SHARED PATHWAYS
MAPPING THE WATERSHED
STURGEON: PROTECTING A SACRED FISH
CANADIAN Geographic
STORIES OF THE
GREAT LAKES
AND ST. LAWRENCE WATERSHED
CANOE CULTURE
Celebrating the iconic watercraft
WILD RICE
Nurturing the good berry
+
CULTIVATING A GREATER UNDERSTANDING OF AGRICULTURE, DIGGING DEEP INTO THE WORLD OF BEAVER ENGINEERING, NEWS ABOUT QUIRKY BELUGAS AND CREEPY CRAYFISH, EXPLORING UNDERWATER CAVES AND MUCH MORE!

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Waasekom Niin (Edward George) paddles along the Bruce Peninsula in Lake Huron during his 2020 Picking Up The Bundles ceremonial canoe journey for the water. Photo by Scott Parent.

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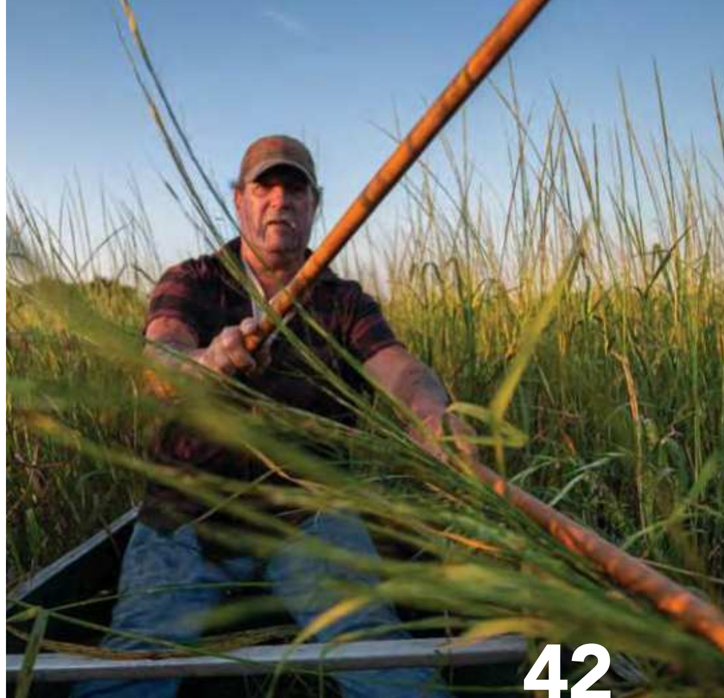
OPPOSITE: GOH IROMOTO; THIS PAGE, FROM TOP: SHELBY LISK; CHRISTIAN FLEURY



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DIGITAL

For even more stories exploring the flora, fauna, geography and people of the Great Lakes watershed visit **biinaagami.org**

NIAGARA'S GULLS

At Niagara Falls, pesky gulls are everywhere – swooping in to snatch a snack or photobombing a family snapshot. But these gulls are more than just opportunistic scavengers and scene-stealers. Birdwatchers call Niagara Falls the "gull capital of the world." It's an extraordinary meeting place – one where 100,000 gulls from up to 19 species congregate each winter to fish in the falls.
biinaagami.org/niagaragulls

SUNKEN TREASURE

Two researchers took to the waters of Lake Huron to make a documentary about invasive quagga mussels plaguing the Great Lakes. Along the way, they stumbled upon the wreck of what is likely the steamship *Africa*, a vessel that disappeared stormy night in 1895.
biinaagami.org/sunkentreasure

THE GREAT LAW

Cayuga Elder Norma Jacobs retraces the Peacemaker's Trail, using the ceremonial pilgrimage to revitalize her connection to the land, to learn about sacred sites along the way and to remember what it means to walk this Earth as Original People.
biinaagami.org/normajacobs

URBAN HEALING

From wasteland to wetland – an ambitious multi-decade flood prevention project in Toronto's Port Lands is set to renaturalize the Don River into Lake Ontario. The revitalization will green huge swaths of aging, underused and derelict shorefront properties.
biinaagami.org/portlands

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EDITORIAL OFFICE
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Founded in 1929, the Society is a non-profit educational organization. Its objective is to advance geographical knowledge and, in particular, to stimulate awareness of the significance of geography in Canada's development, well-being and culture. In short, the aim is to make Canada better known to Canadians and to the world.

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NOTEBOOK

OUR SHARED RESPONSIBILITY

LONG BEFORE THE NATIONS of Canada and the United States were even conceptualized, the waters of the Great Lakes-St. Lawrence watershed were inhabited and loved by countless First Nations. Among them were the Anishinaabek and Haudenosaunee — two powerful, ancient enemies who fought to control the area. But over time, something changed, softened. The nations realized they had a shared responsibility to protect the lands and waters that nourished them. They came together and decided to put away their weapons of war, resolve their greed and create the "Dish with One Spoon" — a wampum belt that signified their commitment to protecting the lands and waters for each other and for future generations. Today, we still honour this treaty — and call on everyone who calls these waters home to accept their shared responsibility to the Great Lakes.

From river to lake to ocean, to our very bodies, water connects us. It flows through the veins of Mother Earth, cleansing and sustaining life where it moves, just as it flows through our own veins. As it nurtures us, we must do the same for water. Biinaagami — meaning fresh, clean water in Anishinaabemowin — is an initiative that uplifts our shared responsibility to the largest freshwater system on the planet.

Biinaagami is a movement of writers, educators, artists, learners, scientists, Indigenous Elders and Knowledge Keepers from all across the watershed — people from all walks of life who want to protect water and its gifts through two-eyed seeing. With one eye, we look at our connection and responsibilities to water from Indigenous perspectives. With the other, we look with western perspectives. Together, we create a holistic approach to learning. As you read through these stories, reflect on the perspectives you bring to the conversation about protecting water. Think about the local waters you connect with. What do they do for you — and what can you do for them?

— Katie Doreen, Biinaagami editorial and education co-ordinator

Read more stories and learn more about Biinaagami at biinaagami.org, and follow us on social media (@Biinaagami).

THE GREAT LAKES ☸ ST. LAWRENCE WATERSHED

Biinaagami
OUR SHARED RESPONSIBILITY TO THE GREAT LAKES

Geographic extent of article in this magazine

Page number where article begins

Pg. X

First Nation community

FRESHWATER FLOW

Greater flow

GREAT LAKES BATHYMETRY

Metres below surface

0
50
100
150
200
250
300
350
400

0 200 km

Gichigami (Anishinaabemowin)
Lake Superior

Michigami (Anishinaabemowin)
Lake Michigan

Gichi-aazhoogami-gichigami (Anishinaabemowin)
Lake Huron

Mnidoo Gamii (Anishinaabemowin)
Georgian Bay

Oniatarí:io (Kanien'kéha)
Lake Ontario
Niigaani-gichigami (Anishinaabemowin)

Kanahnòn'n:ke (Kanien'kéha)
Lake Erie
Aanikegamaa-gichigami (Anishinaabemowin)

Sault Ste. Marie
North Bay
OTTAWA
MONTRÉAL
Québec
Sherbrooke
Burlington
Kingston
Barrie
TORONTO
Kitchener
Hamilton
Rochester
Syracuse
Ithaca
Buffalo
London
Detroit
Toledo
Erie
Clevelannd
Bay City
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Great Lakes – St.Lawrence River Watershed

WATERSHEDS

A watershed is an area that collects and directs all the water that falls within its boundaries into a larger body of water, and is typically named for this larger body of water. A large watershed is made up of many smaller subwatersheds.

BIINAAGAMI WATERSHEDS

LAKE SUPERIOR
LAKE HURON
ST. LAWRENCE RIVER
LAKE MICHIGAN
LAKE ONTARIO
LAKE ERIE

PHOTO BY **DAVE SANDFORD**

The raw power of Mother Nature is on full display here in November. As frigid Arctic air pushes southward and collides with the warmer air above the Great Lakes, it produces massive storms with gale-force winds known as the "Witch of November ". This is the season of roiling waves that resemble liquid mountains, crashing, exploding and careening every which way. Lake Erie's shallowness and powerful storms have resulted in it having one of the greatest concentrations of shipwrecks in the world – estimated at up to 2,000.

Follow Dave Sandford (@davesandford) and see more monster waves at davesandfordphotos.com.

EXPOSURE

Showcasing our photo community

PHOTO BY **ANTHONY URSO**
Vibrant fall foliage encircles Ontario's spectacular Aguasabon Falls as they tumble over ancient cliffs and plunge 30 metres into the Aguasabon River before flowing into Lake Superior. Photographer Anthony Urso used a drone to capture the dramatic scenery, which includes craggy rose-coloured igneous rock walls that date back some 2.6 billion years.

Join the Canadian Geographic Photo Club at photoclub.cangeo.ca and upload your best shots for a chance to be featured online or in the magazine!

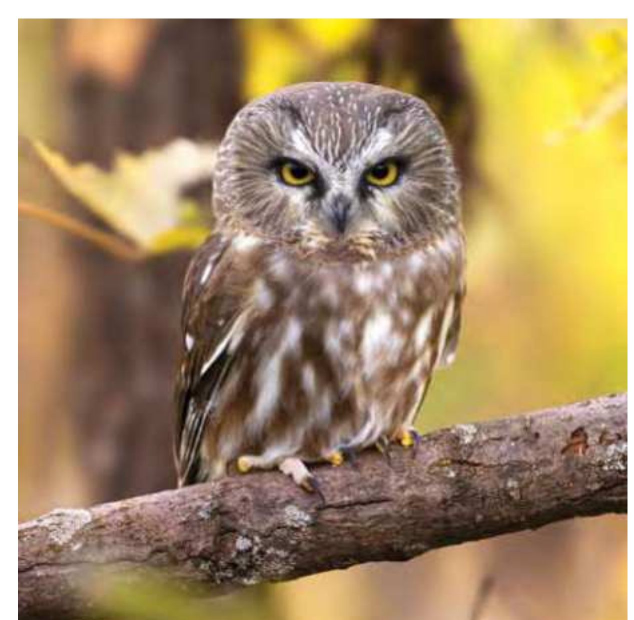
IN A SNAP

Sharing Can Geo via Instagram

@nicholasjpoirier Nicholas Poirier
With their acute hearing, red foxes can detect the squeak of a mouse from 30 metres away.

@dancadphotography Daniel Cadieux
Green herons are a common visitor to wetlands.

@followmenorth Jesse & Susan Villemaire
A bull moose can stand as tall as two metres.



@francoispotvin.photography François Potvin
The secretive northern saw-whet owl hunts at night — mainly for mice.

@erikaesquiresphotography Erika Squires
The eastern wolf preys mainly on white-tailed deer, beaver and moose.

Find us @CanGeo and share your best photos with us using the hashtag #ShareCanGeo.

Dawn Martin-Hill, with daughter Makasa Looking-Horse, leads Ohneganos Ohnegahdę:gyo, a Haudenosaunee-led water research program.

On a summer's day, a group of friends and colleagues joined Dawn Martin-Hill Dawn (ABOVE, LEFT) at Chiefswood Park, located in Six Nations of the Grand River, to share knowledge and record stories. Participants included (ABOVE, right to left) Karissa John, Denise McQueen, Leroy (Jock) Hill, Dawn Martin-Hill, Norma Jacobs, Mary Sandy, Makasa Looking-Horse, Karen Knott, Kaeliana Smoke, Emily Anson and Hiliary Monteith.

Dawn Martin-Hill

The educator and activist on decolonization, social justice and why water is at the heart of everything

INTERVIEW BY **KATIE DOREEN**

AT THE END OF A CONSPICUOUSLY CANOE-SHAPED ROOM on the McMaster University campus in Hamilton, professor emeritus Dawn Martin-Hill reflects on her academic career. A clothed table by her side holds reminders of her home in Ohswé:ken — Six Nations of the Grand River. While not distinctly Kanyen'kehà:ka, the beaded turkey feather and sticky remains of medicines-turned-ash in an abalone shell quietly nod to Martin-Hill's advocacy for Indigenous students and their place at the university. She founded the Indigenous studies program as a graduate student in 1992 and has spent the three decades since researching, teaching and championing water security.

On her original motivations

I've always been a social justice person. It's in your DNA — where you just can't stomach to see injustice towards anyone. When I started university, I would point out the erroneous assumptions that they [professors] were making, and I was very critical when I saw racism in the academy. They [academics at the university] had no idea they were projecting European social mores and values onto Indigenous people. But they said Indigenous knowledge was just mythology, and I could not use it [in my academic writing]. Everything was a fight. There was never a time I wasn't at war with something or someone.

On understanding her role

Eventually, I started seeing the value of education. But early on, I kept thinking I should be taking language. I should be learning our ways. I was very hard on myself. There was never a time that I thought, "this is great, having a PhD." It was almost an embarrassment that you've got a PhD, but you're not fluent. But then I realized that was a trauma response — to constantly feel inferior no matter what I had achieved. That's part of colonization; it's violence in our self-worth. So now I try to teach students about not feeling inferior, whether it's in western education or in your language and culture. The goal [of colonizers] is that you will continuously feel incompetent. So I try to broaden the experience of decolonization.

On water as "everything"

[When I began my career in academia] I was trying to figure out our traditional ways of knowing and how to write about our people in a way that isn't demeaning or diminishing. I was also working on environmental issues with the Elders. And then they said to focus on water. And I said, "Okay, it's water." But it's not *just* water. We know that. It's everything. It's about our relationships and our cultural survival, our sustenance from the land, *including* the water. That's always been under threat through colonization. I wanted to make that wisdom accessible to a larger audience so they could gain the guidance that I'm privileged to have.

On fighting for the water

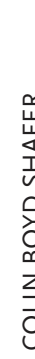
We talk about the parts of colonization: the invasion, and then death and destruction, and then the reshaping and renaming of our lands to be foreign to us. Colonization is the destruction and displacement of not only human beings but also the displacement of the waters. The bottom line is, without these things, we have no future. When the dam for the Grand River Navigation Company was going up [in Caledonia in 1980], our people were saying, "Do they understand this is where the fish are breeding?" "Do they understand putting a dam there is going to destroy every generation of fish afterwards?" They were in disbelief that people were so careless about that. I've heard these stories from a lot of Elders over the years, about their frustration and their feeling of helplessness.

On heeding Mother Earth

I think the Earth is going to spit it all back at us — at least that's what the Elders said. So, I'm going after avenues like decommissioning dams. Let her flow. If she could just flow freely, she'll clean herself out. We all know that. So let's start harassing these companies [that extract millions of litres of precious spring water for their operations]. If we don't listen, Mother Earth will *take* those dams down. One swipe. So I'm not afraid of what they call climate change or crisis, because of the prophecies I've heard over the years. The Elders talked about it all the time, that this day is going to happen. She's going to shake the fleas off her, and she'll be fine because she's done it before and she's going to do it again.

On surviving the future

The Elders talk about the world of ice — they're going way back in history, and then they're pulling it forward. Young people are scared. They think of the apocalypse and the end times, which is all they've been hearing in the last decade. Whereas these Elders just say, "We know what to do when these things happen. We know where to go. We know what our instructions are. We've survived the last Earth change. We will survive this one." But you have to keep your head about you. You have to get your seeds, get your clean water, identify your medicines and know your land.


COLIN BOYD SHAFER

Melon Heads

BELUGAS — those stocky, white, dome-headed whales with a perpetual smile and worry-lined brow — just got even quirkier. Researchers at the University of Rhode Island in the U.S. have observed belugas changing the shape of their melon — the fatty bulb atop their head used for communication and echolocation — during social interactions. After watching various beluga pairs in the U.S. and Canada, they identified five major patterns: shake, push, press, lift and flat. While the researchers were not able to decipher the meanings behind each shape, they noted that males changed their melon shape more often than females — and that the shake and flat patterns occurred most often during courtship rituals.

OPPOSITE: JC LEMAY/CG PHOTO CLUB. THIS PAGE, CLOCKWISE FROM TOP: PUBLIC DOMAIN ILLUSTRATION BY CHARLES HENRY DESSALINES D'ORBIGNY (BY RAW PIXEL, CC 4.0 VIA WIKIMEDIA COMMONS); F. LYKO (CC 3.0 VIA WIKIMEDIA COMMONS); RHODODENDRITES (CC 4.0 VIA WIKIMEDIA COMMONS)

Canuck Credentials

FORGET THE ICONIC LOON, the polar bear, the beaver. Apparently the most Canadian of all animals is feather-free, hair-free and decidedly cold-blooded. A study recently published in *The Canadian Field-Naturalist* ranked Canada's terrestrial vertebrates — animals with backbones that live on land — to determine which species was the most evolutionary distinct. And the winner is a shy and unassuming reptile with a tube-shaped nose and a leathery shell. The spiny softshell turtle is listed as endangered in Canada, living only in southwestern Ontario and in the St. Lawrence watershed just west of Montreal. Conservationists are restoring protected areas and monitoring nests around Lake Champlain, Que., to ensure the species thrives. The study analyzed 222 mammal, 674 bird, 48 amphibian and 49 reptile living species.

Go, Gabby, Go!

AT 16, GABBY IS THE OLDEST living Great Lakes piping plover — and she's still going strong. The celebrity bird was spotted last February foraging at her winter home in Georgia after migrating 1,600 kilometres south from her summer breeding grounds in the Great Lakes. Piping plovers are listed as endangered in Canada and the United States due to habitat loss and disturbance, and so most are banded, allowing researchers to document their migrations and determine strategies to aid in their recovery. Gabby, who has fledged a whopping 33 chicks in her life, has far exceeded the usual piping plover lifespan of five years.

1,600 kilometres

THERE'S SOMETHING STRANGE maneuvering its way into our ponds, rivers and lakes. It's a mutant, entirely female species with an extra set of chromosomes. It's a mysterious product of the 1990s German aquarium trade. It's also self-cloning, birthing hundreds of identical offspring at a time. And it could be coming to a pond near you. The marbled crayfish was identified in the wild for the first time in North America in summer 2023 after being discovered in a Burlington, Ont., pond. Experts are now scrambling to halt its spread, concerned that it will outcompete native crayfish species, alter biodiversity and spread disease. Says Premek Hamr, a crayfish biologist who has been helping with attempts to drain Burlington-area ponds to remove the species: "If one survives, then boom — you're going to have 200 pretty soon."

CALL *of the loon*

THESE ICONIC BIRDS HAVE ADDED MAGIC to the soundscapes of Canada's lakes for millions of years — but will we hear them forever? A 40-year survey by Birds Canada has found that fewer common loon chicks are surviving to adulthood than in the past. In the 1990s, loons had an average of 0.7 young per pair per year survive to six weeks (six-week loons are about two-thirds the size of an adult loon, which means they have a much lower chance of being eaten by a predator and are likely to survive to adulthood). In recent years, that number has fallen to 0.55. Scientists believe if productivity falls below 0.48, loon populations will likely start to decline. Researchers theorize a complex interaction of damage caused by acid rain, mercury pollution and climate warming may all be at least partly responsible.

Mushroom quest

THE FUNGI REVOLUTION IS HERE! Mushrooms are having a moment, and Quebec's Kamouraska and Mauricie regions, in particular, are hotspots for mycotourism as mushroom lovers flock to the region to find, identify and forage the myriad wild mushrooms that thrive in these rich forest landscapes. Interest in edible, medicinal and even psychedelic mushrooms for improving health and wellness has skyrocketed in recent years, and about 100 forest mushroom enthusiasts gathered at a mycotourism summit in Bas-Saint-Laurent last February to brainstorm ideas on how to make mushroom foraging part of a sustainable tourism strategy. When done correctly, mushroom foraging can improve mushroom biodiversity by spreading their spores more widely in the ecosystem.

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PUBLIC DOMAIN ILLUSTRATION BY JAMES SOWERBY (CC 4.0 VIA WIKIMEDIA COMMONS)

4.42 acres

THAT WAS THE AREA occupied by eastern monarch butterflies wintering in Mexico in 2025. It was a huge rebound — double the 2.22 acres occupied by monarchs in central Mexico's forests in 2024. Scientists attribute much of this year's population growth to better weather conditions last year — with less severe drought than in previous years — along the butterflies' migration route from Canada and the United States to Mexico. But scientists warn that monarch populations remain far below the long-term average. "It's now time to turn this year's increase into a lasting trend with an all-hands approach where governments, landowners, conservationists and citizens continue to safeguard critical habitats along the monarch's North American migratory route," said Jorge Rickards, director general of WWF Mexico.

Changes in the land, changes in us

His grandparents passed away a long time ago, and their house and small dock are also long gone. Now, as an old man with his own children and grandchildren, he remembers what was lost when the St. Lawrence Seaway was built

BY **TAIAIAKE ALFRED**

YOU GO OUT ONTO THE LITTLE DOCK your grandfather built out of logs and tied down in the spring as soon as the water was warm so you could swim and fish off it all summer long. Dipping the pail into the river, you get some of the water your tó:ta will cook with. "Go get me some water for cooking, and I'll make you something good to eat," she told you. Later, when the sun starts to fade, your tó:ta will be washing clothes in the river with a washboard and hanging them to dry in the trees. The water she cooks with is the same water you drink and use to take a bath, the same water you do everything in your lives with.

