Pamlico Peninsula in coastal North Carolina. USGS.

to spot ghost forests. Computer analysis helped identify similar patches of dead trees across the entire landscape.

The results were shocking. We found that more than 10% of forested wetland within the Alligator River National Wildlife Refuge was lost over the past 35 years. This is federally protected land, with no other human activity that could be killing off the forest.

Rapid sea level rise seems to be outpacing the ability of these forests to adapt to wetter, saltier conditions. Extreme weather events, fueled by climate change, are causing further damage from heavy storms, more frequent hurricanes and drought.

We found that the largest annual loss of forest cover within our study area occurred in 2012, following a period of extreme drought, forest fires and storm surges from Hurricane Irene in August 2011. This triple whammy seemed to have been a tipping point that caused mass tree die-offs across the region.

Google Earth image of a healthy forest on the right and a ghost forest with many dead trees on the left. Emily Ury and Google Earth.

Should scientists fight the transition or assist it?

As global sea levels continue to rise, coastal woodlands from the Gulf of Mexico to the Chesapeake Bay and elsewhere around the world could also suffer major losses from saltwater intrusion. Many people in the conservation community are rethinking land management approaches and exploring more adaptive strategies, such as facilitating forests' inevitable transition into salt marshes or other coastal landscapes.

For example, in North Carolina the Nature Conservancy is carrying out some adaptive management approaches, such as creating "living shorelines" made from plants, sand and rock to provide natural buffering from storm surges.

A more radical approach would be to introduce marsh plants that are salt-tolerant in threatened zones. This strategy is controversial because it goes against the desire to try to preserve ecosystems exactly as they are.

But if forests are dying anyway, having a salt marsh is a far better outcome than allowing a wetland to be reduced to open water. While open water isn't inherently bad, it does not provide the many ecological benefits that a salt marsh affords. Proactive management may prolong the lifespan of coastal wetlands, enabling them to continue storing carbon, providing habitat, enhancing water quality and protecting productive farm and forest land in coastal regions.

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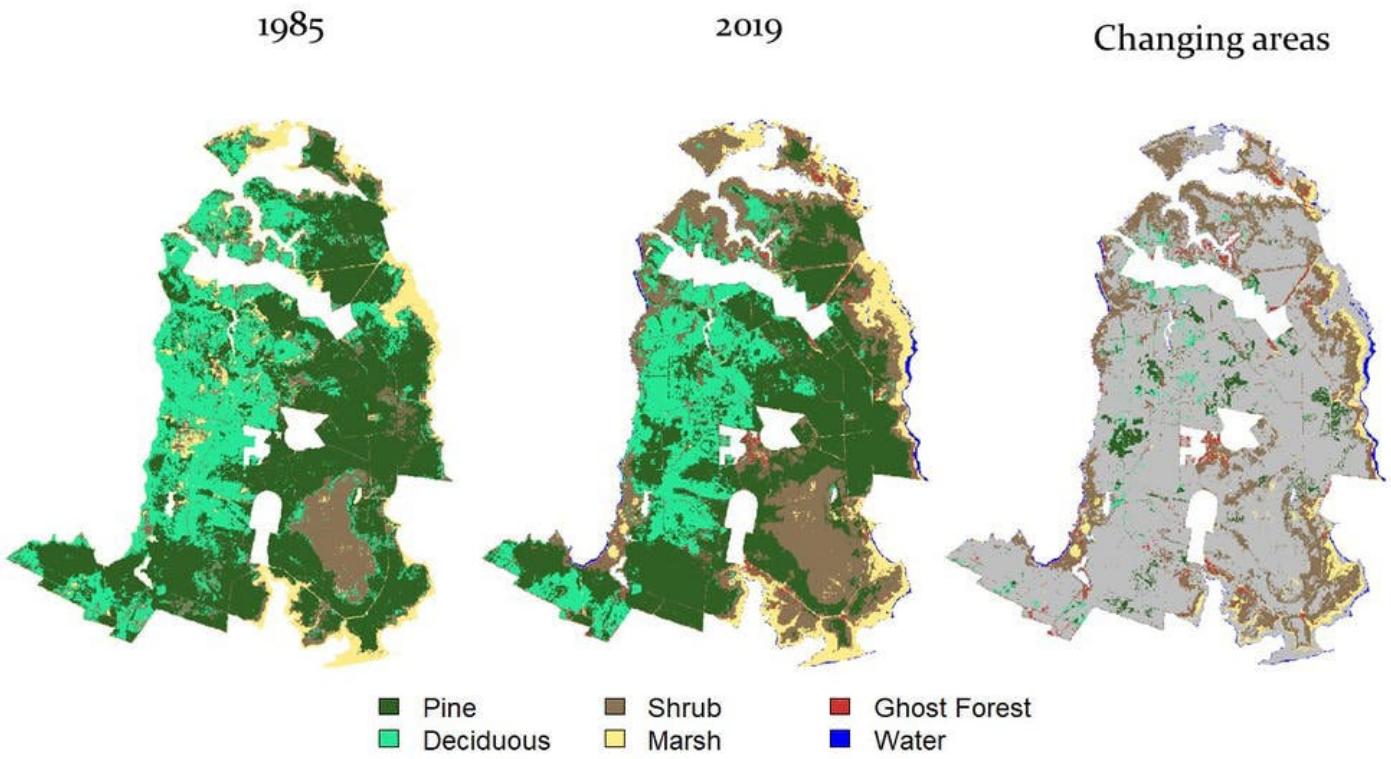

Habitat maps we created for the Alligator River National Wildlife Refuge showing the change over time and the prevalence of ghost forests. Ury et al, 2021., CC BY-ND.

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