

# ROOT & STEM

## Climate Conscious: Supporting a Sustainable Future

### A JOURNEY FROM PLIÉS TO PANELS

Melina Laboucan-Massimo's  
Path to Clean Energy

### FRAMING THE LAND

Art and the Natural World

### FROM OLD-GROWTH RAINFORESTS TO ARCTIC SEA ICE

Indigenous Leadership for  
Conservation and Reconciliation

ROOT & STEM



# PINNGUAQ LIFE CYCLE

Pinnguaq follows a life cycle model to support the core phases of a person's learning journey in STEAM education. We strive to provide educators and students with opportunities and resources each step of the way.



To learn more about what we do, visit our website at

[pinnguaq.com](https://pinnguaq.com)

# Contents

## 5 Featured Contributors

## 6 Guest Editorial: A New Normal in the North

*Caroline Whittle*

## EXPLORE

### Student Spotlight

## 8 Resilience in the Wild

*Somaya Salama*

## LOOK

### STEAM Stories

## 11 Supporting STEM in Remote Regions

*Sharon Aschaiek*

## 12 Sustainable Artistry Blooms in Kawartha

*Warren Frank*

## DISCOVER

### Decoded Technology

## 14 Take Samples, Make Change

*Chloe Phillips*

## CREATE

### Artistic Showcase

## 16 Naturally Ink-quisitive

*Bonnie Schiedel*

## MEET

### Advocacy Action

## 18 A Journey from Plis to Panels

*Karen Pinchin*

## 20 A Conversation on Climate

*Karen Pinchin*

## COMIC

## 22 Obnoxious Fumes

*Kevin Frank*

SPRING 2024

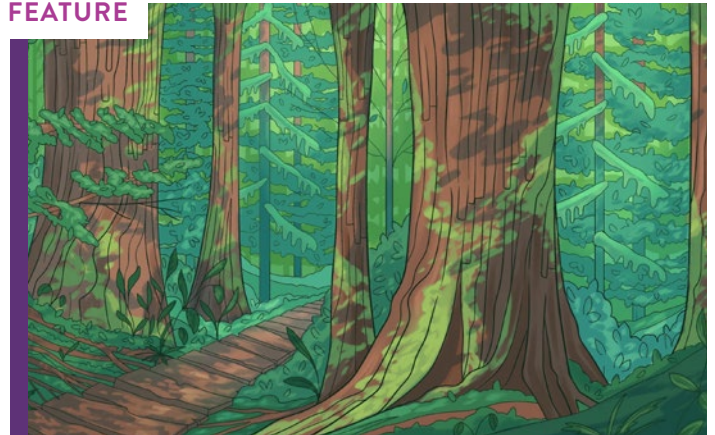
## FEATURE



## 26 Framing the Land

*Sofia Osborne*

## FEATURE



## 33 From Old-Growth Rainforests to Arctic Sea Ice

*CarolAnne Black*

## EDUCATOR RESOURCES

## 38 Digital Kit

Links to additional content and online resources

Flip It!

Flip the cover of this issue upside down to reveal a different world



# ROOT & STEM

## ABOUT PINNGUAQ

The Pinnguaq Association, a not-for-profit organization, incorporates STEAM into unique learning applications that promote storytelling, health, wellness, and growth in rural and remote communities. At its core, Pinnguaq embraces diversity and creates opportunities in order to empower all people.

## DIGITAL TAXONOMY

Computer Science Education is more than just coding. A comprehensive approach to it includes learning skills and competencies from each of the areas listed below. Look for the following icons at the end of each article for suggested curriculum connections. Reference: *Learning for the Digital World: A Pan-Canadian K-12 Computer Science Education Framework*. 2020. [k12csframework.ca](https://k12csframework.ca)



**CODING AND PROGRAMMING**



**COMPUTING AND NETWORKS**



**DATA**



**TECHNOLOGY AND SOCIETY**



**DESIGN**

Root & STEM is printed on certified Forest Stewardship Council paper, to reduce our impact on the natural world.

This publication is funded in part by the Government of Ontario and the Government of Canada.



Root & STEM (ISSN 2563-6979) is published four times a year by the Pinnguaq Association

87 Adelaide St N, Lindsay, Ontario K9V 4L4  
[root\\_stem@pinnguaq.com](mailto:root_stem@pinnguaq.com)  
[pinnguaq.com/root-stem](https://pinnguaq.com/root-stem)

Printed in Oshawa, Ontario, by Maracle Inc.

### Publisher

Ryan Oliver

### Editorial Lead

Chelsea Kowalski

### Editorial Assistant

Nadia Scott

### Copy Editor

Nicholas Davies

### Design & Layout

Emily Canfield, Kelly Eng, Mariana Fernandez, Alyssa Rowe

### Cover Illustration

Jess Spagnolo

### Logo Design

X-ing Design

### Contributors

Sharon Aschaiek, CarolAnne Black, Betty Carpick, Kevin Frank, Warren Frank, Melina Laboucan-Massimo, Sofia Osborne, Chloe Phillips, Karen Pinchin, Somaya Salama, Bonnie Schiedel, Holly Schmidt, Janna Wale, Caroline Whittle, Tania Willard



Follow Us @Pinnguaq



**JESS SPAGNOLO***Cover Illustration*

Jess Spagnolo is a visual artist, muralist, and graphic designer based in Kawartha Lakes. Her work uses seamless blends of colours and details infused with emotion to captivate viewers with the beauty around, above, and beyond us.

**CAROLINE WHITTLE***Guest Editorial: A New Normal in the North • Page 6*

Caroline Whittle was born in Iqaluit, where she resides with her husband and three children, who have shaped the direction of her life, career, and interests. She dreams of having all-Inuktitut-language schooling available in all the communities in Nunavut, with a curriculum focused on Inuit culture and heritage.

**SOMAYA SALAMA***Resilience in the Wild • Page 8*

Somaya Salama is a Palestinian-Egyptian student of the Virtual Learning Centre. She likes to spend her days volunteering with animals, tutoring English, and raising awareness for the environment.

**SHARON ASCHAIK***Supporting STEM in Remote Regions • Page 11*

Sharon Aschaiek, the principal of Higher Ed Communications, writes about the education space, producing articles about research breakthroughs, successful alumni, and innovative practices.

**WARREN FRANK***Sustainable Artistry Blooms in Kawartha • Page 12*

Warren Frank splits his time between his role as Music Coordinator at BGC Kawarthas and writing and performing music as Gamekeeper or with his band, Heaps.

**CHLOE PHILLIPS***Take Samples, Make Change • Page 14*

Chloe Phillips is currently in her fourth year at Trent University, where she is studying environmental studies and education. She enjoys the outdoors and long walks with her dog.

**BONNIE SCHIEDEL***Naturally Ink-quisitive • Page 16*

Bonnie Schiedel has been writing, editing, and producing content for print and web in northwestern Ontario for 20 years. When she's not pounding the keyboard, she enjoys canoeing, camping, snowshoeing, skiing, and exploring Thunder Bay with her family.

**KAREN PINCHIN***A Journey from Plies to Panels • Page 18**A Conversation on Climate • Page 20*

Karen Pinchin is a Kijipuktuk/Halifax-based investigative journalist who writes about food systems and the environment. Her debut book, *Kings of Their Own Ocean: Tuna, Obsession, and the Future of Our Seas*, was published last July. She is on X at [@karenpinchin](https://twitter.com/karenpinchin).

**KEVIN FRANK***Obnoxious Fumes • Page 22*

Kevin Frank is an award-winning author and illustrator and the creator of the popular *Scurvy Dogs* graphic novel series for children. He lives in rural Ontario and steals his best material from his wife and three children.

**SOFIA OSBORNE***Framing the Land • Page 26*

Sofia Osborne is a writer, reporter, and audio producer based in Vancouver. Her environmental journalism has appeared in *The Tyee* and *The Narwhal*, and she is the co-host and producer of *Beyond Blathers*, an Animal Crossing science podcast.

**CAROLANNE BLACK***From Old Growth Rainforests to Arctic Sea Ice • Page 33*

CarolAnne Black tells ocean stories. She writes on all topics related to the ocean, focusing especially on empowering girls and women in ocean science. CarolAnne likes to swim in the Kichi Sibi with her three kids and talk about how the water is making its way back to the ocean. You can see more about her at [carolanneblack.com](https://www.carolanneblack.com).

## A New Normal in the North

*This issue of Root & STEM explores the ways in which climate change is affecting animals, humans, and the environment in which we live. With a focus on sustainability and an understanding of the interconnectedness of ecosystems, biodiversity, and human activities, this issue aims to examine how humans can reverse the effects of climate change and protect the world for future generations. You'll find articles and illustrations from artists, educators, and researchers exploring these topics—from the social, economic, and environmental implications of climate change to examples of sustainable design and art initiatives making a positive impact. This issue encompasses the integration of science, technology, engineering, art, and mathematics to address the challenges—and opportunities—associated with our planet's health and sustainable future.*

I must admit that writing this was a bit difficult.

Climate change has been an important topic for some time now and, although it's getting harder to ignore, that doesn't make it any easier to face. The world, and we humans along with it, is undergoing a massive change and we are seeing the effects right in front of our eyes and in our own backyards. From my observation and experience, people up in the North of Canada have spent years trying to come to terms with climate change and are reacting to the reality that we are seeing in our daily lives.

The land Inuit have been living on for thousands and thousands of years used to be much colder, with mountains and hills covered in glaciers for kilometres. The winters were longer with more ice and the summers were shorter with less life. Now, the land looks very different. Every year, there is less snow. The sea ice breaks up sooner and melting glaciers cause flooding in other parts of the world.

The seasons are changing unlike ever before and there are environmental indicators showing us that this isn't natural. In springtime in the past, we started to see birds, like snow buntings, that we hadn't seen all winter. When the weather started to warm up, all kinds of life started up again. But now, snow buntings seem to be present all year round, pushed off of their previous cycle of migration by changes in the climate.

Unpredictable weather and seasons are particularly harmful to humans in the North because Inuit use the environment to tell

us what we need to know. Malikaat (mountain aven) is the true weather and time indicator. When it starts to get colder, the flower twists and closes up and is blown away in the wind, which indicates that it is prime time to use caribou fur for our winter clothing. Malikaat follows the direction of the sun, which helps us estimate what time of day it is. But, due to the effects of climate change, we can no longer rely on malikaat the same way.

I have vivid early memories of coming back from our spring camping grounds by snowmobile on Canada Day in July. Today, that wouldn't be possible. Boating now happens in July because of the earlier melting of the ice, which starts now in May or June. This has also led to an increase of ships coming into ports in Nunavut and the North, due to longer summers and ice-free areas, something that also has an impact on the human and animal community. Imagine how these changes affect the hunting and travel routes for Inuit, who are reliant on the land, ice, water, and animals of the environment. Hunters can no longer trust their knowledge and skills due to the fast-changing climate and inconsistent weather patterns that cause the trails to change and the ice to thin. Hunters have noticed that caribou and seals have more parasites under their skin and sometimes in their meat, potentially a result of stress caused by a changing diet and climate.

Before colonization, Inuit were a most resourceful and sustainable people. We used what we had to get what we needed to survive; today, climate change has made that nearly impossible. Of course, we can become sustainable again by observing the weather, the stars, the Sun, the Moon, and the seasons, and adapting while learning the new patterns. In collaboration, Inuit harvesters are gatekeepers who ensure knowledge is kept all the while maintaining the community through the tradition of sharing your catch. This way of living educates both the generation we are in, and the next, to protect the valuable skills we have that will ensure we continue, and leave behind, a sustainable world.