You are alone, and it is quiet now as you dip in the water in the early morning, but in the afternoon and at night, people come from the village to picnic or make fires and drink beer. Sometimes people leave their garbage, so you have to clean that up the next day. That's what you do, you and your grandmother, most days in the summer. After she makes you breakfast, you start the day by cleaning up one of the beaches or your special fishing spot, picking up whatever is there messing up the shore or in the shallow water, making it nice again for families and the kids who live here to spend time on the shore and play in the water.

You always do it without complaining, except for one time when your tó:ta got fed up with some kids throwing their Kik Cola soda bottles on the ground and busting them on the rocks in the water, and she yelled at them to stop doing that and told them to pick up the broken glass. There was a family eating lunch at the flat rocks, and the man got mad at her. He said something about the sharp words she used with those kids, even telling her she had a hard face for acting like she owned the beach. "This isn't your river, Konwakeri," he said. "You should just leave them kids alone."

Your grandmother was always so soft-spoken, but you saw a different look in her eyes then, and she got mad at that man. But she didn't swear at him or anything like that. All she did was look right at his wife and say, "That's my house over there, and I've lived in it all my life. I know darn well I don't own the river or the land — nobody does. I don't need to be told that by you. But we are the ones who live here and who take care of this place, who clean it up every day and make it nice for people like you to come over here from town and use it." That's all she said, but she kept looking right at the wife. And the woman turned and looked at her husband, and that man just looked away, and he didn't say anything else that whole day.

There is a rowboat tied to the dock, and you look at it and think back to when she would take you out on the river, just you and her. You were still just small and sitting in the front of the boat while she was rowing up and down the shoreline, in the early morning, when it was so calm on the water. You hung your face over the side of the boat watching fish. You could see all the way to the bottom, and there were all kinds of fish in the water. *Teiotién:taron*, a big sturgeon, swam right under your face and scared the heck out of you.

OPPOSITE: KANIEN'KEHÁKA ONKWAWÉN:NA RAOTITIÓHKWA LANGUAGE AND CULTURAL CENTER, THE ARTS AND ARCHIVE DEPARTMENT; THIS PAGE: CARL MALCOLM, ONTARIO HYDRO.

This one time she took you out onto the river toward one of the small islands, and it clouded over and all of a sudden started to rain, and then a storm came up before you could make it back home. So she headed for the small island. When you got to the shore, she turned the boat over, and you sat with her under it in the rain and the wind. Your tó:ta held you tight and talked to you in a soft voice until the storm passed. When it did, she flipped the boat over, and you kept on going to where you were headed. She would take you out on the water in the summer, and sometimes you'd have to stay under that boat for a long time, once even a whole night, just the two of you out there on a small island in the river. It was okay though because she always had something to eat with her and she always had lots of stories to tell.

Your grandfather uses the boat even more, when he's home from working away in New York. He asks her what kind of fish she wants to eat for supper, and she tells him, and he goes out and, every single time, a little while later, comes back with a bucket full of that kind of fish. He knows just where to go. The best day of your life was the time you went with him to gather some wood and do some fishing, and you saw a big eel in the shallows near the shore. Somebody must have been spear fishing the night before and stabbed it, but it got away. It was hurt, but your Baba knew you were happy to have found it and that it was just barely alive anyway, so you didn't have to be afraid of

The archives at the Kanien'kehá:ka Onkwawén:na Raotitióhkwa Language and Cultural Center hold a very limited number of photos that show what life was like on the river in the 1940s and 1950s (OPPOSITE LEFT and NEXT PAGE). A photo of Kahnawà:ke taken from a church bell tower (OPPOSITE RIGHT) highlights how connected it once was to the St. Lawrence. Ontario Hydro surveyor and photographer Carl Malcolm documented the construction and opening of the Seaway (ABOVE and NEXT PAGE).

THE SEAWAY

POWER AND PROFITS

The St. Lawrence Seaway was a joint infrastructure venture between Canada and the United States. Constructed between 1954 and 1959, it was lauded as one of the world's great feats of engineering. Comprising locks and channels that stretched from Montreal through to the Great Lakes, the seaway was deep and wide enough to support ocean-going ships that could now traverse the 4,000 km from the Gulf of the St. Lawrence to the North American interior. Construction cost more than $600 million ($6 billion in today's dollars) and encompassed the expropriation of a hundred miles of riverfront properties, displacing 650 families from both Kahnawà:ke and nine nearby villages. All told, more than 9,000 were forced out of their homes.

Kahnawà:ke means "By the Rapids" in Kanien'kéha, the Mohawk language. The seaway cut a channel between the river and the community, severing the community's connection to the river and the natural, cultural and spiritual resources it provided them. Kahnawa'kehró:non were dispossessed of 1,260 acres of land for the Seaway, further compounding the loss of 28,000 acres of the Mohawks' original 40,000-acre reserved lands through the fraud and legalized theft they had endured at the hands of French, British and Canadian authorities since 1680.

Taiaiake Alfred is a Kahnawà:ke Mohawk activist and scholar. He is the author of It's All About the Land: Collected Talks and Interviews on Indigenous Resurgence.

it. Seeing that fish, he told you to go get a big long stick that's hook-shaped on the end, and you used that stick to drag that eel behind the boat all the way back to the dock. When you got back to dock and walked toward the house holding the eel, your tó:ta came out wiping her hands on her apron and with a big smile. "Whaaa, what a fisherman you are! The creator must have sent us this great fish so that we can eat good today," and she grabbed the eel with her hands, held it like it was a precious gift and thanked you for it. That night she baked it, and you ate that eel for supper.

Your tó:ta and Baba love eating fish from the river, especially eels. Not only fish — you pick all kinds of plants and eat them too. There's one, everybody calls it *tarakwi*, and it's like a date or a wild candy. You don't even know what they call it in English. *Iowé:kon*, everything was so good back then.

YOUR GRANDPARENTS PASSED AWAY a long time ago, and the small dock and their house are long gone. You are here living in the now, standing there by yourself on the shore where that little dock used to be, and you can't help but think about how life is so different today.

When they moved everybody from the riverside to the village, it was like you became a race of people from somewhere else. They moved you away from the river, and it didn't take long before you had trouble even imagining grandmas and little kids rowing boats against the current in the big river and grandfathers fishing for sturgeons, or young mothers crossing the train bridge over the river on foot and walking five miles to go to work, or people growing and hunting and trapping their own food.

It was just a mile from the river to the place they moved your house to, yet once you were away from the river and living in town, it was like overnight everybody became city people. Your lives were being lived turned away from the water; the seaway was between you and the river, the place where you grew up and where the roots of your family went into the earth and where your father buried the cord that was cut when you were born. It is where your heart and true home are, still. Living in the village right on top of each other, you didn't have the same feeling about your neighbours that you used to have when you lived on the riverside. People started keeping to themselves in their own little houses, and they didn't help each other the way they did before.

For years you used to wonder why that was and how things got that way, but now you know. It's because on the riverside you didn't need money to be complete and to feel happy. They took away your land to build the seaway, and after that your connections to that place and the land got weak; the land was now just a street you lived on, a quarter acre of property that you put a fence around to make sure your neighbours didn't come onto it, where you built your new and better houses with insulated walls and indoor toilets. After you moved from the riverside, you all had jobs and cars and TVs, but you couldn't go to the riverside anymore where your grandparents used to live. You couldn't go on the river and fish for sturgeon and eels, or float down the river on a log past the black bridge and then walk to the place along the shore where the bushes used to be so thick it was like going into a long, dark maze with the berry bushes totally covering the path and hanging overhead like a tunnel. You couldn't walk through the bushes and just reach up over your head and pick ripe *ahtahkwá:ion*, the small, soft, red berries shaped like thimbles, and handfuls of strawberries too that were hanging down on the path, and there were no women and kids gathered there anymore eating their fill and loading up big black ash baskets with wild berries.

You can't do any of that now because it's all noxious weeds and gravel and concrete and junk metal strewn all over the dirt under the footings of the Mercier Bridge. You have money, but you don't have the land. You need money, and your need for money has changed everything, the land, the water, and it has changed you too.

When they came to build the seaway, they made your tó:ta pack all her stuff and move, and they bulldozed her house while she stood there watching with tears flowing from her eyes. They made her move, but before she did, she left her washboard right there on the shore. When she left the riverside for the last time, she leaned her washboard up against her favourite tree, a nice big willow with huge branches and roots. That was her last stand, and it was the mark she wanted to leave. You can still picture her standing there in the doorway of her house looking out over the point and the river that one last time.

From where you are standing, on what little land is left of the place your family lived for many generations, this tranquil bastion of the natural world and ancestral spirit, you feel her heart breaking for the loss. The land is still there, the river is still flowing, but where are the people now? You turn and look the other way, over the seaway at the government buildings, the houses, and roads and cars of the reserve on the other side, and you try hard to not see it as a faraway land where foreign people are speaking a language you can't understand. ❁

LEFT: CARL MALCOLM/ONTARIO HYDRO; RIGHT: KANIEN'KEHÁKA ONKWAWÉN:NA RAOTITIÓHKWA LANGUAGE AND CULTURAL CENTER, THE ARTS AND ARCHIVES DEPARTMENT.

THE SEAWAY
TIMELINE

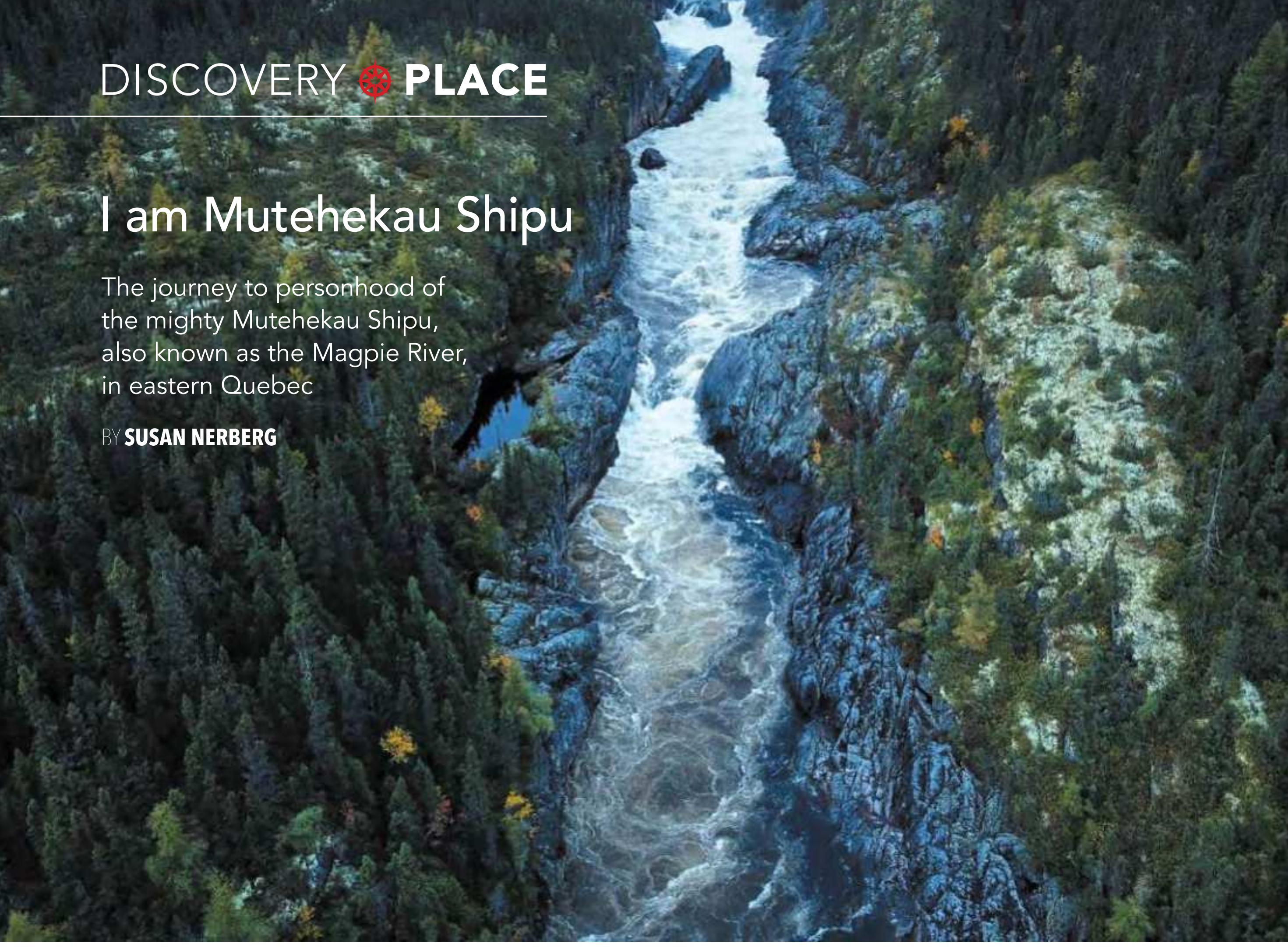
1951 A law is enacted to create the St. Lawrence Seaway Authority as a corporation in the Indian Act with provisions to allow sheriffs to take land without consent and put down resistance.

1955 In a referendum, the people of Kahnawà:ke reject the idea of the seaway.

Section 35 of the Indian Act, the Expropriation Act, and Section 18 of the St. Lawrence Seaway Act are the legal means used to take 1,260 acres from Kahnawà:ke.

1956 Expropriation of Kahnawà:ke properties goes ahead, with payments to owners amounting to less than half the appraised value of their homes.

1959 The seaway is completed, and Queen Elizabeth II and U.S. President Dwight D. Eisenhower arrive to mark the official opening.



I am Mutehekau Shipu

The journey to personhood of the mighty Mutehekau Shipu, also known as the Magpie River, in eastern Quebec

BY **SUSAN NERBERG**

Rita Mestokosho (ABOVE), wearing a traditional Innu bonnet, sings a healing chant for the Mutehekau Shipu and other rivers while standing at the Third Falls. The name Mutehekau Shipu means "the river where water flows between square rocky cliffs" in Innu-aimun.

***I'M ON MY WAY TO MEET THE SEA** when I hear the voice. It's faint at first, a few stray notes climbing on the mist from a waterfall. As I approach the precipice creating the cascade, I see a human on a rocky outcrop. Wearing a red and green bonnet of the type Innu women have worn for centuries, she's beating a drum. She sings. I've heard this chant before, especially in the time since humans with pale faces and neckties started coming to these forests with plans to divert me and other rivers. They said it was for progress. But for me, my progression was slowed down the moment they led me into that concrete box with sluices. She's singing a healing chant — for me, the river — for all of us, for the planet. I hear, even though my voice is louder than her words. I roar. That's how I know I am.*

"We've always known the river is alive. Our ancestors have always said that," says Innu activist, poet and educator Rita Mestokosho as she swaddles her deerskin drum in a fleece blanket. "The river is like the blood that runs in our veins. If the river is sick, we will also be sick. That's why we need to protect her." The waterway she's talking about is the Mutehekau Shipu, also known as the Magpie River, a nearly 300-kilometre ribbon that swirls through a pristine area of the Côte-Nord region in eastern Quebec. For Mestokosho and the people of Ekuanitshit, an Innu community on the Gulf of St. Lawrence, the river has always been family.

In February 2021, the world was introduced to Mutehekau Shipu when the people of Ekuanitshit and the regional municipality got together and made a joint declaration to give this river legal personhood and rights — the first resolution of its kind in Canada.

The province's mightiest rivers have already been dammed (or damned, depending on who you ask) by Hydro-Québec, the fourth-largest hydro-power producer on the planet, but the Innu Council of Ekuanitshit, the community's governing body, hopes the Mutehekau Shipu's personhood status will keep her safe from a similar fate. It was they who initiated a strategic alliance that brought together local Indigenous and non-Indigenous governments, as well as environmental groups, to protect the river.

This declaration of legal personhood carries broader implications. In a global context, it forms part of a mostly Indigenous-led movement that aims to turn corporation law (which grants corporations — from businesses to churches to NGOs — legal rights comparable to those of persons) on its head, by recognizing the rights of nature and to hold governments, corporations and other actors accountable. On a national level, the declaration has the potential to stand as a precedent-setting victory, inspiring other Canadian jurisdictions to give nature the means to defend itself from industrial encroachment. On a regional level, it provides a starting point from which life in Nitassinan, the traditional territory of the Innu, can flourish.

HYDROELECTRIC PROJECTS are a constant threat. Built in 1961, the only existing generating station on the Mutehekau Shipu strangled the First Falls just north of Highway 138. It was upgraded in 2007 to increase its energy output; the expansion flooded a section popular with whitewater kayakers. Then, in its 2009-2013 strategic plan, Hydro-Québec targeted the river for a hydroelectric "complex" that would churn out some 850 MWh, enough electricity to power roughly 290,000 homes. That scheme — and the spectre of the massive, four-dam project that had just broken ground on the nearby Unamen-shipu (commonly known as the Romaine River) — set off alarm bells among Innu, paddlers and environmentalists. But though pressure from those river protectors has led Hydro-Québec to take Mutehekau Shipu out of its near-term proposals, it has, as yet, made no promises for the future.

Still, the personhood declaration could be a game changer for the Côte-Nord region — as well as for the rest of Canada. "It's revolutionary in a Canadian context," according to David Boyd, the former UN special rapporteur on human rights and the environment and an environmental law professor at the University of British Columbia. "But it's difficult to say how revolutionary; it's impossible to say at this point how courts will interpret the law."

But Boyd also makes clear the law is groundbreaking from a cultural perspective. "Canadian culture has — with the exception of First Nations — treated nature as property. This declaration is saying very clearly that that is not the worldview of Indigenous people and it shouldn't be the worldview of Canadians in general. "Nature is far more than just a basket of resources; it's an extraordinary, wondrous community that we're incredibly fortunate to be part of."

Read the feature-length version of Mutehekau Shipu's story and see additional photographs of the river and her protectors at biinaagami.org/magpieriver.

PHOTOGRAPHY: CHRISTIAN FLEURY; MAPPING CHRIS BRACKLEY/CAN GEO

Deep, dark secrets

Pioneering cave diver Jill Heinerth sheds light on Canada's longest underwater cave system beneath the Kichi Sibi Watershed

BY **SARAH BROWN**

IT'S DARK AND DANGEROUS, murky and muddy. But Jill Heinerth is right at home in the labyrinths of caves beneath the surface of the Kichi Sibi watershed, also known as the Ottawa River watershed. The celebrated cave diver and researcher has made it her mission to explore Canada's longest underwater cave system, which meanders beneath the river, its islands and its shoreline for a whopping 10.6 kilometres straddling Ontario and Quebec.

Heinerth likens freshwater cave diving to "swimming through the veins of Mother Earth." Within this particular freshwater labyrinth, she has discovered a completely undocumented ecosystem filled with the greatest density of living organisms she has ever observed in an underwater cave.

The caves — now known as the Gervais and Three Island caves — were formed in the Ottawa River near Westmeath, Ont., over thousands of years as acidified river water gradually forced its way through joints and cracks in the limestone there. In the process, a series of sinkholes and passageways were formed. These passageways are quite shallow, usually just three to nine metres, branching out in multiple directions like a giant underground tree. Heinerth calls it "a remarkable environment — like a museum of natural history." But the extensive network can also be treacherous for divers, with fast-moving water creating strong currents.

The cave system doesn't attract cave divers looking for something beautiful, but to Heinerth, this mysterious underworld is a paradise with much to discover. Fish such as sturgeon, perch, burbot, walleye and smallmouth bass can be found swimming about and hiding in crevasses, while the silty cave bed in some places boasts a whopping 100 or more mussels per square metre, along with myriad sponges and other benthic life. And given how few divers have the skills to navigate the caves, there may still be cave-adapted species awaiting discovery. Beyond the abundant underwater life, the cave walls provide a fascinating glimpse of the area's ancient past — the rock is embedded in places with fossils that harken back to the last glacial period when the Champlain Sea covered much of eastern Ontario.

What makes these caves even more special as a research location is that they remain free of the invasive zebra and quagga mussels that have devastated the Great Lakes (and beyond) by filtering out beneficial plankton and algae, outcompeting native species and disrupting the Great Lakes food chain. Heinerth calls the Gervais and Three Island caves "a place where we can see what the lakes were — and what they could be again — if we can control the invasive species." The native freshwater mussels that live here in the caves play a crucial role in aquatic ecosystems in the Kichi Sibi watershed. Each mussel filters one to two litres of water per hour to obtain food. That works out to 10,000 litres per year per animal! It all adds up to a healthy ecosystem in the caves and supporting life for thousands of kilometres downstream — this fresh water flows east to the St. Lawrence River and, eventually, all the way to the Atlantic Ocean.

The "happy" black sandshell mussel (OPPOSITE) reveals brood pouches filled with tiny mussels. Her "mustache" lures fish that eat crayfish. When a fish comes close, she expels her microscopic larvae. Researchers believe the thin papillae resemble crayfish legs. A calm surface (LEFT) above the mysterious world below.

Jill Heinerth (@jillheinerth) is an Explorer-in-Residence of the Royal Canadian Geographical Society. Read more about her explorations in the Kichi Sibi Watershed at cangeoeducation.ca.

One of the intriguing symbiotic relationships Heinerth is studying in the caves involves their thriving native freshwater mussel population and resident fish. The mussels create a cleaner and healthier environment for the fish; the fish play a crucial role in the mussels' reproductive life cycle.