— CAROLINE WHITTLE



- **Top Left:** Caroline Whittle stands with her successful fishing catch at Sukanga Lake, north of Iqaluit.
- Top Right:** People check out the floe edge for seals in Aulatsiviit.
- Middle Right:** Pitsiit (dried fish) is hung for drying at a cabin after a windy day in Aulatsiviit.
- Middle Left:** A fall time ice formation called Kaikuit in Nunavut waters.
- Bottom Left:** Seal skin is soaked in the ocean to drain any blood before removing fat for skinning.
- Bottom Right:** A fresh water stream flows in Tiggaqtuu





SPRING 2024





# Resilience in the Wild

How Animals Strive to Adapt to a Rapidly Changing Climate

BY SOMAYA SALAMA

**W**hy do geese have beaks instead of teeth? Why do male deer grow antlers, only to lose them? Why do birds migrate in the winter? It's all about adaptation. Every animal goes through adaptations, which can mean changes in appearance or behaviour that are more suitable to their environment. Adaptations happen very gradually over generations as the environment changes. Sadly, because of global warming, habitats are changing so quickly that animals don't have enough time to adapt effectively. This causes a number of problems for both the animals and their environment.

Animals adapt, physically and behaviourally, as a means of survival, so they can reach their main food sources, fend off predators, and survive seasonal changes in the weather. Whether we realize it or not, we see the results of animal adaptation all the time, like when carnivorous animals rip flesh with their sharp canine teeth or when prey travel in herds because there is strength in numbers. Survival isn't the only outcome, however; when animals develop new adaptations, they also develop new relationships with their environments. The monarch butterfly is a great example. Its larvae feed on milkweed leaves, which have a strong, distasteful odour and are poison-

ous. The monarch adapted so that it is able to digest this poisonous plant and because of its smell, predators keep away from the butterfly and its eggs.

Migration is another common result of behavioural adaptation that helps animals, including insects, to survive. Monarch butterflies migrate 4,000 kilometres from Canada to Mexico every fall to avoid winter. For many animals, particularly in Canada, the northern winter weather and cold temperatures present a tough challenge to which they are forced to adapt. For example, thinhorn sheep in the Yukon gather in communal herds in the winter to keep warm and, due to the greater amount of sunlight they receive in the fall, spend most of their time grazing on south-facing hillsides to maximize their access to food and warmth.

Moving northeast to Nunavut, the Arctic fox has seen many adaptations that help it survive winter, such as its fur turning white as cold weather approaches. This camouflage helps the fox hunt prey and avoid predators and, because white fur lacks pigment, it makes a great insulator because there is more room for warm air. Like several other northern animals, the Arctic fox has also adapted to have a thicker body than its southern cousins. This follows an ecogeographical rule, formulated by Joel Asaph



***“In Nunavut, native species such as caribou, Arctic foxes, walruses, and polar bears are forced north to colder climates. The problem is that there aren’t many colder places to go.”***

Allen in 1877, known as Allen's Rule, which states that “animals with a greater surface area, long limbs, ears, tails, and snouts, lose more heat than those with compact bodies and stubbier appendages.”

In the Yukon, the tundra muskox has survived since the ice age because of its ability to adapt. The main reason it out-survived its cousin, the helmeted muskox, has to do with it being both smaller and shorter. Having a slower metabolism also helps as it allows the animal to enter torpor, or “temporary hibernation,” which is a state of decreased activity that allows animals to conserve energy, increasing their chances of surviving unfavourable conditions.

As we know, climate change has been affecting the environment for years. Seasonal patterns are becoming irregular and many habitats are being lost due to global warming. The genes that help animals survive develop gradually: the animals that gain those new traits have more offspring than animals that do not adapt, and offspring with these successful genes have more offspring. Then, after years of this natural selection, those new genes become dominant. For this reason, when the climate changes at the rate it is now, animals find it difficult to adapt to these

conditions and, given the time required, impossible to develop the traits to improve their chances of survival.

The effect is easy to see with the monarch, which migrates in the winter because of the decreasing temperature and lack of milkweed—its primary food source. Now that average temperatures are warming, the butterfly’s usual migration pattern is gradually falling out of sync with the blooming of the milkweed. Along with the dwindling of the milkweed’s habitat due to drought, heat, and herbicides, this has caused the monarch population to decrease by 95 per cent over the last two decades. For animals in the Arctic, these effects are all the more drastic, with issues including loss of habitat and food to new competition due to range shifting, which is when the limits of a given animal’s habitat move because of physical changes in the environment. In Nunavut, indigenous species such as caribou, Arctic foxes, walruses, and polar bears are forced north to colder climates. The problem is that there aren’t many colder places to go.

Alongside the fact that these Arctic creatures are unable to travel farther north, invasive species from the south are moving in. Beavers are a great example of this invasion. Their habitat is the wetlands, but



they've been moving into the Arctic tundra because increasing temperatures and melting ice are creating a habitat similar to the wetlands. Such invasive species carry unfamiliar diseases that can infect the berries and herbs that many of the indigenous species eat. In the Northwest Territories, the collared pika—a cousin of rabbits and hares—is also in danger. Warmer temperatures are affecting the mountain tops where the collared pika resides, resulting in less of the snow that the animal uses as insulation for its nests. Without this protection, they are exposed to extreme temperatures, which impacts their ability to survive in their natural habitat. Unfortunately, the collared pika can't do much to increase its survivability, as the mountain tops are about as cold as the nearby regions get.

Just like butterflies, foxes, and pikas, humans are animals too. Our adaptations can look different though. Migration isn't always a possibility or a solution for many people facing the effects of climate change. Our ability to adapt relies heavily on our relationship to the environment. To help ensure our own survival, we need to look out for other animals as well as the environment. Of course, we can always enforce environmentally friendly practices such as reducing water use, using less electricity, recycling, and composting, but that can only take us so far. We all need to learn from the ways Indigenous communities have fought

against climate change, as they were some of the first to feel its effects. Many Indigenous cultures have practices that already help animals and the environment thrive, like making the most of resources, giving back to the environment, and prioritizing understanding of its needs. This is the result of ancestral knowledge that has been passed down for generations.

As the effects of climate change worsen, many Indigenous communities are working together to combat its effects. A coalition of Indigenous groups in Nunavut has been working to reduce the region's dependence on diesel generators by transitioning towards renewable energy. Indigenous Climate Action (ICA), another coalition of Indigenous communities across Canada, is actively fighting against climate change. Their most recent projects focus on cleaning up toxic tailings, such as the results of the Imperial Oil disaster in northern Alberta. Toxic tailings occur when industrial wastewater is leaked from tar sands into nearby bodies of water, contaminating the environment. ICA has been focused on working with and for the communities affected by the Imperial Oil disaster, which include the Mikisew Cree, the Athabasca Chipewyan and Fort McKay First Nations, the Fort Chipewyan Métis, and others who live and rely on the water and land for drinking water, food, and medicine. In response, the community members in Alberta are focused

on repairing the damage done to the land and the people, which involves demanding accountability from the companies responsible and conducting proper investigations of the environmental impact. Reversing the effects of environmental damage involves working together for a solution—not just with other humans, but with the land itself.

Eriel Deranger, a founding member of ICA, says, "Real climate solutions are decolonial climate solutions because they're taking us back to reconnections with the land, to being on the land, to reconnecting with that intimate understanding of how not just to live and survive on the land, but how to adapt and change with it." The knowledge Indigenous communities have passed down for generations has helped Canada fight climate change effectively. Studies show that when Indigenous Peoples have the right to govern their land, biodiversity increases and forests are protected.

Ultimately, animals need to adapt to survive in their environment. Humans need to allow that process to happen naturally and reverse the ways in which we have hindered that survival by contributing to climate change. With the help of human intervention, these animals may be able to get back to their normal surroundings and adaptations before it's too late. &



#### TECHNOLOGY AND SOCIETY





Representatives of the Society for Canadian Women in Science and Technology participate in an outreach event

# Supporting STEM in Remote Regions

BY SHARON ASCHAIK

**M**ore students in remote, rural, and Indigenous communities in Canada will have opportunities to become proficient in science, technology, engineering, and math (STEM), thanks to the Drax Foundation.

In 2023, Drax, a British power generation firm, donated almost \$250,000 to support four organizations that make STEM education more accessible, in alignment with the firm's objective of advancing positive socioeconomic change.

"It's important to support programs that help educate children in [equity-deserving] and Indigenous communities," says Mark Puglass, Director of Indigenous Engagements and Partnerships for Drax and a Vancouver Island First Nations community member. "A big part of my job is understanding the barriers these communities face and gathering the resources to remove them."

Diane Smit, a regional manager with Scientists in School, a charity that conducts STEM enrichment workshops for students across Canada, says a Drax gift funded hundreds of workshops for roughly 3,500 students.

"Our mission is to engage all children and youth across Canada in [scientific pursuits]," says Smit. "When we provide exposure to STEM engagement, young people start to see a STEM career as a possibility."

Scientists in School conducts workshops where scientists, engineers, and technologists lead hands-on investigations into energy, chemistry, biology, and many other topics that align with curriculum requirements. In the 2022–2023 school year, says Smit, the organization held more than 10,000 workshops, of which approximately one in five took place in small or rural communities.

Twenty per cent of the workshops were also delivered free to promote social equity. Compared to urban schools, Smit notes, those in remote, rural, and Indigenous areas are farther away from STEM learning sites like science centres and museums, and typically have smaller budgets, which impedes their ability to access materials and experts. As a result, students at these schools have fewer chances to gain opportunities that are vital to many career paths.

"We hear all the time from schools in remote communities that they need STEM support," says Smit. "Whether or not [students] pursue STEM careers, being able to look at the world with a sense of discovery and to engage in critical thinking are valuable skills."

Drax's gifts also included donations to the Exploration Place Museum and Science Centre, a non-profit organization that runs free school initiatives in northern Brit-

ish Columbia, and Non-Profit Connected North, which delivers virtual learning experiences to Indigenous students. Drax donated almost \$100,000 to the Society for Canadian Women in Science and Technology, allowing it to engage more women and girls in its STEM workshops, conferences, mentoring, and scholarships.

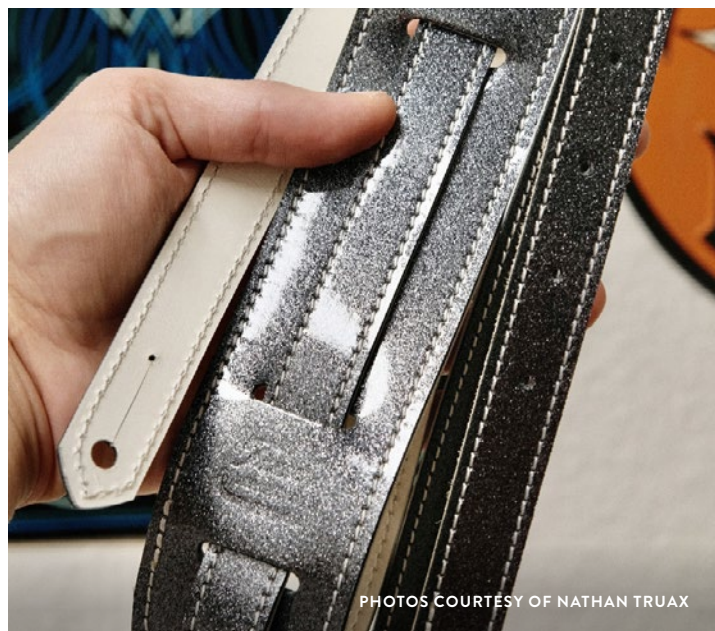
Beyond philanthropy, Drax offers webinars and tours of its power station to engage participants in in-depth explorations of sustainability practices. A notable sustainability initiative is Drax's use of biomass domes that hold 80,000 tonnes of wood pellets, a form of sustainable fuel that contributes to renewable electricity at the station. The company also does significant work towards reducing global emissions and temperature increases with its Bioenergy Carbon Capture and Storage initiative, which captures CO<sub>2</sub> and stores it underground for thousands of years.