Each mussel species has a slightly different strategy for obtaining support from a host fish. In the case of the female pocketbook mussel, it goes like this: Once a year, the mussel grows a lure that looks for all the world like a small fish. Attracted by the wiggling lure, a fish swims in for a closer look at its potential dinner and takes a nip. That's when the mussel expels her microscopic larvae into its face. The parasitic mussel babies go into the fish's mouth and latch onto its gills or fins, hitching a ride while being nourished by its blood serum. Once they reach a certain size, the fish's immune system ejects the juvenile mussels, and they float down and burrow into the silty cave bottom, where they will grow into adults, spending the next decades — or even a century for some species — continuing the cycle of filtering the waters of the Ottawa River.

It all adds up to a whole lot going on beneath the surface in the Kichi Sibi watershed, which Jill Heinerth continues to explore, document and draw inspiration from as she works with scientists and Indigenous partners — and inspires the next generation of students, cave divers, citizen scientists and researchers — to study and protect this very special ecosystem.

PHOTOGRAPHY COURTESY JILL HEINERTH; MAP: CHRIS BRACKLEY/CAN GEO

Water world

How beaver engineering results in biodiverse and climate-resilient landscapes

BY **ABI HAYWARD** AND **KATIE DOREEN**
WITH ILLUSTRATION BY **DAVID WYSOTSKI**

It starts with the sound of running water. There's something in a beaver's rodent brain that draws it to the sound, *compelling* it to build. To dam. To slow the flow. To hold that water in its little chunk of landscape a little longer. The beaver is following its instincts to build a home, with easy access to tasty morsels to gnaw on: aspen, willow, birch, maple. But it's doing something more. It's creating a more resilient watershed.

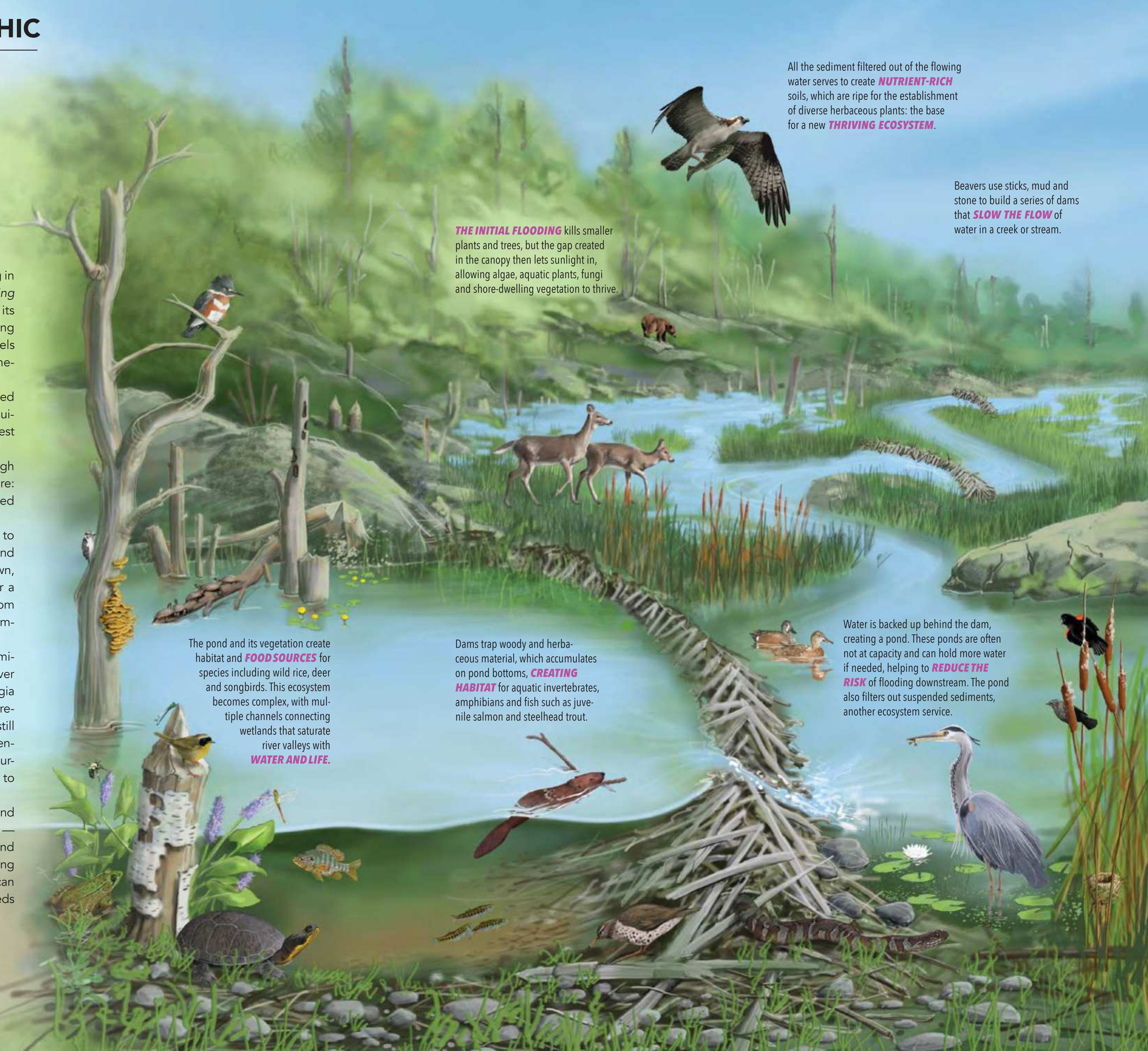
During the 1940s, a bizarre project saw beavers parachuted into Baugh Creek, Idaho, because they were seen as a nuisance in cities and towns. The beavers did what they do best and created a lush mosaic of ecosystems.

Seven decades later, in 2018, a wildfire swept through Baugh Creek. Satellite imagery showed a remarkable picture: that beaver-engineered, verdant valley appeared unscathed amid the wildfire-charred hills.

Researchers have found that beavers contribute more to keeping water in the landscape than climate, precipitation and temperature combined. As beaver dams slow water down, backing it up into ponds, this not only creates habitat for a biodiverse ecosystem but better protects the landscape from increasing droughts and fires that accompany warming temperatures associated with climate change.

Beaver dams also filter the water, which removes contaminants and moderates water temperature. When deeper beaver ponds "stratify," separating into layers, they create cool refugia for various fish species, which can attract protein-loving predators to beaver ponds. The nutrient-rich sediment and still water also cultivate plants for grazing herbivores. Ponds eventually give way to lush meadows as, once the beavers' journey to trees becomes too far, beavers abandon their dams to begin all over again somewhere else.

The resulting landscape is a patchwork of meadows and wetlands — with a range of ages and successional stages — that become more diverse as beavers repeatedly colonize and abandon their dam sites. With droughts, wildfires and flooding predicted to increase in Canadian landscapes, perhaps we can let beavers do what they do best: create resilient watersheds for the future.



Exploring Cartography

Troubled waters

How mid-century diversions in the Great Lakes watershed still affect the communities on its shorelines

BY **CHRIS BRACKLEY**
WITH TEXT BY **SCOTT PARENT**

The Great Lakes hold an estimated 23 quadrillion litres of water and cover about 244,000 square kilometres while draining more than three times as much land. Most of this water enters the system naturally via groundwater pathways, surface run-off and precipitation, but there's also a human element to this story. A small portion of this huge water input comes from people manipulating its flow: two major water diversions at the northwesternmost point of the watershed redirect rivers that once flowed north toward James Bay, changing lives and livelihoods for First Nations in the region.

When the Second World War broke out, it spurred governments on both sides of the border to generate more electricity, a concept they had been considering for decades. "Every cubic foot of water diverted from the relatively useless basin of Hudson Bay into the lakes will prove liquid gold," wrote one commentator in a 1925 op-ed in the *Chicago Tribune*. By adding water volume at the top of the system, the two governments found they could increase the flow rate of water over Niagara Falls to reap the power benefits, while also enhancing the scenic beauty of the falls.

To do this, a set of two control dams were completed in 1943 to redirect a portion of the Ogoki River into Lake Nipigon and ultimately into Lake Superior. Other dams opened in 1941 reversed the Kenogami River through Long Lake and also toward Lake Superior. The two diversions are the only human-made water diversions into the Great Lakes.

But this feat of engineering didn't just increase the volume of water flowing over Niagara Falls: the Long Lake and Ogoki River diversions altered water levels and fish habitat, both along the Albany River system to the north and in the Long Lake and Lake Nipigon watersheds.

The Whitesand First Nation once lived on the northwest shore of Lake Nipigon, but as water levels rose in 1942 following the diversions, eroding the shoreline and flooding homes and burial sites, the community relocated closer to Armstrong, Ont.

"That loss of land, and all those trees, that our people had hunted and fished … it was a very emotional trip for me," said Whitesand First Nation Chief Lawrence Wanakamik following a recent fly-over of the Ogoki Reservoir, Summit Control Dam and Waboose Diversion Dam. "It has affected a lot of people, not only our members but people north of us. There are stories of graves that were washed ashore or washed into the water."

The dams have also contributed to increased levels of methylmercury in fish. When soil is flooded due to dam construction, organic carbon is released, fuelling microbes to convert naturally occurring elemental mercury to toxic methylmercury, which then rises up the food chain.

"We can only eat two fish a month from the Little Jackfish River beneath the reservoir," says Chief Wanakamik. "So a lot of people don't fish at all for eating." A poignant image to keep in mind while admiring Niagara Falls. ❁

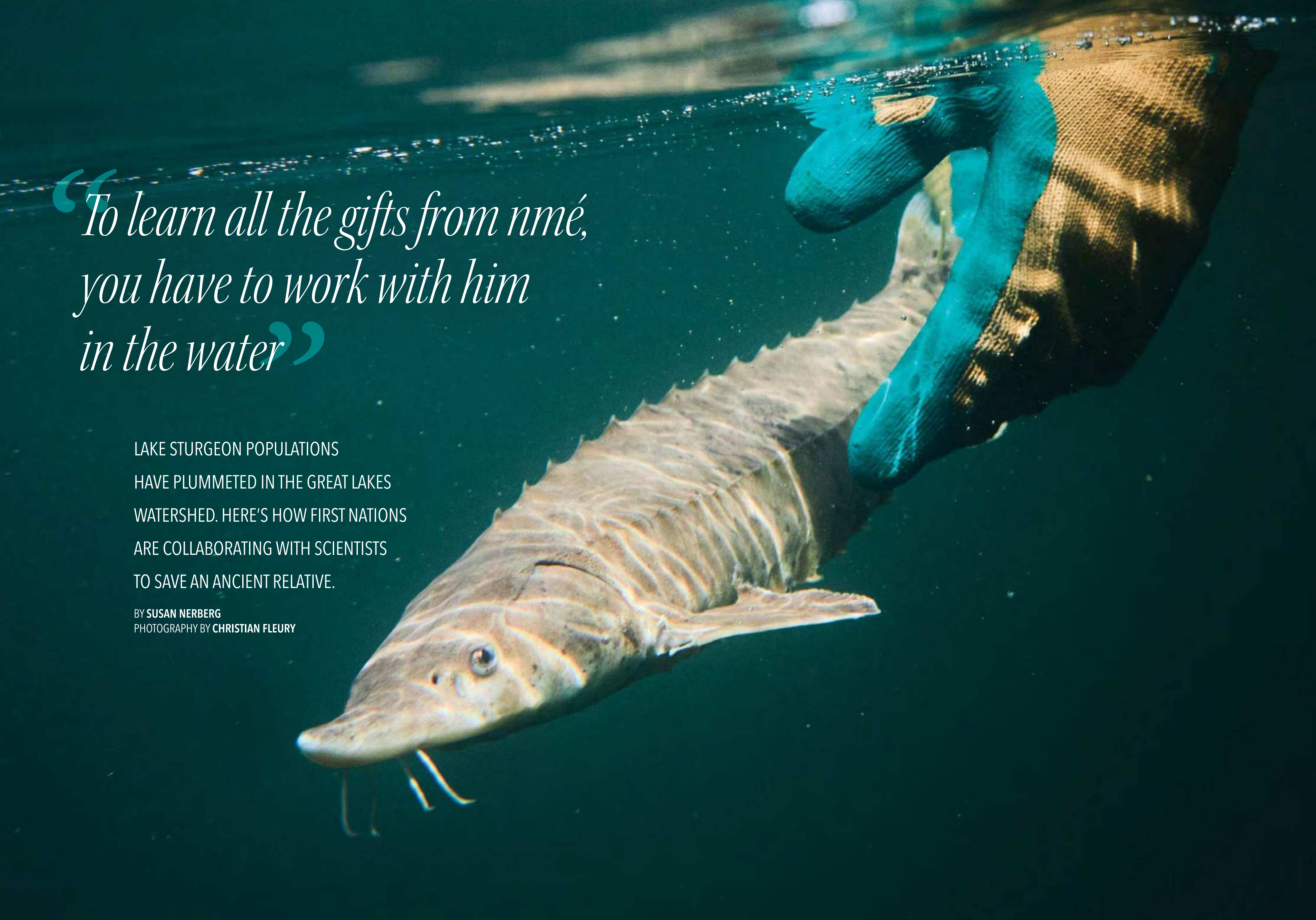
Diversions

Diversions are massive undertakings. The Ogoki diversion required a dam over the Waboose Rapids on the Ogoki River, then more dams to create a reservoir feeding water to the Summit Dam and into Lake Nipigon. At Long Lake, the Kenogami Dam backs up water into the lake, where it's then released through a channel to a control dam and eventually into Lake Superior.

Niagara Power

The International Niagara Control Works structure — a series of 18 sluice gates spanning about half of the Niagara River — ensures a minimum flow of 2,832 cubic metres per second over the falls "for scenic purposes" during the day in tourist season. Additional flow is equally divided between Canada and the U.S. for hydroelectric power generation, except the water from the Long Lake and Ogoki diversions (141.6 m3/s), which belongs to Canada.

NIAGARA MAP: GOOGLE EARTH, IMAGE: AIRBUS © 2024



"To learn all the gifts from nmé, you have to work with him in the water"

LAKE STURGEON POPULATIONS HAVE PLUMMETED IN THE GREAT LAKES WATERSHED. HERE'S HOW FIRST NATIONS ARE COLLABORATING WITH SCIENTISTS TO SAVE AN ANCIENT RELATIVE.

BY **SUSAN NERBERG**
PHOTOGRAPHY BY **CHRISTIAN FLEURY**

> “All of our stories are tied to this river. Once, there was a big celebration that lasted for days. A group of girls who were becoming young women were too powerful to take part in the ceremony. But they were curious and wanted to see what was happening. When they got close, the Water People came out to tell the young women not to eat the pink-bellied sturgeon, because the pink-bellied sturgeon are the people who have drowned in the river. They're our ancestors. Today, some families still won't catch pink-bellied sturgeon. In my community, if we get one in a net, we put it back in the water.”
>
> **–Brent Niganobe**
>
> *Elected Chief, Mississauga First Nation; member of the Sturgeon Clan. Story passed down from Elders Tom Daybutch and Doug Daybutch.*

If Chief Brent Niganobe were to lie down on the smooth rock beside Mississagi Falls, he'd be about as long as an adult lake sturgeon, not counting his braid, the visor on his trucker hat or the tassels on his loafers. But he stands tall as he shares about a time, not too long ago, when there were so many sturgeon you could walk dry-shod on their backs to the opposite shore of the Mississagi River.

The Mississauga First Nation have always gathered at these falls to fish and pass on stories and knowledge. They've lived along this river for as long as anyone can remember, canoeing down it to their traditional summer areas on the shore of Lake Huron's North Channel, where the river fragments into a bird-foot delta. They have ancient knowledge of lake sturgeon, or *nmé* in Anishinaabemowin. Nmé is their oldest existing relative, a pillar of their sustenance for millennia.

A living fossil, sturgeon have been around for more than 200 million years, a time in which they've barely changed. They still sport a shark-like tail fin and body armour that keeps them safe from predators: five rows of diamond-shaped scutes. The younger (and more vulnerable) the fish, the sharper the scutes. They have four barbels, whiskers they use to sniff out food; when they find prey, they pout their protrusible mouth and suck, effectively giving their catch the kiss of death.

The lake sturgeon is the largest and longest-living freshwater fish in Canada, with a historical extent across central and eastern Canada and the United States, from Hudson Bay to the Mississippi. Females roam for up to 150 years (scientists think they might live even longer); males have a lifespan of about 50 years. The megafauna of the Great Lakes, nmé can grow up to two metres long, with record catches topping four metres. Their size combined with their scutes should have made them invincible. But so much has changed around them, and so much force — more than their armour could withstand — has been levelled against these gentle, bottom-dwelling giants.

In the Great Lakes-St. Lawrence watershed, starting in the early to mid-1800s, colonizers ripped Niganobe's kin from their habitats and dumped them on the shore. Seen as pests that tore asunder fishing nets made to catch smaller lake trout, lake sturgeon were stacked like logs by the hundreds of thousands and set ablaze. Then came the logging boom, which destroyed their spawning sites, burying them under silt and sawdust; and the caviar boom, when sturgeon eggs suddenly became a hot commodity. Hydroelectric power dams stopped sturgeon from swimming upstream to their spawning grounds; downstream, they killed eggs and larvae by flushing them away or drying them out as floodgates opened and closed. In all, lake sturgeon populations have plummeted to a mere *one per cent* of their pre-Confederation and pre-Civil War numbers. In not much longer than the lifespan for a female lake sturgeon, the Anishinaabeg's ancient relative was reduced to a shadow.

Thankfully, efforts on both sides of the Canada-U.S. border over the past several decades are finally making strides. Conservation measures — such as strict fishing regulations, rehabilitating cobble reefs for spawning, reducing pollution, creating natural run-of-the-river flows through dams and restocking baby fish — do work. And now that scientists and government agencies working around the Great Lakes are starting to recognize the value of First Nations and Tribal ecological knowledge, two-eyed seeing and data collection has the potential to rewrite the lake sturgeon conservation story.

For the Mississauga First Nation, this approach is fairly recent. Back in the 1990s, the nation, along with the Anishinabek/Ontario Fisheries Resource Centre, started their own sturgeon studies. They felt the Ontario government was doing a less-than-stellar job managing the fisheries. “They weren't on the land, they didn't do any field work and had no true data [from here], only data from elsewhere,” says Keith Sayers, director of Mississauga First Nation's lands and resources department. So, to fill in the scientific knowledge gaps, the nation took data collection into their own hands.

More recently, in 2023, Mississauga First Nation launched a collaborative sturgeon tracking project in the Mississagi River with scientists from Mount Allison University, the Ontario Ministry of Natural Resources and Forestry, the Anishinabek/Ontario Fisheries Resource Centre, Fisheries and Oceans Canada and others. The nation brings multi-generational, on-the-land observations of nmé and its habitat — a culture-based ecosystem view. They know scientific methods can add the fine-grained data needed to ensure nmé will be around seven generations from now. And Mississauga First Nation is one of many nations around the Great Lakes-St. Lawrence watershed adding a new chapter to their rivers' stories — and to their continued relationship with nmé.

MAP: CHRIS BRACKLEY/CAN GEO; TRACKED STURGEON ROUTE DATA: COURTESY LISA O'CONNOR/TOM PRATT (DFO), ED BAKER (MICHIGAN DEPARTMENT OF NATURAL RESOURCES), CHRIS ROBINSON (PARKS CANADA), KEITH SAYERS (MISSISSAUGA FIRST NATION), MATTHEW LITVAK (MOUNT ALLISON UNIVERSITY), WARREN ZEINSTRA (ONTARIO MINISTRY OF NATURAL RESOURCES). GLATOS RECEIVER LOCATION DATA: COURTESY NANCY NATE (U.S. GEOLOGICAL SURVEY). LAND COVER: NORTH AMERICAN LAND COVER, 2020 (LANDSAT, 30M), COMMISSION FOR ENVIRONMENTAL COOPERATION.

A tagged juvenile lake sturgeon (OPENING SPREAD) is released into Lake Superior; Stan Nabigon (OPPOSITE) joins for the ride on the White River (LEFT).

“When I was young, we didn’t talk about conservation. But because fish, including sturgeon, has always been an important source of food and medicine for us, we’ve always been careful not to catch more than we need. I was in my mid-teens when I caught my first sturgeon, using a pole with a short line. My grandpa once caught a sturgeon so big that, when he carried it on his back, its tail dragged along the ground. And my grandma, who made fishing nets for my dad, said that when the tiger swallowtail butterflies show up in spring, sturgeons would be swimming upriver to spawn.”

–Stan Nabigon

Elder from Biigtigong Nishnaabeg, Heron Bay, Ont.; former warden at Pukaskwa National Park, Lake Superior

Stan Nabigon may be retired from his 34 years with Pukaskwa National Park, but, like travelling sturgeons, he’s eager to get out on the water when an opportunity presents itself. So when the park’s ecology team packs a boat for a few days of sturgeon field work in June on the White River, Nabigon joins for the ride.

The survey site is five kilometres upstream from Lake Superior, below the Chigamiwinigum Falls. Old-growth cedars, perhaps as old as the oldest sturgeon in the river, prop up the sandy riverbank alongside balsam firs, white spruce and maples. The team — ecologist Chris Robinson, resource manager Tyler Ripku and technician Marissa Fugere — sets up a sturgeon processing station under a tarp: a two-metre cattle trough to hold sturgeons, a generator, an operating table and three different fish-tracking devices. Then they jump into a small boat and motor out to set nets, which they check the following morning.