With groups like Drax supporting STEM education and sustainable practices, the energy sector appears to have a brighter future ahead—perhaps to be led by a new generation with science and sustainability at the forefront of their minds. &



TECHNOLOGY AND SOCIETY





PHOTOS COURTESY OF NATHAN TRUAX

# Sustainable Artistry Blooms in Kawartha

BY WARREN FRANK

**T**he story can come across as pretty bleak if you're not paying close attention. Consumers are caught on a tightrope between convenience and sustainability amid the ever-scrolling blue-light buzz that permeates the market in 2024. Daunting yes, but a close look at one's own community often points to a treasure trove of sustainable artists. In Ontario's City of Kawartha Lakes and Peterborough, shoppers can find loads of creators to help stock their cupboards,

wardrobes, and minds, all the while decreasing their environmental footprint.

Creators like Nathan Truax, a leatherworker and the proprietor of Truax Leather Co., who specializes in Western-style tooling and carving, finds sustainability can be a pillar of one's practice if production is kept close to the roots of the craft.

"Sustainability is built into this medium," says Truax. "High-quality, handmade leather items significantly outlast their often plastic counterparts. Creating items

that have the potential to last decades if treated right reduces the need to replace lower-quality items that wear much faster."

Truax began analyzing the sustainability focus of his practice after "a recent experience, where my partner purchased a second-hand purse only for it to fall apart in what seemed like weeks; [it] made me rethink the power I have in creating items that can last for many years."

Add to this the heartwarming factor that longevity can increase nostalgic sentiment



► Top: Elise Karklins of On Point Pottery in the midst of her creative process. Middle and Bottom Right: Original mugs by On Point Pottery. Bottom Left: A ceramic mold-cast by On Point Pottery

and you've got a real bang for your buck. "Customers often mention how they love the idea that these pieces can become heirloom-like, with the ability to be passed down to the next generation," says Truax.

Also finding sustainable strength in the classics is On Point Pottery's Elise Karklins, whose practice incorporates a mixture of wheel-throwing, handbuilding, and casting using stoneware.

Karklins notes how pottery centres around sustainability from the ground up, stating, "ceramics are made from renewable sources like clay, which makes them sustainable before the firing process begins." This helps consumers avoid the use of microplastics. Aside from material sustainability, Karklins reuses vintage molds for casting ceramics instead of producing new ones.

Combining agricultural practices with modern digital storytelling is Lindsay's Kawartha Backyard Farms, helmed by E Kelly who, above all, "hopes that we can create a better world for all Earthlings."

Kawartha Backyard Farms is a community food security project that is focused on the process of growing food within living spaces. They aim to "blend the art of gardening with the science of food production while also sneaking in some health promotion as well." Kelly encourages consumers by saying that "just growing food at home is a great way to promote financial sustainability as the overall cost to produce food is drastically lower than the cost of the same produce at grocery stores."

The practices of these folks only begin to scratch the surface of what is available for those willing to listen, search, and learn. Community creators are out there and they are making an impact. By showing them support, you can make one too. &





➤ **Top Left:** Campers of South Nation Conservation Fish Camp and Nikolas MacLean, a Water Rangers employee, test the quality of water in their community. **Middle and Bottom Left:** MacLean and his children use notebooks to record information about the river. **Right:** MacLean and his three children explore the contents of their test kit, specifically the grabber that will help them collect the sample of water that will give them clues about the health of a river in Chelsea, Quebec

# Take Samples, Make Change

## Empowering Citizen Scientists with Water Rangers

BY CHLOE PHILLIPS

**C**lean water is a right for all; the human race, animals, and the water itself. Just as clean water is a right, so is the ability to identify if water is clean.

Water Rangers is an organization that empowers people to sample and study bodies of water using accessible tools and an online platform to share data, all with the hope of sparking greater change.

The organization is creating space to share accessible data on water quality across all communities. Information gathered by the public is shared on a data platform accessed through a tab on the Water Rangers website's main page. On the data platform, citizens are able to record their observations of water pH levels, temperature, and much more.

Knowing whether a water body—be it a river, lake or stream—is healthy is essential for the success of the community that depends on it. Water Rangers was founded in 2015 at the first annual AquaHacking Chal-

lenge, a program that promotes innovation and technologies that support freshwater health. Water Rangers works to tackle issues that water bodies face through the promotion of meaningful citizen science initiatives.

To facilitate this work, Water Rangers engages in educational outreach in numerous ways. They make the accessibility of their materials a priority, which is supported by an NSERC PromoScience grant that makes educational materials affordable and allows Water Rangers to give out quality test kits so citizens can provide data at a reasonable cost. Water Rangers believes it is vital to empower educators to participate in water quality testing so they will inspire their students to take part as well.

"We take a train-the-teacher approach, where we meet with the teacher to show them the tools in their kits, talk about how to engage students, and answer any questions they might have," says Laura Gilbert, community and operations manager for



Water Rangers, in an email to *Root & STEM*. Gilbert emphasizes that they want teachers "to feel empowered to take on water quality testing with their classes."

The test kits come in various sizes, including a compact version, which includes easy-to-understand instructions, a field guide with further instructions, a notepad, a thermometer to measure air temperature, a reacher stick and sample cup, a meter for water temperature and conductivity, and teststrips for chlorination, hardness, alka-





linity, and pH levels. These test kits can be purchased through the Water Rangers online store for about \$140 but subsidies are offered on a case-by-case basis.

Additionally, Water Rangers is working to make a difference in the local and global community by working with Indigenous communities and researchers across North America. Gilbert explains that part of the Water Rangers budget for funded equipment goes to Indigenous and underserved communities based on conversations

with different community members across Canada. To better support these communities, Water Rangers full-time staff also receive training in the First Nations Principles of OCAP (ownership, control, access, and possession), an initiative that ensures First Nations have control over data collection in their communities.

To learn more about Water Rangers, the vitality of water body health, and how to become a citizen scientist for your own community, visit [waterrangers.ca](https://waterrangers.ca). &

 TECHNOLOGY AND SOCIETY

 DATA

Watch this video to learn how to use Water Rangers' Compact Kit!  
[youtu.be/gyD07LOq\\_94](https://youtu.be/gyD07LOq_94)







PHOTOS COURTESY OF BETTY CARPICK

# Naturally Ink-quisitive

How to Make Natural Inks

BY BONNIE SCHIEDEL

**A**rt is a great way to get creative, fire up different parts of the brain, and see something in a new way. To make colourful, sustainable inks that don't come with excess packaging or contain microplastics that end up in nature, just reach for plants from the kitchen, forest, or garden.

Betty Carpick, an artist and arts educator in Thunder Bay, Ontario, of Cree and Eastern European heritage, knows this well. She actively uses a sustainable method for creating inks in educational settings.

"When I go into schools, some of the kids will call me the Ink Lady," says Carpick.

"For me, the inks are a connection to the plant world and water world," she says. "Many people are disconnected from nature, so I feel that to care about and protect it, we have to have a relationship with nature."

While some natural inks are vibrant in colour, others are more subtle and muted, so Carpick likes to ask students to reflect on the way we think about colour and the way it influences us. "We live in a time where we see lots of bright colours; lots of colours now are pigments augmented by chemicals or plastics to keep them bright. The inks that I make, even though we mostly use them on high-quality watercolour paper, they're living, so they will change through time."

For Carpick, art is an essential part of education and inquiry. "Without the art [component], we don't open the STEAM concept wide enough, because art invites play and joy," she says. "It [involves] making mistakes and unpredictability. I like that."

Many artists who make natural inks use a technique similar to Carpick's. To make your own inks, you will need:

- About a ½ cup of plant material (see suggested plants below)
- Water
- Salt
- White vinegar
- A stove or stovetop burner
- Thin strips of paper
- Gum arabic (Optional. Used to thicken ink and available from art supply stores. Or, use a small amount of honey instead!)
- Wintergreen oil or whole cloves (these are natural preservatives)



- An old stainless steel cooking pot (that you won't be using for cooking again!)
- Rubber gloves
- Rags (to clean up spills or protect your work surface)
- Coffee filters
- A funnel
- Container with a wide mouth
- Small glass containers with lids

#### Plants to try:

Beets, spinach, iris petals, sumac berries, red cabbage, blackberries, blueberries, cranberries, saskatoon berries, elderberries, cherries, dandelions, onion skins, grape juice, lavender, turmeric, tea. Remember to only use the green and flowery parts of the plant, not the roots or the soil.

*Please exercise age-appropriate cautions and avoid plants that are toxic if ingested.*

#### To make your ink:

1. Gather your plants. Set up a workspace with all your items.
2. Put a ½ cup of plant material in a stainless steel pot. Cover with water. For every cup of water, add a dash of salt and one teaspoon of vinegar.
3. Simmer, but do not boil, for an hour or more. When the liquid looks rich and dark, put on your rubber gloves and dip a strip of paper in it to check the colour.
4. When you're happy with the colour and the liquid has cooled a bit, place a coffee filter in the funnel. Put the funnel into the wide-mouth container. Slowly pour the liquid through the filter.
5. Take a small glass container. Only if available, add a few drops of gum arabic to emulsify and slightly thicken the liquid. Add one whole clove (or a couple drops of wintergreen oil). Add the ink, stir, and close with a tight-fitting lid.
6. Repeat with different plants to create different coloured inks. Refrigerate inks when not in use.



- ▲ Swatches with plants gathered along Lake Superior: inks of fireweed, harebell (pictured above), tansy, wild blueberry, green alder leaves with catalysts of soda ash, vinegar, and rust water on watercolour paper

Have fun creating art! &



TECHNOLOGY AND SOCIETY



DESIGN

#### RESOURCES

- How Betty Carpick uses the earth to create incredible art and pass on knowledge — [cbc.ca/player/play/2190265411981](https://cbc.ca/player/play/2190265411981)
- Betty Carpick "The Land Is Dancing" — [youtu.be/1u6DQS7jvP4](https://youtu.be/1u6DQS7jvP4)





# A Journey from Pliés to Panels

Melina Laboucan-Massimo's Path to Clean Energy Entrepreneurship

BY KAREN PINCHIN

✓ Melina Laboucan-Massimo in front of the Piitapan Solar Project, a 20.8kW renewable energy installation in her community Little Buffalo

**B**orn in Little Buffalo, a remote Alberta community ringed by oil extraction efforts, Melina Laboucan-Massimo knows the feeling of being helpless in the face of a warming planet. Every time her family drove across their traditional Lubicon Cree First Nation homelands, the landscape felt drier, its vegetation less vibrant.

"It still looked like a forest, but there was a lot of impact from industry, a lot of cutlines," she says. "Or you'd see heavy-haul equipment up and down the highway."

After years of trying to find her path, she eventually found it: fighting climate change, first as a long-time campaigner for the environmental group Greenpeace, and later as the lead of a 20.8 kilowatt solar energy project in her hometown.

Yet, before activism and entrepreneurship, Laboucan-Massimo's first love was dance. She started ballet when she was five years old, practising in a small studio in Slave Lake and continuing when her family



PHOTO COURTESY OF GREG MILLER, UVIC



moved to Calgary, where she also played sports and excelled in academics.

“It was bittersweet, being happy and able to get through the system, but knowing that was definitely not how my own siblings felt,” she says. “Or even how it was for many other Indigenous people.”

It helped, she adds, that two different white teachers—both named Mr. Smith—identified her early promise. “[I felt] accepted in their classrooms, that I was allowed to be there and welcome,” she says, and that made her feel comfortable to excel. Despite being bullied for her background—in Grade 5, kids at school called her an offensive slur related to her Indigenous heritage—she graduated high school at only 16 years old.

Over the next decade, Laboucan-Massimo travelled the world, worked in emerging digital filmmaking, and was hired as an environmental campaigner for Greenpeace, where she testified in front of the US Congress. But her plans changed

suddenly in April 2011, when nearly 30,000 barrels of crude oil spewed across her beloved childhood forests, wafting poisonous fumes towards Little Buffalo, including its local school. Children complained of headaches, dizziness, and nausea, even as Plains Midstream Canada ULC, the oil company responsible for the spill, downplayed the severity of the problem.

That tragedy inspired Laboucan-Massimo to find an energy alternative for her community. She enrolled at the University of Victoria and graduated with a master’s degree in Indigenous governance with a focus on renewable energy. While completing that degree, she planned a solar-energy project for Little Buffalo and brought it to life: it now powers the town’s health centre. That formed the foundation of Sacred Earth Solar, where Laboucan-Massimo started to pair social justice and climate justice for Indigenous communities like her own.