Most fish wouldn’t survive being stuck overnight because they thrash around so much: they get tangled, their gills get smothered and they can’t breathe. But sturgeons tend to stay calm despite being caught, seemingly waiting for what might happen. Rarely is there bycatch: the team uses large mesh nets to let smaller fish swim through. Most net checks yield sticks (“stickerels”) and logs. But sometimes, the team gets lucky.

Ripku rushes sturgeon from the boat to the water-filled trough. Robinson and Fugere lift the fish in a sling, just long enough to record its weight. Back in the water for oxygen, then quickly up on a board to measure its size. Robinson holds the fish steady — sturgeons have a powerful tailkick — while Fugere runs a scanner over the back of the head to check for a tracking tag. Finding nothing, Ripku inserts a PIT tag (like a microchip) and a spaghetti-thin Floy tag with an ID number. This way, growth and movement can be charted over time.

This study, which started in 2023, is part of Parks Canada research on vulnerable, threatened and endangered species. Nabigon and others from the area always knew sturgeon were in the White River, even if their overall numbers in the Great Lakes-St. Lawrence watershed had declined. When sturgeon became listed provincially as a species of special concern in 2008, no sturgeon population survey had been done on the White River. So in 2010 the Anishinabek/Ontario Fisheries Resource Centre, the Biigtigong Nishnaabeg and Pukaskwa researchers struck up a collaboration, tagging 45 sturgeons with radio telemetry implants. They learned the White had one of the most abundant sturgeon populations in the Great Lakes.

The main objective now is to catch adult fish and equip them with acoustic telemetry tags to track their movement. “We want to know how much time they spend here and when, so that we can create a general idea of how they use different areas in the park,” says Robinson. “With that data, we can develop conservation measures, like limiting activity at or access to certain areas at certain times, for example during spawning.” The telemetry will also show researchers how the fish in White River fit into the larger Great Lakes sturgeon-conservation puzzle.

Robinson, the “sturgeon surgeon,” takes a deep breath and sits down beside the upside-down fish in the trough, its snout and gills underwater. After palpating the sturgeon’s abdomen, Robinson injects a local anesthetic, waits for it to set in, then cuts an incision just long enough to insert the pinky-sized tag. Three stitches and a wound cleanup later, Ripku lifts the sturgeon out of the trough, cradles it and carries it to the river. He bids it farewell and puts it back in its element. For the next seven years (the tag’s battery life), the tag sends signals that are picked up when the sturgeon passes within range of the park’s 21 acoustic receivers or any one of the hundreds installed in Lake Superior or the wider Great Lakes. Individuals can be tracked over time, creating a continuum of lines on a map that, if sturgeon are allowed to thrive and reproduce, could come to resemble family trees with roots in different habitats.

Pukaskwa’s ecology team knows it pays to collaborate with the Biigtigong Nishnaabeg. Nabigon’s way of knowing the land and Robinson’s methods of reading it overlap like the lines on a telemetry chart. Put together, it’s not just an image of lake sturgeon: it’s about the ecosystem the species lives in. Seeing it from both worlds is something lake sturgeon will need to survive.

Susan Nerberg is a Sámi writer and editor. Christian Fleury (@christian_fleury) is a documentary photographer and filmmaker. Both live in Montreal.

Fisheries and Oceans Canada researchers (OPPOSITE) team up with the Ontario Ministry of Natural Resources near Sault Ste. Marie, Ont.; a tagged juvenile (ABOVE) returns to the depths of Goulais Bay, where conditions are favourable to support the food sturgeons like to eat: mussels, aquatic insects, crayfish and other fish.

"When they built the locks in St. Marys River, that's a very sad story. Our villages were all along the riverfront where the locks stand today. In 1836, we signed treaties in which we were forced to give up our land with threat of removal. We were able to stay along the shores of St. Marys until the 1850s when the land was required for the locks and then we were forcibly removed. They loaded people in wagons and burned the villages, everything along the shore. Some people were moved to Sugar Island, others scattered. This is an oral history that's in my family; I've never seen it in history books. We, the original people, have been here since the end of the last ice age. Settlers came here 350 years ago. We have been here for 350 generations."

–Cathy DeVoy
Division director of language and culture, Sault Tribe of Chippewa Indians, Sault Ste. Marie, Michigan

Cathy DeVoy's retelling of the colonial onslaught against her people mirrors the erasure of lake sturgeon. Nmé and the Anishinaabe have co-existed along the rivers and bays of southeastern Lake Superior since time immemorial. But when the Soo Locks were built in 1855 and expanded in more recent history, sturgeon spawning sites in the St. Marys River rapids were dredged, substantially reducing the cobble reefs essential for sturgeon eggs and larvae. Nmé — like the Indigenous Peoples that offer it protection — was decimated by settler-colonial "progress."

Sturgeon born around the time of the U.S. Indian Removal Act might still be swimming the Great Lakes. Would they remember the destruction? What would they think about the newcomers' betrayal of an ancient kinship? Luckily, not far from the Soo Locks, young generations of sturgeon are swimming a new wave.

One such place is Goulais Bay, northwest of Sault Ste. Marie, Ont. — it may just be the greatest sturgeon nursery in the world's largest freshwater lake. The embayment is the site of an annual population survey that targets juvenile sturgeon, those between ages three and 15. Lisa O'Connor, Tom Pratt and Bill Gardner, the research team from the Soo office of Fisheries and Oceans Canada, are returning for a week of gillnetting to add to their 14-year dataset that will help them project the future of sturgeon.

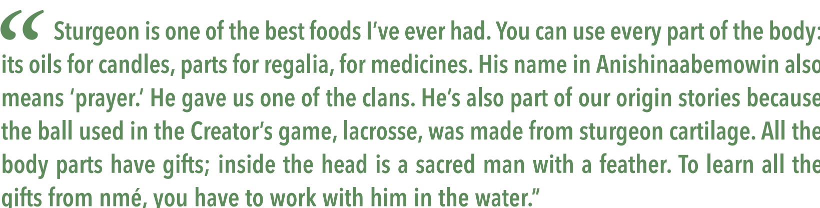
Navigating through dense fog, Gardner takes the team toward Goulais Bay. Although it's the middle of July, it's cold on Lake Superior, on the fast-moving boat. By the time Gardner brings the boat into the bay, the fog has lifted like a theatre curtain to reveal a play of blues and greens stitched together by pebble beaches.

Four nets per day, for four consecutive days, are set and pulled the following morning. Each net is 300 metres long, with different size mesh to capture sturgeons of varying sizes, or ages. "In some places, we see only aging fish," says O'Connor, who's swapped her tuque for a cap with an embroidered sturgeon.

The best way to find out exactly *how* old a lake sturgeon is — without killing it and taking its otolith, a bone in the inner ear — is by cutting off a small piece of the thick, spiny front section of the pectoral fin. At a lab in Sault Ste. Marie, the researchers slice fin samples into fine cross-sections using a saw. Under the microscope, clearly defined rings represent years of growth, with one ring per year, like tree rings. They reveal the fish's age and offer clues to its growth rate — a snapshot of how good a life the sturgeon was leading up to the time of sampling.

Would they remember the
DESTRUCTION?
What would they think about the newcomers'
BETRAYAL
of an ancient kinship?

The youngsters that were caught and tagged in the earliest years of the annual survey might just be reaching spawning age now, says Pratt, because it takes at least 15 years for males and 20 years for females to spawn. And the conditions in Goulais Bay are favourable for supporting a healthy, growing population: the sandy, silty bottom is the right substrate for the food that sturgeons like to eat. Goulais River offers a long flow, giving larvae ample time to drift and learn to feed before they enter the bay. Pratt hopes that if the Goulais Bay population stays healthy and grows, some individuals might start to migrate to other areas in southeastern Lake Superior. Perhaps one day, the Goulais Bay sturgeons will fan out into the lake and start repopulating other shallow and food-rich bays like Whitefish and Batchewana, both Anishinaabe territories where sturgeon were pushed to near-extinction by settlers.



“Sturgeon is one of the best foods I’ve ever had. You can use every part of the body: its oils for candles, parts for regalia, for medicines. His name in Anishinaabemowin also means ‘prayer.’ He gave us one of the clans. He’s also part of our origin stories because the ball used in the Creator’s game, lacrosse, was made from sturgeon cartilage. All the body parts have gifts; inside the head is a sacred man with a feather. To learn all the gifts from nmé, you have to work with him in the water.”

–Dennis Carrick

Member of the Bay Mills Indian Community, Brimley, Michigan; sturgeon spear fisher

On dry land, Dennis Carrick’s day job includes tending to a village of honeybees and a herd of grass-fed cows at Waishkey Bay Farm in Brimley, Michigan. When Carrick leaves dry land for water to harvest sturgeon, it’s to exercise his treaty rights and practise his culture, spearfishing from a boat at night, using a light. He prides himself on providing a taste of this traditional food for Elders.

Carrick laments people catching the fish in shallow river waters when they come up to spawn. “We’ve put in years to re-create and protect natural spawning areas in rivers, so I don’t want anyone to walk in and ruin what took so long to bring back,” he says. “I don’t want to harass fish that are about to spawn. Hopefully, other Tribes will follow.” In the meantime, he takes Tribal people to lakes to show them how to find and harvest sturgeon. “They have a bony armour on the back of the head, so you have to spear them behind their gills,” explains Carrick. The reward for that precision goes beyond safeguarding culture. “Sturgeon tastes like grilled pork chop,” he says. “It’s delicious smoked, with salt or Cajun spices.”

Few people get to catch, much less taste, lake sturgeon. In Michigan, where the species is listed as threatened, a strictly controlled harvest is permitted only in certain inland waters, including Black Lake on the Lower Peninsula. Following the state’s Department of Natural Resources regulations, the 1836 Treaty Tribes (the Bay Mills and Sault tribes on Michigan’s Upper Peninsula and, on the Lower Peninsula, the Little Traverse Bay Bands of Odawa Indians, the Grand Traverse Band of Ottawa and Chippewa Indians, and the Little River Band of Ottawa Indians) can catch a total of six sturgeons per year — one sturgeon per Tribe per year, with an extra tag for one Tribe annually on a rotating basis. Non-Tribal anglers also vie for six sturgeon tags per year, given through a lottery for a winter spearfishing festival, The Shivaree, on Black Lake.

But harvesting on most lakes is not on the immediate horizon. The sturgeon population of Mullett Lake, Black Lake’s neighbour to the west, is too small to sustain even a minuscule quota. The solution? Restocking: raising baby fish in hatcheries and releasing them into the wild.

Restocking rivers and lakes became part of the statewide sturgeon rehabilitation plan in 1998. The Black River Sturgeon Stream Side Research Facility in Onaway — the self-proclaimed “Sturgeon Capital of Michigan” — opened in 2009, with the hatchery-reared fish now released annually into the watersheds of Black Lake, Mullett Lake and four rivers from the Saginaw Bay watershed. Elsewhere on the Lower Peninsula, the Little Traverse Bay Bands and the Little River Band also rear lake sturgeon. While they and other Tribal hatcheries and the state-run hatchery in Onaway work independently, they all contribute to lake sturgeon rehabilitation.

Hatchery-reared fish have been released into Mullett Lake, Michigan (OPPOSITE), since 2006. These fish come from the Black River facility; a sturgeon fingerling (ABOVE) at Little Traverse Bay Band Fish Hatchery, which stocks nearby Burt Lake.

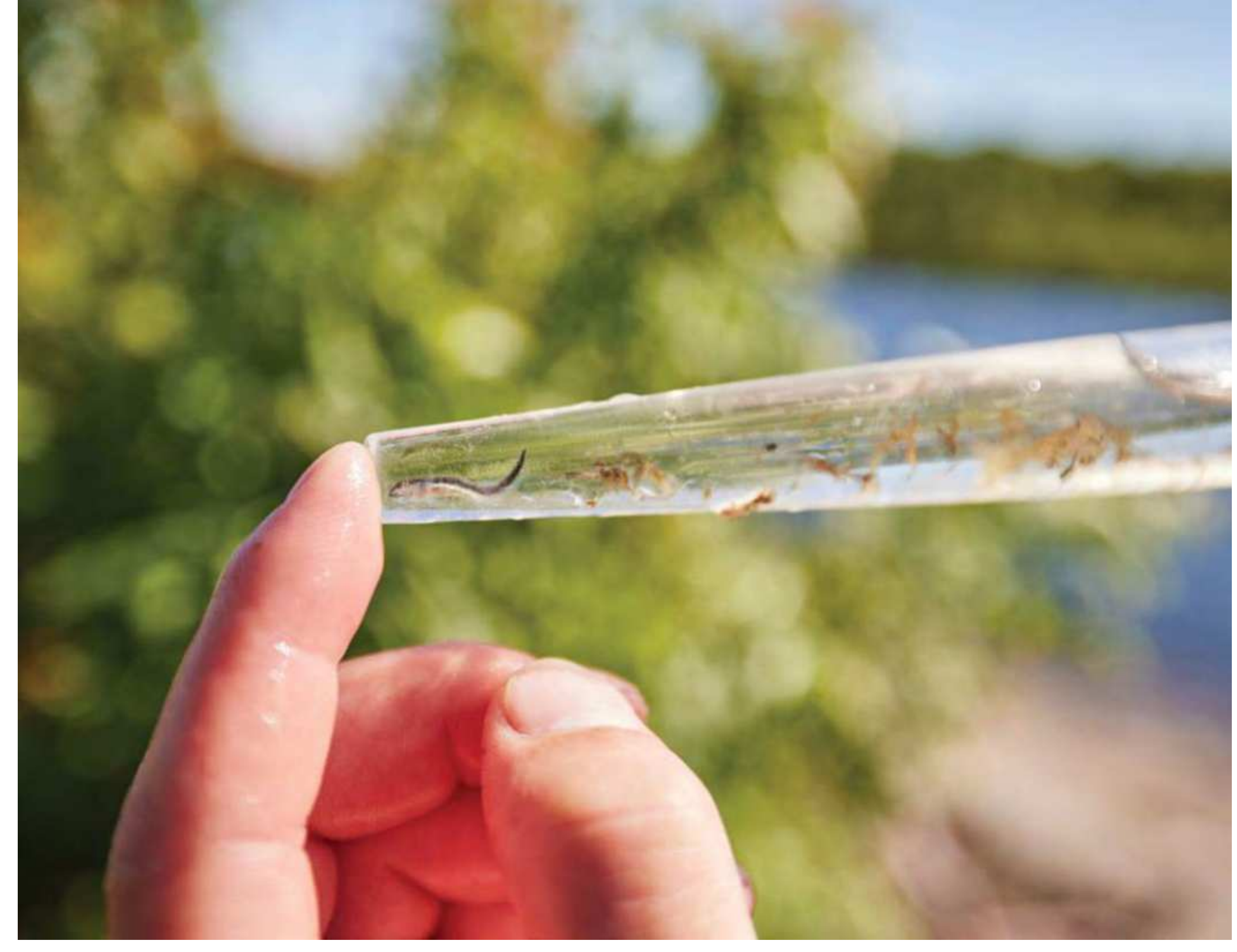
“The purpose of rearing fish in the hatchery is to boost the chance of sturgeon babies reaching adulthood,” says Doug Larson, a research assistant with Michigan State University, who manages the Black River facility, which keeps baby sturgeons safe until they’re old enough to develop sharp, predator-deterrent scutes. “In the wild, only about one per cent of larvae make it. The other 99 per cent become snacks for other fish.”

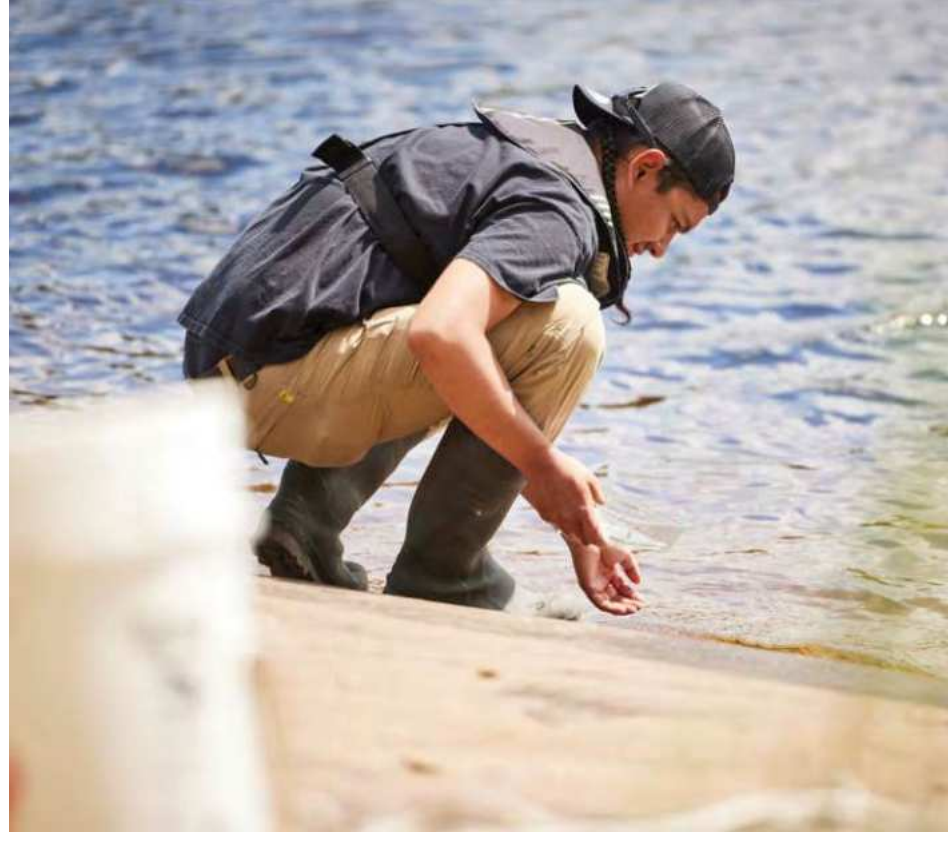
By the time research biologist Ed Baker arrives at the hatchery after a day of surveying sturgeon on Mullett Lake, it feels like a Turkish hammam. Tanks range in size and shape from small hobby aquaria to rain barrels, all containing moving water and tiny sturgeons. With pointy, upturned noses, hedgehog-sharp scutes and mottled, sand-coloured skin, they are simply very cute.

Each spring, staff, students and volunteers collect newly hatched larvae from the spawning site 3.25 kilometres downstream. The larvae are transferred to the rearing facility; there, safe from predators’ maws, they grow into 15-to-20-centimetre-long fingerlings. At the end of the summer, they’re tagged and released into the wild. Every year, 500 lake sturgeon each are released into Black Lake, Mullett Lake and the rivers of the Saginaw Bay watershed. Baker hopes, one day, hatcheries will become obsolete. “The goal, ultimately, is to remove lake sturgeon from the [threatened]-species list,” he says.

Maybe there’s reason for optimism. Fishing restrictions, habitat restoration and restocking have led to an increase in several sturgeon populations. In some regions, anglers can take part in sturgeon fishing derbies. Don Tadgerson, a commercial fisherman and Bay Mills member, scoffs at spearfishing as a sport. Spearing has been an important fishing method for his people, and the practice has cultural value. “But it’s not sport; you’re just standing there, waiting to spear the fish.”

For Tadgerson, fishing is intertwined with Tribal identity. “I was up at 3:30 a.m. to smoke whitefish for a dip I make with Miracle Whip,” he says with a glint in his Superior-blue eyes. Still, the offshore fisherman is no stranger to sturgeon. “We don’t target them, because they’ve been protected for decades,” he says. But two decades ago, he tagged 50 sturgeon that had accidentally ended up in his trap nets for a Bay Mills biologist who saw the bycatch as an opportunity to tag and gather biological data from the species in Whitefish Bay. As he swipes through photos on his phone — boxes of whitefish he’s caught, the limitless lake, his boat, named *Mr. M$NE* as he “bought it off a rich guy” — he stresses the need for collaboration between Indigenous People and biologists *and* across the border because “fish don’t see imaginary lines drawn by humans.” Today, Tadgerson feels cautiously optimistic about the future of lake sturgeon. In Anishinaabe culture, the sturgeon is known as the chief, or king, of fish. “It probably can be, if it wants to,” says Tadgerson.





Tiny sturgeon larvae (ABOVE and OPPOSITE) from the Mississagi Delta; Anthony Chiblow (ABOVE, LEFT) returns the baby fish to their watery home. The goal, researcher Matthew McIsaac says, is to figure out the time between spawning and hatching, but also to get a sense for what larvae eat and which parts of the delta they use to get to Lake Huron.

"Fish will figure things out – the more we get out of their way, the better for them. We should stop referring to 'fish management' because fish manage themselves. Instead, we should manage humans to care better for the fish. We have an agreement with the Creator, who said we can harvest animals, but we have to be responsible and not take more than we need. Still, I'm hopeful for nmé because fish have intelligence, they have resilience, even though we don't give them credit for that. Lake sturgeon have their own knowledge systems. They're our oldest relative, but they're in trouble, so we have a responsibility to help them out – to help sturgeon be sturgeon."

–Kathleen Ryan
Anishinaabe ecologist; investigator on the Mississauga First Nation's lake sturgeon research project

O*gimaa giigonh*: the king, or chief, of fish. The philosopher, the mediator. The Anishinaabeg have always known that nmé holds ancient wisdom — how else would the species have survived the extinction of the dinosaurs and, more recently, the onslaught of colonial greed? For ecologist Kathleen Ryan — a self-described "fish nerd" who can talk for hours on end about kinship with fishes — protecting sturgeon is as much about helping a relative as it is about safeguarding Anishinaabe knowledge.

For Mississauga First Nation's sturgeon project, Ryan sat down with nation members with a paper map of the Mississagi River. They shared anecdotes and memories, saturating the map with colours, details and textures that show how, when and where people have interacted with nmé, and why. Did they catch them for food, medicine or ceremony? Are the fish bigger or smaller than before, are there more females vs. males, has their range changed?

Together, they created a living picture of the river as lifeline, a cultural chart. "Indigenous knowledge is the longest time series of knowledge we have," Ryan says. That granular, qualitative information enhances the quantitative data derived from scientific study. "The more Indigenous people are involved in research projects, the better for lake sturgeon."

Guided by the nation, biology professor Matt Litvak of Mount Allison University has been spending time on the water to map the subsurface topography and zoom in on sturgeon specifics — how many are there, where do they go, how old and what sex are they. Empirical data, to this day, still garners more attention from policymakers and academia than lived experience, but Ryan says, with both sets of information, the nation can develop its own management plan and use it to hold outsiders accountable. Litvak points to co-production of science as a question of ethics: collaborating to make sure nmé is around 200 million years from now. It's a big responsibility that includes tracking the littlest of sturgeons.

Shortly after the spawning season, in mid-June, Anthony Chiblow from Mississauga First Nation sets out on the delta in a boat, together with Matthew McIsaac and Kenneth McLaughlin from the Litvak Lab. It's a Friday morning, and the team is on its last larvae-catching expedition of the field season. Chiblow steers through zigzagging channels with riverbank vegetation so dense it's a bit like whizzing through canyons. Chiblow knows this water (he was seven when he started fishing salmon to give to Elders), but for outsiders, finding the way is a challenge.

Chiblow stops at the first buoy. McIsaac and McLaughlin pull up the sock-shaped drift net and pour the contents into a white dish pan. On a nearby island, the crew peers at what looks like seaweed soup and proceeds to remove bit by slimy bit to see if there are larvae. When they find them, they're sucked into a turkey baster and moved to a clear container.

The larvae are about 20 millimetres long. Some of them already show a hint of pectoral fins and barbels. McIsaac guesses they're about 10 days old. They dart about, so they're captured in photographs to be counted and measured later in the lab. After their mugshot, Chiblow takes them to the water's edge. He kneels, pouring them back into the river they came from. "Grow up and make lots of new babies!" he tells them.

Each of the babies released back into the Mississagi Delta has the potential to become part of new river stories — for Mississauga First Nation and the world. Sturgeon aren't just a resource to be managed. They're individuals who animate the intricate weave that humans are part of. To rescue sturgeon is to open the door to new narratives. Nmé, if we help them live, can guide us along rivers and bays and lakes, and in so doing, help us chart a new course on the maps of our own imagination. ❁

MANOOMIN

THE GOOD BERRY

THROUGHOUT THE GREAT LAKES, ANISHINAABEG COMMUNITIES WORK TOGETHER TO SOW THE SEEDS OF SUCCESS FOR WILD RICE

STORY AND PHOTOGRAPHY BY **SHELBY LISK**

PREVIOUS SPREAD: Curve Lake ricers paddle through a Manoomin patch. THIS PAGE, FROM LEFT: Ryerson Whetung (left) and his uncle Billy Whetung (right) float among the Manoomin on Chemong Lake; Ryerson's medicine pouch sits in the belly of his canoe, holding a tobacco offering.

EVEN WITH A BALL CAP ON, Ryerson Whetung still squints looking out over Chemong Lake in the intensity of the early-September evening sun. "Our waterways have never been surrendered," he says, as he makes himself comfortable in the back of his uncle Billy's canoe. Through the tall grass-like plants behind him peek glimpses of cottages on the shore across from Curve Lake First Nation.

As Ryerson waits for his uncle to join him, he quietly opens a leather pouch decorated with intricate beadwork. Removing a pinch of medicine and reaching down, he opens his hand to release an offering of asemaa (tobacco) atop the shimmering ripples, as small bugs dance along the surface of the water. "Our Ojibwe bands down here, we put [into our treaties] that we did not want a dwelling within 20 metres of the waterway, and that was to be able to protect the waters," he says, referencing Treaty 20, also known as the Rice Lake Purchase, signed in 1818. "Those treaties have been violated, because you can go to any lake in the Kawartha Lakes region and you can find a cottage, you can find a dock, you can find a boat house. You can find restaurants, nuclear plants and dams. You can find all this within 20 metres of the waterway. We are being stolen from by all of these entities that think that they have some rights in the waters."

> "**Every time we go and harvest Manoomin,** we are acting in resistance, we are acting in resilience, and we're thriving as a people."

He looks down to see the asemaa slowly sinking as sunlight glints through the clear lake, a beam illuminating the water to the aquatic plants below. This clear, shallow water is vital for the growth and survival of one of the community's most cherished plant relatives: Manoomin. "Without the land, without the water, without the animals and without the Manoomin, we're not Ojibwe people," says Ryerson. "Every time we go and harvest Manoomin, we are acting in resistance, we are acting in resilience, and we're thriving as a people."

Manoomin, also known as *Zizania aquatica* or *Zizania palustris* to scientists and as "wild rice" in English (although it is not a rice but actually North America's only native cereal grain), thrives in the shallow and slow-moving fresh waters of the Great Lakes region. Because Manoomin needs to be reseeded every year, it does best when it lives in relationship with human and non-human relatives that help to move the seeds around.

While communities have variations on the spelling of Manoomin (Manomin, Mnomin, Mnoomin), they all carry a similar translation. To the Anishinaabeg, Manoomin is "the good berry" or "the good seed" and is an important grain that they have cared for, relied on for sustenance and honoured in ceremony since their migration to the region thousands of years ago, when they came in search of the prophesied "food that grows on the water." Manoomin continues to offer a path for the Anishinaabeg today — now to a sense of belonging, cultural connection and fulfillment of their original instructions from the Creator to be caretakers of the land and waters. When they translate Manoomin as "the good berry," the "goodness" that the name refers to is the beneficial relationship to the Anishinaabeg and all their relations. They truly mean that this seed represents only goodness: for your body, for the animals and for the environment.

Billy Whetung points towards the Manoomin growing in the middle of the water, a patch he estimates to be about 180 metres wide, remarking that his Elders say there was a time when Chemong Lake used to be so full of Manoomin that there were only a few small paths through the plants, just wide enough for canoes to move through. "My Elder told me, from the beach, as far as you could look down this lake was rice." But the Manoomin was flooded and nearly decimated by the rising water levels that accompanied the addition of the lock and dam systems along the Trent-Severn Waterway. "My Uncle James [Whetung] travelled to Ardoch and got rice seed and reintroduced it to Curve Lake waterways about 40 years ago," says Billy, "and it's just now come back to the point where we can have a community harvest each year."

Adds Ryerson, "One of the big reasons why they [flooded], specifically these lakes, was a tactic by the government to get rid of the Indians. Because that was our main food source, and if we didn't have that,

Shelby Lisk (@shelbyliskphoto) is a Kanyen'kehá:ka artist, photographer, filmmaker and writer based in Tyendinaga Mohawk Territory.

Billy Whetung (OPPOSITE) knocks Manoomin from the stalks. **THIS PAGE:** Caleb Musgrave (RIGHT) carves a ricing stick. Manoomin (BELOW) is ready to be winnowed.

why would we want to live here?" If the water levels are raised before the Manoomin shoots poke out of the water, the plant doesn't have enough energy to grow through the water and reach the air. But once it passes the water's surface, in the "floating leaf" stage, around June, it needs air to continue growing, and if the levels are raised at this point, the plants will drown. Conversely, if the water gets lowered later in the summer, when the plants are standing tall, the stalks will fall over and possibly break.

A speedboat zooms past the men, rocking their canoe, but the relatives pay no attention as they talk and joke back and forth. Billy joins his nephew in the boat with the ease of an experienced canoer and takes up his position paddling, while Ryerson holds two cedar "rice knockers" or "thrashing sticks" at the ready. "Gathering," "ricing" and "knocking" are all terms used by "ricers." In Anishinaabemowin, "our word is bawaam," says Ryerson, explaining that it means he or she knocks rice. "You've got your ricing sticks, you're hitting that rice, and what's that sound you're hearing? BA-WAAM!"

As they glide through the Manoomin, Ryerson reaches behind with one arm, pulling a small bundle of the plant over their canoe with one wooden stick, using the other to tap, carefully knocking down twice — bawaam! bawaam! — on the bent stalk, scattering the ripened seeds around his feet in the bottom of the canoe. A few land back into the water for the animals to eat or to reseed the plant for future years.

Billy picks his canoe paddle up high out of the water, over the tops of the Manoomin stalks, taking care to disturb them as little as possible as he pulls the canoe slowly through the aquatic garden. The two men move back and forth, back and forth, until only the tops of their heads are visible, and then they disappear into the Manoomin entirely. Back at the shore, they bag up every last grain of Manoomin from the bottom of their canoe as the sun ducks behind the treeline, leaving traces of light pink just above the horizon and a nip in the air.

THE HARVEST SEASON begins as the Manoomin seeds turn from green and milky to a reddish-brown colour in the late days of August and early September. The plant ripens slowly

from the top of the seed head to the bottom, over several days or a couple of weeks, so this patch can be revisited in a few days to gather again. But the window for collecting Manoomin is short, typically only about two weeks long, and can be difficult for families to accommodate around the start of the school year.

The transmission of knowledge and seasonal access to the Manoomin harvest was greatly disrupted when Anishinaabe children started being forced to participate in the colonial school system. "Residential schools made it exceptionally difficult for families to pass down their plant knowledge and their plant teachings on the land and in season," says Brittany Luby, professor of history at the University of Guelph and a descendant of Niisaachewan Anishinaabe Nation in Treaty 3.

Settler colonialism brought the suppression of Indigenous hunting and gathering rights, along with growing human interference along waterways. These impacts, as well as climate change and invasive species, threaten the plant and have even caused it to disappear from certain lakes and rivers. Even still, every year in late summer, families in Anishinaabe-Aki get into their canoes to gather, honour and feast on Manoomin. And bringing in a canoe full of Manoomin is only the start of the work to prepare to eat, sell, share, trade and reseed the plant for future generations.

To the Anishinaabeg, Manoomin is "the good seed" and is an important grain that they have cared for, and relied on for sustenance.

THROUGH A CLEARING of trees off a dirt road in Hiawatha First Nation, Caleb Musgrave sits by a fire carving a cedar rice knocker, a basket full of Manoomin at his feet and a large kettle warming in the fire.

As part of his complex network of land-based knowledge, Musgrave has spent more than 15 years honing his skills in Manoomin parching, which he says is the most delicate step in processing Manoomin. "This batch that I have in the basket was gathered four years ago," says Musgrave. Dry Manoomin "can keep for a long time until you're ready to process it." After gathering, he submerged the bags of rice in water for a couple of days to kill off the rice worm moth that will eat away at it, and then laid the wet seed on a tarp, exposing it to sun and wind until it hardened and became tough enough to withstand the force of processing.

Clockwise from TOP LEFT: Caleb Musgrave demonstrates winnowing; ricers rock their mocs and dance to thresh the Manoomin; the Manoomin is ready to eat after a long day of ricing.

As Musgrave throws the seeds into the kettle, they have the colour and smell of a handful of straw or dried grass. He watches closely to see how the Manoomin moves, never looking away as he stirs it gently with a wooden paddle. As the tails start to get charred off and break down and oils are expelled from the seed, the Manoomin takes on a more fluid motion in the large cauldron and releases a rich nutty, oily smell. A good parcher must engage all their senses, observing how the seeds look, smell and move and continuously adjusting the temperature of the fire. Even the sound changes.

After the parching, children would often be the ones to lace on their moccasins and dance or jig on the Manoomin — stepping on the parched seeds to thresh them. The grains are placed in a shallow pit or hole in the ground lined with hide or a tarp and then stepped on until the friction loosens the inedible seed coat from the kernel inside. Then they are gathered up to be winnowed, and on a day with a nice breeze, the loosened husks and chaff will blow away, leaving just the edible seed, ready to cook and enjoy.

Luby emphasizes that in Manoomin camps, each community member

has a place, and children learn about their roles and responsibilities within the community and the ecosystem, in caring for the waters, plants, animals and future generations. Even something as simple as children's joy is seen as integral to their operations, as the sound of their laughter and play scares away larger animals like bears and keeps the community safe.

The intergenerational space also instills a sense of belonging; as children carry the knowledge that their ancestors have seeded and cared for the Manoomin, they see that they, too, will do so for future generations. "You can see people at different life stages contributing to their community, and you know you will always belong and have a role," says Luby. "How you participate may change over time, but for as long as you are in your earth body, you know you have something that you can give to your community."

Within that sense of community are also the non-human relatives that benefit from sharing their environment with healthy Manoomin patches, including many species of birds that feast on and help to spread Manoomin in their beaks and feathers as they travel to different waterways. In return, the plant provides protection, habitat, breeding areas and nesting materials. "Thousands of species are partially or tangentially dependent on Manoomin," says Musgrave. It also filters phosphates, nitrogen, potassium and other nutrients that flow from farmlands down into our rivers and waterways. Manoomin, says Musgrave, is "the kidneys and the liver of our waterways."

WHEN SETTLERS ARRIVED, they were threatened and taken aback by the independence and sustainable lives of the Anishinaabeg, fearing that there was nothing they could offer the people to motivate them to act in accordance with their religion, law and desires. Luby and her father, Allan Luby, who joined our conversation over the phone, have spent hours listening to stories about Manoomin from Elders in Niisaachewan. Allan recounts instances where a treaty commissioner said it was difficult to negotiate with Treaty 3 because of their abundant food supply. Harming the environment to starve Indigenous Peoples became a significant tactic of colonialism and land acquisition.

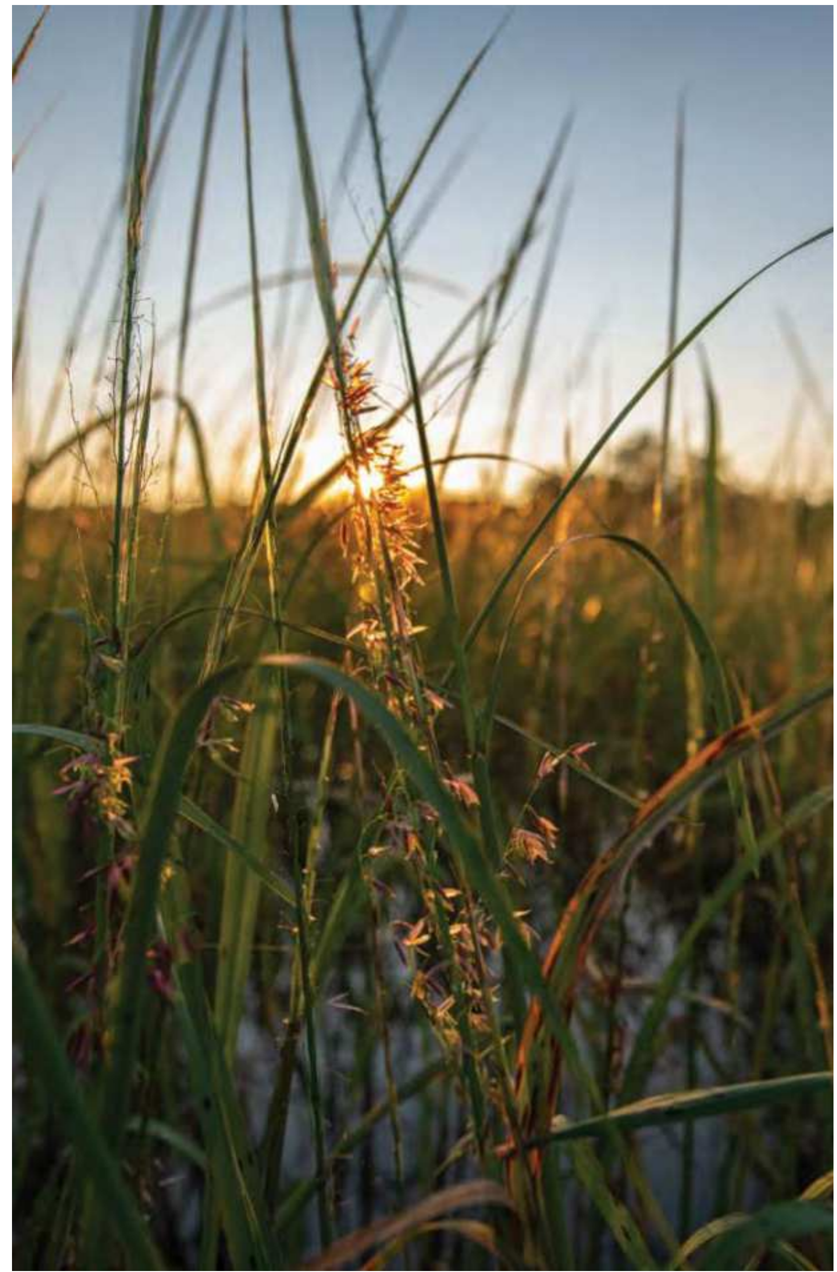
"We were, for a period of time, able to feed and to raise warriors to defend the territory. And when you jeopardize somebody's food supply, you jeopardize their ability to raise healthy families," says Brittany Luby. In 1873, when the community was negotiating Treaty 3 with the newly federated Canadian government, the leaders of Niisaachewan Anishinaabe Nation communicated their worry that food was becoming more scarce where it was once plentiful in the rivers and their wish that the rivers should be left as they were.

In the Trent-Severn Waterway, there has also been great cultural and economic loss to surrounding Anishinaabe communities. "Up until the completion of the Trent-Severn lock system, we had an average annual harvest of 10,000 bushels per year from Rice Lake alone. That's over half a million kilograms harvested annually, all done with canoes and ricing sticks," says Musgrave. "The financial independence and economic sovereignty of this community was stolen to build a lock system that was immediately obsolete when it was completed."

Despite Manoomin being such a delicate plant, Anishinaabe communities successfully maintained its ecosystem until settlers started to manipulate the waterways. "The oldest [Manoomin] fossil that I've heard of was located in northeastern Minnesota, and it dated back 10,000 years. So, it fits with our migration story," says Jeff Beaver, an avid ricer from Alderville First Nation who has been working on community Manoomin research for over 30 years. Archeologists have found evidence that people have been processing and cooking Manoomin for at least 2,500 years and that communities are still using many of the same methods to harvest, process and cook Manoomin today.

"Jeff Beaver is, for the Mississaugas of Rice Lake, the closest person we have to a ricing chief," says Musgrave. "When it comes down to Manoomin in this territory, I defer to Jeff for everything. If he says, 'don't pick in this area,' I don't pick in that area. If he

Curve Lake ricers (OPPOSITE) winnow the harvest together using a big tarp. **THIS PAGE:** the setting sun (TOP) peeks through ripened Manoomin; Jeff Beaver (BOTTOM) knocks rice into his canoe.



Jeff Beaver shows where the Manoomin used to grow around Alderville First Nation. (ABOVE); Beaver looks over Manoomin seeds (OPPOSITE), freshly sown for future generations.

says, 'go and gather over here next week; it'll be ripe by then,' guaranteed it's going to be ripe by then."

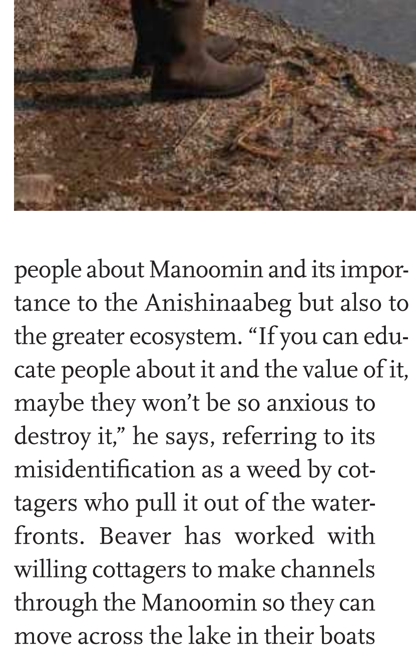
After moving around the country and working as a Parks Canada warden for 14 years, Beaver returned to Alderville in 1988 and became involved with Manoomin research before moving into full-time monitoring and management of the rice beds around 2008. He maps and restores the beds in the surrounding lakes and works with nearby schools to educate and offer students and community members hands-on experiences with Manoomin.

"We go around with a GPS unit, so as you paddle it's tracking you," says Beaver. He'll paddle around the perimeter of a rice bed so they can track which way it's spreading from year to year and reseed the beds in that direction. He also monitors the Manoomin beds to inform the community when it's ready to harvest. His restoration and monitoring work is funded within the community, something Beaver says is better than relying on provincial or federal government funding that might fluctuate or disappear from year to year, leaving them with missing data.