“Resources have been taken from our homelands, and we have seen billions and

billions of dollars extracted from our territories,” she says. “Energy transition is not going to happen unless we push for it.”

Laboucan-Massimo is now the co-founder and senior director of Indigenous Climate Action, the host of the documentary series *Power to the People*, and she speaks on climate change panels alongside celebrities including Jane Fonda and Mark Ruffalo. Her passion for renewable energy, she says, has finally dovetailed with the agency and justice she’s been chasing—in hindsight—all her life. &

#### TECHNOLOGY AND SOCIETY

- Left: Little Buffalo students taking part in solar development.
- Top Right: Students taking part in climate workshops at their school.
- Bottom Right: Laboucan-Massimo spends time playing climate literacy games with students



PHOTO COURTESY OF MELINA LABOUCAN-MASSIMO



PHOTOS COURTESY OF SACRED EARTH SOLAR



➤ Janna Wale standing in the Okanagan campus of the University of British Columbia, which is located on the traditional, ancestral, and unceded territory of the Syilx Okanagan People

# A Conversation on Climate

Balancing Science and Self-Care with Climate Researcher Janna Wale

BY KAREN PINCHIN

**A**s a young Gitksan and Cree-Métis girl growing up in Gitanmaax First Nation in northern British Columbia, Janna Wale loved school—even to the point of wanting to do her sister’s homework for her. Once her family moved away to the city, they returned every year for her community’s annual salmon harvest, and with every visit, something became clearer: the salmon were disappearing. Spurred to do something, Wale pursued her passion for learning into the natural sciences. Now a policy advisor at the Canadian Climate Institute, Wale talks to Karen Pinchin about her earliest memories and the educators who helped her integrate her scientific career with her Indigeneity.

• • •

**Can you tell me about your earliest memories of how nature’s cycles were being altered by human behaviour?**

Climate change is something our communities have been speaking about since I can remember; it’s never really been

something I *didn’t* experience. There were always conversations when we were [fishing] or going up to pick berries: “When I was little, it was like this.” It was always talked about as something that was happening *to* us, rather than something we had an active role in contributing to, and also fighting against. Salmon got me thinking about climate because the fish are so important to our culture; our community is a fishing community. Growing up away and coming back every year, fishing was how I connected to my identity as a Gitksan person. Having that be at risk motivated me to figure out what I could do and where I could contribute.

**After the challenges of an undergraduate degree in natural resource sciences at Thompson Rivers University, what inspired you to keep working toward your graduate degree?**

To get into spaces where decisions are being made about the environment, it does, honestly and unfortunately, require more of that Western education. To advocate for the

changes I want to see, I needed to be in these rooms, either as somebody who can speak to these issues, or even just as somebody who’s creating space and representing our communities until somebody else is able to come up behind me. Indigenous people specifically have been left out of conversations relating to the environment and our natural resources, and I wanted to be able to help create that change. But it was difficult. I did my honours thesis on environmental racism, and the question I proposed was: If you expose students at the beginning of the year to more Indigenous content, does their perception of Indigenous people change over time related to natural resources? At the end, my supervisors said, “This is amazing research, but we don’t know how we’re going to mark this. We haven’t even thought about these things.”

**Can you tell me about one educator or teacher in particular who shaped your path as an academic, and what it was about their mentorship and method that you found inspiring?**



PHOTO COURTESY OF YELLOWHEAD INSTITUTE



PHOTO COURTESY OF JOSHUA WESLEY



PHOTO COURTESY OF SHAE WALE



PHOTO COURTESY OF MAURY WALE

In my undergrad, Dr. Sereana Naepi, who is from New Zealand, got me interested in the idea of Indigenous research. Up until that point, I hadn't thought about what Indigenous scholarship looks like, because I had no metric. In that program, there was nothing about how Indigenous people could be researchers, that Indigenous people are scientists. She wasn't in the faculty of science, but she still told me, "No, we belong here. And your voice is valuable." It was about her making the time for me to explore research that was important to me, and how I could use that to create the future that I wanted to see. It was just about creating space and time.

**Can you talk a bit about the work you do now, and how your training and experience has brought you to this moment of doing work on climate?**

My generation is the generation that's hyper-aware of the changes we're seeing, and a lot of people are feeling that grief and anxiety. A lot of the advice you get is, "Go connect with nature; go outside." I find that hard because outside is where

the changes are happening. It's December in British Columbia right now, and we have no snow. I've never experienced that in my life. It's hard. But for me, working through that is about finding agency in those difficult moments and helping to find solutions with the capacity that I have. For me, it is about connecting to my home territory, even when that's difficult, and making sure that I'm in a good place to contribute.

**So perhaps you're then more attuned to observations in nature, like when salmon do return to rivers after being absent for decades—that there can be beautiful recoveries, and nature is strong?**

I expressed this to a community member, and it completely changed my thinking. He was so wise and I've carried his words with me. I said that I felt like everything should have been done yesterday, that we're moving too slowly, and the changes are happening so fast. He said, "You need to think about it from a seven-generations principle. It's your job to move the work forward as much as you can, and then trust that the next gener-

▲ **Left:** Wale (middle) harvests huckleberry with family members Kate and Alyssa Wale. **Middle:** Wale processes salmon at Ksan, in Gitanmaax, in front of the Skeena River. **Right:** Wale (left) packs sockeye salmon for the winter months

ation is going to pick up where you left off." It really took some of the urgency off. It is an urgent problem, but it's not just me against this problem. It's not just *us* against this problem. There are lots of good minds—now and in the future—that are going to help bring us through this. That's what gives me hope.

**What advice or perspective would you give a younger version of yourself?**

It may not get easier, but you're going to get stronger. Try to enjoy and be proud of the work that you're doing. You're going to learn so much. &

*This conversation has been edited and condensed for space and clarity.*



TECHNOLOGY AND SOCIETY



# OBNOXIOUS FUMES

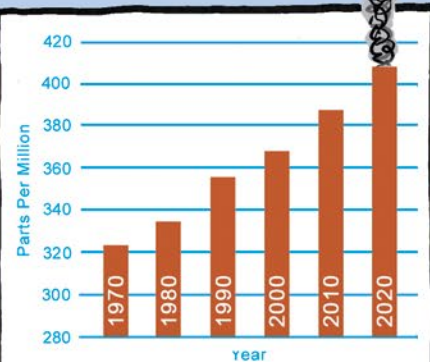


Wow, what a glorious time to be CARBON DIOXIDE.



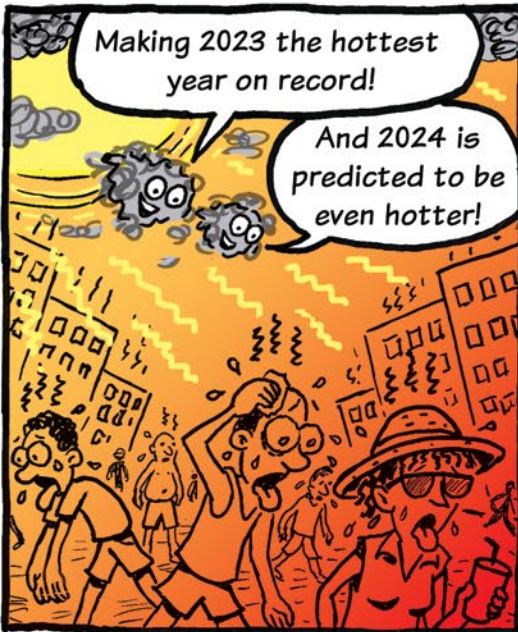
You said it, boss!

Since the 1970s, CO<sub>2</sub> emissions have increased by about 90%.



Making 2023 the hottest year on record!

And 2024 is predicted to be even hotter!



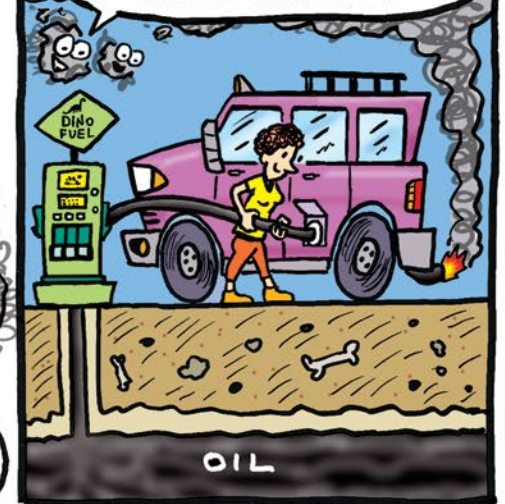
**EXACTLY!**

We're on the verge of conquering Earth!



Team CO<sub>2</sub> is unstoppable!

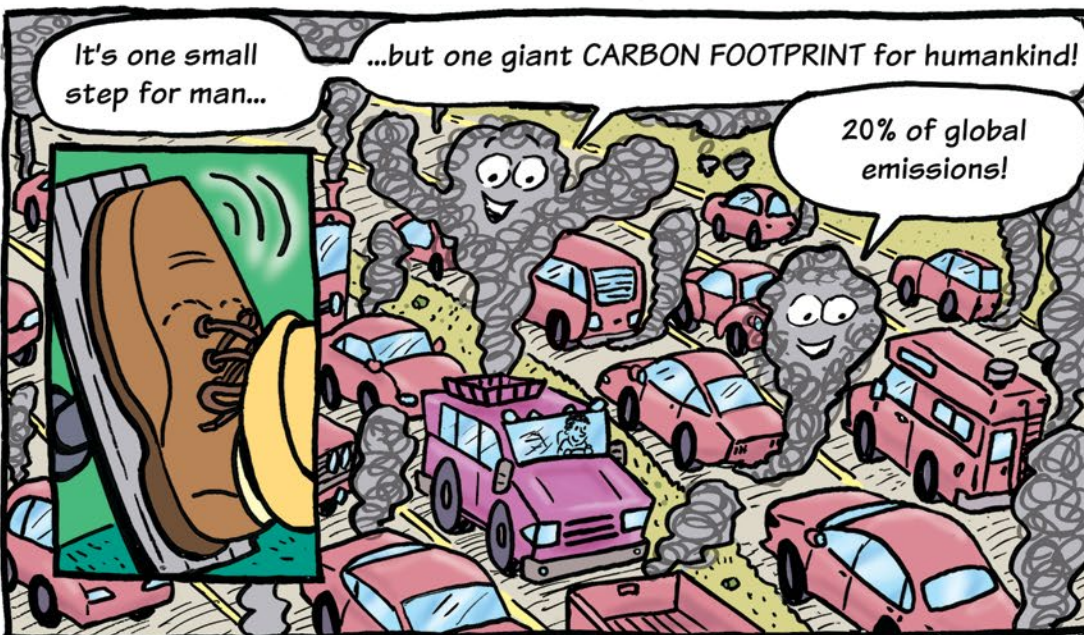
Thanks in part to the humans who continue to burn fossil fuels in their cars.



It's one small step for man...

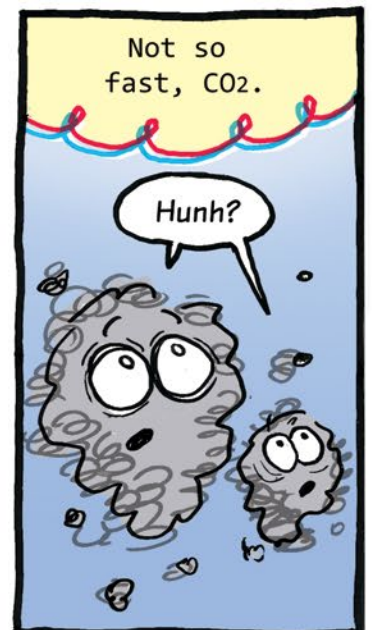
...but one giant CARBON FOOTPRINT for humankind!

20% of global emissions!