FROM THE BACK ROOM of his family's craft store in Alderville, Beaver pulls out old photos, newspaper clippings and maps from the archive he has compiled of community knowledge on Manoomin. On an old wooden desk, he unfolds a large map of Rice Lake, named for the Manoomin that used to be plentiful in the 28-kilometre-long waterway between Hiawatha and Alderville First Nations.

Someone has written 1938 on the map, but Beaver believes it could be older. "The shaded areas — that's where the rice was on Rice Lake," says Beaver, circling the large, dotted areas labeled "rice bed" with the end of a pen, "There were still 2,500 acres [1,011 hectares] left when this map was made. It wasn't long after that that it was all gone."

Before the Manoomin was decimated, people used to travel by canoe from all over to gather in Rice Lake. Beaver hopes to restore the rice beds to a state where that will be possible again. His other hope is to educate people about Manoomin and its importance to the Anishinaabeg but also to the greater ecosystem. "If you can educate people about it and the value of it, maybe they won't be so anxious to destroy it," he says, referring to its misidentification as a weed by cottagers who pull it out of the waterfronts. Beaver has worked with willing cottagers to make channels through the Manoomin so they can move across the lake in their boats with the least amount of disruption to rice beds as possible.



With his canoe loaded up in the back, Beaver gets into his truck, headed towards the water for another day of work. "Hopefully it hangs on," he says, looking up to the cloudy sky. "If we get a big thunderstorm now, a lot of wind, it will probably blow it all off. It's pretty delicate." He doesn't do much harvesting himself these days. The rice he gets from Rice Lake, he throws back in to increase the size of the patch. His goal is for there to be enough Manoomin in Rice Lake that all of the surrounding communities will be able to harvest there once again. "It's going to be nice if we get a full bed there. That might be about half a square kilometre in one spot, maybe a quarter in another. If we had that much rice, that'd be enough."

> **"If you can educate people about it and the value of it,** maybe they won't be so anxious to destroy it."

The effects of his work might not be seen right away, but it's a labour of love and care for the future generations in his community. "We get only 10 per cent of what's actually there, doing the two-stick method, so the rest of it just goes back into the water. That's your seed for the future," he says. "Not every seed comes up right away. They can lie dormant down there for a while, until the right conditions come along. Even if you don't see any rice this year or next year, you'll know it's all down there. Just wait for the right conditions to come along, and it'll come back."

TYONNHEHKWEN

THE LIFE SUSTAINERS

WEAVING TOGETHER INDIGENOUS KNOWLEDGES AND SETTLER WISDOM TO WORK WITH THE LAND THAT FEEDS US

BY **KATIE DOREEN** AND **J.R. PATTERSON**
ILLUSTRATIONS BY **CORRIE HILL**

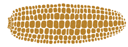
WE HAUDENOSAUNEE *say we descend from celestial beings. We're in relation with Elder Brother Sun — our Creator — as well as ancestral relatives who are the stars, Mother Earth and Grandmother Moon, who came to our world in her human form, carrying life in the water of her womb. Skywoman, as she was known back then, was a divine being who fell through a hole beneath a towering white pine in the Skyworld where, at the base, grew strawberries and sacred tobacco. As she plunged into the expansive darkness below, Skywoman grasped at the roots of the plants above, hands searching out any piece of home that she could cling to, bringing with her the seeds she would sow for humankind.*

Our planet, at that time, was wholly water, with no light from sun or moon in the sky. On a turtle's back, Skywoman danced the Earth into being — a turtle island for her descendants. And, for the second time, a hole opened up, and a girl fell from the spirit world into ours, from the water of Skywoman's womb to the turtle's back. When the girl grew into a woman, she was visited in the night by the West Wind, who would make her into the mother of creation.

Skywoman's daughter became pregnant with twins who would represent the eternal contention between good and evil. From their inception, these two beings fought inside their mother as each sought to dominate the other. When it came time to be born, the good twin chose to come out the usual way. But his evil brother was impatient. He tore his way up through his mother's body, killing her as he burst through her underarm.

But a mother's love is powerful. In the death of her human form, the mother's body became one with Turtle Island. Alongside her daughter's burial, Skywoman planted the seeds she had brought from the Skyworld, and plant life burst forth from her body, and she became Yethinihstenha tsi Ohwentsya:te, our Mother Earth, who continues to nurture life to this day.

Among the berries, the four sacred medicines and other plant life grew the Three Sisters. In time, the good twin instructed the sisters that they would be tyonnhehkwen ne ne áhsen nikontate'kén:'a — the three sisters who sustain life — once human beings came around. In turn, the people would follow their own instructions from the Creator: to take care of Yethinihstenha tsi Ohwentsya:te, to give thanks to all of creation and to maintain the natural balance between good and evil. Every living thing received a role in keeping peace on Earth.



In the credulous and expansionist decades following Canada's Confederation, when land was free and dreams were cheap, prospective homesteaders were coaxed west with promises of fat cattle, sunny days, happy families and the chance to run the latest plowing technology on mile-long furrows. If agriculture was the future, the plow was the spear tip of progress, wielding both axiomatic and societal power, entrenching the idea that if the value of soil — and civilization — was to work well, it should be well worked.

European settlers arriving in North America brought many novel things with them, but the concept of agriculture wasn't one of them. Haudenosaunee and Huron-Wendat cultivation of corn, beans and squash (collectively known as the "Three Sisters"), as well as sunflower and tobacco, on the shores of Lake Ontario and the St. Lawrence River long predated colonization of the Americas. Jacques Cartier, on the first recorded up-river voyage on the St. Lawrence River by a European in 1535, noted the "good and large fields of corn" being grown by the Haudenosaunee people living in what is present-day Montreal. *The Old Farmer's Almanac* still calls the Three Sisters "companion planting at its best," as the trio grow "symbiotically to deter weeds and pests, enrich the soil, and support each other."

Of course, left alone, the Earth has no trouble supporting all manner of flora and fauna. Agriculture is simply the process of managing that growth and of directing resources into plants and animals we want to use. Western farming practices have exacerbated that control, through a cycle of creation and disruption: a crop is planted into a prepared seedbed, nursed to maturity and harvested, after which the field is readied for another planting through tilling into the soil. Done to extremes, this works to the detriment of natural systems, leaving soil compacted, exposed to erosion and leached of nutrients. Some farmers hope to alleviate those effects and to change the agricultural question from "What is the soil worth?" to "How can I contribute to the soil's value?" One answer to that question is regenerative farming.

> "Farmers are going to do what farmers do until they **can do it better**."

Norm Lamothe, who farms near Cavan, Ont., is one of those farmers — and he looks to the forest for answers. "The forest doesn't need fertilizer," he says. "The forest can produce trees. It can produce nuts. It can produce the species that thrive and survive in that ecosystem without any external influences. We're trying to mimic as much of that diversity as we can."

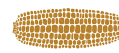
His family's 500-acre property, Woodleigh Farms, is a sundry of agricultural trappings: fields of corn, soybeans, wheat and oats are rotated over a layer of cover crop (plants sown not for harvesting but for secondary benefits), 100 Barbados black belly and Katahdin sheep graze on pastureland, their maple stands produce organic syrup, and their greenhouse supports a small market garden. Most recently, Lamothe introduced a biomass recovery service, turning unwanted trees into carbon-rich "biochar" that is worked into the farm's fields. While Lamothe is hesitant to ascribe a label to himself or his farm (unlike organic agriculture, regenerative has no standardized oversight or certifying bodies), his concentration on soil and ecological stability hews close to regenerative principles of producing crops in a way that allows natural systems to be retained and only minimally disturbed.

By using methods, some new, others time-tested, that prioritize soil health and maintain ecological biodiversity — zero-tillage, cover cropping, diverse crop rotations and livestock integration — regenerative farming aims to work with nature rather than wrestle against it. Think deep-rooted plants, multi-species fields, little to no bare ground and grazing animals — all of which can aid nutrient cycling, water filtration, erosion prevention and carbon fixing.

"We spent so much time in agriculture focusing on the bushels and the yields above the ground," Lamothe says. "But very little attention has been paid to what's happening under the plants."

Katie Doreen is Kanyen'kehà:ka from Kenhtè:ke (Tyendinaga Mohawk Territory). As a former teacher, she enjoys writing to help people understand environmental issues through a Haudenosaunee worldview.

J.R. Patterson was born in Manitoba and raised on a beef and grain farm on the Canadian prairies. His experiences as a farm labourer, factory worker and musician inform much of his writing.



Every year, Ó:nenhste, Corn, is the first sister to return — tall, slender and stoic, with silky yellow hair that glistens in the July sun. Her ambition to stretch for the sky sets her apart, earning her the posture of confident authority that eldest sisters tend to have. After all the growth she achieves, Ó:nenhste watches over her sisters from above and guides them to grow in their own ways. Her strong will and even stronger stalk make her a natural-born leader, helping and inspiring her sisters to fulfil their original instructions.

Ohsahè:ta, Bean, is the second sister. As a wandering spirit, she winds her way from place to place; opportunity to opportunity, blindly sending tendrils in every direction. But without someone or something to cling to, many of them would wither and die, wasting her precious energy. When, instead, she finds the eldest sister, her purpose to sustain life is emboldened. She clings to Ó:nenhste and, with the support of her sister, climbs to new heights. Using stalk as trellis, Ohsahè:ta will gift a bountiful harvest that far exceeds what she could have grown along the ground by herself.

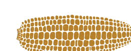
Ohsahè:ta has a secret gift, invisible to the naked eye. As the Three Sisters grow, they feed on limited nutrients in their little mound of earth. Ohsahè:ta, an understated mediator who builds connections in her travels, hosts bacteria in her roots. These bacteria can capture more nutrients from the air and return them to the ground below, fuelling the growth of our life sustainers, and maintaining the quality of the soil for the next growing season. Ohsahè:ta reminds her sisters to accept help when they need it and offer it when they can.

Onon'ónsera, squash, is the youngest sister, a sensitive and short-tempered girl who holds her mother the Earth close. She has unmatched love for her family, content to bloom where she is planted, rather than seek out the open sky like Ó:nenhste and Ohsahè:ta. Onon'ónsera makes the sisters strong as a unit, protecting them with all that she is. Her leaves grow wide and thick, shielding her sisters' roots from baking under

the heat of the sun and saving water in the soil from evaporating in the process. Her vines are often prickly, keeping ground predators away.

The Three Sisters know they are stronger together and rely on each other to best fulfil the responsibilities given to them by the Creator, proudly sustaining the Haudenosaunee for generations. In return, the Haudenosaunee uphold their vows to Mother Earth, protecting and respecting all of creation, including the Three Sisters. Our people offer greetings and thanks to those life sustainers in a daily prayer and continue to plant them together in one mound the way Creator instructed so long ago.

At the spring seed ceremony, the Haudenosaunee thank their plant relatives for sustaining them over the winter and humbly ask them to grow again that year. Each family takes home heirloom seeds to plant together in small mounds, with fresh thoughts of their responsibilities to care for the Three Sisters — to plant them in a good place, offer them thanks and nourish them so the sisters will want to keep nourishing us in the way they have always done.



Nourishment and good management of the soil are not always a certainty in agriculture. We need look no further back than the 1930s, with its dust storms and failed crops, to know that poor farming practices can turn good soil into what one Canadian farmer at the time called, a "dust-choked perdition… dried out, lifeless expanses of sun-smitten prairie." Alongside releasing stored carbon into the atmosphere, excess tillage leaves soil vulnerable to wind, sun and water, hastening erosion and the loss of nutrients. Chemical fertilizers swept away during that accelerated erosion and introduced into water systems have been linked to eutrophication, algal blooms and the death of aquatic life.

Corrie Hill (corriehill) is a self-taught artist whose work is deeply rooted in her Haudenosaunee identity. She is Kanyen'kehà:ka, Bear Clan, from Six Nations of the Grand River.

Blake Vince operates a 1,200-acre farm near the shores of Lake Erie, producing corn, winter wheat, soybeans and cattle. Vince chose to shift his oper-ation towards regenerative techniques after learning of the detrimental effects pollutants have on water systems. And he was no longer comfortable with his crops being put towards non-edible products like ethanol, plastic and biodiesel. "I recognized that I was growing commodities. I wasn't growing food."

Already a no-till operation since the 1980s, he switched to using primarily non-GMO seeds, planted cover crops, installed water monitoring equipment and purchased a small herd of grazing cattle. Like Lamothe, Vince is hesitant to ascribe himself any labels. "I don't want to hitch myself to a wagon. I'm not about buzzwords. I'm doing it because I believe it's the right thing to do. It makes sense physically, psychologically and financially."

> Readdressing **agriculture** is as much a **social change** as a technological one, as rooted in emotions as it is in economics.

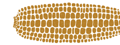
For many farmers across the Great Lakes-St. Lawrence watershed, finances were a consideration on par with the environment. Yet the annual cost of soil erosion in Canada from reduced crop yield alone is estimated to be in the billions, and the cost of fertilizers is substantial. Sébastien Angers, an agronomist in Nicolet, Que., says these costs could be minimized if we stop practising agriculture through an "empty space" mindset. In conventional agriculture, he says, "we destroy and create a vacuum into which the weeds come." It takes time and money to clear that space by applying pesticides and herbicides. Angers, who is also a farmer and practises regenerative techniques on the commercial pumpkin fields of his Ferme de l'Odyssée, says the ecological structure created through regenerative techniques allows farmers to limit inputs like pesticides and herbicides while buoying a crop's natural resilience.

Farmers lead chancier lives than most, their income relying heavily on structures far beyond their influence, including the global economy and the weather. It stands that farmers desire to control what they can, be it by using ever-improving mechanical equipment, irrigation practices, hybrid and genetically modified seeds, and chemical fertilizers and pesticides. It's through these techniques that the total yield for key crops like potatoes, corn and barley has increased more than twofold over the past 20 years. As long as high yields are the metric used to measure successful agriculture, conventional farmers have little reason to alter their methods.

While the commercial farmer bases their income on high volumes of product, and the organic by demanding a higher price, Angers thinks the value of a regenerative farm should be measured by what natural systems it is able to retain. While it may be a little esoteric to put a dollar price on biodiversity, water and soil health, it creates a major incentive for farmers. He is hopeful that as more farmers apply these techniques, data gleaned from their efforts can go toward creating roadmaps to help farmers optimize any particular crop they want to grow in concert with their farm's natural biodiversity. "A lot of people think I'm crazy," he said. "I'm just 25 years too early."

Though Angers' work may seem inchoate to some, it is an endeavour to modernize and scale practices that

have existed for millennia, an attempt to refashion techniques that were standard in pre-contact North America, such as the Three Sisters.

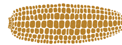


There was a dark time in Haudenosaunee history, when people forgot how to live in accordance with their original instructions. They were so preoccupied with warring against local and European nations, fighting for territory, power and even money, that they harmed the land in the process without care. In the new world, many Haudenosaunee stopped conducting ceremonies, taking care of their mother and even giving thanks to the life sustainers. The rest of creation began to take notice of their wicked ways.

Feeling that their hard work was unappreciated and unreciprocated, the sisters wanted to end their lives on Earth and return to the Skyworld. In a vision, they met a Haudenosaunee man called Kaniatario, Handsome Lake. He, too, was feeling hopeless after surviving a gruesome attack from a more powerful nation (America) and deeply mourned the state of the world in constant despair. Kaniatario and the Three Sisters prepared to journey to the other side of the sky together.

Before they could leave, Kaniatario saw that his people had forgotten their instructions and that was the reason for such bloodshed and fear. He convinced the Three Sisters to stay with him on Earth and vowed to re-teach his people the old ways. The sisters agreed, and Kaniatario fulfilled his promise. To this day, Haudenosaunee still plant the Three Sisters in one mound and offer them our thanks and appreciation.

As life on Earth changes rapidly and new environmental threats emerge, so too do our responsibilities to protect thenatural world that sustains us. When Haudenosaunee gather, we begin by bringing our minds together as one, akwé:kon énhska entitewahwe'nó:ni ne onkwa'nikòn:ra, to offer our thanks and greetings to the natural world as a collective voice. We recognize the work the life sustainers do to allow life to thrive and ask that they continue. Our stories teach us that everything we need is freely given to us by creation. Now we need to pull that wisdom from the old ways and use it alongside settler agriculturalists to collaboratively respect the land we've borrowed from future generations and ensure the life sustainers never want to leave us again.



There are some 190,000 farms in Canada, and of the roughly 62 million hectares they cover — about six per cent of the country's land base — it's unclear how many use regenerative practices. Régénération Canada, a non-profit that organizes workshops and connects farmers, scientists and consumers across the country, works directly with around 500 farms and indirectly with up to 3,000. It's worth mentioning that some regenerative techniques are used by self-styled conventional farmers; my father's farm and many other farmers I know in southern Manitoba use swidden agriculture (burning to promote growth), rotational cropping (moving crops from field to field), livestock grazing and multi- or polycropping without invoking the regenerative name.

"Farmers are going to do what farmers do until they can do it better," Lamothe says. "No one goes out every day and says, 'I'm going to go pollute the water,' or 'I'm going to taint the creek with my manure application.' They're going [to] do what they think is best given their circumstances and given their knowledge and practices, and to the best of their abilities. They don't want to lose money. They don't want to hurt the environment. They don't want to hurt animals. They don't want to endanger the population."

The disconnect between farmer and non-farmer today is large enough to render farming something of an abstract concept — something that happens *over there* under vague circumstances. Farmers are under pressure to bridge the gap between nostalgic perceptions and modern realities. "I remember my father-in-law saying that, when he was farming, it was 95 per cent art and five per cent science," said Lamothe. "Today, it's the complete opposite. We're looking at a system that's 95 per cent science and five per cent art. I don't wake up in the morning and look at the moon, smell the soil or listen to what birds are chirping to decide what I'm going to do that day or how I'm going to plant my crops. I'm looking at weather patterns and soil temperatures, at the soil analysis that I get from my GPS soil sampling points, at hybrid results from trial plots — and things of that sort to decide what kind of practices I'm going to use to grow my crops and improve my soil."

Technologies are moving agriculture towards a future where sustainability encompasses both economics and the environment. Recent innovations have included heavy machinery that is less disruptive to the soil, smart seeds that read soil composition, and the use of microbes that remove methane from the soil and others that fix nitrogen. Yet readdressing agriculture is as much a social change as a technological one, as rooted in emotions as it is in economics.

In his 1733 work "An Essay on Man," the English essayist Alexander Pope was already alluding to the battle between human desires and nature's capabilities, writing "Where grows? — where grows it not? — If vain our toil, We ought to blame the Culture, not the Soil."

Culturally, western nations have become accustomed to a worldwide agricultural system that prioritizes our eclectic tastes over the fair distribution of food globally, the treatment of agricultural workers and impacts on the climate. Grabbing a banana in Toronto in January today goes without a second thought. Philip Loring, the global director of human dimensions science for the Nature Conservancy's global science team, suggests that changing this mentality is not merely about the facts but about rethinking how a farm works. "What is a farm for? Is it for producing commodity crops? Or is a farm for producing food?"

Loring, whose Conservation of Change initiative looks to Indigenous cultures around the world for examples of how communities can work with nature to survive over hundreds of generations, points to agricultural systems like those of the Haudenosaunee, who, Loring says, practised "great diversity in the food system, seasonal eating and a willingness to give space for aspects of the envi-

ronment to heal." Many studies, including several involving Loring, have shown that traditional polycropping techniques, along the lines of the Three Sisters, are sustainable and cost-effective.

"Regenerative thinking," Loring says, "is asking people to realize that for us to get what we need, we need to leave space in that system for things that we don't need, that aren't for us."

"Many farmers now have been coerced onto a treadmill of supporting seed and chemical companies — and getting locked into bank notes and cycles of debt and finance. It's almost a subservience to the commodity market they are selling into. Imagine getting out of that!"

The dual role of farmers as both scion and arbiter of the social direction was explored by the American naturalist writer Aldo Leopold in his 1949 book *A Sand County Almanac*. Leopold appealed to farmers' sense of social responsibility when proposing the idea of a *land ethic*, which he envisioned as a widened notion of community, including the health of all soil, waters, plants and animals — and thereby extending to them the same social conscience we impart and expect of others to make coexistence peaceful and progressive. If not quite bestowing personhood upon creeks, dandelions and frogs, it was at least suggesting that minding them was an act of civility and good conscience.

As "ethic" implies, Leopold's philosophy tended toward the moral, not the practical: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community," he wrote. "It is wrong when it tends otherwise." Still, Leopold was not ignorant of the schism between a farmer's pragmatic approach to land and the public's remove from it, nor did he turn a blind eye to economics. Rather, he appealed to their "time, forethought, skill, and faith."

Because of consolidation and an aging farmer population, the number of small farms (those under 2,000 acres) in Canada has dropped steadily since 2001, according to the National Farmers Union, while large farms (those over 3,500 acres, roughly 14 square kilometres) have nearly doubled. There is more pressure on fewer people to produce the food we need. "It's very difficult to have a long-term vision," said Lamothe. "A lot of land is leased; a lot of land is about to change hands or has already changed hands. There's a tremendous generational shift." The National Farmers Union also reports that 60 per cent of farmers are over 55, and only 12 per cent of farms reported having a succession plan in place for what happens to that land next. Some would rather their kids not farm because of the tight economic margins and long working hours.