Not so fast, CO<sub>2</sub>.

Hunh?





Humans are buying more electric vehicles every year. That means ZERO carbon emissions.



Wait - who are you?

I'm THE CLOUD. The place where the humans store their digital information.



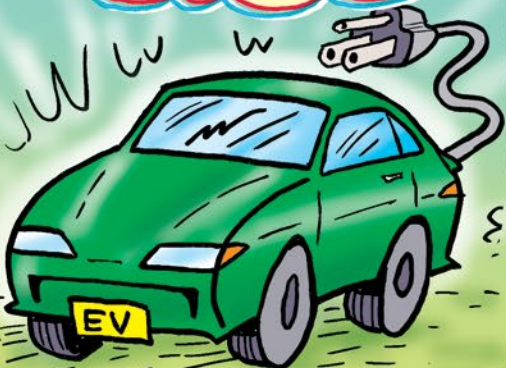
Um, I don't think "The Cloud" is a real cloud, buddy...

That's true, I'm actually just a METAPHORICAL cloud.

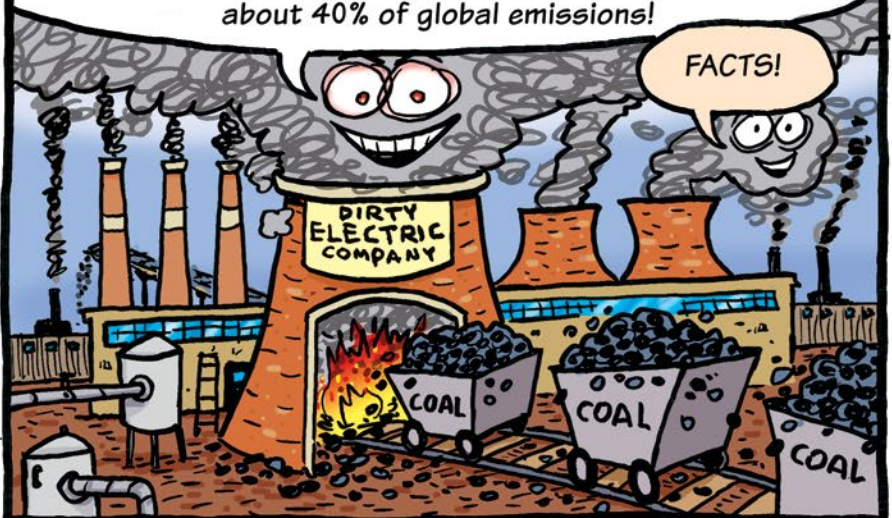


Oooh, I've never met a metaphor before!

But with my real access to all human information, I know that Canada has mandated that all cars sold will be ZERO EMISSION by 2035.



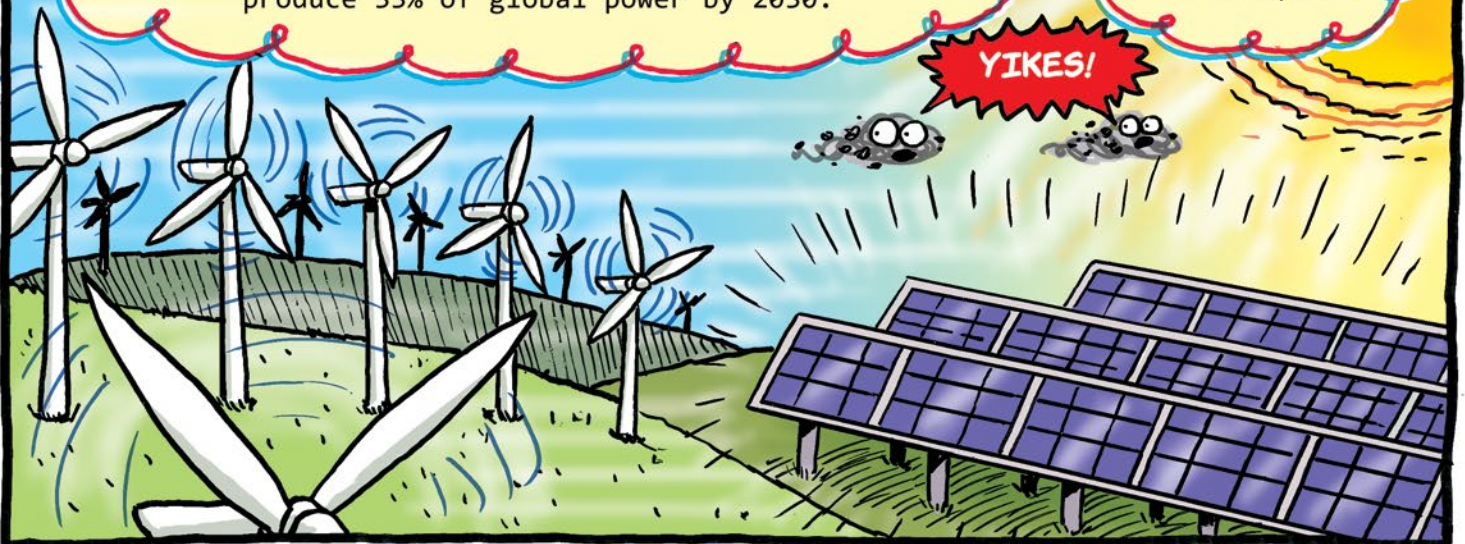
So what? All of those batteries will need to be charged by electricity, and energy production accounts for about 40% of global emissions!



FACTS!

For now, maybe. But wind and solar are on track to produce 33% of global power by 2030.

And that's no metaphor.





In fact, in May of last year, wind and solar produced more energy than all fossil fuels in Europe.



...and India has slashed its emission rate by one third.

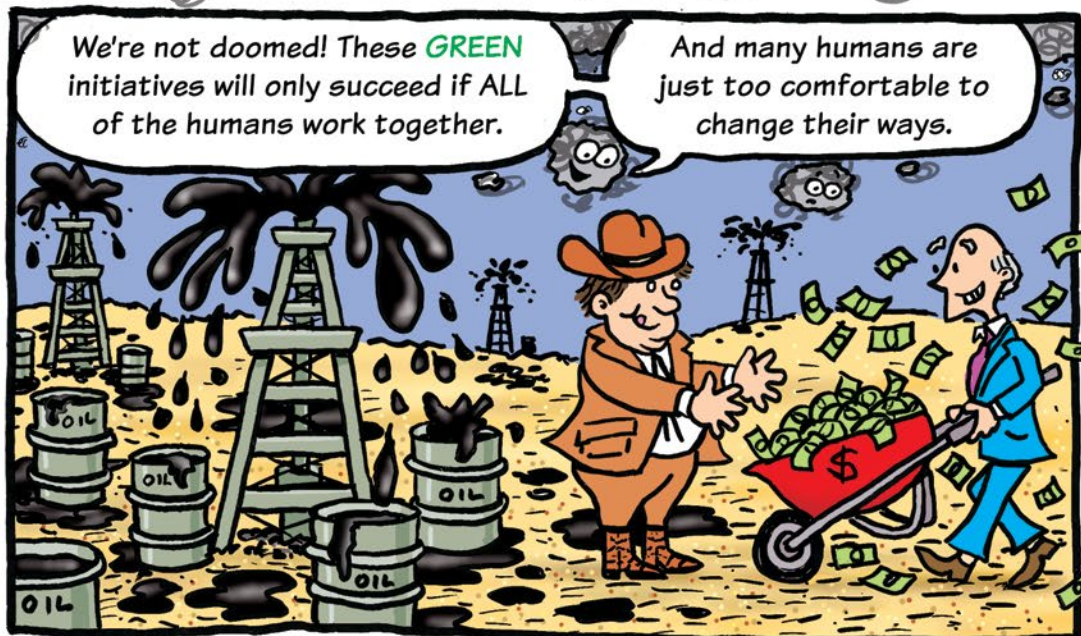


Plus, renewable energy is the cheapest form of power today!



We're not doomed! These **GREEN** initiatives will only succeed if ALL of the humans work together.

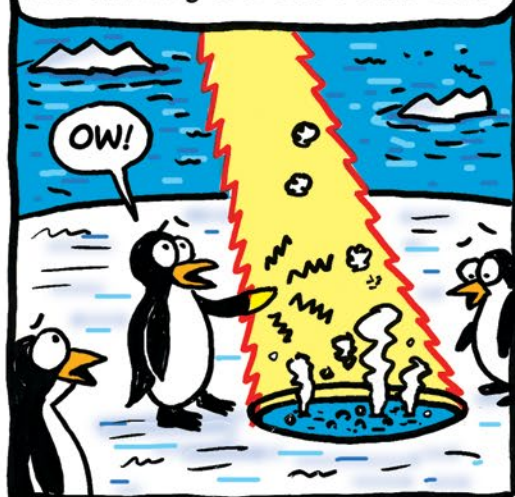
And many humans are just too comfortable to change their ways.



I don't know, boss. Remember the ozone layer?



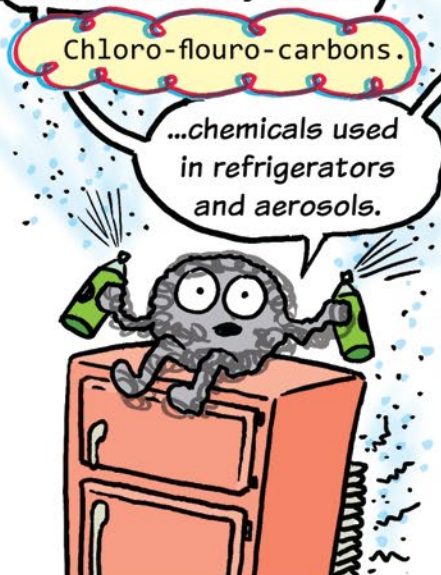
Back in the 1980s, scientists discovered that the ozone layer was thinning over the South Pole.



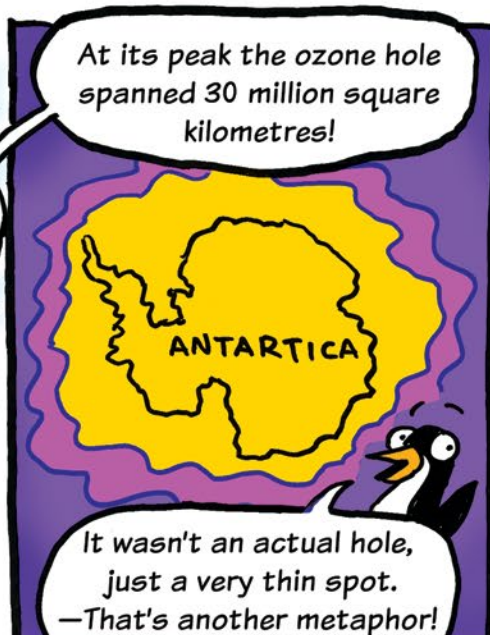
It was caused by CFCs...

Chloro-flouro-carbons.

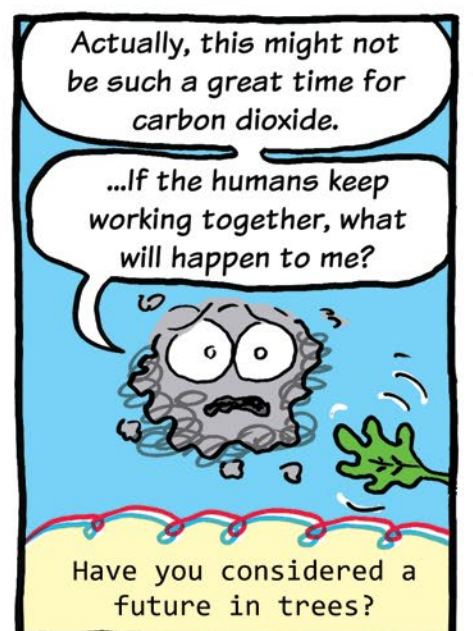
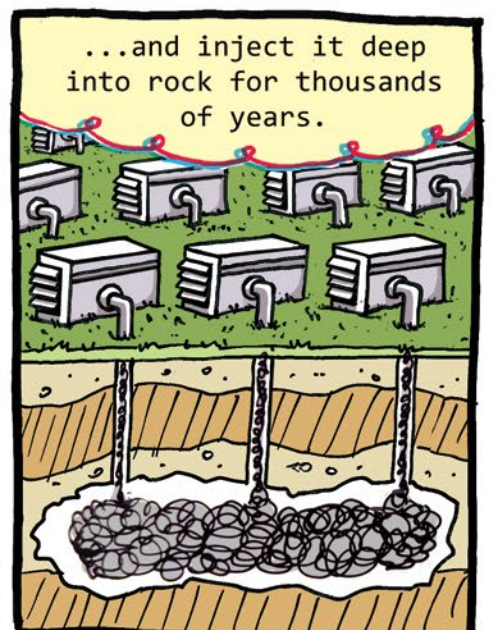
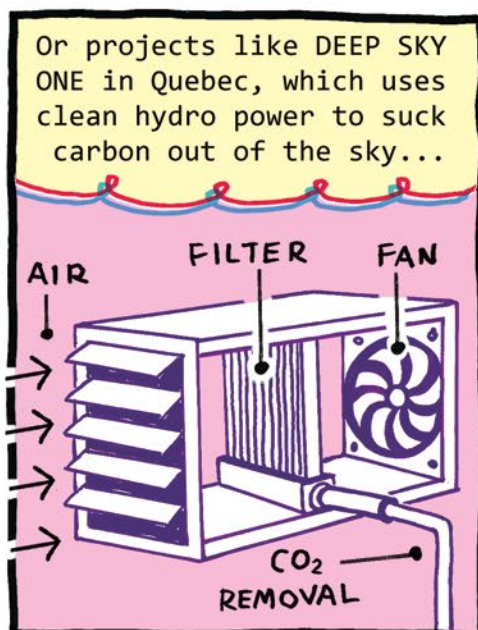
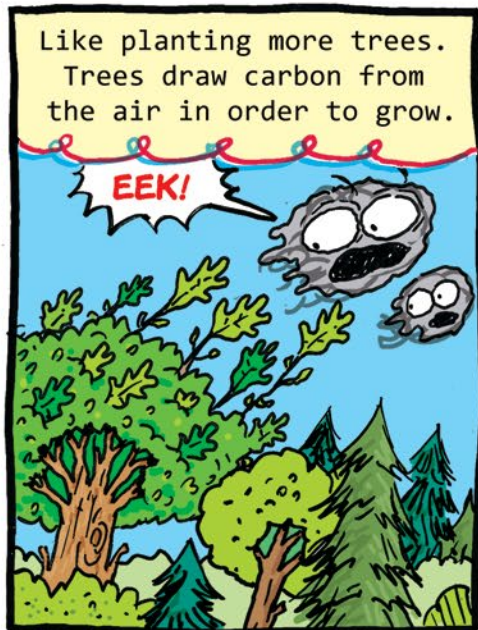
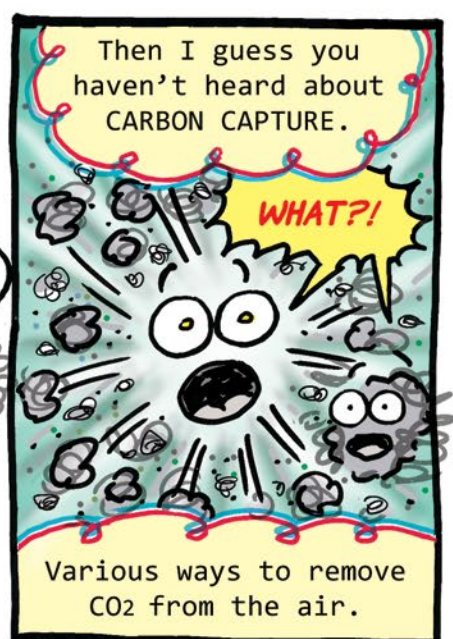
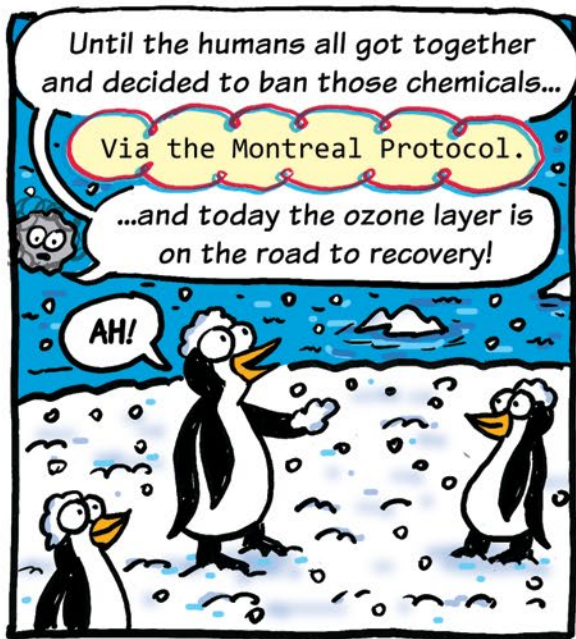
...chemicals used in refrigerators and aerosols.



At its peak the ozone hole spanned 30 million square kilometres!









# Framing the Land

How Art Can Change Our Relationship to the Natural World

BY SOFIA OSBORNE





◀ Tania Willard's *Carriers*, 2023, is composed of bins stitched with a variety of materials, representing birch-bark baskets, as a response to the need to be on constant alert during wildfire season, and honours the art of basketry taught to her by an Elder

### Tania Willard

When Tania Willard was growing up in the small town of Armstrong, British Columbia, she knew she was interested in art, but the path to becoming an artist felt unclear. It wasn't until she was mentored by Syilx Elder and artist Barb Marchand and the late Secwépemc artist Dave Seymour that she began to think of a future in art.

Now, Willard is an artist, curator, and assistant professor at the University of British Columbia (UBC), Okanagan. A mixed Secwépemc and settler, Willard's research is focused in part on providing a view of the art world in small towns, rural centres, and on reserve.

"I've had to really think through what art is in a Western context, and how that has been divorced from a lot of Indigenous ideas of art," she says. "That's really the focus of my practice ... the overlaps, the intersections, and the omissions between those kinds of art practices."

When her first son was born, Willard decided to move back to the Neskonlith Indian Reserve, where her father lived, so her son could be surrounded by Secwépemc culture, language, and land.

"That was a big move, because a lot of how we think about arts and culture [revolves around how it] functions in urban centres in Canada," she says. "We have different forms of arts and culture that are active and beautiful and inspiring and enduring on a reserve, but they're not positioned in the same way."

Thinking through that inequity, while at the same time reconnecting with the beauty of the land and the way Secwépemc forms of art are born from land-based materials, led to a shift in Willard's work.

"I really wanted to reposition and recentre the work. Instead of asking to come in the door and show Indigenous art, I wanted to shift that centre completely and say, 'Our art is valid, our land is central,'" she says. "If I think through an Indigenous-knowledge-based way of working, then the real gallery is the land."

For Willard, rather than trying to fit into a western, urban model of art, it's been much more generative to reject that path and carve out her own space. Part of that work has been through the creation of BUSH Gallery, a collaborative project with Tahltan performance artist Peter Morin, Vuntut Gwitchin artist Jeneen Frei Njootli, and Métis artist Gabrielle Hill. The gallery is a radically re-centred approach to art-making, situated on reserve, which grew from imagining a space for art and connection outside of the overly Westernized institutions for art.

"It has this reach that is addressed by a simple question ... How *do* we see art galleries? How would we, as Indigenous Peoples, create, or how do we create, spaces to think through and appreciate art?" says Willard.

Inspired by the abundance of the land, Willard's art incorporates practices like hide-tanning and basketry, to collaborations with nature, like sun-printing, an alternative photographic process that requires exposure to the sun to develop.

A recent exhibition of Willard's work at Pale Fire Projects called *Sensitized*, which she created in mid-2023, brought together her interests in archives, Indigenous resurgent acts, land-based work, and lens-based media. The exhibition included sun prints from the leaves of tobacco plants she grew, images of baskets from collec-

***“It’s for our health,  
it’s our rights.  
It can continue the  
traditions of our  
ancestors, and extend  
the continuum of  
land rights.”***

Left and Bottom Middle:  
Willard’s *Carriers*.  
Top, Middle, and Bottom Right:  
Willard’s exhibition *Sensitized*,  
hosted at Pale Fire Projects,  
features *Carriers*, sun prints,  
an anthotype, and images of baskets  
from collections of Secwépemc  
and interior Salish artworks

Left: Future Prayers from *Sensitized*, made from  
tobacco leaves, paper, and synthetic sinew

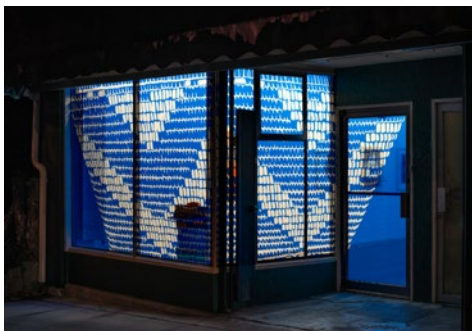
tions of Secwépemc and interior Salish artworks that are in museum collections—often unnamed and unacknowledged—and an anthotype she created using harvested wild berries to develop an exposure mimicking smoky skies.

The exhibition also included a new sculptural work called *Carriers*—a series of Rubbermaid bins Willard stitched over with leather, rope, sheep rawhide, cedar root, and other materials to make them resemble birch-bark baskets. Drawn from her experiences with wildfire haze and threatening winds, Willard’s art formed a response to the need to be on constant alert during wildfire season. In addition to the materials, Willard’s skills in basketry, taught to her by Elder Delores Purdaby, a master artist in basketry, were a part of the art she created.

“As part of relearning those skills, and that relationship, that artistic process, it’s not just the skill of doing it, it’s also knowing how to harvest, having a relationship to the land around me, and being in reciprocity. So making an offering, harvesting, knowing how to work the material, and then also knowing yourself in order to work it,” she says. “We have many teachers in the land.”

Ultimately, Willard wants to encourage young people to express themselves in ways that nourish them.

“It’s for our health, it’s our rights. It can continue the traditions of our ancestors, and extend the continuum of land rights. And that’s so important. And it’s also a way of us connecting to each other, and to the lands around us. And that includes all of us,” she says. “Because after all, we all need to nourish each other and the land to live together.”















## Holly Schmidt

As an artist, curator, and educator, Holly Schmidt is trying to put a frame around something that is often taken for granted: the natural world around us.

“Ultimately, the goal is really to have people, through their attention, actually begin to care about all of these living beings and about their relationship and interaction with the natural world,” she says.

For the last five years, Schmidt served as the artist-in-residence at UBC’s outdoor art program, a residency she called *Vegetal Encounters*, which ended in fall 2023. Rather than being focused in the visual arts department, her work reached broadly across campus, engaging students and faculty from many disciplines around the theme of human relationships with plant life.

“I really saw myself working in a very

plant-like way, or a kind of rhizomatic way,” she says. “I could send these roots and tendrils out and create networks and connections between many of these disparate departments across campus.”

Inspired by Potawatomi ethnobotanist Robin Wall Kimmerer, Schmidt wanted to explore the ways plants can teach us and how we can learn from plants.

“Being on the unceded territory of the Musqueam people, I just gained such an incredible appreciation for the significance of plant life on campus; how it’s really a shared responsibility to care for that plant life and imagine new ways of considering it,” she says.

One of Schmidt’s projects, called *Fireweed Fields*, transformed the grass lawn outside UBC’s Belkin Art Gallery into a

plant meadow, with a particular emphasis on fireweed. As we find ourselves in a time of climate crisis, Schmidt was drawn to fireweed as it is one of the first plants to come up after a forest fire.

Fireweed also holds deep significance to the Musqueam Nation. The Musqueam Environmental Stewardship Department advised and worked with Schmidt on the project, helping to develop the fields into a full and abundant meadow.