Agriculture is looking over a precipice. If it is true that the methods used by industrial farms today, whether it is pesticides or continual tillage, are indeed harmful then that, too, has meaning. Those who choose to farm regeneratively are making that wager and doing what they can to improve the land around them.

Being on the edge of an agricultural shift can be lonely, but Vince finds solace in the global regenerative community. "Knowing that I have like-minded people, not necessarily my immediate neighbours, but other people who make this transition and implement it with success, gives me the only validation that I need."

Lamothe waits ready for when anyone wishes to join them. "I'm very careful not to preach or push my practices or ideas on anybody. All I can do is hope that they see the success that we're having on our farm and approach us with a query, or inquisitive mind, about why we're doing it." Lamothe is the sixth generation to operate his family farm, and his goal is to leave the soil better than he found it. "I can't think of anyone that's going to be upset with me for having done that when I pass the farm on to, hopefully, another generation." ❁

Olympic-size pools of fresh water protected.

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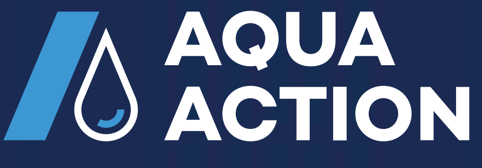

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MAKING history

AN EMBLEM OF COMMUNITY AND CONNECTION, THE CANOE HAS CARRIED HUMANS THROUGHOUT THE MAGNIFICENT GREAT LAKES WATERSHED SINCE THE TIME IMMEMORIAL.

BY **JAMES RAFFAN**

> "A journey by canoe along ancient waterways is a good way to **rediscover our lost relationship** with **the natural world and the Creator** who put it all together so long ago."
>
> — Bill Mason

IT GOES LIKE THIS: a young boy with big ideas sets his carving in the snow at the edge of a stream that flows into Lake Superior, and when spring arrives, the little canoe is swept into the stream and carried along on a grand adventure filled with twists and turns as it makes its way through the Great Lakes, up the St. Lawrence and, eventually, to the Atlantic Ocean.

So flows the plot of *Paddle-to-the-Sea*, a 1941 children's book by American author Holling C. Holling, which became a classic centred on the epic journey of a wooden canoe and paddler carved by an Indigenous boy and set free in Nipigon country, Ont. The story enthralled young readers and inspired a 1966 film adaptation of the same name by celebrated Canadian paddler, conservationist and filmmaker Bill Mason. That short film, nominated for an Oscar for best live action short film in 1968, went on to become one of the most requested titles of all time from the National Film Board library.

The collective stories of the canoes of the Great Lakes and St. Lawrence watershed are almost endless. They have much to tell us about both the natural and supernatural character of the watershed and its people. But these craft also illustrate so beautifully the transcendent power of the canoe to transport its occupants from one world to another. Whether it is a canoe that takes us back in time or one that allows us to leave one culture to understand another, whether it is a canoe used for commerce or one used for recreation, whether it is a canoe that takes us into the wilderness or through the middle of a metropolitan area, this simple vessel without decks is a truly liminal transportation device. In this rich riparian continent, in this singing river of nations, the canoe can take us exactly where we need to go — still.

It seems fitting to explore the iconic role canoes have played in the Great Lakes and St. Lawrence watershed by tying them to the storied waters travelled by the paddler, named Paddle-to-the-Sea, in his little canoe. Starting at the headwaters of Lake Gitchi-gami (Lake Superior) and meandering along to the Gulf of St. Lawrence, here is an ode to the canoe and its role in the lives and lore of the people who have lived along the watershed for millennia.

James Raffan is a prolific writer, speaker, geographer and explorer, as well as the author of numerous books. He is the former executive director of the Canadian Canoe Museum.

The 1966 film adaptation by Bill Mason of *Paddle-to-the-Sea*, highlighted the Great Lakes journey (MAP, ABOVE) of this carved canoe (BELOW). Students at Fort William First Nation near Thunder Bay, Ont., built a full-sized birchbark version (OPPOSITE) by hand.

LAKE SUPERIOR:

The canoe as a community builder

THE STORY of Paddle-to-the-Sea starts slowly. After leaping and plunging his way along engorged streams and rivers, the canoe with its little paddler, nicknamed Paddle, spends many days drifting around on the currents of the largest freshwater lake in the world, a vast expanse paddled for centuries by the original people of Canada who understood and respected its many moods.

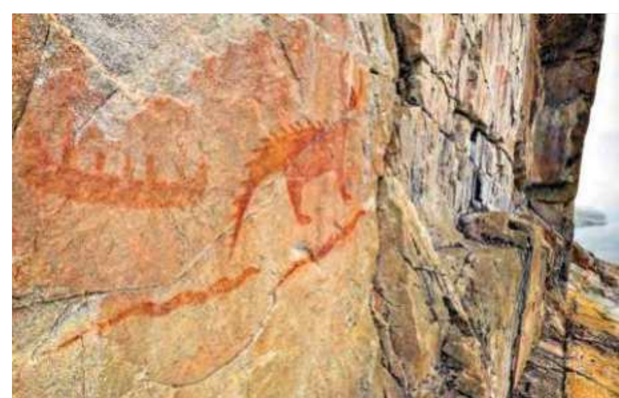
For these original canoe makers, the birchbark canoe was more than just a transportation device, and their connection to Gitchi-gami was far more complex than as a body of water that could be used to get from one place to another. And so, a few years ago, Gail Bannon, then the culture and recreation coordinator for the Fort William First Nation, decided the best way to engender understanding and pride among youth was to involve them in building an Anishinaabe birchbark canoe. Reclaiming this knowledge and practice would also allow the team of builders to revive their connections to this Great Lake.

In a cabin halfway up to the powwow grounds on Anemki-waucheau, Bannon oversaw a project that would produce wide-ranging and powerful benefits for those who took part. (Often translated as Thunder Mountain, Anemki-waucheau is a sacred site to the Anishinaabe. Settlers call the area Mount McKay in honour of a mythic Scottish fur trader known as a "founding father" of Thunder Bay.) She joined local teacher and canoe builder Darren Lentz, and the two spent several summers with students gathering the spruce root, pine pitch, birch bark and cedar needed to build a bark canoe.

Elders came to help and to share their knowledge and memories about the canoes. Once the raw materials were gathered, building the canoe required learning new skills, using traditional language and working together to make something both beautiful and useful. Most importantly, the time

PREVIOUS SPREAD: FOLLOW ME NORTH/ JESSE AND SUSAN VILLEMAIRE; THIS PAGE: GOH IROMOTO; FACING PAGE: MAP: CHRIS BRACKLEY CAN GEO; PHOTO REID MCLACHLAN

“Whether **flying** through the skies, **careening** through the rapids or **floating** across a placid lake, the canoe is a **potent symbol** to people living in the Great Lakes and St. Lawrence watershed.”



Canoes have always played an iconic role in the Great Lakes-St. Lawrence watershed. Gail Bannon (RIGHT, in orange), then the culture and recreation coordinator for the Fort William First Nation near Thunder Bay, Ont., decided the best way to engender understanding and pride among youth in the community was to involve them in building an authentic birchbark canoe (TOP LEFT and CENTRE); canoes figure prominently on the ancient paintings still visible on the cliffs at Agawa Rock on the eastern shore of Gitchi-gami (TOP, RIGHT); this dugout canoe (OPPOSITE) found in Lake Mendota, Wisconsin, is estimated to be 3,000 years old.

THIS PAGE, CLOCKWISE FROM TOP: GOH IROMOTO; GOH IROMOTO; GOH IROMOTO, ALAMY/INTERFOTO; GOH IROMOTO. OPPOSITE: © MARK HOFFMAN – USA TODAY NETWORK VIA IMAGN IMAGES

spent together allowed the youth to mark and celebrate the spiritual relationship between Fort William First Nation and the land and water. The simple and elegant conduit for this profoundly important coming together was, of course, the canoe.

EASTERN SHORE OF LAKE GITCHI-GAMI:

The canoe as a vision

POWERED BY THE WIND and currents, moving through the summer mists formed by warm, moist air over cold water, Paddle-to-the-Sea might well have passed underneath the 15-storey cliffs of Agawa Rock on the eastern shore of Gitchi-gami.

The fogbanks here still hold echoes of the visions of ancient inhabitants, for this area is a spiritual fasting ground, the cliffside pictographs depicting visions painted during vision quests. Canoes figure prominently among the more than 100 separate images rendered in red ochre on the granite. The biggest one, with six or seven paddlers, is tucked in behind the spiked tail of Mishi Pizhiw, the Great Lynx who is tied to the often-capricious moods of the lake.

Today, Agawa Rock continues to be a significant spiritual place for Anishinaabe. In his 2015 memoir, *The Reason You Walk*, Wab Kinew, now the premier of Manitoba, describes his own transformative visit here: “I had travelled to this place … for the same reason our ancestors had come there over many millennia: to fast, and to seek a vision.” Although he was drawn particularly to Mishi Pizhiw, “a supernatural creature that rose from the depths of proto-Anishinaabe subconscious to populate our legends, traditions, and dreams,” he was surrounded, in the sense that he was not alone, by rock depictions by the *odoodeman*, or clans — deer, bear, marten, bird, fish, loon, crane. These ancients journey here by canoe in perpetuity with anyone who seeks guidance from the rocks.

LAKE MICHIGAN:

The canoe as a modern icon

IN THE ORIGINAL STORY, Paddle makes it through an incredible series of hair-raising adventures before ending up in Sault Ste. Marie, where he is given to the mate of an ice-bound laker carrying iron ore and awaiting the spring breakup. The tiny canoe hitches a ride to the port of Gary, Indiana, at the bottom of Lake Michigan (Michigami).

Had Paddle shimmied up the shore a little way to the west, there is little doubt that he would have caught the attention of the legendary Ralph “Mr. Canoe” Frese at the Chicagoland Canoe Base. A blacksmith and canoe builder from the 1950s until his death in 2012, Frese did for canoes and canoeing in the United States what Kirk Wipper, the founder of the Canadian Canoe Museum collection in Peterborough, Ont., did for canoes and canoeing in this country.

In his shop at Chicagoland Canoe Base on Narragansett Avenue, Frese tinkered with all kinds of canoes, starting with birchbarks and moving to canvas-covered cedar craft and eventually to his own distinctive brand of faux-bark fibreglass voyaging canoes.

It was Frese who developed a proprietary way of printing fibreglass cloth in a birchbark pattern, saving countless birch trees while evoking the adventure and romance of the massive birchbark canoes of old. He would go on to organize re-enactments of the explorations of colonial traders, including the 1673 voyage of Louis Jolliet, a French fur trader, and Jacques Marquette, a Jesuit missionary, who canoed along with a number of coureurs de bois from Quebec to St. Ignace at the top of Lake Michigan. From there, they continued down the Mississippi on a quest to determine whether the great river really flowed all the way to the Gulf of Mexico. The traders made it as far as the present-day boundary between Louisiana and Arkansas before turning back for fear of running into the Spanish who were known to be in present-day Florida.

LAKE MENDOTA:

The canoe as a storyteller

LONG BEFORE Jolliet and Marquette mapped this winding route, it was traversed by members of the Siouan-speaking Ho-Chunk Nation and other original peoples of the region. Their traditional canoe pathway passed through Lake Mendota, which is now in the heart of Madison, Wisconsin.

In 2021, Lake Mendota's murky depths offered up confirmation of this long, long canoe history when recreational divers found a series of spectacularly old canoes buried in its silty bottom. The ancient canoes of Lake Mendota have much to teach us about the lives of the ancestors of the Ho-Chunk Nation who have inhabited this watershed since time immemorial.

The first canoe lifted from the depths proved to be a 1,200-year-old dugout canoe. Nearly a year later, divers painstakingly pulled a second wooden boat from the lake. This dugout was estimated to be 3,000 years old. At that point, it was the oldest of its kind ever discovered in the Great Lakes region. The Ho-Chunk people marked the occasion by building a replica of one of the ancient canoes from a local cottonwood log and, in 2022, embarking on a five-day journey to commemorate the tribe's history in the southern Wisconsin region.

Subsequent investigations uncovered nine more dugouts, the oldest of which dates back 4,500 years. The canoes' original builders likely buried them in lake sediments over the winter to keep the wood from cracking or warping and, over time, some canoes got completely covered and were replaced by newer builds.

The oldest canoe from the underwater find is made of elm wood, but the remaining 10 canoes in this cache are fashioned from a variety of woods — white and red oak, ash and cottonwood. Elm thrives in savannah environments, oaks like moist environments but are drought tolerant, ash prefers cooler conditions, and cottonwood grows best in sunny places near water. In other words, the wood used to make these canoes, which date from 800 to 4,500 years old, not only tells us where people were travelling but gives insight into how the climate changed over this 4,000-year timespan. The collection will also reveal clues as to how the hunters and gatherers of the Late Archaic period were able to work these hardwoods with fire, stone and bone gouges, copper knives and axes, and other tools and techniques of the day.

LAKE HURON:

The canoe as a commercial vessel

GETTING BACK to Paddle's route to the sea, the figure in the little-canoe-that-could eventually finds his way out of Lake Michigan and heads into Lake Huron (Gichi-aazhoogami-gichigami) and the Georgian Bay region.

This segment of Paddle's Great Lakes journey once formed part of the voyageur trail from the mouth of the French River along the north shore, past Manitoulin Island to the Soo. At the zenith of the fur trade in the 18th century, the freight and personnel of the Hudson's Bay Company were carried in 11-metre birchbark Montreal canoes or *canots du Maître* (after Louis Maître, a craftsperson from Trois-Rivières who made them). These hardy craft are depicted in the romantic paintings of Frances Anne Hopkins, who was roughing it in the Canadian wilderness some 60 years before the Group of Seven came along. Married to a man who worked for the Bay, she and her husband would occasionally join the voyageurs on their journeys, and Hopkins would sketch what she saw. When they returned to England in 1870, she used those sketches as inspiration for oil paintings that romanticized the voyageur lifestyle.

These handsome birchbark craft played a central role in most of Hopkins' paintings — crashing through rapids, being used as tents, being portaged along trails by just a few sturdy men and, loaded to the gills, carrying ten times their weight in passengers and cargo through stormy waters.

Part of the charm of Holling's Paddle character is the heroic aura the canoe commands, evoking all of the colour, vigour, courage and resilience of the storybook voyageurs. In truth, historical accounts tell us time and time again that it was a brutal life.

NIAGARA FALLS:

The canoe as connector to divine teachings

AFTER BOBBING his way down to the southern tip of Lake Huron, Paddle wends his way along the St. Clair River, makes a brief stop in Detroit, then heads across Lake Erie to Niagara Falls.

Canoes are tied to the instructional power of Niagara Falls through multiple teachings, including knowledge centred on the Thunder Beings and shared by Haudenosaunee Knowledge Keeper Leroy "Jock" Hill, a member of the Cayuga Nation and Bear Clan. "Inside the falls dwelt the Thunder Beings," he explained. "So our ancestors made an offering, and they interacted with them. They would appear sometimes, and they taught our ancestors things about what was expected of their behaviours. They were the mentors of our ancestors. And from time to time they would give a teaching."

The knowledge Hill shared revolves around a group of young men testing their courage by getting into their bark canoes in the river above the falls. Part competition, part test of courage, the goal was to see who could get the closest to the brink without actually going over. Of course, eventually — young men being young men and needing to

CLOCKWISE FROM TOP LEFT: LASALLE EXPEDITION II, RICH GROSS COLLECTION; SHOOTING THE RAPIDS, QUEBEC (1879) BY FRANCES ANNE HOPKINS; COURTESY JOHN HICKS; RALPH FRESE, RICH GROSS COLLECTION; LASALLE EXPEDITION II, RICH GROSS COLLECTION.

Chicago-based canoe builder Ralph "Mr. Canoe" Frese (BOTTOM LEFT) designed fibreglass canoes to look like the birchbark canoes paddled by voyageurs (BELOW, as depicted in a painting by Frances Anne Hopkins in the 1870s). Frese also organized re-enactments of the explorations of colonial traders (LEFT and MIDDLE LEFT); The Sunnyside Cruiser (BOTTOM RIGHT) was known as "the canoe that made Toronto famous." In 1910, Walter Dean of Walter Dean Canoes and Boats designed and built the Sunnyside Cruiser for recreational use along the waterfront. This photo dates from a 1907 regatta on the Humber River.

"Part of the charm of **Holling's Paddle character** is the heroic aura the canoe commands, evoking all of the colour, vigour, courage and resilience of the **storybook voyageurs**."

A series of photos and artworks gives a sense of the canoe's importance in the life and lore of the watershed. **Clockwise from LEFT:** A busy portage painted by Frances Anne Hopkins in the 1870s; Quebecois folk tale *La Chasse-galerie* reimagined by a Quebec brewery; the Canadian Canoe Museum; a scene from the short film *Paddle to the Sea;* Canadian canoe legend Bill Mason.

CLOCKWISE FROM TOP LEFT: FRANCES ANNE HOPKINS; COURTESY UNIBROUE; COURTESY CANADIAN CANOE MUSEUM; COURTESY MASON FAMILY ARCHIVES; COURTESY MASON FAMILY ARCHIVES.

"**The collective stories** of the canoes of the Great Lakes and St. Lawrence watershed are **almost endless**."

test fate to the max — someone went over. However, instead of dying in the maelstrom, the offending young man was saved by the Thunder Beings and placed back up above the falls, safe and sound. Other young men then followed the first paddler, thinking that paddling a canoe over the falls was a way to accrue some kind of divine power. That was, of course, until the Thunder Beings conjured a huge storm to gather everyone's attention.

Once the people were gathered, said Hill, "the Thunder Beings said, 'Your Creator has made every human being to have everything they need. You have courage, and you don't need to test that. You have courage because each of you have been given courage. This is foolishness you're embarking upon. From now on, we're not going to rescue you. If you go over those falls because you're testing something, then you should know that you're testing the Creator of all living things. You don't need to test them if you have courage. The Creator gave you courage. That's what the message of the Thunders was."

LAKE ONTARIO:

The canoe as a pleasure boat

PADDLE-TO-THE-SEA also plunges over Niagara Falls and survives to live another day, making his way to some calmer waters and a calmer pastime: pleasure boating. Paddling into Toronto, it's time to meet up with the canoes on Lake Ontario and a handsome watercraft billed in brochures as "the handsomest canoe in the world" and "the canoe that made Toronto famous." In 1910, Walter Dean of Walter Dean Canoes and Boats designed and built the 4.8-metre (16-foot) Sunnyside Cruiser for recreational use along the waterfront. A torpedo-decked, all-wood canoe with flush brass battens and closely spaced half-round ribs, the Sunnyside Cruiser was not only handsome, but it was also versatile — fast enough to attract the attention of serious canoe racers and stable enough to serve as a "girling" canoe for courting couples who wanted to escape the glare of their parents' gaze by paddling into the shadows of the weeping willows overhanging the Toronto waterfront.

In many ways, the success of Walter Dean's Sunnyside Cruiser was powered by the dramatic growth in the popularity of canoeing as a sport. The Lachine Boating Club, Longueuil Boating Club, the Grand Trunk Boating Club and the Point-Claire Boating Club were founded between 1863 and 1879, while the Toronto Canoe Club launched in 1880 and the Ottawa Canoe Club in 1883. Physical fitness was de rigueur and both recreational and competitive canoeing took off. Some competitors jumped aboard so-called "war canoes" that accommodated 15 kneeling paddlers, while smaller wooden canoes like the Sunnyside Cruiser could hold single racers, as well as teams of two and four.

THE GULF OF ST. LAWRENCE:

The canoe as a supernatural being

AS PADDLE bobs atop the waves in the mighty St. Lawrence, getting closer and closer to his destination, this tale must also conclude with one final storied canoe. It is the flying canoe in the Quebecois folk tale La Chasse-galerie.

This fanciful tale, which dates back to the era of lumberjacks and voyageurs, revolves around a group of lonely lumberjacks in the *pays d'en haut* who want nothing more on a New Year's Eve than to be with their loved ones back in the St. Lawrence River valley. As the story goes, they make a deal with the devil to make a one-night return trip in a bewitched canoe that, at the devil's command, can fly like a zephyr through the night sky.

Of the many versions of the story, the best known is by Honoré Beaugrand, who published his take on the tale in 1892. It had a happy ending. The lucky lumberjacks, despite having a bit too much to drink, manage to speed their way back home before the next dawn without blaspheming or touching any crosses atop church steeples. The devil therefore lets the men return to the logging camp unhurt, their souls intact.

Subsequent imaginings of this bewitched canoe have been rendered by numerous artists, never more vividly than on the label of Maudite a strong beer cooked up by Unibroue, a boutique brewery in Chambly, Quebec. I suspect this might have been a tipple that Holling Clancy Holling's Irish-French-Canadian dad might have enjoyed, particularly the flying canoe on the label.

WHETHER FLYING through the skies, careening through the rapids or floating across a placid lake, the canoe is a potent symbol to people living in the Great Lakes and St. Lawrence watershed. It has become intertwined with their history and their spirituality, their work and their leisure. It is an icon.

But even as the canoe continues to inspire our imaginations, Paddle's epic adventure must eventually end. In the National Film Board adaptation by Bill Mason, Paddle-to-the-Sea speeds past into the Gulf of St. Lawrence, where he rides the currents to a lighthouse by the edge of the sea. There, he is picked up by the lighthouse keeper. The story ends as the lighthouse keeper repaints the sun- and sea-bleached carving, then sets Paddle-to-the-Sea free once more to travel the great currents of the oceans.

"Who knows how far you may go," intones the narrator. "Who knows how far you've come. That secret is known only to you and the boy who dreamed a dream and made him one winter long ago."

Jeff Ridal

Combining traditional and scientific knowledge at the River Institute in Cornwall, Ont.

INTERVIEW BY **JAMES IVISON**

He's passionate about science, laser-focused on fresh water and committed to working collaboratively to make the St. Lawrence River a cleaner and healthier place for all living things. Jeff Ridal is the executive director and chief research scientist at the River Institute, a non-governmental organization based in Cornwall, Ont., that uses the St. Lawrence River as its natural laboratory, doing scientific work that contributes to a greater understanding of how large river ecosystems work. The institute, founded in 1994, uses a two-eyed seeing approach to its work, taking into account western scientific knowledge and the traditional knowledge of the nearby Mohawks of Akwesasne. Ridal, who has been with the institute for three decades, grew up in Cornwall and has always had a relationship with the St. Lawrence River. Here, he talks about the body of water so close to his heart.

On how it all started

I joined the institute in 1995 as its first research scientist. There is a long history of heavy industry along the St. Lawrence, which has worsened the water quality and affected many aquatic species. When the institute first started looking at the river, we saw there was a lack of data on these issues [affecting the flora and fauna]. We said, "We need to do something about that!" The institute provided me with a great opportunity to work on research that is really beneficial to the St. Lawrence and to the Cornwall community. I still swim and sail in my part of the river, so it remains very relevant to me.

On studying the river

From the get-go, the partnership with the Mohawks of Akwesasne has been incredibly enriching. They were extremely involved in the founding of the institute, and provided a lot of the philosophy that informs how we [the Akwesasne community and Institute researchers] collaborate. Our partnership is based on the concepts of mutual respect, equity and empowerment. If we [the scientists] get an idea for a project, we don't just go ahead with it and then show it to the people of Akwesasne once it's finished. When we have an idea, we bring it to them early, so that they're part of the whole process. We call this co-development — co-development tries to ensure that everyone is working on a project as equals.

Jeff Ridal (pictured, in three settings) is the executive director at the River Institute. The institute has taken a two-eyed seeing approach to understanding the ecosystem of the St. Lawrence River since its founding in 1994.

COURTESY RIVER INSTITUTE

On the health of the river

When you ask scientists about the river's health, they usually say, "It's complicated." The indicators tell us that some parts of the river are improving, while others are under stress. When I consider the health of the river, I ask myself, "Are all my relations whole?" This is something that Akwesasronon say — that we should consider all our relationships with the natural world. We recently published a really positive report about the numbers of yellow perch in the river. These fish are at similar levels to 100 years ago. This is great, because it means the river is returning to its natural form. But other species, like American eels, aren't doing so well. American eels face many threats in the St. Lawrence, including hydroelectric dams. When eels migrate out of the river to spawn, they pass through the turbines, which kill about 40 per cent of them. Are all my relations whole? Are we doing all we can for those eels? I would say not, in this case.

On the future of river work

There are a variety of career paths in environmental conservation. At the institute, some people do communications or run education programs. Others work in the field collecting data or in the lab analyzing that data. We're really excited about our plans to build a lab dedicated to analyzing environmental DNA. eDNA allows us to take a sample of river water, process it through an instrument that amplifies the DNA, and, from there, we can see every species that was in that water. This allows us to fill in a lot of data gaps, especially for species that are hard to find. But this science is just starting. There are so many new technologies currently being developed that we can look forward to.

The good place

Profiling four organizations dedicated to making meaningful change around the watershed — and how to connect and volunteer

INTERVIEWS BY **JAMES IVISON**

1. GEORGIAN BAY MNIDOO GAMII BIOSPHERE

Nicknamed the sixth Great Lake, Georgian Bay encompasses stunning pink granite shorelines, a scattering of some 30,000 islands and pristine forests and wetlands that are home to more than 840 native plant species, 170 types of breeding birds, 44 mammal species and 34 species of reptiles. The freshwater ecosystems of Georgian Bay are integral to the health of the Great Lakes basin.

But for Becky Pollock, executive director of the Georgian Bay Mnidoo Gamii Biosphere, Georgian Bay is, simply, a uniquely beautiful area that must be protected for future generations. Her grassroots non-profit focuses on protecting the lands and waters along the east coast of Georgian Bay, an area designated by UNESCO as a biosphere reserve. As much as it is an important ecosystem, Georgian Bay is also frequented by boaters and anglers, hikers and kayakers. With that being the case, Pollock says her organization knows it must strike a balance between nature and the people who want to enjoy it. "Our focus is on conservation of biodiversity but also on community development and sustainability."

Interested in helping out? Many youths monitor wild animals and plants in the area. Hands-on workshops are another popular way to help out. "You can learn how to build bat boxes or turtle nest protectors," says Pollock.

The Georgian Bay Mnidoo Gamii Biosphere collaborates with the seven First Nations in the biosphere. One initiative is the Georgian Bay Anishinaabek Youth, which builds community and cultural connections. A birchbark canoe building event in 2019 involved more than 700 community members. "Every year, the members take a trip with this canoe," says Pollock.

The charity also supports education initiatives organized by biosphere supporters throughout the region. One example is the Georgian Bay Youth Climate Collective. Members of the collective have travelled to local elementary schools to talk to kids about the importance of protecting the biosphere.

"Youth are absolutely critical," Pollock says. "They're the ones who are going to decide the future of the biosphere."

2. BIRDS CANADA
GREAT LAKES MARSH MONITORING PROGRAM

Small commitments can lead to big impacts. All volunteers with the Great Lakes Marsh Monitoring Program need to do is get outside, enjoy nature and collect a little info about the birds and frogs they see. Most volunteers pitch in to monitor a specific marsh in or near their community — there are 6,500 survey stations across Ontario — recording their observations on the flora and fauna. The data these community scientists collect helps researchers better understand and protect the Great Lakes.

"By tracking the number of birds and frogs in certain wetlands, we'll see how abundant these species are and how healthy the wetlands in general are," explains Doug Tozer, the program's lead scientist. Tozer recommends working in pairs. "It's fun getting out and doing this stuff together." The information they collect can make a huge difference — Tozer notes that western chorus frogs were identified as threatened in Canada almost solely based on program data.

Every contribution helps. "Even your one station can be important on a local scale or on a Great Lakes basin-wide scale. We might use your data to show that marsh's worth in the face of, say, a housing development in the field adjacent to that marsh. On the other hand, we might also combine everybody's data to do analyses across the whole basin. It could be your data that helps scientists protect a certain species."

3. RIPARIA
SCIENCE PROGRAM FOR YOUNG WOMEN

"Land and water are incredible teachers that have a lot to share with us," says Dalal Hanna, co-founder of Riparia. "But unfortunately, the western education system doesn't always allow learners to spend time with these teachers." This is something Hanna and co-founder Andrea Reid are rectifying through Riparia, an annual week-long science program for women age 13 to 19. Every second summer, it takes place on the Poisson Blanc Reservoir in Quebec.

The free program combines paddling trips with hands-on learning. "Land-based learning centres the relationships between Indigenous Peoples and the lands and waters that learning takes place on," says Hanna. "This means spending time discussing the deep-time history of the places where we gather, as well as inviting local Indigenous Elders and knowledge keepers to join our programming."

It also means actively decolonizing science. Reid, who is Nisga'a, leads a fish dissection that diverges greatly from the western education model. Reid speaks about her nation's connection to fish, and the science they've developed over millennia to sustainably steward the fish of the rivers where they live. "And then we take these fish we've dissected, filet them and enjoy the gift of these fish together," says Hanna. It's just one of the learning experiences that makes Riparia a one-of-a-kind program.

4. A GREENER FUTURE
LAKE ONTARIO LITTER CLEANUPS

"We have a serious waste issue in Canada," says Rochelle Byrne, founder of A Greener Future, a non-profit that organizes litter cleanups along the shores of Lake Ontario. Every year, A Greener Future brings together volunteers and environmental experts to pick up trash that would otherwise end up in the lake.

"When you come together for a litter cleanup event, you can see the garbage that you picked up, so you know you made a difference — it's a tangible way for people to understand their role in protecting the environment," says Byrne, adding that participating in a cleanup event is also a great way to meet others who care. In 2024, A Greener Future organized 359 cleanups in hundreds of locations.

"It's a fun opportunity to come out with your friends, do something good for the environment and, if you're in high school, also check off those community service hours. We've had a lot of students that get all of their hours done with us in one summer," says Byrne.

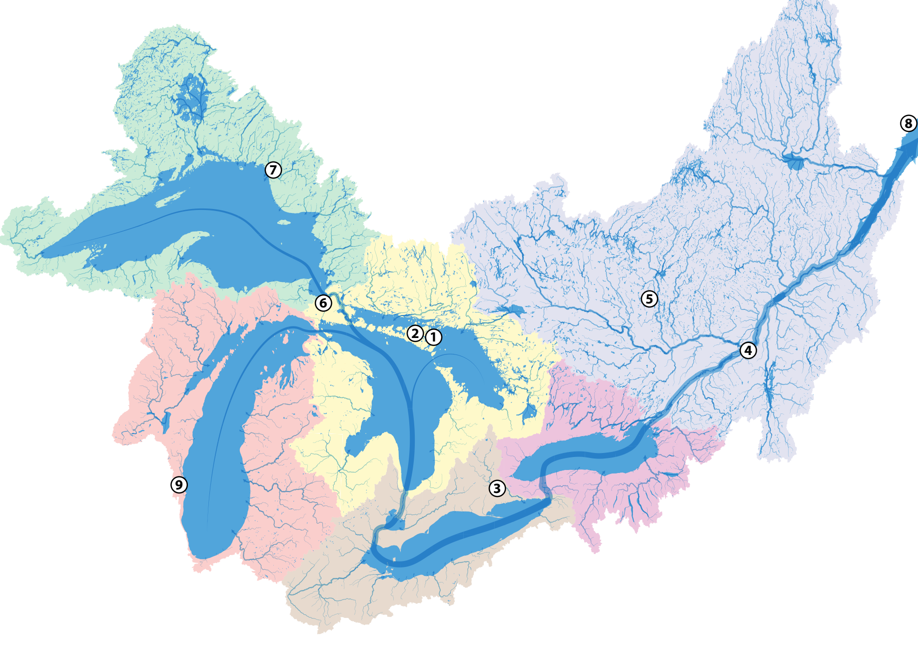
Since 2014, volunteers have picked up more than seven million pieces of litter. The organization's also raises awareness of the need to avoid accumulating waste in the first place. "During our events, we talk about waste reduction and limiting our plastic use; we have petitions that people can sign to advocate for the health of the Great Lakes and the planet," says Byrne.

Honouring our water guardians

Introducing the Shared Circle, nine Biinaagami collaborators who are committed to sharing their knowledge and experience to help *Canadian Geographic* and Swim Drink Fish illuminate the lands and languages of the largest freshwater ecosystem on Earth.

INTERVIEWS BY **MEREDITH BROWN**

BIINAAGAMI IS ROOTED in collaboration, bringing together storytellers, Indigenous leaders, educators, scientists, artists, filmmakers and change-makers to protect the lands and waters of the Great Lakes–St. Lawrence watershed. Knowing that we all share in the responsibility to protect the lands and waters within the watershed, members of the Shared Circle have been sharing stories about their powerful connections to this water. Here are excerpts from interviews with four members of the Shared Circle — and a map highlighting their ties with Nations across the watershed.



Biinaagami collaborators (left to right) Meredith Brown, Patrick Madahbee, Kahsennenhawe Sky-Deer, Linda Debassige, Katie Doreen and Mark Mattson on a Giant Floor Map of the Great Lakes-St. Lawrence watershed.

1. PATRICK MADAHBEE

Aundeck Omni Kaning
Anishinaabek Nation
Manitoulin Island

I've been on the water around this area, the North Channel, and Georgian Bay, part of Lake Huron, all my life. I've been on the water since I was five or six years old. And very early, my uncles started teaching me how to respect the water, drive a boat out there and fish, show me where all the spots were, where the shoals were. I continue to be on the water every year; it's one of my favourite places to be. It's just so peaceful out there — I see wildlife of every kind. Eagles, otters, fish swimming below, beavers, bears — there's all kinds of wildlife out there. Late April and May is, for me, the nicest time on the lake. It's not that hot yet and the bugs aren't out as much. And it's a good time to catch the fish because they're very firm. The water's still pretty cold. It's nice to be out there in the summer, too, but I prefer the spring and the fall fishing. The best of times are when I'm out in the lake fishing with my daughter. She's very competitive. She likes to beat me — to out-fish me — but she doesn't do it too often.

2. LINDA DEBASSIGE

M'Chigeeng First Nation,
Grand Council Chief,
Anishinaabek Nation

The water body that I have a connection with is Lake Huron. Manitoulin Island is in the heart of Lake Huron. It's where I grew up learning how to fish, skating on the lake, ice fishing and spending a lot of family time. I also grew up listening to the stories that are told during the winter months. The Great Lakes as a whole was always important to my family.

My ancestors came from what is now known as the U.S. — pre-contact, pre-confederation, they traveled through Lake Superior through Sault Ste. Marie (Bawating) and landed on Manitoulin Island. My early memories include learning our history and way of teaching through oral knowledge and oral history as to how the Great Lakes were essentially the biggest waterway for us. There were no highways back then. The Great Lakes were central.

3. KAHONTAKWAS DIANE LONGBOAT

Six Nations of the Grand River,
Mohawk Nation

I feel so heart-filled and connected to the Grand River. It is the river that runs through my community and it is the river that we leave medicine in as we do healing ceremonies for the water. Over time with our healing ceremonies for the water, prayers for the water, offerings put into the water, we have seen such a beautiful transition to healthy water. As a child growing up in the 1950s, we did not have many cars in our community and so often when people wanted to visit or they wanted to go anywhere, we would just walk. We'd walk down hot, dusty country roads. I remember as a child walking a couple of miles to get to the river and finding a place along the riverbank in which we could just jump in to cool off. In my later years, we would canoe on the river and it was such a beautiful experience.

4. KAHSENNENHAWE SKY-DEER

Kahnawà:ke Kanien'kehá:ka

Our people historically were tied to the river. It was right there in our backyard. The building of the St. Lawrence Seaway cut us off completely from the river. Now there's a channel that runs through our backyard that ships traverse daily and we've noticed significant changes to the water. I'm a fisherwoman. I've been fishing since I was a young girl. I still love to go fishing, but it has changed for me now. I seek other bodies of water to fish in because you can't catch the same kind of perch or rock bass or sunfish that we used to find. They are being replaced by round goby, which are an invasive species. The water is dirty. We can't see to the bottom.

A whole lifestyle and a connection to the water has been lost forever. I was lucky to get to know all four of my grandparents and to get to hear their stories. They remembered what it was like before the Seaway came. When we hear those stories we feel the pain of our grandparents and their parents and those generations before them. I always tell young people you don't have to be a politician, you don't have to be a great leader to be somebody who wants to take initiatives to get involved and to leave a lasting impact or a legacy. You have a short time here on Earth — what are you going to do and how are you going to make it count? That's what my time here revolves around.

OTHER MEMBERS OF THE SHARED CIRCLE

5. SIMON BRASCOUPÉ

is Anishinabeg/Haudenosaunee, Bear Clan, and is a member of Kitigan Zibi Anishinabeg First Nation. He is the acting president and chief executive officer at the First Nations Education Administrators Association.

6. WHITNEY GRAVELLE

is a citizen of the Bay Mills Indian Community "Gnoozhekaaning." She is president of the executive council on behalf of Bay Mills Indian Community, sits as a commissioner on the Michigan Advisory Council on Environmental Justice, and on the board of directors of the Inter-Tribal Council of Michigan.

7. DUNCAN MICHANO

is the Chief of Biigtigong Nishnaabeg, an Anishnaabe First Nation whose traditional territory lies on the northern shore of Lake Superior.

8. GHISLAIN PICARD

is an Innu from Pessamit and recently retired as the Chief of the Assembly of First Nations Quebec-Labrador.

9. BREE BZDAWKA

is an enrolled member of the Mashkiiziibii (Bad River Band of Lake Superior Ojibwe) and a descendant of the Ho-Chunk, Menominee, and Oneida Nations of Wisconsin. She is from the thunderbird and deer clans and grew up on the Oneida Reservation.

A MOSAIC OF WETLANDS, forests and rock outcrops that look like they were carved by giant claws: that's how Steven Kell describes the landscape along eastern Georgian Bay. The head biologist at Shawanaga First Nation helps administer the Indigenous Guardians program here. There are more than 200 Guardian programs across Canada, with Guardians acting as caretakers of their lands and waters. The Shawanaga First Nation community is also working to establish an Indigenous protected and conserved area, which would see Indigenous laws, experience and knowledge at the forefront of environmental protection. Shawanaga's Guardians are called the mnisinoog,Ojibwe for "warriors for the bay." These are just three of the many activities they would be involved with over the course of a year.

A bird's-eye view shows the rocky outcrops that the head biologist at Shawanaga First Nation describes as looking like they are "carved by giant claws." Guardians, who act as caretakers of the land and water, are shown helping with the moose hunt (INSET).

SPRING - WALLEYE HATCHERY

Spring is spawning season in the waters of the Great Lakes watershed, and a Guardian might start their day by helping out at Shawanaga's walleye hatchery (walleye were once abundant in Georgian Bay, but stocks have declined due to overfishing, human alterations to the waterways and the introduction of invasive species). This hatchery was launched in 2002 to give walleye a helping hand. During the spawning season (April and May), hatchery workers gather eggs from the Shawanaga River and bring them to the hatchery. The juvenile fish are reared at the hatchery before being released back into the river. If an Elder knows the Guardians are at the river, they might receive a call asking if they can bring back a fish or two for lunch. By stocking walleye through the hatchery, Shawanaga's community members can harvest fish while maintaining walleye populations at sustainable levels.

SUMMER - WOLF TRAPPING

Next, it's time to check on the wolf traps. Trapping might take place in the late spring through fall, when it is easier to travel the land. Guardians have confirmed the presence of the eastern wolf, a species at risk, in Shawanaga's territory and are working to learn more about the elusive predator. How did they do this? Rubberized leg traps! Once the traps are set, Guardians check them daily. A trapped wolf is tranquilized, and Guardians work quickly to collect blood and hair samples and put on a non-invasive tracking collar, which is designed to fall off after around 16 months. When the wolf wakes up, it is released, and its collar begins transmitting precious data on its life and travels.

FALL - YOUTH HUNT

Autumn brings the week-long community youth hunt, when adults take youth out onto the land to hunt for deer and moose. Each day, youth "push the bush" — they form a moving wall, walking through forest and wetland, yelling and blowing whistles. In doing so, the youth flush deer and moose toward the waiting adult hunters. Later, hunters show youth how to cut up the animals and prepare the meat. That meat is shared with the whole community, making for a sustainable harvest. Guardians chip in to make sure the hunt runs smoothly. They might lend a hand hauling a moose out of the bush, butchering the animals or driving kids home after a long day on the hunting grounds.

COURTESY STEVEN KELL

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Honouring the Great Lakes

NATASHA DONOVAN

Christi Belcourt

The Métis environmentalist and artist on how the north shore of Lake Huron has shaped her worldview

For the past 25 years, I have lived on the north shore of Lake Huron in Anishinaabe territory. The landscape here is very rocky, with lots of lakes, islands and connected waterways. There are blueberries and junipers, big pines and birch trees. This is also maple sugar country — the Anishinaabeg have done maple sugaring here since the beginning of time. The waters are filled with all sorts of life — water snakes and turtles and big fish like muskie and sturgeon, pike and walleye — and the air is fresh. Spending time on these lands and waters has given me a well-rounded education that came straight from the water and the plants. It's not from a position of studying them; it's from a position of respecting them and allowing them to teach us. I spent years with my nose to the ground, looking at all the plants and really getting to know them. I started to understand their medicinal properties and learned their Indigenous names and how they're used in ceremonies, as well as their relationship with animals and insects.

Living here has allowed me to understand the importance of fighting for this Earth, fighting for all of the species and being an unapologetic environmentalist. We owe everything to the Earth. We owe everything to the water. We owe everything to the plants. And we don't revere them enough. The north shore of Lake Huron anchors me and grounds me. It reminds me that the Earth is powerful and able to heal itself. A love of place makes you, by nature, a land and water protector.

—as told to Sarah Brown

The north shore of Lake Huron is within the traditional territory of the Anishnaabeg, within the Robinson-Huron Treaty territory.

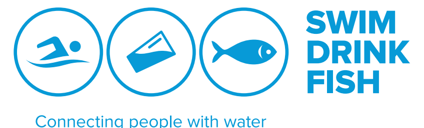
Some WATERBODY, somewhere, is part of who YOU are.

PHOTO BY: ALYSSA BARDY

The watermark project collects stories of **water** and **connection** from across the world.

Learn more at
biinaagami.org/watermark-project

SHARE YOUR STORY!
HELP PROTECT THE WATER YOU LOVE



Travel back in time as the Grandfather Thunders and giant serpents collide in the Haudenosaunee story of how Niagara Falls came to be.
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