“Fireweed provides shelter and sustenance, so it provides a kind of care for other beings around it. And it’s really the begin-

▲ Left and Bottom Right: Summer 2021 participants of Holly Schmidt’s slow walking workshop sketch in the fields at the Morris and Helen Belkin Art Gallery. Top Right: Artist Chrystal Sparrow holds a sketch created in the workshop



***“Having time even just to play and to explore in the natural world, it opens up a whole world of learning.”***

ning of a new sort of ecosystem,” she says. “I wanted to think about fireweed as this plant that has the potential to bring new life, a kind of resurgence of life, back to campus.”

As an artist, Schmidt has always been intrigued by the sciences, and she met many scientists on campus who were open to, and enthusiastic about, her work. She brought environmental science and biology students into *Fireweed Fields* to do observational drawing, encouraging them to think about drawing as an important tool for slowing down and really seeing.

Schmidt also took students from various disciplines on sensorial walks into the small pockets of forest on the UBC Vancouver campus, exploring how our senses allow us to slow down enough to build a relationship with the natural world. She encourages educators to take the time to immerse their

students in their environment—reflecting on what they see, smell, and hear—as a way to begin to incorporate an artistic perspective into their teaching.

“Once you do that kind of immersion work, then I think it’s possible to pick up on so many different ways of responding,” she says. “That could be through creative writing or drawing. I know drawing can seem a little bit daunting for some, but the kind of drawing exercises that I do with students are very simple. It’s more about recording and responding to what you’re seeing. It’s not about creating masterpieces.”

Pedagogy is a significant part of Schmidt’s work as an educator. She says her present-day commitment to the natural world and her desire to contend with climate change were shaped by her childhood experiences in nature.

“Having time even just to play and to explore in the natural world, it opens up a whole world of learning,” she says. “It may not exactly check all the boxes in a [traditional] curriculum, but I feel like it’s the source of so much potential learning.” &



#### TECHNOLOGY AND SOCIETY

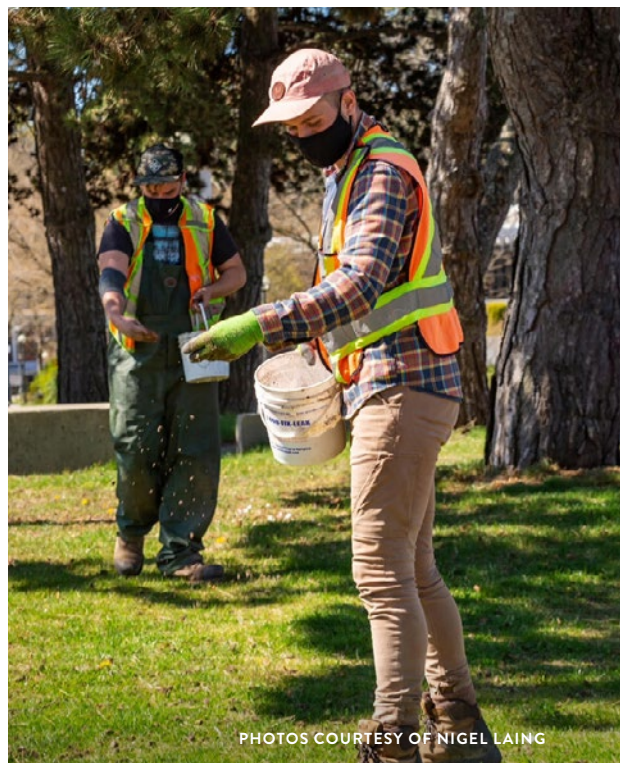


#### DESIGN

- ▼ Top Left: Schmidt spreads a seed mixture for the planting of her project *Fireweed Fields* in fall 2022 at the Morris and Helen Belkin Art Gallery.
- Top Middle: Schmidt’s *Fireweed Fields* project being planned out.
- Bottom Left: *Fireweed Fields*, artist’s rendering.
- Right: Participants in the planting of *Fireweed Fields*



PHOTO COURTESY OF HOLLY SCHMIDT



PHOTOS COURTESY OF NIGEL LAING





# From Old-Growth Rainforests to Arctic Sea Ice

## Indigenous Leadership for Conservation and Reconciliation

BY CAROLANNE BLACK

### The Birth of Tribal Parks

The Tla-o-qui-aht Nation's territory extends from one of the few remaining ancient temperate rainforests down to the Pacific Ocean. It is a place of thousand-year-old cedars up to 12 metres tall. Elk run through the misty woods, and black bears catch salmon as they migrate upstream, pulled back to rivers and streams by an unstoppable urge to spawn the next generation where they themselves hatched.

All of this remains because, to stop the proposed clear-cut logging of Wanačas Hihhuu?is (Meares Island), in 1982 the Tla-o-qui-aht Nation declared it a Tribal Park.

Bringing the small island tucked into the coast of Vancouver Island under Traditional Law, the Tla-o-qui-aht began the successful protection—through advocacy, litigation against the British Columbia government, and blockades—of the island, their territory, and their people.

In 2014, they took the concept of Tribal Parks even further. After the treaty process with the BC government had failed twice, “our chiefs and Elders at that time declared

the entirety of our traditional territory a Tribal Park and added three more land designations: Ha'uukmin Tribal Park, Esowista Tribal Park, and the Tranquil Tribal Park,” says Terry Dorward, a member of the Tla-o-qui-aht Nation who worked for the Tribal Park at that time.

In creating the Tribal Parks, the Tla-o-qui-aht Nation both protected their lands and reasserted governance over their traditional territory.

### Tallurutiup Imanga, Tuvaijuittuq, and Conservation at Your Doorstep

Thousands of kilometres northeast of Tla-o-qui-aht territory, in a place so different as to be absent of trees, a process to develop Inuit co-managed conservation came to fruition in 2019. The resulting Tallurutiup Imanga Inuit Impacts and Benefit Agreement (IIBA) and Tuvaijuittuq Agreements created, by a staggering margin, Canada's largest marine conserved area.

Tuvaijuittuq, north of Umingmak Nuna (Ellesmere Island) and home to the oldest and thickest sea ice in the Arctic, covers

319,411 square kilometres (5.55 per cent of Canada's marine area), and is 28 times larger than the next-largest Marine Protected Area. Tallurutiup Imanga National Marine Conservation Area (Lancaster Sound) covers 108,000 square kilometres (1.9 per cent of Canada's marine area) and is an area of central importance to Inuit of the Qikiqtani Region (Baffin Region).

“For Inuit in the region, Tallurutiup Imanga is at the heart of our conservation goals,” says Richard Paton, Assistant Executive Director for Marine Wildlife Conservation at the Qikiqtani Inuit Association (QIA). “It's the bridge that connects our northernmost waters in Tuvaijuittuq all the way down to our southernmost waters in Hudson Bay. Inuit are not a stationary people. We historically, and even today, move great distances, and we move because we follow the wildlife.”

Beluga whales travel as far north as Tallurutiup Imanga, and have their spring birthing in the waters of Hudson Bay. Caribou migrate through the Qikiqtani Region not only seasonally, but in cycles





of seven and seventy years. For QIA, which represents Qikiqtani Inuit, negotiated the IIBA, and co-manages Tallurutiup Imanga and Tuvaijuittuq, conservation means maintaining the environment such that, after 70 years away from Qikiqtani, caribou can come back.

“We conserve [the land] because of Inuit cultural continuity—our ability to transfer knowledge from generation to generation and access to the wildlife that we rely on and have relied on for millennia. We understand and relate to the dynamic relationship we have with wildlife,” explains

Paton. “Migratory birds like geese, waterfowl like ducks and eider; or [species] in the marine environment that include Arctic char, turbot, beluga, narwhal, seal, or on the terrestrial environment that transitions out of the marine, like polar bear, caribou, fox, or wolf. Those are all species we actively look to conserve.”

Three Qikiqtani communities (Resolute Bay, Pond Inlet, and Arctic Bay) are located on the shores of Tallurutiup Imanga, with two more (Grise Fiord and Clyde River) nearby. The communities benefit from the conservation area for travel, camping,

fishing, and harvesting the marine environment. They also bring back freshwater from ice caps and glaciers.

“We undertake [these activities] as a people because we’re living and breathing in the waters that surround Tallurutiup Imanga. Inuit are a part of Tallurutiup Imanga,” says Paton.

Inuit leaders first spoke out for conservation measures when resource extraction loomed. In the 1960s, oil and gas exploration was beginning in the North. The possibility of an oil leak into the water where they harvest was unacceptable.

***“We undertake [these activities] as a people because we’re living and breathing in the waters that surround Tallurutiup Imanga. Inuit are a part of Tallurutiup Imanga”***





Paton says those first conversations about conservation gained momentum into the 1970s, when Inuit first began proposing the creation of Nunavut as a territory.

With the Nunavut Land Claims Agreement of 1993 (and the creation of the territory of Nunavut in 1999) came the concept of IIBAs, which included the stipulation that Inuit would benefit from activities in their territory.

## The Four Moose Narrative

As a signatory to the 1992 United Nations Convention on Biological Diversity, in 2015, Canada adopted Aichi Target 11, a target for the protection of biodiversity. The country had agreed to protect at least 17 per cent of its land and inland water and 10 per cent of its coastal and marine areas by 2020. The Government of Canada recognized that to reach this target and in a way that honours reconciliation, they would need to work with Indigenous Peoples.

"[Justin] Trudeau's government brought me in, and it was a little weird, I have to say, in the beginning," says Eli Enns, who worked alongside Terry Dorward at the Tribal Parks, and co-founded Tla-o-qui-aht's Ha'uukmin Tribal Park.

In the spirit of reconciliation, The National Steering Committee asked Enns to create an advisory body made up of Indigenous Experts and government representatives, which would eventually become the Indigenous Circle of Experts (ICE), to

provide recommendations for meeting Canada's conservation targets.

Enns's role also meant partnering with various levels of government and representing that partnership with Indigenous Nations. Enns told the committee, "If you're looking for a token Indian in this process, I'm not the right guy for you. Respectfully, I said to them, 'If you're looking for somebody to help sell a watered-down version of Tribal Parks to First Nations across Canada, I'm not the right guy for that job either.' And I honestly thought they weren't gonna call me back."

He received a contract offer the next day.

Due to his experience with the treaty process between the Tla-o-qui-aht people and the BC government, Enns continued to test the waters of good faith. “Before I can go public with you in our relationship,” he reports saying to the committee, “I need to clear the air on the elephants in the room.” Then he identified the four things he knew Indigenous communities would need before they would consider developing their own version of Tribal Parks or conserved areas. Enns got the responses he needed.

Alongside ICE co-chair Danika Littlechild, assistant professor in the Department of Law and Legal Studies at Carleton University, Enns hosted four Regional Gatherings across Canada to have meaningful and difficult conversations with Elders, youth, community members, and government representatives, to collect

## The Four Moose

## Jurisdiction

Co-management governance structures in which Indigenous Nations have an equal role to the Government

## Financial Solutions

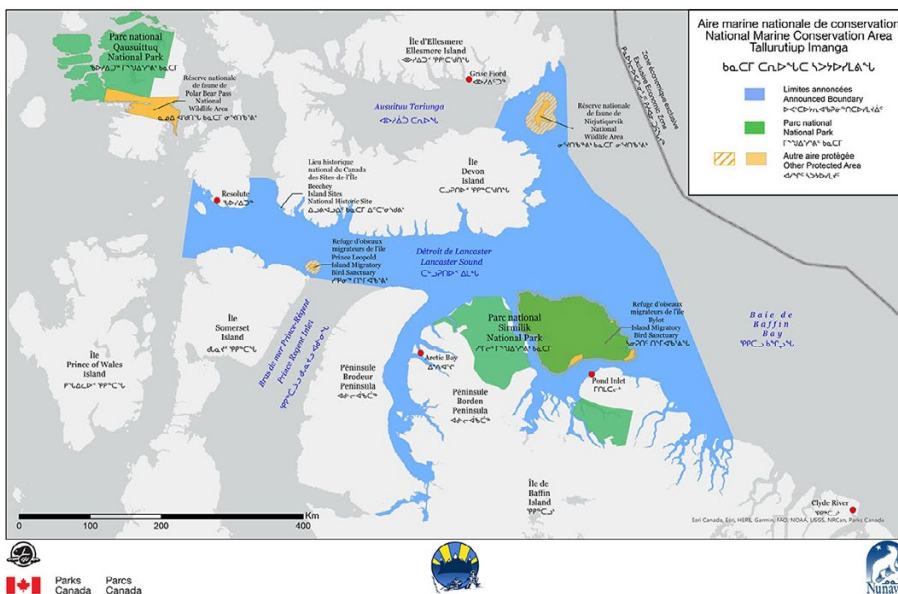
Dynamic funding that lets each Indigenous Protected and Conserved Area (IPCA) have its own unique character ensuring its viability and sustainability

## Capacity Development

Indigenous Nations are equipped to establish, govern, and manage their own IPCA

## Cultural Keystone Species

Extra protective care to the moose, caribou, salmon, and other species that are important for the people living close to the land



their stories about their territories and talk about a collective future.

By the time ICE's final report, "We Rise Together," was published in 2018, the elephants had been replaced and these key pieces to working with Indigenous Nations in conservation became known as the Four Moose Narrative. "The Four Moose Narrative is a memory device; it's a story," says Enns, relating it to the oral basis of many Indigenous cultures and the critical importance of memorable stories and concepts in transmitting information between people and generations.

The “We Rise Together” report has been credited with catalyzing the concept of the IPCA in Canada and providing a way for Canada to move forward with reconciliation and reach its conservation goals.

◀ A map of the National Marine Conservation Area Tallurutiup Imanga



***“When we did our watershed planning, we changed the concept of ‘land use’ to ‘land relationship’ because we felt [the utilization of the land] was just kind of a one-way approach”***

### **How much conserved area does this represent?**

The population of Qikiqtani comprises 16,500 Inuit and just under 21,000 people in total, or about 0.003 per cent of the Canadian population. Under QIA’s proposal, the total area to be conserved is 1,000,000 square kilometres; equal to 10 per cent of Canada’s total area, and one third of Canada’s 2030 conservation target. “For a very, very, very small percentage of the Canadian population,” says Paton, “we are conserving approximately 33 per cent of Canada’s intended total target.”

### **Outsized Conservation and a Shift to Self-Governance**

In 2022, Canada upped its conservation goal to what’s known as “30 by 30”—30 per cent of land, inland water, and ocean area conserved by 2030. The prime minister also announced up to \$800 million to support the creation of four IPCAs using a funding model based on partnerships between Indigenous organizations, governments, and philanthropic interests. QIA is one of the four selected Indigenous organizations.

For QIA, Paton says that the process of creating and co-managing Tallurutiup Imanga catalyzed Inuit-led conservation. Now, “Inuit leaders have said, for conservation space to occur, it needs to be done through an IPCA because then Inuit leaders are coming forward with the ability to conserve as opposed to having it legislated and Inuit being told: ‘This is an area that you will conserve on behalf of Canada.’”

The Qikiqtani Region spans 13 communities of which only five are adjacent to or nearby Tallurutiup Imanga; QIA’s goal in creating more conservation space is to reach all of their communities. QIA is proposing an Inuit-led governance model for the new conserved areas, in which the government still has a role but final decision-making lies with Inuit. Under this agreement, government-run parks and migratory bird sanctuaries within Tallurutiup Imanga would also eventually transition to the new governance model.

The new areas they are seeking to conserve focus on Qikiqtait, which covers the waters surrounding Nunavut’s southernmost community, Sanikiluaq (the Belcher Islands) and Sarvarjuaq (the North Water Open Polynya).

### **Guardians and Stewards of the Land**

Enns says if he could have it his way, all of Canada’s newly created conservation areas would be IPCAs. But, he disagrees with the concept of conservation to protect just a fraction of our environment.

“All of this still stems from a worldview of disconnectedness. We’re going to create

a park for nature over here and an industrial sacrifice area for the economy over here; in the same watershed, no less. So both the conventional protected area and the industrial sacrifice area stem from the same worldview of disconnectedness, which primarily sees human beings as separate from nature.”

Terry Dorward says that, in the past, 10,000 people lived in the Tla-o-qui-aht rainforest and it remained intact. Dorward sees IPCAs as an expression of Indigenous Peoples regaining autonomy, stepping outside reserves and upholding their roles and responsibilities, “including measures of conservation on how we as Indigenous people see it.”

“In Tla-o-qui-aht, for example,” says Dorward, “when we did our watershed planning, we changed the concept of ‘land use’ to ‘land relationship’ because we felt [the utilization of the land] was just kind of a one-way approach.” In discussion with Elders, to address areas impacted by poor logging operations, tourism, and other factors, they made a plan to restore these areas, and include a small human activities footprint. They also set out no-go zones. Called Qwa-siin-ap, the idea is to leave the area alone for the animal world, in particular because the strain on bears, elks, and other animals is increasing. This change in land relationship is also a return to traditional ways; entire communities once moved to let Chims (bear) hibernate in peace.

To implement their land relationship plan, Dorward helped to create and launch the Tla-o-qui-aht Guardian Program in 2009. “Guardians are the front lines for the hereditary chiefs, ensuring traditional laws are upheld.” They also work in the restoration of rivers that have been degraded by unsustainable logging practices, the revitalization of salmon habitat, environmental monitoring, the removal of derelict vessel and marine debris, and recycling, trail maintenance, and other improvements. More recently, Guardians have taken on acting as guides and ambassadors, helping visitors under-





PHOTOS COURTESY OF TERRY DORWARD

stand who the Tla-o-qui-aht people are and how they can become allies, which includes encouraging them to take the ʔiisaak Pledge, setting an expectation that visitors “carry themselves with dignity, honour, humility, and respect.”

• • •

In Tallurutiup Imanga, the Nauttiqsuqtiit Inuit Steward Program is evolving as Inuit move toward self-governance. Paton says this year will be the first when the research priorities for monitoring Tallurutiup Imanga’s waters, sea ice conditions, and wildlife will be set entirely by Inuit Stewards, who conduct that research. They are also responsible for harvesting marine animals and sharing their catch with the communities, community engagement and youth mentorship, gathering Inuit Qaujima-jatuqangit (Inuit knowledge) and traditional skills from Elders, and search and rescue. Just like the Tribal Park Guardians, they act as cultural liaisons.

As the IIBA is implemented, physical infrastructure continues to be put in place, supporting the Stewards. This year will see the start of the development of multi-use facilities, which eventually will be built in

all five affected communities. These facilities include “a place where the Stewards can store their skidoos or their boats or have a place to distribute country food to community members, a place for them to do their reporting, and a place where Elders can gather and share information with our Stewards.” The communities are also set to receive small-craft harbours, which, in places with little to no physical infrastructure, will give them a safe haven for their boats in the summer.

### With Hope and Commitment Comes Change

Now, Enns and Dorward work for the IISAAK OLAM Foundation, an educational not-for-profit Enns co-founded to address the Capacity Development Moose. One of their many projects, led by Dorward, is delivering a fully accredited IPCA planning certificate that is associated with Vancouver Island University. Through the certificate program, they are reaching people across the country and around the world who are interested in developing IPCAs.

Enns says the main goal of IISAAK OLAM is sharing good practices quickly as they emerge, “because we’re in a time crunch. The real time crunch is the survival of our

species and for us to be better at managing our relationship with nature. But the artificial time crunch is the 30 by 30 goal.”

Enns is endlessly hopeful that we can meet all our conservation and reconciliation goals, and save the planet. At the start of 2024, Canada stands at having about 16 per cent of its land and water areas protected. In the next six years, that number needs to double.

“I know a lot of people are feeling hopeless these days, and we really want people to be hopeful because when we turn that light on, that’s a prerequisite to achieving the things that we need to accomplish. So, I want people to feel hopeful and to believe.” &

Left: Terry Dorward and the Naa’uu (feast) team at a cultural and social event to attract more Tribal Park allies with a Tla-o-qui-aht history presentation. Right: Sofía Rodríguez from the Wilson Botanical Gardens in Costa Rica and Dorward signing a sister agreement with Our Naywaysim botanical gardens

TECHNOLOGY AND SOCIETY

DATA





# Digital Kit

## PAST ISSUES

If you missed past issues of *Root & STEM*, you can find them online at

✦ [pinnguaq.com/root-stem](https://pinnguaq.com/root-stem)

## RESOURCES

We have developed additional digital resources for educators to use in the classroom that connect to the theme of climate and sustainability—including podcasts and interactives. They can be accessed online via the links that follow.

### Root & STEM Podcast

This podcast expands on *Root & STEM* content and invites subject experts from each issue of the magazine to share their knowledge. The current series explores the theme of climate and sustainability in relation to STEAM education. Episodes are approximately 15–30 minutes long and are available on the Pinnguaq website or your streaming platform of choice.

✦ [pinnguaq.com/learn/the-root-stem-podcast](https://pinnguaq.com/learn/the-root-stem-podcast)

### Root & STEM App

Filled with the same informative articles, podcasts, and lesson plans as its printed counterpart, the *Root & STEM* educational app is a free digital resource for K–12 educators and learners of all ages. The app puts the magazine’s STEAM content and curriculum in the palm of your hand. Interactive elements are added regularly. Available for download on the App Store and the Google Play Store.

### The Science Behind Podcast

This podcast explores the ways in which science is connected to humans and the world around us in an interactive format that follows the scientific method. Let’s think like scientists and find the answers to the questions that make us wonder! Designed for children, episodes are approximately 4–5 minutes in length and are available on the Pinnguaq website or your streaming platform of choice.

✦ [pinnguaq.com/learn/science-behind](https://pinnguaq.com/learn/science-behind)

### Sea Tangle

In *Sea Tangle*, users explore a kelp forest off the coast of British Columbia. Players learn why the kelp forest and its inhabitants are important to one another. This experience includes information from a member of the Hailzaqv (Heiltsuk) Nation who took the time to share their knowledge and experience. This journey can be taken as a solo player or along with a group. Once the learning adventure is complete, the host of the game can choose to play a game of hide and seek, with the hiders turning into the creatures they just learned about. Good luck hunting in *Sea Tangle*!

✦ [pinnguaq.com/learn/sea-tangle](https://pinnguaq.com/learn/sea-tangle)

### Scientists Who Inspire Podcast

This podcast explores the pioneers of science and the characteristics that allowed them to thrive. The series follows scientists, researchers, and inventors like Marie Curie, Jane Goodall, and Alexander Graham Bell, and the traits that helped them make strides forward in the field of science, like perseverance, confidence, and courage. Designed for children, episodes are approximately 4–5 minutes in length and are available on the Pinnguaq website or your streaming platform of choice.

✦ [pinnguaq.com/learn/scientists-who-inspire](https://pinnguaq.com/learn/scientists-who-inspire)

✦ To learn more about *Sea Tangle* (left) or *The Science Behind* podcast (right), go to [pinnguaq.com](https://pinnguaq.com)





# PINNGUAQ MAKERSPACES

Community spaces for people to explore, make, create,  
think, play, share, learn, unlearn, hack, and discuss

[pinnguaq.com/makerspaces](http://pinnguaq.com/makerspaces)





# Discover Diverse Voices in STEAM Learning



Expanding on the print edition, the *Root & STEM* podcast introduces listeners to communities, projects, and activities that explore STEAM education in a digital world.

LISTEN ON  Spotify

 Listen on  
Google Podcasts

 Listen on  
Apple Podcasts

[pinnguaq.com/learn/the-root-stem-podcast](https://pinnguaq.com/learn/the-root-stem-podcast)

Interested in following the journey of *Root & STEM*? Follow Pinnguaq on Facebook and Instagram to share thoughts about the podcast using the hashtag **#RootandSTEMPod**.